A revision of some North American species of *Microcreagris* Balzan, 1892 (Arachnida: Pseudoscorpiones: Neobisiidae)

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Summary

The accessible neobisiid pseudoscorpions, assigned to the genus *Microcreagris* Balzan, 1892 and present in North America, have been revised. The type material previously described from the United States, along with undetermined species from different regions of that country, have been re-examined. The presence of three genera (*Tuberocreagris* Ćurčić, 1978, *Lissocreagris* Ćurčić, 1981, and *Americocreagris* Ćurčić, 1982) formerly reported from this region has been confirmed, and the occurrence of another seven genera and two species previously unknown from North America, has been proved. All are newly described. The new genera and species are as follows: *Lissocreagris parva* n. sp., *Fissilicreagris* n. g., *Australinocreagris* n. g., *Saetigerocreagris setifera* n. g. and n. sp., *Cryptocreagris* n. g., *Globocreagris* n. g., *Alabamocreagris* n. g., and *Tartarocreagris* n. g. Ecological and available zoogeographical information on the taxa described is briefly discussed. In addition, the taxonomic status of some pseudoscorpion species which have not been allocated to any of the newly-established genera in the present treatment, owing to lack of pertinent information, is discussed.

A key to genera and illustrations of diagnostic characters of each new genus and species are provided.

Introduction

A number of pseudoscorpion species occurring in North America have been included, at one time or another, in the genus *Microcreagris* Balzan, 1892, which is restricted to China and Afghanistan (Ćurčić, 1981). These records would pose an interesting biogeographical problem if the species were correctly placed. However, as is shown below, they belong to a number of different new genera.

Although new forms of pseudoscorpions are still being described, taxonomic and phylogenetic studies of the higher categories have, in general, lagged far behind the description of species. This study of the genus *Microcreagris* in North America was undertaken to add to knowledge of the taxonomy and to present a better understanding of the systematic positions of the species in the light of modern concepts of higher taxa. Taxonomic investigations were carried out by studying, in types and type series, the variation of morphological characters, and especially of those with high taxonomic weight. This has resulted in the appearance of synonymy in the previously accepted name and in the description of seven genera and two species new to science.

Eighteen of the species included in *Microcreagris* by different authors (Beier, 1931, 1932; Hoff, 1945, 1958; Chamberlin, 1952, 1962; Muchmore, 1966, 1969) have been removed from the genus in the present treatment. The excluded species fall into ten genera, seven of which are newly-established. The first to be considered, *Tuberocreagris* Ćurčić, 1978, comprises the former *Olpium rufulum* Banks, 1891, which was transferred to *Microcreagris* by Beier (1932). In an earlier study (Ćurčić, 1978), a number of differences between this species and the modern concept of *Microcreagris* (Mahnert, 1979; Ćurčić, 1983) have been noted. In general, the characters by which the excluded species is distinguished from *Microcreagris* proper, warrant its separation at the generic level.

The second group of excluded species comprises the former *Microcreagris pluto* Chamberlin, 1962, *M. valentinei* Chamberlin, 1962, *M. persephone* Chamberlin, 1962, *M. subatlantica* Chamberlin, 1962, and a new species from Florida. The differences between this species group and *Microcreagris* are manifested in the features with high taxonomic value; the distinctions established, however, have ensured recognition of this group of pseudoscorpions as a separate genus: *Lissocreagris* Ćurčić, 1981.

The third recently established genus is *Americocreagris* Ćurčić, 1982, whose type-species is *M. columbiana* Chamberlin, 1962. Furthermore, the former *M. chamberlini* Beier, 1931 is considered the type-species of *Fissilicreagris*, new genus. These two species also differ considerably from representatives of *Microcreagris* and therefore are each elevated to

***Lissocreagris parva*, new species**

Etymology: This species is so named because of its small body size.

Material examined: Holotype male (Hoff: S-3514.3) and paratype male (Hoff: S-3514.4), from Torreya State Park, Florida, 4 April 1957, W. J. Gertsch and R. Forster leg., in collections of American Museum of Natural History, New York. Specimens previously unnamed.

Diagnosis: Carapace longer than broad; epistome absent, anterior carapacal margin convex; four eyes resembling eye-spots, posteriors less prominent; carapacal chaetotaxy: 4-6,24.

Tergal formulae: 7-9-10-11-13-12-11-12-11-12, and 9-9-12-13-13-11-13-12-11-11. Male genital area (Fig. 2): sternite II with 8 posterior and median setae, sternite III with a transverse row of 5 or 6 setae, one or no intermediary setae, and a posterior series of 8 marginal setae. Stigmatic plates with 3 or 4 setae each. Sternite IV with 7, sternite V with 13 setae, sternite VI with 12 to 14 setae; sternites VII-X carry 11-14 setae each. Female genital area: unknown.

Galea small and unbranched (Fig. 45). Cheliceral palm with 6 (or 7) setae, movable finger with one seta. Flagellum eight-bladed, two distal blades dilated basally, the proximalmost blade half the length of the others; all blades pinnate anteriorly.

Manducatory process with 4 long acute setae. Pedipalpal articles smooth (Fig. 43). Chelal fingers longer than chelal palm. Fixed chelal finger with 43-52 small teeth, movable finger with 48-55 contiguous teeth.

Tibia IV, basitarsus IV and telotarsus IV carry a single tactile seta each (Fig. 44).

Morphometric ratios and measurements are presented in Table 1.

Remarks: This new species seems to be close to *L. subatlantica* from Alabama. It can easily be distinguished from the latter species by the carapacal and abdominal chaetotaxy, by the form of the pedipalpal articles, and by some morphometric ratios.

Genus *Americocreagris* Ćurčić, 1982

Type species: Microcreagris columbiana Chamberlin, 1962.

Material examined: Microcreagris columbiana Chamberlin, holotype male (JC 1081.01001), "drawn from well" at Clatskanie, Oregon, 18 August 1938, E. A. Gibson leg.

Diagnosis: Carapace longer than wide; epistomal process absent; two weakly corneate eyes; carapacal chaetotaxy: 4-6,28.

Cheliceral palm with 7 setae, movable finger with one seta. Flagellum nine-bladed, all except acute basal blade unilaterally serrated; the most proximal blade is smooth and half the length of the others (flagellum not seen by the present author!). Galea small and simple, stylet-like (Chamberlin, 1962: fig. 11A).

Abdominal tergites and sternites uniseriate. Pleural membranes granulostriate. Male genital area (Ćurčić, 1982: fig. 1): sternite II with numerous median and posterior setae; sternite III with a cluster of anterior and median setae and a series of posterior setae. Lateral genital sacs large and slenderly ovate; median genital sac elongate and reaches level of sternite IV (Ćurčić, 1982: fig. 2). Five microsetae anterior to each stigma. Female genital area: unknown.

Manducatory process with 5 long setae. Distinct granulations over anterior surface of femur and chelal palm. Trichobothriotraxy: *esb* distal to *eb; ist-isb-ib* grouped on finger base, and *est-it-et* on distal finger part. Seta *st* closer to *t* than to *sb, sb* somewhat closer to *st* than to *b*. Chelal fingers shorter than chelal hand.

Leg IV: tibia, basitarsus and telotarsus with one long tactile seta each. Subterminal tarsal setae furcate, each branch with few spinules.

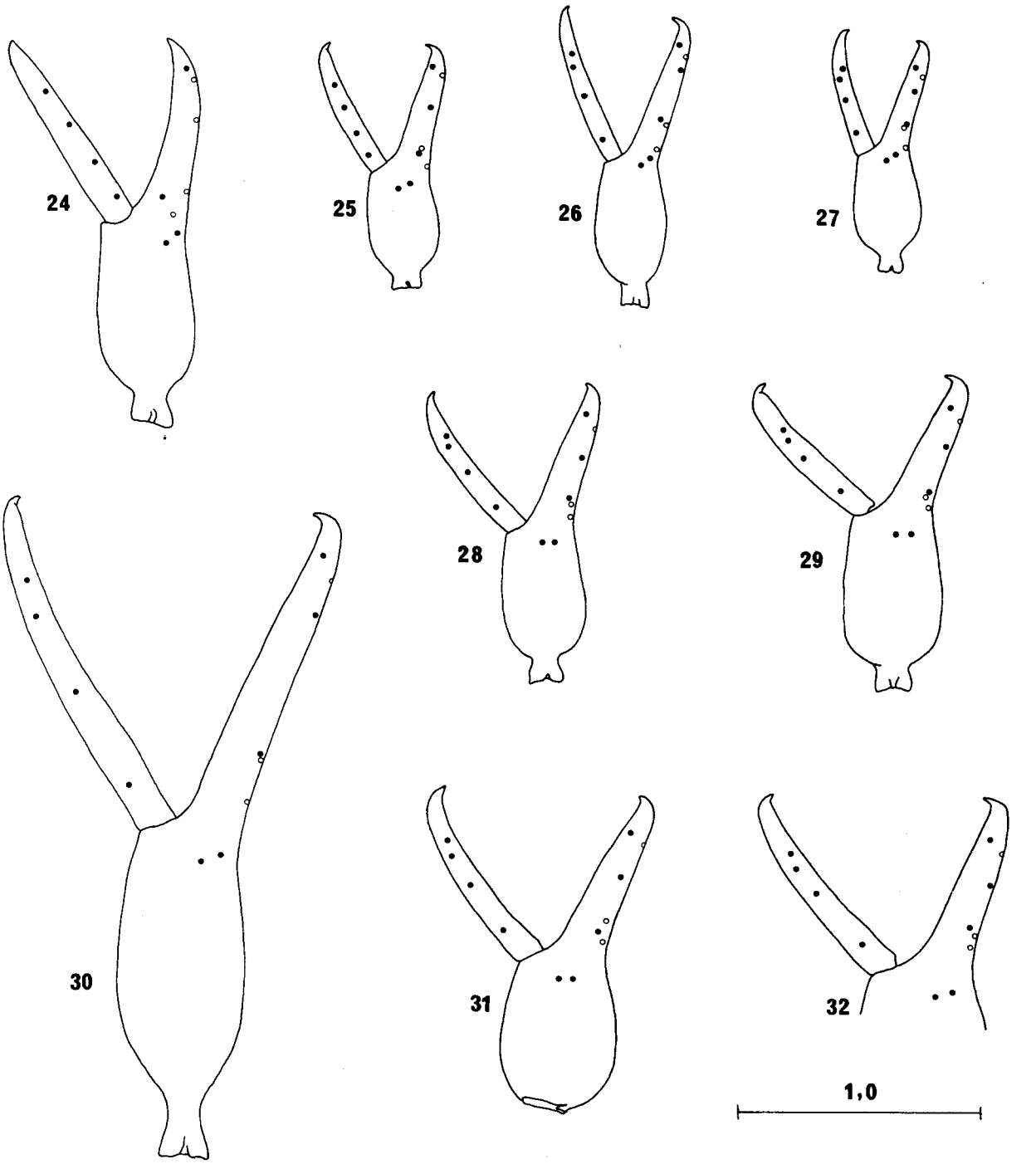
Remarks: The only known species of this genus, *A. columbiana* (Chamberlin) is found in hypogean habitats in the states of Oregon and Washington.

