

**THE EREMOBATES PALPISETULOSUS
SPECIES-GROUP (SOLPUGIDA: EREMOBATIDAE)
IN THE UNITED STATES**

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Muma (1962 and 1963) described 2 additional species based on single male specimens, and described the female of *Eremobates nodularis* Muma. In 1970, Muma reported on a study of the types of North American solpugid species deposited in European museums. This study resulted in the synonymizing of 6 species described in 1951, but validated species previously misplaced or unrecognized, and extended the known number of United States species to 17. These species were distinguished by the same characters utilized in Muma (1951). They were *Eremobates affinis* (Kraepelin) males and females, *E. bantai* Brookhart males and females, *E. fagei* (Roewer) females, *E. girardi* (Putnam) males, *E. gracilidens* Muma males, *E. hessei* (Roewer) (= *nodularis* Muma) males and females, *E. kraepelini* Muma males and females, *E. marathoni* Muma males, *E. nanus* Muma males, *E. palpisetulosus* Fichter males and females, *E. papillatus* Muma males, *E. purpusi* (Roewer) males and females, *E. tejonus* Chamberlin males, *E. titschacki* (Roewer) males, *E. tuberculatus* (Kraepelin) males, *E. vicinus* Muma males, and *E. villosus* Muma males and females.

Between 1963 and 1973 numerous specimens of the species-group were collected throughout western United States. These specimens were identified by the characters used in Muma (1951), and would have resulted in the description of 33 new species. Since it seemed to us illogical that this many new species could have been collected in 10 years we decided to study character variability within the group and investigate the possibility of previously overlooked diagnostic characters.

The present review is the result of this investigation. We have been materially aided by the National Science Foundation Grant cited in footnote 1.

Within this review, we recognize 5 sub-group of species. They are the *nodularis* series, the *palpisetulosus* series, the *ajoanus* series, the *kraepelini* series, and the *scopulatus* series. Altogether, within the United States, there are 34 species; 17 previously described and 17 described here as new.

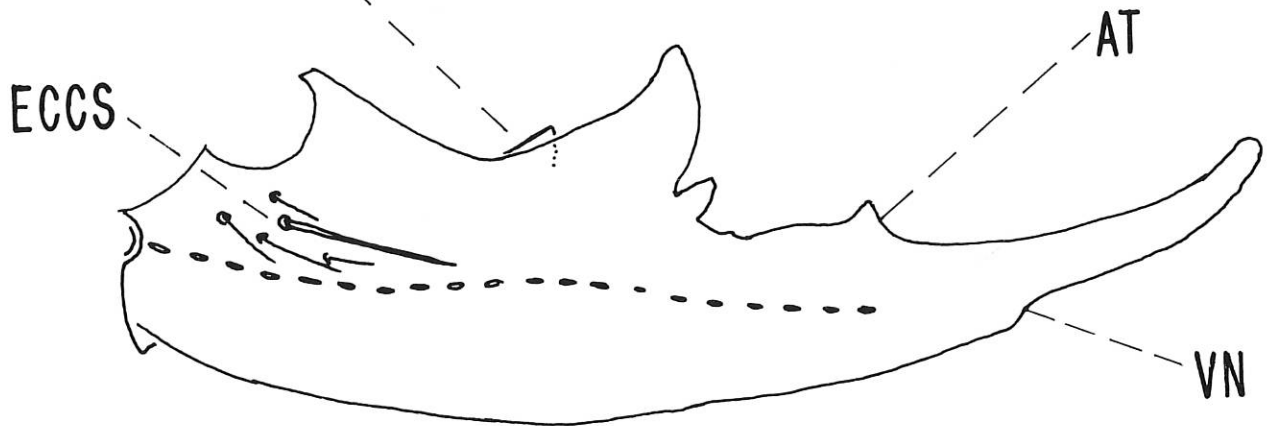
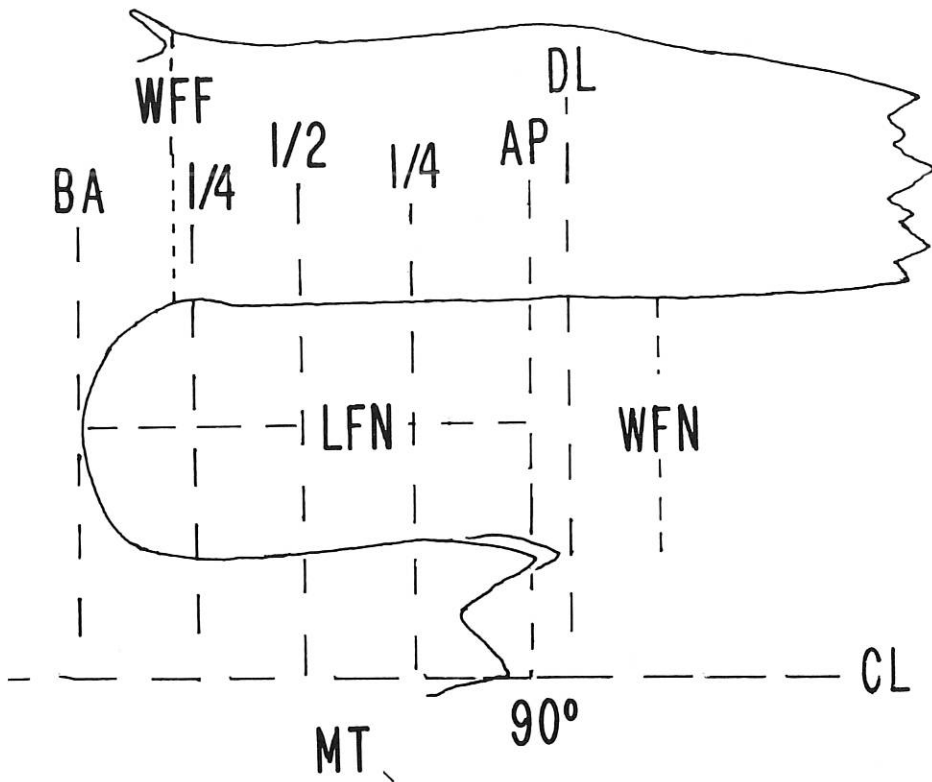
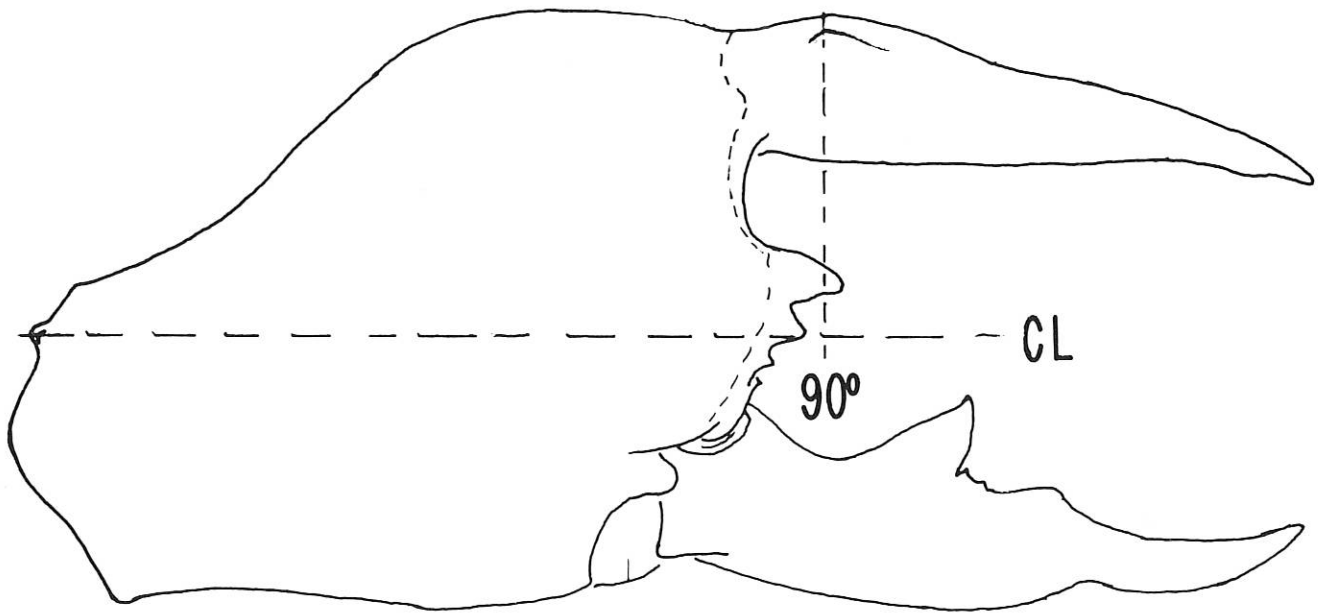
METHODS AND MATERIALS