Genus *Fissilicreagris*, new genus

Etymology: fissilis, adj., Latin = fissile: referring to the anteromedian groove of sternite II in the male.

Type species: Microcreagris chamberlini Beier, 1931.

Material examined: Microcreagris macilentum (Simon) misident. (=*Fissilicreagris chamberlini* (Beier)), two females (Hoff: S-3526.3-6), from Oakland, Alameda County, California, 30 November 1953, W. C. Bentinck leg., one male (Hoff: S-3578.1) from Mt. George, Napa County, California, 14 February 1954, Wm. Ferguson leg., one male (Hoff: S-3336.6-7) from Little River, Mendocino County, California, 7 June 1955, S. R. Heifer leg.



Figs. 24-32: Pedipalpal chela (trichobothrial pattern). **24** *Tuberocreagris rufula* (Banks), male; **25** *Lissocreagris parva* Ćurčić, male; **26** *Fissilicreagris chamberlini* (Beier), male; **27** *F. chamberlini* (Beier), female; **28** *Australinocreagris ozarkensis* (Hoff), male; **29** *A. ozarkensis* (Hoff), female; **30** *A. grahami* (Muchmore) male; **31** *Saetigerocreagris setifera* Ćurčić, male; **32** *S. phyllisae* (Chamberlin), male. Scale line in mm.

Diagnosis: Carapace somewhat longer than broad, epistome knob-like; four weakly-developed eyes; carapacal formula: 4-6,24-26.

Cheliceral palm with 6 setae, movable finger with one seta. Flagellum seven- to nine-bladed, the distalmost blade dilated basally and distant from other blades; other blades of approximately the same size, the proximalmost blade the smallest. All flagellar blades pinnate along their anterior margins. Galea small and bifurcate.

Abdominal tergites and sternites uniseriate; pleural membranes granulostriate. Male genital area (Fig. 3): sternite II with a cluster of median and posterior setae; sternite III with an anteromedian groove in the form of a V, bordered by two pairs of setae and followed by some intermediary setae, and by a posterior setal row. Female genital area (Fig. 4): sternite II with a group of setae on either side of mid-line, sternite III with a transverse row of posterior setae. Stigmatic plates with 5 (occasionally 4) small setae each. Lateral genital sacs dilated distally.

Manducatory process with 4 (male) or 3 long setae (female). Pedipalpal articles granulate. Trichobothriotaxy (Figs. 26, 27): *esb* distal to *eb, esb* close to *ib; isb* and *ist* on base of finger and close to each other; setae *est, it* and *et* located distally, *est* closer to *it* than to *ist.* Seta *st* closer to *t* than to *sb, sb* closer to *st* than to *b*. Chelal fingers longer than hand.

Leg IV: tibia, basitarsus and telotarsus with one tactile seta each.

Remarks: The only known representative of this genus, *F. chamberlini* (Beier), occurs in California.

Genus *Australinocreagris*, new genus

Etymology: Referring to southern parts of the United States, the terra typica of its representatives.

Type species: Microcreagris grahami Muchmore, 1969.

Material examined: Microcreagris grahami Muchmore, holotype male (WM 1125.01001), from Moaning Cave, Calaveras County, California, 17 August 1963; paratype female (WM 1124.01001), same site, 22 August 1963; R. E. Graham leg. *Microcreagris ozarkensis* Hoff, one male (WM 616.01001) and two females (WM 616.01002 & 01004), Cove Cr. Vall., 15 mi. S Prairie Grove, 1000′, Washington County, Arkansas, Sept.-Oct. 1955, M. Hite leg.

Diagnosis: Carapace longer than broad; epistome small, rounded or triangular; with four eyes or eyeless; carapacal formula: (4-6)-(4-7),23-30.

Cheliceral palm with 6 setae, movable finger with one seta. Flagellum eight-bladed, two distal blades dilated basally, other blades subequal in size, except the most proximal one, which is three-quarters the length of the others; all flagellar blades pinnate along their anterior margins. Galea simple and stylet-like, with a tiny subterminal spinule.

Abdominal tergites uniseriate, sternites VI-VIII carry 2 anterior and median discal setae each. Pleural membranes granulostriate. Male genital area (Figs. 5, 7): sternite II with a cluster of median and posterior setae, sternite III with a small group of anterior and median setae, followed by a few intermediary setae, and a transverse row of posterior setae. Female genital area (Figs. 6, 8): sternite II with a group of setae on either side of mid-line (setal groups not distant from each other), sternite III with a posterior series of marginal setae. Three to five microsetae along each stigma.

Manducatory process with 3 (occasionally 4) long acuminate setae. Pedipalpal articles (trochanter, femur and chelal palm) granulate. Trichobothriotaxy (Figs. 28-30): *esb* distal to *eb,* both setae on bulb of chela; *ist* and *isb* close to each other, *ib* somewhat closer to *ist* than to *esb; est-it-et* in distal finger half. Seta *st* closer to *t* than to *sb, sb* closer to *st* than to *b*. Chelal fingers longer than palm.

Tibia IV, basitarsus IV, and telotarsus IV carry one long tactile seta each. Subterminal tarsal setae furcate, each branch with a few spinules.

Remarks: Representatives of this genus are known from Arkansas (*A. ozarkensis*) and California (*A. grahami*).

Genus *Saetigerocreagris*, new genus

Etymology: saetiger, adj., Latin = setaceous, referring to numerous setae on sternite II of the female.

Type species: Saetigerocreagris setifera, new species.

Material examined: Saetigerocreagris phyllisae (Chamberlin), unidentified male (Hoff: S-3544.2), from *Quercus agrifica* litter, near Prado Dam, Riverside County, California, 24 March 1956, I. M. Nevell

	L. parva ♂♂	*S. setifera* ♀	♂
Body			
Length (1)	2.08 – 2.54	4.39	3.36
Cephalothorax			
Length (2)	0.64 – 0.69	0.89	0.89
Breadth	0.59 – 0.65	0.80	0.80
Abdomen			
Length	1.44 – 1.85	3.50	2.47
Breadth	0.82 – 0.96	1.65	1.10
Chelicerae			
Length (3)	0.36 – 0.40	0.54	0.535
Breadth	0.20 – 0.22	0.30	0.27
Length of movable finger (4)	0.25 – 0.27	0.38	0.34
Ratio 3/4	1.44 – 1.48	1.42	1.57
Length of galea	0.05	0.075	0.065
Pedipalps			
Length with coxa (5)	3.05 – 3.275	4.58	4.29
Ratio 5/1	1.29 – 1.47	1.04	1.28
Length of coxa	0.445 – 0.46	0.70	0.64
Length of trochanter	0.36 – 0.37	0.535	0.49
Length of femur (6)	0.64 – 0.69	0.95	0.89
Breadth of femur (7)	0.17 – 0.185	0.27	0.25
Ratio 6/7	3.73 – 3.76	3.52	3.56
Ratio 6/2	1.00	1.07	1.00
Length of tibia (8)	0.545 – 0.58	0.76	0.73
Breadth of tibia (9)	0.23	0.33	0.315
Ratio 8/9	2.37 – 2.52	2.30	2.32
Length of chela (10)	1.05 – 1.175	1.635	1.54
Breadth of chela (11)	0.29 – 0.305	0.49	0.48
Ratio 10/11	3.62 – 3.85	3.34	3.21
Length of chelal palm (12)	0.49 – 0.535	0.795	0.71
Ratio 12/11	1.69 – 1.75	1.62	1.48
Length of finger (13)	0.56 – 0.64	0.84	0.83
Ratio 13/12	1.14 – 1.20	1.06	1.17
Leg IV			
Total length	2.05 – 2.32	2.98	2.94
Length of coxa	0.30 – 0.34	0.47	0.43
Breadth of coxa	0.20 – 0.23	0.29	0.25
Length of trochanter (14)	0.24 – 0.26	0.36	0.34
Breadth of trochanter (15)	0.12 – 0.15	0.19	0.15
Ratio 14/15	1.73 – 2.00	1.89	2.27
Length of femur (16)	0.57 – 0.64	0.84	0.81
Breadth of femur (17)	0.205 – 0.22	0.22	0.23
Ratio 16/17	2.78 – 2.91	3.82	3.52
Length of tibia (18)	0.47 – 0.52	0.71	0.72
Breadth of tibia (19)	0.10 – 0.11	0.12	0.12
Ratio 18/19	4.70 – 4.73	6.21	6.00
Length of basitarsus (20)	0.20 – 0.22	0.22	0.26
Breadth of basitarsus (21)	0.075 – 0.085	0.085	0.10
Ratio 20/21	2.59 – 2.67	2.59	2.60
Length of telotarsus (22)	0.27 – 0.34	0.38	0.38
Breadth of telotarsus (23)	0.06 – 0.065	0.08	0.075
Ratio 22/23	4.50 – 5.23	4.75	5.07
Tactile seta (TS) ratio – tibia IV	0.24 – 0.31	0.51	0.61
TS ratio – basitarsus IV	0.125 – 0.15	0.22	0.18
TS ratio – telotarsus IV	0.275 – 0.31	0.34	0.40

Table 1: Range in measurements (mm) of various structures, together with selected ratios, in *Lissocreagris parva* n. sp. and *Saetigerocreagris setifera* n. g., n. sp.

leg. *Saetigerocreagris setifera,* new species, see species description.