In general, the methods used here for measuring previously identified characters are the same as those utilized by Muma (1951) except that total lengths are no longer recognized owing to extreme variations in abdominal lengths. Length measurements are the same as those recognized by Brookhart and Muma, 1981, and involve only combined lengths of chelicerae and propeltidium excluding the abdomen; they are cited here under symbol CP. In our quest for new and more reliable characters we have discovered several new sets of measurements and values. These are detailed in the Key to Ratios and Symbols and the following (Plate I).

All of the numerical citations of measurements in this paper refer to millimeters (mm.)

KEY TO RATIOS AND SYMBOLS

Fixed finger. Form of dorsal process on males varies from a low elongate ridge with a basal peak, through a moderate-sized subquadrate to subtriangular blade with a basal to medial peak, to a short triangular to rounded spur with a basal peak.



Length is determined by dividing the length of the process by the length of the finger and expressing the result as a percentage of the finger.

Position of the peak of the dorsal process is determined by extending a right angle (90 degree) line from the cheliceral line to the apex of the peak of the dorsal process. The cheliceral line extends from the cheliceral articulation sclerite to the distal apex of the second ectal fondal tooth. Positions noted in the illustrations.

Fondal notch ratios. L/W is the length of the notch divided by the width of the notch. W/W is the widest basal width of the fixed finger divided by the apical width of the notch.

Movable finger. The anterior tooth, mesal tooth and ventral notch of males are noted in the illustration.

The mesal tooth of females are shown among the diagnostic drawings for each series of species.

Symbols: AP-apex or apical. AT-anterior tooth. BA-base or basal. CL-cheliceral line. DL-distal of or distad. ECCS-ectal cheliceral cluster setae. FF-Fixed finger. LFN-length fondal notch. MT-Mesal tooth. VN-ventral notch. WFN-width fondal notch. WFF-width fixed finger. 90 degree-right angle line.

SOURCES OF SPECIMENS

The solpugid specimens utilized in the study have been obtained on field trips through western Texas, southern Colorado, New Mexico, Arizona, Utah, Nevada and southern and central California. Additional specimens have been obtained from biological and populations studies of solpugids in Colorado, New Mexico, extreme western Texas and extreme eastern Arizona. Numerous friends, colleagues and peers have also allowed us to utilize their private solpugid collections.

The following institutions have loaned us types and special specimens, are the repositories of the types of species described in this paper, and/or are the repositories of types of previously described species included in this paper: American Museum of Natural History (AMNH), New York, NY; Zoology Department, Brigham Young University (BYU), Provo, UT; California Academy of Sciences (CAS), San Francisco, CA; Entomology Department, University of California (EDB), Berkley, CA; Entomology Department, University of California (EDR), Riverside, CA; Florida State Collection of Arthropods (FSCA), Gainesville, FL; Los Angeles County Museum (LACM), Los Angeles, CA; Museum of Comparative Zoology, Harvard University (MCZ), Cambridge MA; Museum Nationale d'Histoire Naturelle (MNHN), Paris, France; Santa Barbara Natural History Museum (SBNHM), Santa Barbara, CA; San Diego County Museum (SDCM), San Diego, CA; Biology Department, Texas Tech University (TTU), Lubbock, TX; Zoologisches Staatsinstitut ad Museum (ZSM), Hamburg, West Germany. We are very grateful to these institutions and their curators for their cooperation and assistance.

In general, we have not recalled previously identified and recorded institutional and museum specimens except for isolated study specimens.

STATISTICAL PROCEDURES

Except for the commonly understood and used statistics such as maximum, minimum, mean, and mode, the broad range of species, and the paucity of significant numbers of specimens made statistical analyses extremely difficult and in the case of the *scopulatus* series impossible.

All data were analyzed using a modified analysis of variance referred to as the Scheffe test at the 95% level of significance; see Sokal and Rohlf, (1981, pp. 253, 255, and 256). This method is reportedly most powerful for samples that are small in number and unequal in degrees of freedom.

First, we separated specimens into geographic areas, roughly based on the desert regions and adjacent plains or grasslands. Larger collections by the authors and helpful friends and colleagues from limited areas over continuous time spans were then selected to test variability of specific characters for separating species.

Although A/CP ratios used in identifying species of the *pallipes* species-group of this genus (Brookhart and Muma, 1981) were not completely satisfactory in separating series and species within the series, they were helpful when combined with other characters. A/CP ratios, ratios of fondal notch length to width, fondal notch width to cheliceral fixed finger width, and position of dorsal process on fixed cheliceral finger of males, and A/CP ratios, and ratios of opercular notch length to opercular length of females were subjected to the Scheffe test. All analyses proved helpful in distinguishing members of the *nodularis* and *palpisetulosus* series, and some species of the *kraepelini* series.

Use of this technique enabled us to sort out uncertainly placed species and specimens.

Statistical comparisons involving the number and length of abdominal ctenidia, and the number of palpal scopular papillae were not made owing to the extreme variability of setal characters.

Utilizing all measured specimens in each series, the finger width to notch width ratios, and the notch length to notch width ratios showed significant differences between the following pairings but none between other pairings.

FN/NW ratios of series
nodularis-palpisetulosus
nodularis-ajoanus
ajoanus-scopulatus
scopulatus-palpisetulosus

NL/NW ratios of series
nodularis-palpisetulosus
nodularis-ajoanus
nodularis-scopulatus
palpisetulosus-kraepelini
palpisetulosus-scopulatus
ajoanus-kraepelini
ajoanus-scopulatus

There were not enough specimens of many species to permit intra-series comparisons. Only 5 species of the *palpisetulosus* series with 5 or more specimens showed significant differences:

FW/NW ratios of species
norrisi-palpisetulosus
norrisi-texanus

NL/NW ratios of species
norrisi-marathoni
norrisi-texanus
texanus-kiseri
texanus-palpisetulosus

None of the common species of the *ajuanus*, *kraepelini*, or *scopulatus* series showed any significant differences. Many more specimens of most of the species must be collected before additional statistical analyses can be made.

TAXONOMY AND SYSTEMATICS

The 5 sub-groups of species recognized in this review are distinguished in the following tabular key (Table 1) to males. Although females are diagnosed and described under various species, many species are known only from males, and only one species of the group is known from females.

In fact, females collected alone are nearly impossible to determine beyond the group, unless they have distinctive opercula, distinctive coloration, or inhabit allopatric specific ranges. Even under these conditions, placement of females must be considered questionable. If the ectal, cheliceral, cluster, setae (ECCS), see Muma (1985), prove to be diagnostic for the species-group, the character may permit placement of females. However, at the present time, the ECCS are themselves open to question. In this paper the ECCS are illustrated only for *Eremobates scopulatus* Muma to show placement and arrangement of those setae that could be seen and studied.

Nodularis Series

DIAGNOSIS: Males without a palpal scopula. Dorsal process of fixed cheliceral finger a low elongate ridge occupying about 40% of finger length in both dorsal and lateral view. Males and females both with basal intermediate tooth of movable cheliceral finger located on anterior margin of the principal tooth. Males with basal notch barely one-half the width of base of fixed cheliceral finger and much deeper than wide; no definitive anterior tooth; and no (0) mesal tooth on movable cheliceral finger. Females with opercula typical of those of the species group, about 1.5 times wider than long, with the opercular notch occupying more than 30% of the opercular area. The vulvular opening is transverse, wide, and lies at or just caudad of half the longitudinal length of the opercular notch.

REMARKS: There are 3 known species of this series. One occurs in arid regions of southwestern United States. The other 2 were described from Mexico. We have also examined another, possibly 2, undescribed species of the series from the Mexican State of Coahuila.

Table 1. Tabular key to males of 5 series of species of the
palpisetulosus species-group of *Eremobates* Banks

Sub-groups	Characters						
	Palpal scopula	Fixed Process Form	Finger (x)% of Finger	Fondal notch length/ width mean (x)	Finger/ notch width mean (x)	Movable Finger Basal intermed. tooth	Mesal tooth
<i>nodularis</i>	absent	ridge	40.0	1.78	1.41	on primary tooth	0
<i>palpisetulosus</i>	absent	ridge	25.0 to 35.0	1.0 to 1.87	0.96 to 1.33	basal angle tooth and finger	2
<i>ajouanus</i>	absent	spur	9.0 to 15.0	0.91 to 1.51	1.08 to 1.22	on finger margin	2
<i>kraepelini</i>	absent	blade	20.0 to 35.0	0.73 to 1.17	1.00 to 1.46	on finger margin	1
<i>scopulatus</i>	present	blade	15.0 to 30.0	0.73 to 1.50	1.29 to 2.50	on finger margin	0-1

Eremobates nodularis Muma

Figures 1 to 10

Eremobates nodularis Muma, 1951, p. 69 (male); Muma, 1963, p. 6 (female).

Eremobates hessei (Roewer), Muma, 1970, p. 18; not Roewer, 1934, p. 563.

(misplacement)

TYPES: Males holotype from Carlsbad, NM, in AMNH. Female allotype from Portal, Cochise, County, Arizona, also in AMNH.

DIAGNOSIS: Males distinguished by 2 short, flat ctenidia; on most specimens lengths of ctenidia less than 1/2, many less than 1/4, and only 2 ctenidia equal to 1/2 width of succeeding abdominal sternite. Roewer's *guenini* has no ctenidia, males of *hessei* (Roewer) are unknown, and males of an undescribed Mexican species have 4 ctenidia.

Females distinguished by broad anterior and posterior lobes of opercula, and presence of 2 intermediate teeth between medial and anterior teeth of fixed cheliceral finger. Type of *hessei* has narrower anterior lobes of opercula and only 1 intermediate tooth between medial and anterior teeth of fixed cheliceral finger, females of *guenini* are unknown.

DESCRIPTION: Species basically pale to dusty yellow in color with dark purplish markings. Palpi pale with occasional specimens darker yellow or faintly dusky on tarsi or metatarsal tips and tarsi (fig. 10). Legs pale. Propeltidia pale with dark anterior margins (fig. 2); occasional specimens have anterior third of propeltidia dusky. Four specimens from southeastern Arizona have entire propeltidia dusky (fig. 3). Abdominal terga dark with pleura dark or at least dark adjacent to terga, causing abdomen to appear annulate, sterna pale.

Males (18) highly variable in size; CP varies from 7.3-13.0 (mean 10.3). Legs short; A/CP varies from 4.9-5.8 (mean 5.3). Fondal notches deeper than wide varying in L/W ratio from 1.2-1.8 (mean 1.4) (fig. 1). Short ctenidia varying in number from 0-3 (mean 2.0) (fig. 4). Males with no mesal tooth on movable cheliceral finger.

Females (10) also highly variable in size. CP varies from 7.0-13.0 (mean 9.8). Legs short; A/CP varies from 4.2-5.4 (mean 4.9). Females either have no mesal tooth or a small indistinctly peaked mesal ridge on movable cheliceral finger, (figs. 5, 7, 8). Opercula with broad anterior lobes occasionally enlarged apically; opercular notches occupying 34-47% of opercula (mean 38) (figs. 6-9).

DISTRIBUTION: Species ranges from southwestern Texas through southern New Mexico and southern Arizona to San Diego in southern California. We have had numerous males and females to evaluate. See Plate XIX.

REMARKS: This is the widest ranging species of the *palpisetulosus* group. It is also quite variable in size, morphology, and coloration. For these reasons it is possible that 2 or more species are still confused under this name. For example: some males from Arizona are small and dark in color but otherwise are characteristic of the species; some have no abdominal ctenidia but otherwise seem to be conspecific. Also some females have only 1 intermediate tooth between the medial and anterior teeth of fixed

cheliceral finger but have opercula typical for species; and an occasional female will have no trace ctenidia but otherwise will be conspecific. This problem cannot be resolved at this time. Additional study specimens must be collected from further study.

Another anomaly has to do with apparent sympatry of this species with other species of the *palpisetulosus* species-group. Throughout its geographic range it coexists with at least 1 or 2 other species of the group. However, it is probable that this species is seasonally isolated from other members of the group, as shown by Muma (1979) for southwestern New Mexico. In that publication *E. nodularis* was referred to as *Eremobates hessei* (Roewer). Males of this species mature in July, and females in August in southwestern New Mexico.

We have resurrected this species from synonymy with *hessei*, Muma (1970), on the bases of minor differences in the female opercula and chelicerae, and until males of *hessei* have been collected for comparison with known males of *nodularis*.

Palpisetulosus Series

DIAGNOSIS: Males without palpal scopula; with dorsal process of fixed cheliceral finger a posteriorly elevated elongate ridge that occupies 25-35% of finger length; basal intermediate tooth of movable cheliceral finger located in basal angle of principal tooth with dorsal margin of finger; fondal notch nearly as wide as or wider than width of base of fixed cheliceral finger and as wide as long or slightly to distinctly longer than wide; a distinct (2) small to large mesal tooth on movable cheliceral finger and an anterior tooth of movable cheliceral finger composed of a more or less basally flattened ridge and apical conical process. Females with opercula typical of group, varying from 1.5-1.8 times wider than long, with opercular notch occupying from 17-51% of opercular area, and anterior opercular lobes tapered to a rounded distal point. Vulvular opening transverse, narrow to wide, and lies in posterior half of notch with fold extending to nearly posterior margin of opercula.

REMARKS: There are 8 known species of this series. They are restricted to western Texas, Colorado, Kansas, Nebraska, Oklahoma, New Mexico, southeastern Utah, and eastern Arizona. Three species, *palpisetulosus*, *marathoni* and *bantai*, are previously described. Five species are new, *bajadae*, *kiseri*, *norrissi*, *texanus*, and *polhemusi*.

Males of 3 of the species, *marathoni*, *bajadae*, and *texanus*, are large; 2, *bantai* and *norrissi* are small; and 3, *palpisetulosus*, *kiseri*, and *polhemusi* are moderate and nearly equal in size. Excluding the abdomens, *palpisetulosus*, *bajadae*, *marathoni*, *kiseri*, and *texanus* have males larger than females; *bantai* and *norrissi* have females larger than males.