Diagnosis: Carapace longer than broad; epistome small and tubercular; four weakly-developed corneate eyes; carapacal chaetotaxy: 4-6,22-24.

Cheliceral palm with 6 or 7 setae, movable finger with one seta. Flagellum of six to eight unilaterally pinnate blades, the proximalmost blade the smallest. Galea simple or branched (bifurcate).

Abdominal tergites uniseriate; sternites VI-VIII carry 2 anterior and median discal setae each; pleural membranes granulostriate. Male genital area (Figs. 9, 11): a cluster of median and posterior setae on sternite II; sternite III with a row of several anterior and median setae, one intermediary seta, and a row of posterior marginal setae. Lateral genital sacs bent towards the anterior part of the body, non-sclerotic and subcylindrical. Female genital area (Fig. 10): sternite II with a unique group of setae in the form of an inverted U, sternite III with a posterior setal series. On each side, suprastigmal microsetae number 7 (sternite III) or 4-7 (sternite IV).

Apex of pedipalpal coxa with 4 (occasionally 5) long setae. Trochanter and tibia inconspicuously granulate, femur and chelal palm with distinct granulations. Trichobothriotaxy (Figs. 31, 32): *esb* slightly distal or not distal to *eb, ist-isb-ib* grouped on base of finger, *it* and *et* clustered in distal part of finger; *est* somewhat closer to *it* than to *ist,* or equidistant from these. Seta *st* closer to *t* than to *sb, sb* closer to *st* than to *b*. Chelal fingers slightly longer than palm.

Tibia IV, basitarsus IV, and telotarsus IV carry one long tactile seta each. Subterminal tarsal setae furcate, each branch with a few spinules.

Remarks: Saetigerocreagris setifera is found in California, where its congener *S. phyllisae* (Chamberlin) is also known. Thus, according to the available data, representatives of *Saetigerocreagris* occur in south-western areas of the U.S.A.

Saetigerocreagris setifera, new species

Etymology: The species is so named because of numerous setae on sternite II of the female.

Material examined: Holotype male (Hoff: S-2016.2) and paratype female (Hoff: S-2016.1), from Altadena, California, 24 December 1951, E. I. Schlinger leg., in collections of American Museum of Natural History, New York. Specimens previously unnamed.

Diagnosis: Epistome knob-like; with four weakly-developed eyes; carapacal chaetotaxy: 4-6,24.

Tergal formula of male: 8-13-14-13-12-14-14-13-12-12. Male genital area (Fig. 9): sternite II with a group of 25 posterior and median setae, sternite III with 6 anterior and median setae, one intermediary seta and 15 posterior setae. Sternites IV-X with 11-15 setae each. Female genital area (Fig. 10): sternite II with 16 small clustered setae in the form of an inverted U, sternite III with 22 posterior setae. Sternites IV-X with 11-15 posterior setae (female), or with 12-14 setae each (male); sternites VI-VIII carry 2 anterior and median discal setae each. Each stigmatic plate with 4-7 microsetae.

Galea branched (Figs. 46, 47). Cheliceral palm with 6 or 7 setae, movable finger with one seta. Flagellum of eight unilaterally pinnate blades; the most proximal blade is half the length of the others.

Manducatory process with 4 long acuminate setae. Trochanter and tibia inconspicuously granulate, femur and chelal palm with distinct granulations (Fig. 49). Chelal fingers slightly longer than palm. Fixed chelal finger with 47 (male) or 48 (female), and movable finger with 55 teeth (in both sexes).

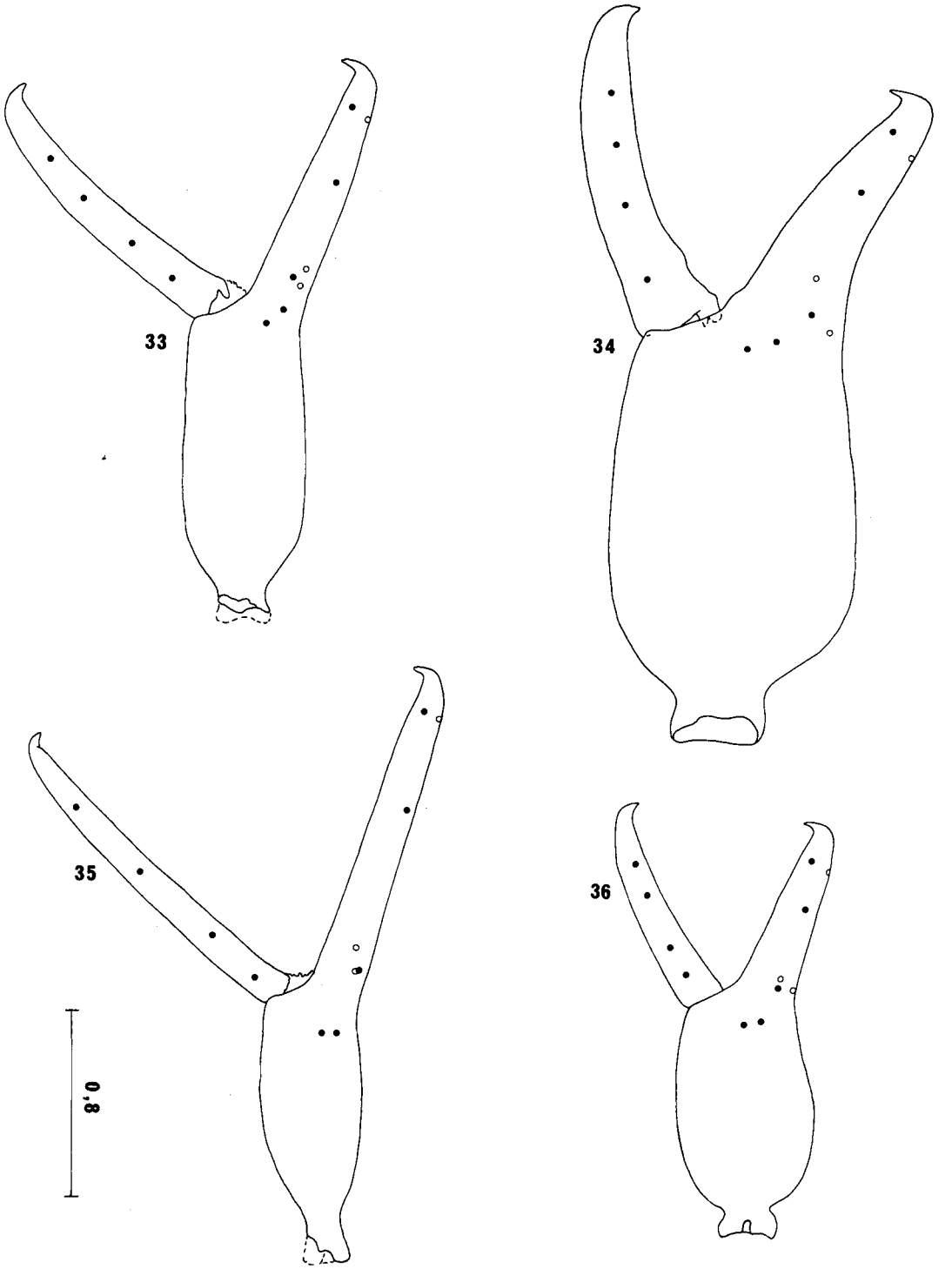
Pedal chaetotaxy as in diagnosis of genus (Fig. 48). Morphometric ratios and measurements are presented in Table 1.

Genus *Cryptocreagris,* new genus

Etymology: Referring to the hidden way of living (environmental niche) of the representatives of this genus.

Type species: Microcreagris laudabilis Hoff, 1956.

Material examined: Microcreagris laudabilis Hoff (type-series), four males (Hoff: 9038-S-2083.3, 9039-S-2083.4, 9155-S-2083.8, 9157-S-2083.10), from fir litter, under rocks, near top of Mt. Taylor, 11,150′, Valencia County, New Mexico, 21 July 1953; three females (Hoff: 9036-S-2083.1, 9037-S-2083.2, 9035-S-2082), same site. *Cryptocreagris magna* (Banks), unidentified material; three females (Hoff: S 3345.4-.12) from Mt. St. Helena, Napa County, California, 7 February 1955, J. R. Helfer leg., one female (Hoff: S 3556.2) from Mt. St. Helena, Napa County, California, 31 December 1935, Marsh, Schuster and Roth leg., one female from



Figs. 33-36: Pedipalpal chela (trichobothrial pattern). **33** *Cryptocreagris laudabilis* (Hoff), male; **34** *C. magna* (Banks), female; **35** *Alabamocreagris pecki* (Muchmore), male; **36** *Globocreagris nigrescens* (Chamberlin), male. Scale line in mm.