The species of this series also may be categorized on the bases of both male and female characters, but the resulting groups are not parallel. Males of *palpisetulosus*, *bajadae*, *marathoni* and *polhemusi* have the peak of the dorsal process of the fixed cheliceral finger occurring over the distal half of the fondal notch; those of *norrissi*, *kiseri*,

texanus, and *bantai* have the peak over the basal half. Females of *palpisetulosus*, *bantai*, and *kiseri* have the vulvular openings narrow and crescentic; those of *bajadae*, *marathoni*, *norrisi*, and *texanus* have the openings wide and bowed. Females of *polhemusi* are presently unknown.

Known species are identified in the following tabular key to males (Table 2).

Eremobates palpisetulosus Fichter
Figures 11 to 20

Eremobates palpisetulosus Fichter, 1941, p. 179 (male): Muma, 1951, p. 61: Muma, 1970, p. 20. (males and females)

TYPES: Male cotype (syntype) from Sidney, Nebraska, July 9, 1939 (J.C. Swinbank), in AMNH; and the other from Harrisburg, Nebr., June 16, 1939 (V.C. Jacobson), in Dept. Ent., Univ. Nebr.

DIAGNOSIS: Males distinguished by long slender ctenidia ranging between 2-5 in number; anterior tooth of movable cheliceral finger conical, associated with a posteriorly extended low obscure ridge, and a laterally distinct ventral notch on movable cheliceral finger. Dorsal process of fixed cheliceral finger peaked over distal half of the fondal notch. Only 1 of 9 specimens examined had 5 ctenidia, the others had either 2 or 4.

Females distinguished by slender mesally dentate or uniformly tapered anterior lobes of opercula, concave lateral margins of posterior opercular notch and narrow crescentic vulvular openings.

DESCRIPTION: Species pale to rusty yellow in color with following dark purplish markings. Palpi pale to faintly dusky from apical end of femora distally; dusky to dark on tarsi and apical 1/4-1/2 of metatarsi (fig. 20). Legs pale with at most unions of femora and tibiae of legs III and IV faintly dusky. Propeltidia dark along anterior margin (fig. 12), with some specimens lightly dusky over anterior 1/3 to all of sclerite with a narrow pale median stripe (fig. 13). Female propeltidia are dark along anterior margin but not or only faintly dusky otherwise. Mesopeltidia, metapeltidia, and abdominal terga dusky to dark with pleura paler to pale. Sterna pale.

Males (9) somewhat variable in size; CP varies in size from 10.0-12.3 (mean 11.2). Legs shorter than usual for males of series. A/CP varies from 5.8-6.2 (mean 5.9). Fondal notches longer than wide but just average for series; length/width ratio varies from 1.1-1.5 (mean 1.4) (fig. 11). Ctenidia long and slender varying from 2-5 (mean 3) (figs. 14-15). Males have a small to medium sized mesal tooth on movable cheliceral finger; mode medium sized.

Females (8) quite variable in size; CP varies from 8.3-12.5 (mean 11.0). Legs shorter than those of other females of series; A/CP varies from 4.8-5.3 (mean 5.0). Females have indistinct to medium sized mesal tooth on movable cheliceral finger (figs. 16-17); mode small. Opercular notches smallest for this series, varying from 21-37% (mean 27) (figs. 18-19) of the opercula.

DISTRIBUTION: This species was described from western Nebraska. It is now known from Nebraska, Colorado, Kansas, Oklahoma, and extreme northern Texas.

Table 2. Tabular key to males of the *palpisetulosus* series of the *palpisetulosus* species-group of *Eremobates* Banks in the United States.

Species and Palpal Coloration	Position Peak Dorsal Process Mean (x)	Form Anterior Tooth Movable Finger	Fondal Notch L/W Ratio Mean (x)	Number Ctenidia Mean (x)	CP Mean (x)
<i>palpisetulosus</i> Fichter Palpi dark apically	Distal 1/2	Low Ridge + Cone	1.34	3.0	11.2
<i>bajadae</i> new species Palpi pale apically	Distal 1/2	Round Ridge + Cone	1.46	0.06	12.1
<i>marathomi</i> Muma Palpi dark apically	Distal 1/2	Round Ridge + Cone	1.64	2.3	12.3
<i>polhemusi</i> new species Palpi dark apically	Distal 1/2	Indistinct Ridge	1.16	0.0	11.8
<i>norrissi</i> new species Palpi pale to dusky apically	Basal 1/2	Low Ridge + Cone	1.10	4.0	10.7
<i>kiseri</i> new species Palpi dusky apically	Basal 1/2	Low Ridge + Cone	1.32	2.4	11.1
<i>texanus</i> new species Palpi dark to dusky apically	Basal 1/2	Round Ridge + Cone	1.87	3.3	12.8
<i>bantai</i> Brookhart Palpi dark apically	Basal 1/2	Low Ridge + Cone	1.48	1.7	9.7

We have examined 15 males and 18 females. Muma's (1951) records from south and southwest Texas, and southern Arizona are suspect. See Plate XIX.

REMARKS: This species has a great number of affinities with *kiseri*, as stated under that species. The 2 could well prove to be synonyms but for the present they are maintained separately because of differences in position of the dorsal process of the male fixed cheliceral finger, male ctenidia, and female opercular notch and coloration.

Muma's (1951) description and figures of this species are reasonably accurate, except for his figure 79 of the opercula, which does not delineate the vulvular opening adequately.

According to our records males mature in May and June, and females in June and July.

Eremobates bajadae Muma and Brookhart new species

Figures 21 to 24

TYPES: Male holotype and female allotype collected in can traps in a *Larrea* thicket, June 1, 1973, north of Deming, NM by M. H. Muma and K. E. Muma, in FSCA.

DIAGNOSIS: Males distinguished by lack of ctenidia, rounded elements of anterior tooth of movable cheliceral finger, and laterally obscure ventral notch of movable cheliceral finger. Of many specimens examined casually and 17 examined closely only 1 had a single tiny (trace) ctenidium. Ventral notch of movable finger always obscure from ecto-lateral view, although it becomes distinct if chelicera is rotated ventrally. Dorsal process of fixed cheliceral finger peaked over distal half of fondal notch.

Females distinguished by apically, broadly rounded, anterior lobes of opercula, concave lateral margins of posterior opercular notch, and the wide, bowed vulvular opening.

DESCRIPTION: Species pale to dark, dusty yellow in color with dark purplish markings. Palpi pale with many specimens faintly dusky on tarsi or tarsi and metatarsal tips. Legs pale with rare specimens dusky at femoral-tibial union of leg IV. Propeltidia dark on anterior margins with some specimens also faintly to distinctly dusky on anterior 1/3 (fig. 22), to all of sclerite with narrow pale stripe; a few specimens also have median, longitudinal, pale, oval area behind eyes. Population at Portal, Arizona frequently has the propeltidia dusky for 1/3 to all of the sclerite and the legs and palpi with dusky areas. Abdominal terga dusky to dark with pleura pale to dusky. Sterna pale. Many females lack dusky areas on propeltidia.

Males (17) somewhat variable in size; CP varies from 10.0-13.8 (mean 12.1). Legs long; A/CP varies from 6.3-6.9 (mean 6.6). Fondal notches longer than wide varying in length/width ratio from 1.3-1.9 (mean 1.7) (fig. 21). Males have small to medium sized mesal tooth on movable cheliceral finger; mode medium sized.

Females (15) more variable in size; CP varies from 9.8-15.3 (mean 11.6). Legs short; A/CP varies from 4.9-5.6 (mean 5.3). Females have small or medium sized mesal tooth on movable cheliceral finger; mode small. Opercula with anterior lobes undulate or

concave mesally; opercular notches occupying 21-51% of opercula (mean 31) (figs. 23-24). Opercular notches with straight or concave lateral margins.