Patrick, Del Norte County, California, 16 September 1961, W. Ivie and W. J. Gertsch leg.

Diagnosis: Carapace longer than broad, epistome poorly developed and rounded; two pairs of weakly-developed eyes; carapacal formula: 4-(6-7),23-26.

Cheliceral palm with 6 (rarely 7 or 8) setae, movable finger with one seta. Flagellum of eight unilaterally serrate blades (with long serrations); anteriormost blade slightly dilated basally, other setae subequal in size, except the proximalmost one, which is half to three-quarters the length of the others. Galea elongate and quadrispinose.

Abdominal tergites uniseriate; sternites VI and VII, apart from posterior setae, carry 2 more anterior than median discal setae each. Pleural membranes granulostriate. Male genital area (Fig. 14): sternite II with an anteromedian group of setae, a few irregularly placed intermediary setae, and a series of marginal setae. Lateral genital sacs dilated distally. Female genital area (Fig. 15): sternite II with a group of setae on either side of mid-line, sternite III with a unique row of posterior setae.

Apex of pedipalpal coxa with 5 (occasionally 3, 4, or 6) long setae. Pedipalpal articles (chelal palm) very inconspicuously granulate. Trichobothriotaxy (Figs. 33 & 34): *esb* distal to *eb; ist-isb-ib* clustered on finger base, *it* and *et* located distally, on finger tip; *est* nearer to *it* than to *ist.* Seta *st* slightly closer to *t* than to *sb, sb* slightly closer to *b* than to *st.* Chelal fingers shorter or as long as palm.

Remarks: C. laudabilis (Hoff) from New Mexico belongs in this genus; *C. magna* (Banks) from California can also be assigned to the same genus. Thus, the members of *Cryptocreagris* are distributed in the southern parts of the U.S.A.

Genus *Globocreagris*, new genus

Etymology: Referring to the shape of the lateral genital sacs in the male.

Type species: Microcreagris nigrescens Chamberlin, 1952.

Material examined: Microcreagris nigrescens Chamberlin, holotype male (JC 2099-01001), from Francis Simes Hastings Nat. Hist. Reservation, Robertson Creek, Monterey, California, 26 March 1946, J. M. Linsdale leg., allotype female (JC 2063.01001), from F. S. Hastings Nat. Hist. Res., in Neotona midden, 646 LPT, Monterey, California, 24 January 1946, paratype male (JC 2260.01001), from Cumberland Gap, King Solomon Cave, Tennessee, 19 March 1971, J. M. Valentine and A. Petrunkevitch leg.

Diagnosis: Carapace as long as broad; epistomal process well-developed, rounded; four eyes present; one or two preocular setae on each side; carapacal formula: 4-6,26-28.

Cheliceral palm with 7 setae, movable finger with one seta. Flagellum six- to eight-bladed, anteriormost blade well separated from the rest by a distinct gap two or three times as great as average width of blade itself; posteriormost blade half as long as others, simple or finely serrate; all blades finely serrate unilaterally. Galea small and quadrispinose.

Abdominal tergites and sternites uniseriate; pleural membranes granulostriate. Male genital area (Fig. 13): sternite II with densely grouped posteromedian setae, sternite III with an anterior group of setae, a series of irregularly placed intermediary setae, and a posterior row of marginal setae. Lateral genital sacs prominent, globular and sclerotic (Chamberlin, 1952, fig. 1A). Female genital area (Fig. 16): sternite II with a group of setae on either side of mid-line, sternite III with a posterior setal row. Stigmatic plates with 5 or 6 (occasionally 4) small setae each.

Apex of pedipalpal coxa with 4 (rarely 5) long setae. Pedipalpal articles smooth except for trochanter (male) and chelal palm (both sexes) which carry tiny and inconspicuous granulations. Trichobothriotaxy (Fig. 36): *esb* slightly distal to *eb; ist-isb-ib* clustered on finger base, *it* and *et* located distally on finger; *est* nearer to *it* than to *ist.* Seta *st* closer to *t* than to *sb, sb* closer to *b* than to *st* (*st* and *sb* equidistant from *t* and *b* respectively). Chelal fingers shorter than palm.

Leg IV: tibia, basitarsus and telotarsus carry one long tactile seta each. Subterminal tarsal setae furcate, each branch with a few spinules.

Remarks: At present, only the species *G. nigrescens* from California belongs in this genus.

Genus *Alabamocreagris*, new genus

Etymology: After its terra typica.

Type species: Microcreagris pecki Muchmore, 1969.

generic rank.

The next group of species removed from *Microcreagris* comprises the former *M. grahami* Muchmore, 1969, and *M. ozarkensis* Hoff, 1945. Representatives of this group are also characterised by conspicuous features which are not shared by the species of the above-mentioned genera. These outstanding differences appear to be great enough to allow separation at the generic level of these pseudoscorpions, for which the name *Australinocreagris,* new genus, is proposed.

The remaining species fall into five new genera, of which the first, *Saetigerocreagris,* comprises the former *M. phyllisae* Chamberlin, 1930, and a new species from California. The next newly-established genus, *Cryptocreagris,* comprises the former *M. laudabilis* Hoff, 1956, and *M. magna* (Banks, 1909), while *Globocreagris,* new genus, is based on the former *M. nigrescens* Chamberlin, 1952 as the type-species. Next, the former *M. pecki* Muchmore, 1969 is the type-species of *Alabamocreagris,* new genus, and *M. infernalis* Muchmore, 1969 is considered the type-species of the new genus *Tartarocreagris.* All these species-groups and species are indeed distinct from each other as well as from the representatives of *Microcreagris* proper.

Anatomical evidence has played a significant role in the determination of generic limits, particularly with regard to the identification of the probable synapomorphic characters of the species.

Thus the purposes of this paper are: (1) to demonstrate the outstanding heterogeneity of *"Microcreagris"* in North America, (2) to offer evidence supporting the view that the newly-established taxa are generically and specifically distinct, and (3) to present objective criteria for the identification of specimens of some North American species of *"Microcreagris".* These studies, however, impose the necessity of further confirmation of the taxonomic status of all other North American species included in the genus *Microcreagris.* At the present moment, with a limited number of some specimens and species examined, it did not seem practical to allocate such species to any of the newly established genera, especially since no ample evidence was available. This refers particularly to: *"Blothrus" californicus* (Banks, 1891), *"Microcreagris" eurydice* Muchmore, 1969, *"M." imperialis* Muchmore, 1969, *"M." pumila* Muchmore, 1969, and *"M." nickajackensis* Muchmore, 1966, whose taxonomic status remains uncertain until new collections become available.

Family NEOBISIIDAE Chamberlin, 1930

Genus *Tuberocreagris* Ćurčić, 1978

Type species: Olpium rufulum Banks, 1891.

Material examined: Ideobisium rufulum (Banks), holotype male (WM 1212.01001), from Washington, D.C., 1890; topotype female (BM1922.6.28.28), from District of Columbia, USA, now in collections of British Museum (Nat. Hist.).

Diagnosis: Carapace longer than broad; epistome distinct, triangular; four eyes resembling eye-spots; carapacal chaetotaxy: 4-(6-7),27-28.

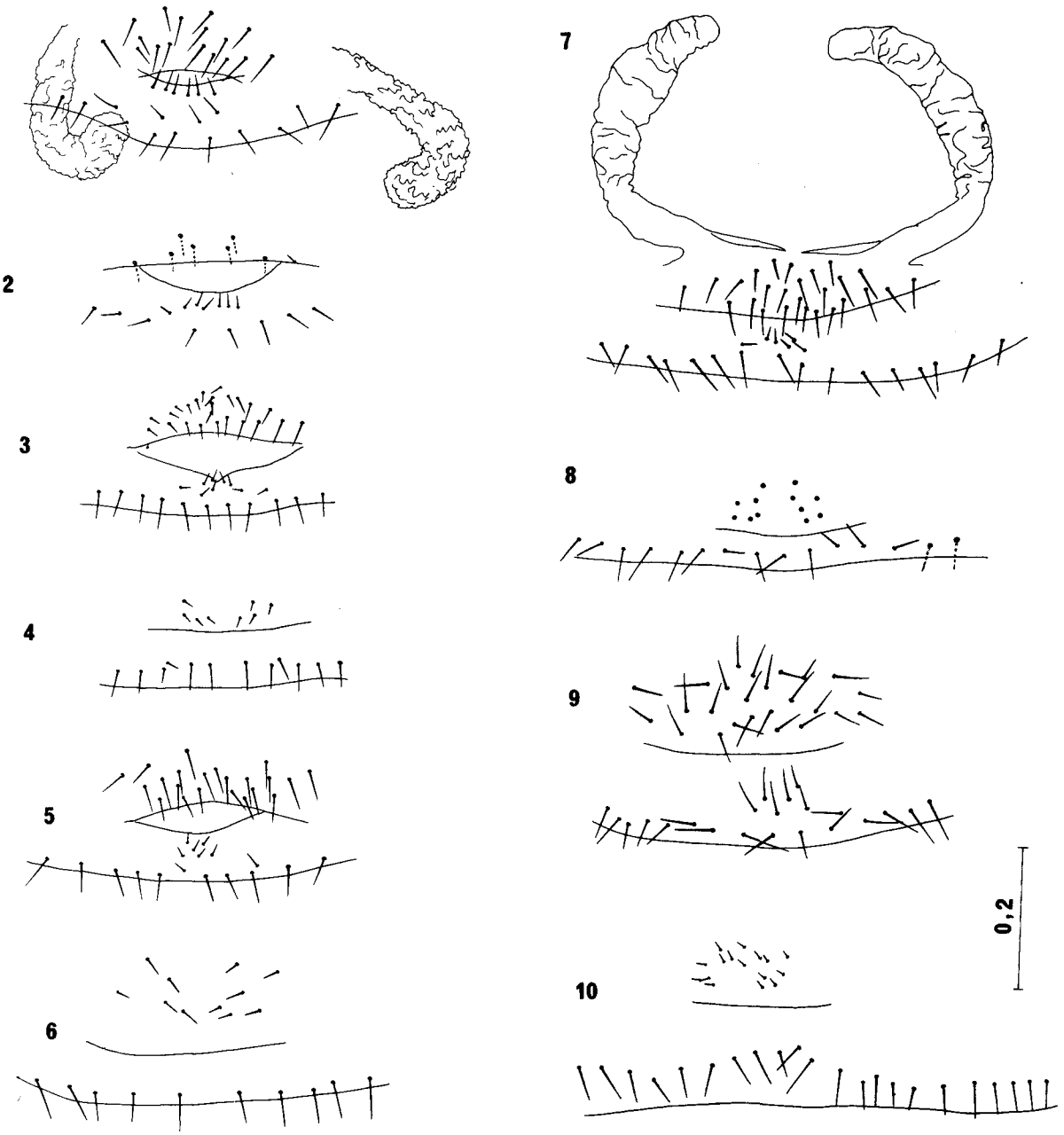
Cheliceral palm with 6 setae, movable finger with one seta; flagellum seven- or eight-bladed, two distalmost blades dilated basally and somewhat further from other blades; the most proximal blade is half the length of others; all flagellar blades unilaterally pinnate except the proximalmost one, which is finely dentate. Galea stylet-like, but with subterminal spinule.

Abdominal tergites and sternites uniseriate; pleural membranes granulostriate. Male genital area (Fig. 1): sternite II with a group of median and posterior setae; sternite III with a distinct transverse row of anterior setae, some intermediary setae, and a series of posterior marginal setae. Lateral genital sacs bent posteriorly and dilated distally (holotype). Female genital area: sternite II with a group of setae on either side of mid-line; sternite III with a transverse series of posterior setae. Three or four microsetae along each stigma.

Manducatory process with 3 long setae. Pedipalpal articles (femur and chelal hand) with distinct granulations. Interiorly, a large accessory tubercle on femur and two such tubercles on tibia*; exterolaterally, femur with a small tubercle. Trichobothriotaxy (Fig. 24): *esb* distal to *eb, ib-isb-ist* grouped in proximal part of finger; *est* closer to *it* than to *ist.* Setae *sb* and *st* equidistant from *b* and *t* respectively. Chelal fingers approximately as long as chelal palm.

Leg IV: tibia, basitarsus and telotarsus with one

*These tubercles are not easily seen on fixed slides; however, they can be observed without much trouble by gently rotating the pedipalp in preparations with glycerol.



Figs. 1-10: Genital area. **1** *Tuberocreagris rufula* (Banks), male; **2** *Lissocreagris parva* Ćurčić, male; **3** *Fissilicreagris chamberlini* (Beier), male; **4** *F. chamberlini* (Beier), female; **5** *Australinocreagris grahami* (Muchmore), male; **6** *A. grahami* (Muchmore), female; **7** *Australinocreagris ozarkensis* (Hoff), male; **8** *A. ozarkensis* (Hoff), female; **9** *Saetigerocreagris setifera* Ćurčić, male; **10** *S. setifera* Ćurčić, female. Scale line in mm.

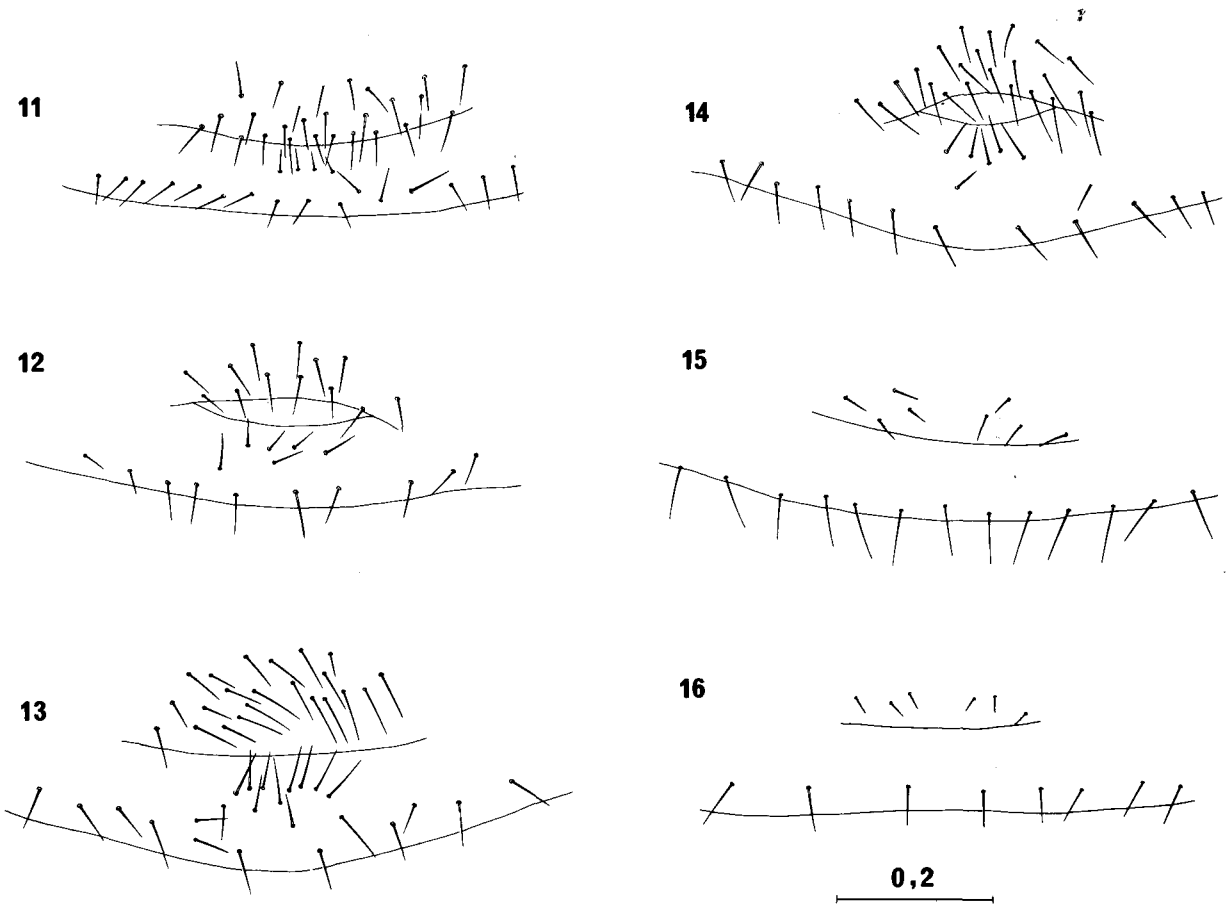
long tactile seta each. Subterminal telotarsal setae furcate, each branch with a few spinules.

Remarks: According to present knowledge, *Tuberocreagris* comprises only one species, *T. rufula* (Banks), which inhabits eastern parts of the U.S.A., i.e. the District of Columbia and the surrounding states (Ćurčić, 1978). Records of this genus and species in Kentucky, Virginia and Texas need to be verified and confirmed, especially since Hoff (1958) considers that the Texas record by Banks may be based on misidentification.

Genus *Lissocreagris* Ćurčić, 1981

Type species: Microcreagris pluto Chamberlin, 1962.

Material examined: Microcreagris pluto Chamberlin, holotype male (JC 1261.01001) and allotype female (JC 1261.01002), from Terrell Cave No. 1, Marshall County, Alabama, 11 June 1938, W. B. Jones leg. *Microcreagris valentinei* Chamberlin, holotype male (JC 2261.01001), from Cudjo's Cave, Lee County, Virginia, 14 March 1932, J. M. Valentine leg., erroneously placed by Chamberlin at Cumberland Gap, Tennessee (Muchmore, 1966). *Microcreagris persephone* Chamberlin, holotype female (JC 1257.01001), from Davidson Cave, "N.W. corner 34-8-3", Marshall County, Alabama, 29 December 1938, W. B. Jones leg. *Microcreagris subatlantica* Chamberlin, holotype male (JC 1292.02001), from Spring Cave, allotype female (JC



Figs. 11-16: Genital area. **11** *Saetigerocreagris phyllisae* (Chamberlin), male; **12** *Alabamocreagris pecki* (Muchmore), male; **13** *Globocreagris nigrescens* (Chamberlin), male; **14** *Cryptocreagris laudabilis* (Hoff), male; **15** *C. laudabilis* (Hoff), female; **16** *Globocreagris nigrescens* (Chamberlin), female. Scale line in mm.

1263.01001), from Dickey Cave, both near Maud, Colbert County, Alabama, 25 September 1940, "Jones and Archer" leg. *Lissocreagris parva,* new species, see species description.