DISTRIBUTION: This species is known only from western New Mexico and eastern Arizona. We have examined and studied numerous males and females from Portal and Douglas, Arizona and Rodeo, Road Forks, Lordsburg, Deming and Silver City, New Mexico.

REMARKS: This species has no known close relatives within the group and series. It is nearly as large as *marathoni* Muma with a deep narrow fondal notch but lacks the markings and ctenidia of that species.

There are indications that this species hybridizes with *norrisi* new species. See remarks under that species for maturity dates.

Eremobates marathoni Muma
Figures 25 to 29

Eremobates marathoni Muma, 1951, p. 63; Muma, 1970, p. 18. (males).

TYPES: Male holotype from Marathon, Texas, in AMNH. Female allotype from 6 mi. s. of Nueva Laredo, Mexico, 10-VII-66, at night on desert by R. E. Woodruff, in FSCA.

DIAGNOSIS: Males distinguished by their 2 short, seta-like ctenidia which range from 0-4 in number, long narrow fondal notch, and obscurely to distinctly cleft anterior tooth. Dorsal process of fixed cheliceral finger peaked over distal half of fondal notch.

Females distinguished by slender tapered anterior lobes of opercula, anteriorly concave but posteriorly convex lateral margins of posterior opercular notch and wide, bowed, vulvular opening.

DESCRIPTION: This species pale to dark yellow in color with following dark purplish markings. Palpi pale with tip to 1/2 of metatarsi and all of tarsi dark (fig. 29); specimens from extreme south Texas often have the dark areas dusky. Legs pale with occasional specimens having unions of femora and tibiae of legs III and IV lightly dusky; rare specimens have all of tibiae and distal 1/3 of femora dusky. Propeltidia dark along anterior margins. Mesopeltidia, metapeltidia, and abdominal terga faintly dusky to dark with pleura paler to pale. Sterna pale.

Males (8) quite variable in size; CP varies from 11.8-13.3 (mean 12.5). Legs long; A/CP varies from 6.2-6.5 (mean 6.4). Fondal notches longer than wide varying in length/width ratio from 1.4-2.2 (mean 1.6) (figs. 25-26). Ctenidia short and seta-like varying from 0-4 (mean 2.3, mode 2) (fig. 27). Males have small to large mesal tooth on movable cheliceral finger; mode medium sized.

Female allotype: CP 11.88. Legs short; A/CP is 5.0. Medium sized mesal tooth on movable cheliceral finger. Opercula with slender anterior lobes, and opercular notch occupying 46% of opercula (fig. 28).

DISTRIBUTION: This species ranges from Alpine to Laredo in southern Texas and into Mexico. We have examined 13 males from Texas and Mexico; the female allotype is from Laredo, Mexico.

REMARKS: This is among the largest of the *palpisetulosus* series. It has affinities with *texanus* and *bajadae*. This species is slightly smaller than *texanus* with longer legs in both sexes and the female opercula differs in attenuation and length of the anterior lobes and form of the vulvular opening. It is similar to *bajadae* in size but males of that species lack ctenidia, female opercula differ in form of the notch, and *E. marathoni* has dark palpal tips.

It is unfortunate that the type of this species, selected by Muma (1951), had a distinctly cleft anterior tooth on the movable cheliceral finger as shown in fig. 80 of that publication and fig. 26 here. Most males do not have a cleft anterior tooth.

The limited collection records for this species indicate maturity during May, June, and July.

Eremobates norrisi Muma and Brookhart new species

Figures 20 to 34

TYPES: Male holotype in a house in the pinyon pine-juniper association north of Silver City, New Mexico, March 9, 1972, M. H. Muma, and female allotype in the pinyon pine-juniper association north of Silver City, New Mexico, May 2, 1972, M. H. Muma, both deposited in FSCA.

DIAGNOSIS: Males distinguished by striking cheliceral profile, pale coloration, short fondal notch and long slender legs. Ventral notch of movable cheliceral finger very distinct in lateral view. Species with shortest fondal notch of any species of series. Dorsal process of fixed cheliceral finger peaked over basal half of fondal notch.

Females distinguished by pale coloration, abruptly tapered anterior lobes of the opercula, the anteriorly convex and posteriorly concave lateral margins of posterior opercular notch and wide bowed vulvular opening.

DESCRIPTION: Species pale to dusty yellow in color with following dark purplish markings. Palpi pale to faintly dusky on metatarsal tips and tarsi. Legs pale with rare specimens faintly dusky on unions of femora and tibiae of leg IV. Propeltidia dark along anterior margin with occasional specimens dusky on anterior 1/3 of sclerite (fig. 33). Mesopeltidia, metapeltidia, and abdominal terga dark to dusky with pleura either dusky, paler or pale. Sterna pale.

Males (11) somewhat variable in size; CP varies from 9.5-12.3 (mean 10.7). Legs long; A/CP varies from 5.9-7.22 (mean 6.7). Fondal notches nearly equal in length and width; length/width ratio varies from 0.8-1.3 (mean 1.0) (fig. 34). Males have small to medium sized mesal tooth on movable cheliceral finger; mode small.

Females (12) are quite variable in size. CP varies from 9.0-13.3 (mean 11.5). Legs short; A/CP varies from 4.9-5.6 (mean 5.2). Females have indistinct to medium sized mesal tooth on movable cheliceral finger; mode small. Opercula with anterior lobes lobate, dentate or uniformly tapered mesally; opercular notches occupying 30-43% of opercula (mean 37) (figs. 31-32).

DISTRIBUTION: This species is known from southeastern Colorado, southwestern New Mexico, and Pecos, Texas. It is probably distributed through southwestern Texas

and southern New Mexico into southeastern Arizona. We have examined and studied numerous males and females from southern New Mexico. See Plate XIX.

REMARKS: This species has no known close relatives within the group and series. It is nearly as small as *bantai* but differs from that species in proportions of the male fondal notch, number of male ctenidia, profile of male chelicerae, and form of female opercula.

There are indications that this species hybridizes occasionally with *bajadae*. Specimens with combined characteristics of the two species are collected. The two species appear to be sympatric in certain areas; but *norrissi* (n.sp. #1 Muma, 1979), lives primarily in pinyon-juniper plant association and matures in March (new records), April and May, whereas *bajadae* (n. sp. #2 Muma, 1979) lives primarily in grassland communities and matures in May, June, and July. Our records show that *norrissi* was 4 times as abundant as *bajadae* in pinyon-juniper associations, whereas in most arid grassland associations *bajadae* was 4 to 5 times as abundant as *norrissi*. Only at the Lordsburg population study plot, a grassland association, was the population of *norrissi* nearly 1/2 that of *bajadae*. This, as stated by Muma (1979), may have been the result of the location of the plot, adjacent to the Burro Mountains. The phenomenon was probably intensified by large populations of *norrissi* during 1974, 1975, and 1976. All suspected hybrids were collected during May and June of those years.

Eremobates kiseri Muma and Brookhart new species
Figures 35 to 39

TYPES: Male holotype from Turkey, Texas, 21 May 1970, D. Kiser and female allotype from 6 mi. S.E. of Turkey, Texas, 4 June 1970, D. Kiser, in FSCA.

DIAGNOSIS: Males distinguished by their short slender ctenidia which range from 2-5 in number, frequent absence of anterior intermediate tooth of movable cheliceral finger, and laterally distinct ventral notch of the movable cheliceral finger. Most specimens examined had only 2-3 short ctenidia; 1 had 2 long ctenidia and 1 had 5 long ctenidia. Dorsal process of fixed cheliceral finger peaked over basal half of fondal notch.

Females distinguished by abruptly tapered anterior lobes of the opercula, convex lateral margins of posterior opercular notch and narrow, crescentic vulvular opening.