Diagnosis: Carapace longer than broad; epistome small and rounded; with four eyes or eyeless; carapacal formula: (4-5)-6, 23-28.

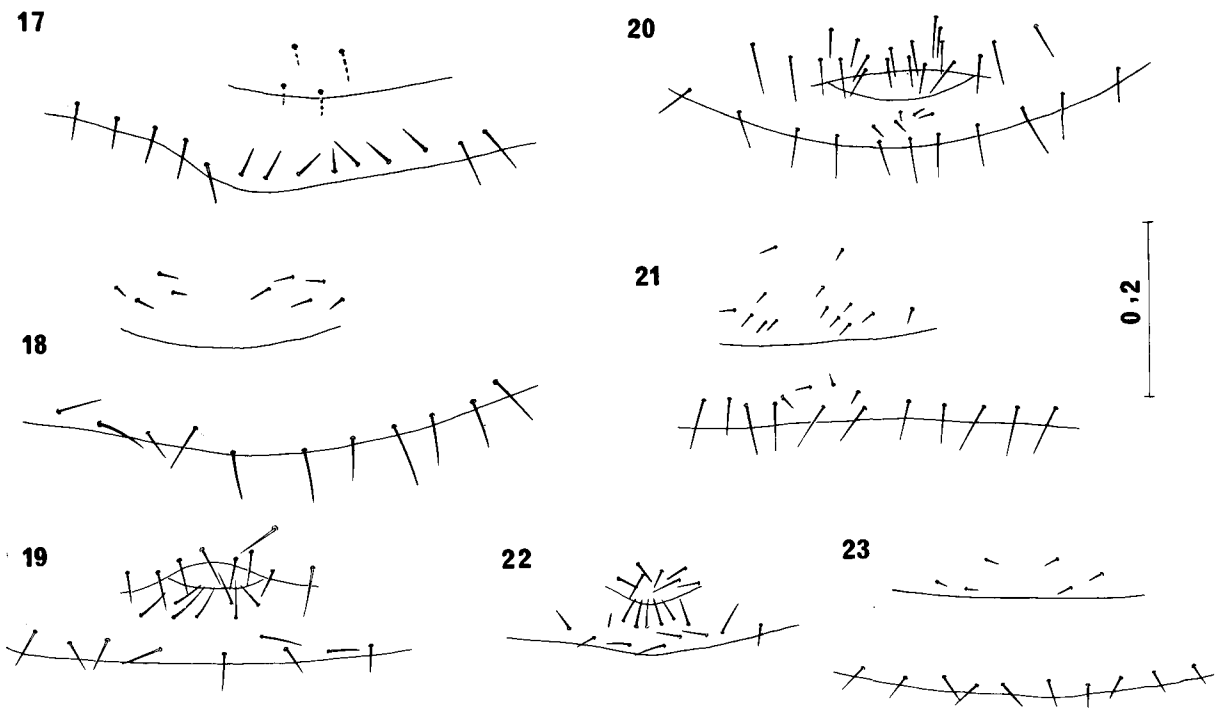
Cheliceral palm with 6 (occasionally 5) setae, movable finger with one seta; flagellum seven- or eight-bladed (occasionally nine-bladed); the two distalmost blades somewhat dilated basally; subproximal blades with less prominent serrations; the most proximal blade, half the length of the others, is almost smooth. Galea small and stylet-like, unbranched.

Abdominal tergites and sternites uniseriate. Pleural membranes granulostriate. Male genital area (Fig. 2): sternite II with median and posterior setae; sternite III with a small transverse row of anterior and median setae and a series of posterior setae. Lateral genital sacs elongated and bent distally; median genital sac short. Female genital area: sternite II with a group of small setae on either side of mid-line, sternite III with a single row of posterior setae.

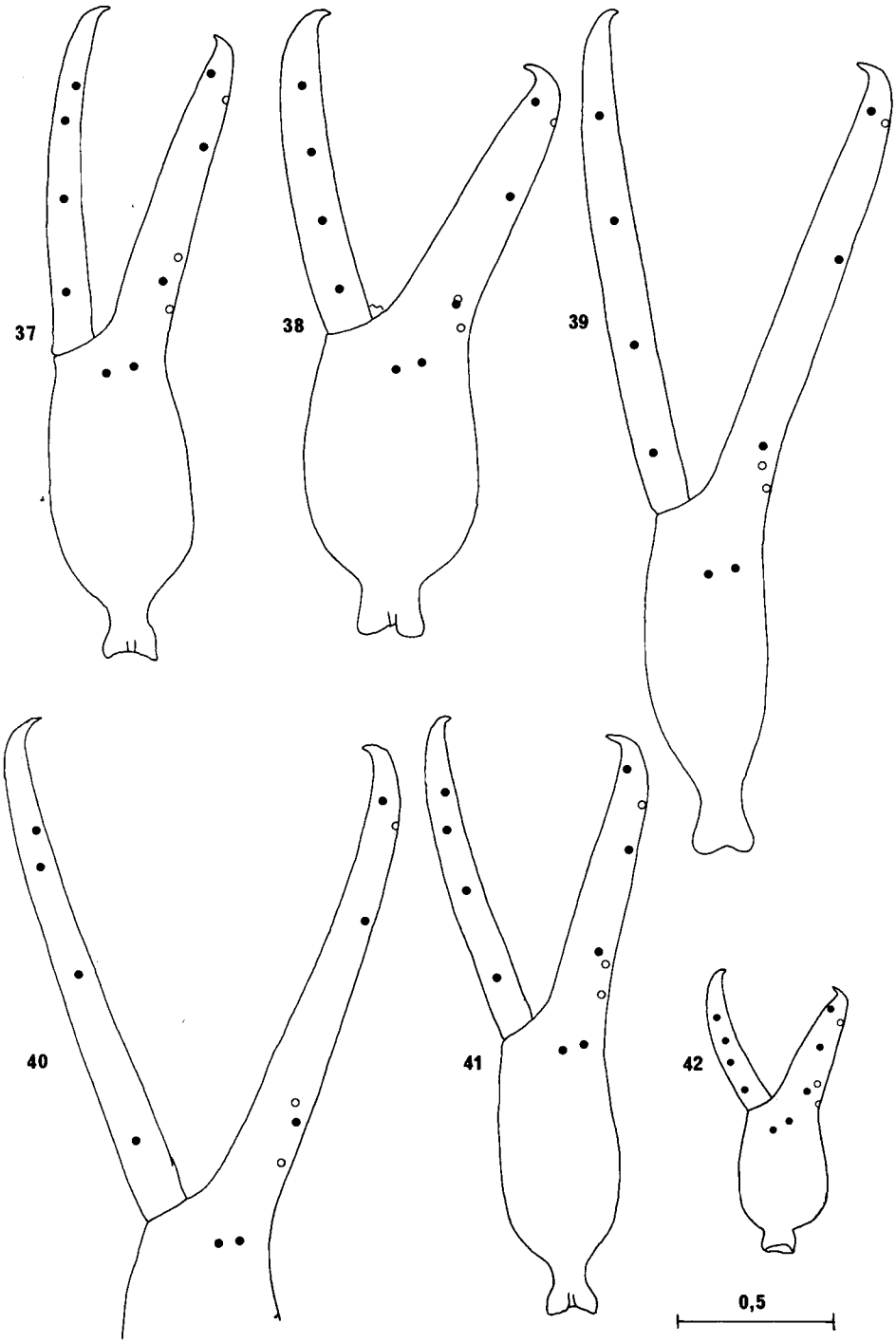
Apex of pedipalpal coxa (manducatory process) with 4 long setae. Pedipalpal articles smooth (non-granulate). Trichobothriotaxy (Fig. 25): *esb* distal to *eb, ist-isb-ib* grouped on finger base; *est* on middle of finger or somewhat closer to *it* than to *ist*; setae *et* and *it* located distally and close to each other. Setae *st* and *sb* equidistant from *t* and *b* respectively. Chelal fingers longer than chelal palm.

Leg IV: tibia, basitarsus and telotarsus with one long tactile setae each. Subterminal telotarsal microsetae furcate, with a few small denticles.

Remarks: Representatives of this genus have been found in Alabama (*L. pluto, L. persephone* and *L. subatlantica*), Virginia (*L. valentinei*), Georgia (*L. subatlantica*), and Florida (*L. parva* n. sp.).



Figs. 17-23: Genital area. **17** *"Blothrus" californicus* Banks, female; **18** *"Microcreagris" eurydice* Muchmore, female; **19** *"M." nickajackensis* Muchmore, male; **20** *"M." imperialis* Muchmore, male; **21** *Tartarocreagris infernalis* (Muchmore), female; **22** *"Microcreagris" pumila* Muchmore, male; **23** *"M." pumila* Muchmore, female. Scale line in mm.



Figs. 37-42: Pedipalpal chela (trichobothrial pattern). **37** *"Blothrus" californicus* Banks, female; **38** *"Microcreagris" eurydice* Muchmore, female; **39** *"M." nickajackensis* Muchmore, male; **40** *Tartarocreagris infernalis* (Muchmore), female; **41** *"Microcreagris" imperialis* Muchmore, male; **42** *"M." pumila* Muchmore, male. Scale line in mm.

Material examined: Microcreagris pecki Muchmore, holotype male (WM 863.01001), from Beech Spg. C #347, Gunter Dam, Marshall County, Alabama, 9 September 1965.