DESCRIPTION: Most specimens examined had been darkened by inadequate preservation but the species apparently is pale to dusky yellow in color with the following dark purplish markings. Palpi pale with distal 1/3-2/3 of metatarsi and all of tarsi dusky to darker. Legs pale with little or no dusky markings. Propeltidia dark along anterior margin with occasional specimens also lightly dusky on anterior 1/3 to all of sclerite; some specimens also have a narrow pale median stripe as on *palpisetulosus* (fig. 350). Mesopeltidia, metapeltidia, and abdominal terga dark; pleura pale. Sterna pale.

Males (10) quite variable in size; CP varies from 8.8-13.0 (mean 11.1). Legs moderate in length; A/CP varies from 5.8-6.2 (mean 6.0). Fondal notches longer than wide, varying in length/width ratio from 1.3-1.7 (mean 1.4) (fig. 36). Ctenidia short and slender, varying from 2 to 5 (mean 2.4) (fig. 37). Males have a small to medium sized mesal tooth on movable cheliceral finger; mode medium sized.

Females (11) also variable in size; CP varies from 9.3-12.5 (mean 11.0). Legs short; A/CP varies from 5.0-5.2 (mean 5.1). Females have an indistinct to medium sized mesal tooth on movable cheliceral finger; mode small. Opercula with anterior lobes undulate mesally; opercular notches occupying 30-47% of opercula (mean 37) (figs. 38-39).

DISTRIBUTION: This species is presently known only from Turkey, Texas from which we have examined 13 males and 11 females.

REMARKS: This species has affinities with 2 other species of this series. It is similar in coloration, size and general morphology to *palpisetulosus* from which it differs in location of the peak of the dorsal process of the fixed finger; size of male ctenidia, and form of the female opercula. It is also similar to *norrisi* but differs from that species in size of male ctenidia, profile of male chelicera, fondal notch ratio, A/CP, and form of the female vulvular opening.

Collection records indicate maturity during May and June.

Eremobates texanus Muma and Brookhart new species
Figures 40 to 43

TYPES: Male holotype, running at night 12 mi. E of Van Horn, Texas, July 4, 1965, Martin H. Muma; female allotype, running at night, 12 mi. east of Van Horn, Texas, July 3, 1965, Martin H. Muma, both in FSCA.

DIAGNOSIS: Males distinguished by 4 distinct slender ctenidia that are about half as long as succeeding abdominal sternite, a long slender fondal notch, and distinct ventral notch of movable cheliceral finger visible from ecto-lateral view. This species has the longest fondal notch of any species of series. It is also largest species of series. Dorsal process of fixed cheliceral finger peaked over basal half of fondal notch.

Females distinguished by slender, mesally undulate, anterior lobes of the opercula, concave-convex lateral margins of posterior opercular notch, and wide, bowed vulvular openings.

DESCRIPTION: Species pale to dark yellow with pale to dark purplish markings. Palpi commonly pale with tarsi and 1/3-2/3 of metatarsi dusky to dark; occasional specimens will have dark areas dusky, and rare specimens have tibiae and femoral tips dusky. Legs pale with unions of femora and tibiae faintly to distinctly dusky on legs III and IV. Propeltidia dark along anterior margin and dusky on anterior half to all of sclerite with narrow pale median stripe. Mesopeltidia, metapeltidia, and abdominal terga dusky to dark with abdominal pleura pale or lightly dusky. Sterna pale.

Males (6) variable in size; CP varies from 11.2-14.5 (mean 12.8). Legs long; A/CP varies from 6.2-6.5 (mean 6.4). Fondal notches much longer than wide, varying from

1.5-2.0 (mean 1.8) (fig. 40). Ctenidia varying in number from 2-4 (mean 3.3, mode 4), and short and slender (fig. 41). Males have small to medium sized mesal tooth on movable cheliceral finger; mode medium sized.

Females (5) also variable in size; CP varies from 10.3-14.0 (mean 11.8). Legs short; A/CP varies from 5.0-5.7 (mean 5.5). Females have small to medium sized mesal tooth on movable cheliceral finger; mode small. Opercula with elongate, slender, mesally undulate, anterior lobes; opercular notches occupying 17-46% of opercular area (mean 30) (figs. 42-43).

DISTRIBUTION: This species is known only from Alpine and Van Horn in western Texas. We have seen and studied 6 males and 6 females from this area, collected from April through July. See Plate XIX.

REMARKS: This species may easily be confused with *E. marathoni*. Early in this study, we had the two species combined. The male cheliceral profiles of this species and typical males of *marathoni* are very similar, primarily differing in the position of the peak of fixed finger, dorsal process. Both species are large and have relatively long legs. Male ctenidia of both species are short and variable in number, but much more distinct on this species. However, ranges of the two species are separate, although adjacent; *marathoni* has not been recorded west of Alpine, Texas and *texasus* is known only from Alpine west.

Eremobates bantai Brookhart

Figures 44 to 49

Eremobates bantai Brookhart, 1965, p. 153; Muma, 1970, p. 16. (males and females).

TYPES: Male holotype from Phantom Canyon, Fremont Co., Colo. June 24, 1964, in the AMNH. Female allotype from same locality, June 30, 1964, also in AMNH.

DIAGNOSIS: Males distinguished by 2 long flat ctenidia, frequent lack of anterior intermediate tooth, and laterally distinct ventral notch of movable cheliceral finger. One of 5 specimens examined apparently lacked ctenidia; one specimen also had an anterior intermediate tooth on movable cheliceral finger. The ventral notch of movable cheliceral finger always distinct from ecto-lateral view and becomes more distinct if chelicera is rotated ventrally. Dorsal process of fixed finger peaked over basal half of fondal notch.

Females distinguished by apically, narrowly rounded anterior lobes of opercula, angular straight or lightly concave lateral margins of posterior opercular notch, and narrow, weakly crescentic, vulvular opening.

DESCRIPTION: Species pale to dark yellow in color with following dark purplish marking. Palpi pale with dark metatarsal tips and tarsi (fig. 44). Legs pale with legs III and IV frequently dusky at femoral-tibial unions. Propeltidia dusky along anterior

margin (fig. 45); one female had this sclerite faintly dusky behind eyes. Mesopeltidia, metapeltidia, and abdominal terga dark with pleura pale. Sterna pale.

Males (6) somewhat variable in size; CP varies from 8.8-10.3 (mean 9.7). Legs long; A/CP varies from 6.1-6.6 (mean 6.4). Fondal notches longer than wide varying in length/width ratio from 1.1-1.7 (mean 1.4) (fig. 46). Ctenidia long and flat, varying in number from 1-2 (mean 1.7) (fig. 47). Three specimens had ctenidia longer than 1/2 width of succeeding abdominal segment, 1 had ctenidia shorter than 1/2 the width. Males have a small to medium sized mesal tooth on the movable cheliceral finger.

Females (8) also somewhat variable in size; CP varies from 10-12.8 (mean 11.2). Legs short; A/CP varies from 4.6-5.3 (mean 5.1). Females have either an indistinct or small mesal tooth on movable cheliceral finger; mode small. Opercula with anterior lobes toothed or undulate mesally; opercular notches occupying 35-45% of opercula (mean 39) (figs. 48-49).

DISTRIBUTION: This species known only from several localities in southcentral Colorado. We have studied 6 males and 8 females collected during June and July.

REMARKS: This species has no known close relatives within the group and series.

Eremobates polhemusi Muma and Brookhart new species
Figures 50 to 52

TYPES: Male holotype, "attracted to black light", Mesa, Grand Flat, nr. Hall's Crossing, San Juan Co., Utah on June 4, 1978 by J. T. and D. A. Polhemus, deposited in AMNH.

DIAGNOSIS: Type distinguished by pale coloration; lack of abdominal ctenidia; lack of a conical process on low, indistinct, ridge-like anterior tooth of movable cheliceral finger; and laterally obscure ventral notch of movable cheliceral finger. Dorsal process of fixed cheliceral finger peaked over distal half of fondal notch.

DESCRIPTION: Species pale to dark yellow in color with dusky purplish markings. Palpi pale becoming darker yellow on metatarsal tips and tarsi (fig. 50). Legs pale becoming darker yellow on the femora and tibiae, especially at union of two segments. Propeltidium dark along anterior margin and lightly dusky medially to just behind ocular tubercle (fig. 51). Mesopeltidium, metapeltidium, and abdominal terga dusky with pleura pale. Sterna pale.

Holotype has CP 11.75 long. Legs long; A/CP 6.68. Fondal notch longer than wide by a ratio of 1.40. There is an elevated but small mesal tooth; series typical low ridge-like anterior tooth lacks anterior conical process and ventral notch of movable cheliceral finger is obscure when viewed laterally but distinct when finger is rotated ventrally (fig. 52).

DISTRIBUTION: This species is known only from the type locality in extreme southeastern Utah.

REMARKS: Species has no known close relatives within group and series. It is a moderately large species but lacks conical process on low, ridge-like anterior tooth of

male movable cheliceral finger that is present on all other species of this series.

Ajoanus Series

DIAGNOSIS: Males without palpal scopula. Males with dorsal process of fixed cheliceral finger a short posteriorly elevated spur in lateral view; posterior intermediate tooth of movable cheliceral finger located at base of principal tooth but not in angle of tooth with dorsal margin of finger; fondal notch nearly as wide as base of fixed cheliceral finger and slightly longer than wide; variable sized (2) mesal tooth; and anterior tooth of movable cheliceral finger modified into a low or indistinctly rounded bilobed process.

Females have opercula typical of group, about 1.5 times wider than long, with opercular notch occupying 29-38% of opercular area, anterior opercular lobes tapered to rounded distal point, and wide, bowed, vulvular openings located near posterior margin of opercula.

REMARKS: There are 3 known species of this series. They are presently seemingly restricted to southern and western Arizona. Two are previously undescribed species.

They are all small to moderate sized species, and in general the males have longer legs than those of the *palpisetulosus* series. They are identified in the following tabular key to males (Table 3).

Eremobates ajoanus Muma and Brookhart new species Figures 53 to 58

TYPES: Male holotype at night lights, Child's Ranch, 4.5 mi. south of Ajo, Arizona along Highway 85, June 3, 1975, and female allotype at night lights, 1.2 miles north of Organ Pipe National Monument along Highway 85, June 3, 1975, J. O. Brookhart and M. H. Muma, both deposited in FSCA.

DIAGNOSIS: Males distinguished by tiny triangular dorsal-ectal spur on fixed cheliceral finger; irregular rounded or indistinctly lobed anterior process on movable cheliceral finger; no ctenidia; and palpi dark apically on metatarsi and all of tarsi. Dorsal process of fixed cheliceral finger peaked over distal end of fondal notch.

Females distinguished by mesally undulate anterior lobes of opercula, and anteriorly concave and posteriorly convex lateral margins of small posterior opercular notch. Vulvular opening located essentially at posterior end of opercular area.

DESCRIPTION: Species pale to dark yellow in color with dark purplish markings as follows. Palpi yellow basally to dark yellow distally with distal 1/4-1/2 of metatarsi and all of tarsi dark (fig. 53). Legs pale yellow basally to yellow distally with femoral-tibial unions lightly dusky on legs IV, III and sometimes II (fig. 53). Propeltidia dark along anterior margin, lightly dusky throughout with wide marginal posterior pale area, pale transverse ovate area on each side of eyes, large pale longitudinal ovate area behind

Table 3. Tabular key to males of the *ajoanus* series of the *palpisetulosus* species-group of *Eremobates* Banks in the United States

Species and Palpal Coloration	Position Peak Dorsal Process Mean (x)	Form Anterior Tooth Movable Finger	Finger/Notch Width Ratio Mean (x)	Fondal Notch L/W Ratio Mean (x)	CP Mean (x)
<i>ajoanus</i> new species Palpi dark apically	Distal 1/3	Not or weakly bilobed	1.09	1.44	10.9
<i>bixleri</i> new species Palpi dark apically	Distal 1/4	Notched	1.22	1.51	10.1
<i>affinis</i> (Kraepelin) Palpi pale apically	About 1/2	Bilobed	1.08	0.91	10.0

eyes, and narrow yellow longitudinal stripe extending from eye tubercle to posterior margin (fig. 54). Mesopeltidia, metapeltidia, and abdominal terga dusky to dark with pleura paler to pale. Sterna pale.

Males (6) somewhat variable in size; CP varies from 9.5-12.8 (mean 10.9). Legs long; A/CP varies from 6.4-7.2 (mean 6.9). Fondal notch slightly longer than wide with length/width ratio varying from 1.1-1.5 (mean 1.4) (fig. 55). No ctenidia. Mesal tooth on movable cheliceral finger varies from medium sized to large with mode medium sized.

Females (6) also somewhat variable in size; CP varies from 10.8-13.0 (mean 11.88). Legs short; A/CP varies from 5.6-5.9 (mean 5.7). Mesal tooth on movable cheliceral finger varies from small to medium sized with mode medium sized (figs. 56-57). Opercula 1.5 times wider than long; opercular notch occupies 29-38% of the opercula (mean 33) (fig. 58).

DISTRIBUTION: We have examined 8 males and 7 females of this species from the Organ Pipe Cactus National Monument, Ajo, and Gila Bend area of Arizona. All of our specimens were collected during June. The species probably ranges from south-central through southwestern Arizona. See Plate XIX.

REMARKS: This species and *bixleri* are either very closely related or synonyms; until more specimens of the latter are available for study we maintain them separately.

Eremobates bixleri Muma and Brookhart new species
Figures 59 and 60

TYPES: Male holotype from Pima Co., Tucson, Arizona, April 30, 1968, David E. Bixler, deposited in FSCA.

DIAGNOSIS: Males distinguished by tiny triangular dorso-ectal spur on fixed cheliceral finger; rounded, but apically notched process on movable cheliceral finger; no ctenidia; palpi dusky on metatarsal tips and all of tarsi. Dorsal process of fixed cheliceral finger peaked over distal half of fondal notch.

Females known from a single badly fragmented, previously dehydrated specimen from Tucson, Arizona.

DESCRIPTION: Species pale to dusty yellow in color with dusky purplish markings as follows. Palpi pale yellow basally to dusty yellow distally with distal 1/4 of metatarsi and all of tarsi dusky. Legs pale yellow with femoral-tibial union of leg IV dusty yellow to dusky. Propeltidia dark along anterior margin with dusky marking and pale area as on *ajoanus*. Mesopeltidia, metapeltidia, and abdominal terga dusky with pleura pale. Sterna pale.

Males (3) relatively uniform in size; CP varies from 9.1-10.6 (mean 10.1). Legs long; A/CP varies from 6.4-6.9 (mean 6.7). Fondal notches slightly longer than wide; length/width ratio was same for all 3 specimens, 1.3 (fig. 59). No ctenidia. Mesal tooth on movable cheliceral finger varies from small to large; mode small.

Single female designated here too badly dessicated and fragmented to permit accurate description; opercula (fig. 60).

DISTRIBUTION: All 3 of our male study specimens and the single female from Tucson, Arizona, collected between April 20 and June 2. See Plate XIX.

REMARKS: Paler coloration, pale, less distinct markings, and distinctly notched anterior process on movable cheliceral finger presently distinguish this species from *ajoanus*. Ventral notch of movable cheliceral finger completely obscured from a lateral view for this species, and may also prove diagnostic.