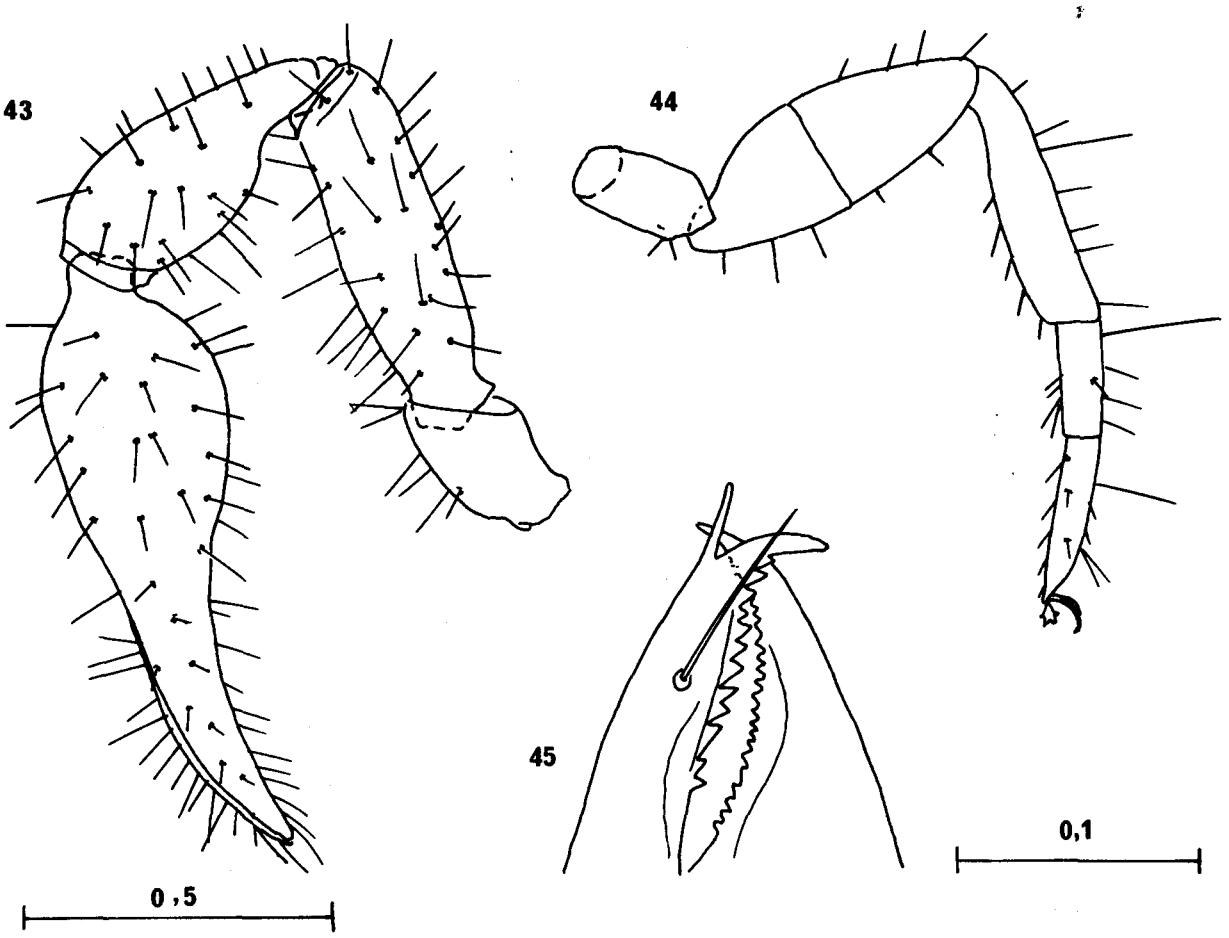
Diagnosis: Carapace slightly longer than broad; epistome distinct, rounded; one eye-spot on each side; carapacal formula: 4-6,27.

Cheliceral palm with 6 setae, movable finger with one seta. Flagellum eight-bladed, the distalmost blade dilated basally; two distal blades separated by a gap from the rest; all blades finely pinnate; blades nearly equal in size except the most proximal one, which is half the length of the others. Galea very short and unbranched.

Abdominal tergites and sternites uniseriate. Pleural membranes granulostriate. Male genital area (Fig. 12): sternite II with some median and posterior setae, sternite III with an anterior row of few setae and a posterior setal series. Each stigmatic plate with two setae. Female genital area: unknown.

Apex of pedipalpal coxa with 4 long setae. Pedipalpal articles smooth except chelal palm which is inconspicuously granulate. Trichobothriotaxy (Fig. 35): *esb* not distal and close to *eb; ist-isb-ib* on finger base, *it* and *et* located distally; *est* closer to *it* than to *ist.* Seta *st* equidistant from *t* and *sb* respectively; *sb* closer to *b* than to *st.* Chelal fingers longer than palm.

Leg IV: tibia with one, basitarsus with 2, and telotarsus with one long tactile seta. Subterminal tarsal



Figs. 43-45: *Lissocreagris parva* new species; male holotype. **43** pedipalp; **44** leg IV; **45** cheliceral fingers. Scale lines in mm.

setae unequally furcate at middle, each branch with a few spinules.

Remarks: According to present knowledge, only the species *A. pecki* (Muchmore) from Alabama pertains to this genus.

Genus *Tartarocreagris*, new genus

Etymology: Tartarus is the name given in Greek mythology to the deeper of the two divisions of the underworld; referring to the subterranean habitat of the type species of the genus.

Type species: Microcreagris infernalis Muchmore, 1969.

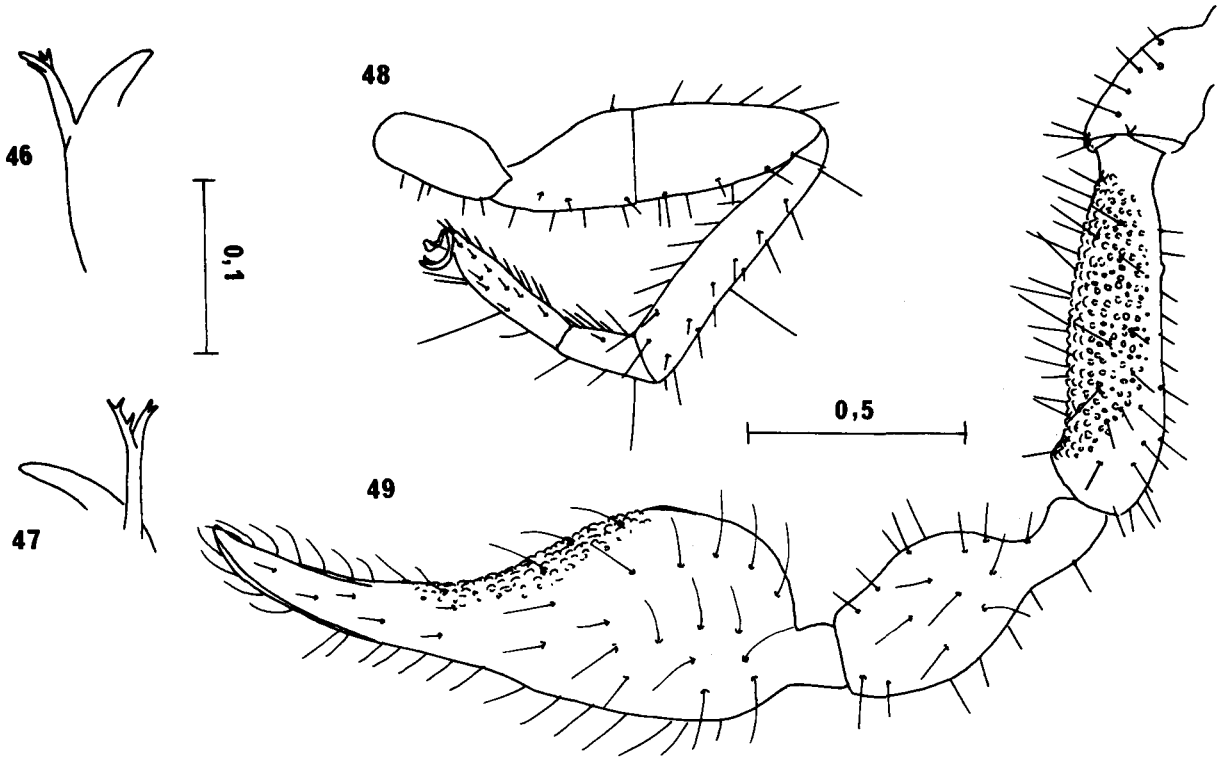
Material examined: Microcreagris infernalis Muchmore, holotype female, from Core hole Cave, 2 mi. S of Georgetown, under rock, several thousand ft. from entrance, Williamson County, Texas, 16 November 1963, D. McKenzie and J. Porter leg.

Diagnosis: Carapace longer than broad; anterior margin with tiny, rounded epistome; no eyes or eyespots present; carapacal formula: 4-6,27.

Cheliceral palm with 6 setae, movable finger with one seta. Flagellum of eight blades; two distal blades dilated basally; all blades pinnate along anterior margins, most proximal blade only half the length of the others. Galea bifurcated distal to midpoint, each ramus with two or three terminal branchlets.

Abdominal tergites uniseriate; sternites VI-VIII, apart from marginal setae, each with 2 setae on face near middle. Pleural membranes granulostriate. Male genital area: unknown. Female genital area (Fig. 21): sternite II with two groups of setae on either side of mid-line, sternite III with a posterior setal series and a few small setae on face near middle. Each stigma with six setae.

Apex of pedipalpal coxa with 3 or 4 setae. Pedipalpal trochanter, femur and chelal palm with distinct granulations, tibia inconspicuously granulate. Trichobothriotaxy (Fig. 40): *esb* slightly distal to *eb, ist-*



Figs. 46-49: *Saetigerocreagris setifera* new genus and species. **46** galea, male; **47** galea, female; **48** leg IV, male; **49** pedipalp, male. Scale lines in mm.

isb-ib on base of finger, *it* and *et* on distal finger part, *est* closer to *it* than to *ist.* Seta *sb* nearer to *b* than to *st,* seta *sb* closer to *st* than to *b*. Chelal fingers longer than palm.

Tibia IV, basitarsus IV and telotarsus IV carry one long tactile seta each. Subterminal tarsal setae furcate, each branch with a few spinules.

Remarks: Until more evidence becomes available, the new genus comprises a single species, *T. infernalis* (Muchmore), which is known to inhabit the Inner Space Caverns, 3 km south of Georgetown, Williamson County, Texas.

The taxonomic status of *"Blothrus" californicus* Banks, *"Microcreagris" eurydice* Muchmore, *"M." pumila* Muchmore, *"M." imperialis* Muchmore and *"M." nickajackensis* Muchmore

The taxonomic relationships of *"Blothrus" californicus* Banks, and four species assigned to *Microcreagris* (*eurydice* Muchmore, *pumila* Muchmore, *imperialis* Muchmore and *nickajackensis* Muchmore) have remained enigmatic ever since they were described. In the present treatment, however, it has been confirmed that they all belong beyond doubt in the family Neobisiidae.

Material examined: Blothrus californicus Banks, holotype female (WM 1952.01001), California, 1890, N. Banks leg. *Microcreagris eurydice* Muchmore, holotype female (WM 1010.01001), from Kennamer Cave, Jackson County, Alabama, 15 March 1966, S. Peck leg. *Microcreagris pumila* Muchmore, paratype male (WM 1358.01002), from 1 mi. SE Blount Spo., Blount County, Alabama, 5 April 1967, S. Peck leg., female paratype (WM 1270.02001), from Parker Cave, Chatooga County, Georgia, 20 June 1964, Peck and Fiske leg. *Microcreagris imperialis* Muchmore, holotype male (WM 1126.01003) and paratype male (WM 1126.01002), from Empire Cave, Santa Cruz County, California, 26 August 1963, R. E. Graham leg. *Microcreagris nickajackensis* Muchmore, holotype male (WM 754.01001), from Nickajack Cave, Marion County, Tennessee, 1 August 1964, R. Horton leg.

Let us consider the case of *"B." californicus* (Figs. 17, 37) first. It was Chamberlin (1930) who confirmed that this species does not belong in the genus *Blothrus* Schiødte (which was later assigned as a subgenus of *Neobisium* Chamberlin, 1930), but the left its precise taxonomic status open. Since *californicus* is known only from a single specimen (holotype female), its precise classification is made even more difficult. Analysis of diagnostic features such as the presence of elongated (although damaged) galea and serrations on all flagellar blades, a small number of setae on the manducatory process of pedipalpal coxa, distinct trichobothrial pattern, and distinct chaetotaxy of genital area, clearly shows that this pseudoscorpion does not belong in *Neobisium (Blothrus),* which is otherwise broadly distributed in the Mediterranean region. This conclusion, then, is supported by the zoogeographical factor, since *"B." californicus* occurs only in the U.S.A., i.e. in California.

Judging by the presence of the galea (damaged in the only specimen), *"B." californicus* could be classified into one of the genera established in the present treatment. This assumption, however, is difficult to verify until additional specimens of this species are available. For example, on the basis of the number of setae on the manducatory process alone, *"B." californicus* could be assigned to any of as many as five genera (*Tuberocreagris, Fissilicreagris, Australinocreagris,* and perhaps *Cryptocreagris* or *Tartarocreagris*). The distinctive trichobothrial pattern in this species, however, clearly indicates that *californicus* probably does not belong to any of these genera. *"B." californicus* is also distinguished from the species of *Cryptocreagris, Australinocreagris* and *Tartarocreagris* by the lack of anterior discal setae on abdominal sternites. Apart from all this, it is very difficult to define precisely the taxonomic position of the species, especially on account of the specific (?atypical) chaetotaxy of sternite II (anterior genital operculum). It may be concluded, then, that the status of this species is still obscure today, just as it was over fifty years ago (Chamberlin, 1930). More light will be shed on the problem of allocating *californicus* to one of the newly-established genera or, even to a special new genus, only when more specimens of this pseudoscorpion become available.

According to some diagnostic characters, *"Microcreagris" eurydice* (Figs. 18, 38), known to date only by the female holotype from Alabama, seems to be similar to *Alabamocreagris* whose type species is *A. pecki.* The species *eurydice* differs considerably from this species and genus, however, in the trichobothriotaxy of the movable chelal finger (in *A. pecki, sb* is

nearer to *b* than to *st*, while in *"M." eurydice*, *sb* is equidistant from *st* and *b*). A further difference is the presence of only one tactile seta on basitarsus IV in *eurydice* as opposed to two such setae in *pecki*. Besides, the variable number of setae on the manducatory process in *eurydice* (3 or 4) makes it impossible to classify this species precisely. Furthermore, the chaetotaxy of the female genital area, compared with that of other newly-established genera, shows no specific feature by which *eurydice* could be assigned to any of the existing or even new genera of pseudoscorpions. In this case, too, it is evident that the exact determination of the taxonomic position of *eurydice* would be possible only when its variability, including that of males (which are presently unknown), is studied.

The taxonomic status of *"M." pumila* (Figs. 23, 42) from Alabama and Georgia is also debatable. In the shape of the flagellum and number of setae on the manducatory process, *pumila* resembles *Australinocreagris*, but it differs from members of this genus in the lack of anterior discal setae on abdominal sternites. On the other hand, the dermal structure of its pedipalpal articles (all articles smooth except for chelal palm which is inconspicuously granulate) prompts the opinion that *pumila* could be assigned to the genus *Alabamocreagris*. The members of this genus, however, bear 4 setae on the manducatory process (3 in *pumila*) and have a distinct trichobothrial pattern (*sb* nearer to *b* than to *st*) compared with *pumila* (*sb* closer to *st* than to *b*). Apart from that, *pumila* has only one tactile seta on basitarsus IV, while representatives of *Alabamocreagris* have two. Whether this species can be allocated to one of the genera established, or whether a separate genus should be created, will be shown by future research on additional material.

The position of *"M." imperialis* (Figs. 20, 41) is also hard to establish. In most of its diagnostic characters (shape of flagellum, presence of anterior discal setae on abdominal sternites, chaetotaxy of manducatory process, and trichobothriotaxy), it is closest to the genus *Australinocreagris*. Certain differences between *imperialis* and members of *Australinocreagris* are seen in the distribution of setae on sternite III of the male. Although it is evident that this species is closest to *Australinocreagris*, nevertheless further verification and more exact definition of its taxonomic assignment is necessary. This can be done only by comparative analysis of the diagnostic features, based on additional material, when available.

Finally, let us mention the case of *"M." nickajackensis* from Tennessee (Figs. 19, 39). The shape of the galea and flagellum, as well as the chaetotaxy of the manducatory process, bring this pseudoscorpion close to *Tuberocreagris*. It differs from this genus, however, in the trichobothriotaxy of the fixed chelal finger and in the dermal structure of the pedipalpal articles (in *nickajackensis*, only the chelal palm is very inconspicuously granulate, while the other articles are smooth; in the only species of *Tuberocreagris*, the pedipalpal articles are distinctly granulate). There are also differences in the chaetotaxy of the genital area. Thus, *nickajackensis* could not be assigned to *Cryptocreagris* either (although it is rather similar to this genus), for it does not possess anterior discal setae on the abdominal sternites. It is to be hoped that future research on more numerous specimens will provide more precise information on the taxonomic status of this species.

Key to the newly-established genera of North American pseudoscorpions

The newly-established genera may be distinguished by means of the following key:

1. Some abdominal sternites biseriate 2
– Abdominal sternites uniseriate 5
2. Sternites VI and VII biseriate . . . . . *Cryptocreagris*, new genus
– Sternites VI-VIII biseriate 3
3. Sternite III of female with a transverse row of posterior setae 4
– Sternite III of female with a transverse row of posterior setae and a few setae on face near middle . . . . . *Tartarocreagris*, new genus
4. Sternite II of female with a group of setae on either side of mid-line; manducatory process with 3 setae . . . . . *Australinocreagris*, new genus
– Sternite II of female with a unique group of setae in the form of an inverted U; manducatory process with 4 setae . . . . . *Saetigerocreagris*, new genus
5. Sternite III of male with an anteromedian groove in the form of a V, bordered by two pairs of small setae . . . . . *Fissilicreagris*, new genus

– Sternite III of male with an ungrooved anterior margin; anterior setae clustered, or arranged in a row 6

6. Pedipalpal articles smooth . . . . . *Lissocreagris* Ćurčić, 1981
Pedipalpal articles granulate 7

7. Setae *sb* and *st* equidistant from *b* and *t* respectively 8
– Setae *sb* closer to *b* than to *st*, or somewhat closer to *st* than to *b* 9

8. Manducatory process with 3 long setae; pedipalpal femur granulate, femur and tibia with one and two large accessory tubercles respectively . . . . . *Tuberocreagris* Ćurčić, 1978
– Manducatory process with 4 long setae; pedipalpal femur and tibia smooth . . . . . *Alabamocreagris*, new genus

9. Sternite III of male with a cluster of anteromedian setae, and a series of posterior setae . . . . . *Americocreagris* Ćurčić, 1982
– Sternite III of male with an anteromedian group of setae, a series of intermediary setae, and a transverse row of posterior setae . . . . . *Globocreagris*, new genus

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