Eremobates affinis (Kraepelin)
Figures 61 to 63

Datames affinis Kraepelin, 1899, p. 242. (male and female)

Eremobates affinis, Kraepelin, 1901, p. 128 (not *E. affinis* (Kraepelin) Muma, 1951, p. 65); Muma, 1970, p. 14. (male and female)

Eremoperna affinis (Kraepelin), Roewer, 1934, p. 558.

TYPES: Male and female types from Arizona (Arkansas?), no locality, No. 7297, Roewer No. 9129, supposedly deposited in MNHN are actually in ZSM. These specimens agree with Kraepelin's (1899) description and are therefore the types of the species. Those in MNHN (Muma 1970) are not the types.

DIAGNOSIS: Males distinguished by small, low, rounded dorsal spur on fixed cheliceral finger, closely grouped intermediate teeth and lack of distinct rounded anterior process on movable cheliceral finger, and lack of post-stigmatic abdominal ctenidia. Dorsal process of fixed cheliceral finger peaked in basal half of fondal notch.

Females distinguished by elongate, slender, anterior lobes of opercula, large concave-sided posterior notch of opercula, and wide, bowed, vulvular openings.

DESCRIPTION: Coloration pale to dark yellow with dusky purplish markings. Palpi pale to dark yellow on all segments. Legs pale to dark yellow on all segments. Propeltidia seemingly faintly dusky throughout. Mesopeltidium, metapeltidium, and abdominal terga faintly to distinctly dusky; pleura pale. Sterna pale.

Males (2) smallest of series; CP varies from 9.0-11.0 (mean 10.0). Legs moderate size; A/CP varies from 5.8-7.0 (mean 6.4). Fondal notches equal in width to base of fixed cheliceral finger; length/width ratio same for both males 0.9 (figs. 60-62). Mesal tooth of movable cheliceral finger small but distinct on type and small but indistinct on other male.

Female largest of series; CP 12.8. Legs shortest of series; A/CP 3.8. Mesal tooth of movable cheliceral finger small but distinct. Opercula 2.1 times wider than long with anterior lobes indistinct distally, and opercular notch with concave lateral margins but occupying 56% of opercula (fig. 63).

DISTRIBUTION: Types are known only from Arizona (certainly not Arkansas) with no locality recorded.

REMARKS: The above diagnoses and descriptions are based on Kraepelin's 1899 descriptions, pages 242 and 243, and figures 20a and 20b, and descriptive notes, computations, and illustrations of the types, made by the senior author in the late 1960's.

Until additional specimens of this species have been collected, there will continue to be questions concerning this species. Why are the male and female types in the ZSM when Kraepelin recorded them in the Simon collection? Where did the so labeled

paratypes come from since Kraepelin did not record them? Finally, where in Arizona is the species located? Muma (1970) erred in stating that the female in the ZSM was a specimen of *Eremorhax formidabilis* (Simon). He further erred in referring to an "abor-tive setal socket" on the male in the Simon collection and in stating that the specimens in the Simon collection agreed with Kraepelin's (1899) description.

Kraepelini Series

DIAGNOSIS: Males without palpal scopula. Males with dorsal process of fixed chelic-eral finger short to elongate elevated blade that is peaked over distal portion of fondal notch; posterior intermediate tooth of movable cheliceral finger located at base of or well removed from principal tooth; fondal notch as wide as to much narrower than base of fixed cheliceral finger and as wide as or wider than long; and anterior tooth of movable cheliceral finger that varies from indistinct to well elevated rounded process. Mesal tooth of movable finger indistinct (1).

Known females have opercula typical of group, about twice as wide as long, with opercular notch occupying 28-56% of opercular area, anterior opercular lobes either enlarged at distal ends, or greatly attenuated, and wide bowed vulvular openings.

REMARKS: There are 7 known species of the series. They are presently known from California, Nevada, Utah, Arizona, and questionably from northern New Mexico and Texas. Three are previously described, *kraepelini*, *gracilidens* and *titschacki*; 4 are described here, *pimanus*, *pallidus*, *pyriflora*, and *otavonae*.

All are small to moderate sized; 4 are moderate sized and pale and 2 are slightly smaller and well marked. Females of 3 species, *titschacki*, *kraepelini* and *otavonae*, have the anterior lobes of the opercula enlarged distally and 2, *gracilidens* and *pallidus* have these lobes greatly attenuated. The females of the other 2 species are unknown.

The known species are identified in the following tabular key to males (Table 4).

Eremobates pimanus Muma and Brookhart new species Figures 64 to 66

TYPES: Male holotype from Organ Pipe Cactus National Monument, Pima County, Arizona, August 31, 1961, D. C. Rentz, deposited in AMNH.

DIAGNOSIS: Males distinguished by enlarged mesal flange of mesoventral groove and large, elongate blade-like, dorsal process of fixed cheliceral finger that is peaked over basal half of fondal notch; lack of anterior process on movable cheliceral finger; and 2 long flattened abdominal ctenidia.

Females unknown.

DESCRIPTION: Coloration pale to dusty yellow with dusky purplish markings. Palpi pale to dusty yellow with the tarsi and 3/4-4/5 of metatarsi dark. Legs pale to dusty yellow. Propeltidium pale with anterior, lateral, and posterior margins dark to lightly dusky as on *ajoanus* (fig. 64). Mesopeltidium, metapeltidium, and abdominal terga

Table 4. Tabular key to males of the *kraepelini* series of the *palpisetulosus* species-group of *Eremobates* Banks in the United States.

Species and Palpal Coloration	Position Peak Dorsal Process Mean (x)	Form Anterior Tooth Movable Finger	Fondal Notch L/W Ratio Mean (x)	Number Ctenidia Mean (x)	CP Mean (x)
<i>pimannus</i> new species Palpi dark apically	Basal 1/3	None	0.91	2	9.6
<i>pallidus</i> new species Palpi pale	Distal end	Rounded lobe Indistinct	1.12	4	9.6
<i>gracilidens</i> Muma Palpi pale	Distal of	Rounded lobe	0.93	6-7	8.9
<i>pyriflora</i> new species Palpi pale	Distal 1/3	Rounded lobe	1.00	10	9.8
<i>kraepelini</i> Muma Palpi pale	Distal end at or near	Rounded lobe	1.04	4	9.6
<i>titschacki</i> (Roewer) Palpi dusky all segments	Distal 1/4	Rounded lobe Long	0.89	8	8.5
<i>otavonae</i> new species Palpi dusky all segments	Distal 1/4	Rounded lobe Short	0.85	9-10	8.8

dusky; pleura pale with lightly dusky anterior and posterior margins. Sterna pale.

Male moderate sized; CP 9.6. Legs long; A/CP 6.6. Fondal notch nearly as wide as long; length/width ratio 1.1, and with 2 slender teeth clearly visible in fondal notch from ectal view (fig. 65). Mesal tooth of movable cheliceral finger indistinct. Movable cheliceral finger distinctly sinuate from a dorsal or ventral view with posterior intermediate tooth located in basal angle of principal tooth and finger margin. There are 2 long flattened ctenidia that are nearly as long as width of succeeding sternite (fig. 66).

DISTRIBUTION: Known only from holotype from southwestern Arizona. See Plate XIX.

REMARKS: The unusual cheliceral structure and the late summer collection date cause us to include this species provisionally. It may be a Mexican species belonging to a different species-group of *Eremobates* Banks.

Eremobates pallidus Muma and Brookhart new species

Figures 67 to 71

TYPES: Male holotype collected with white light and sweep net at Pear Blossom, San Bernardino County, California, April 28, 1973, Lon Kincannon, deposited in AMNH. Four male paratypes and female allotype from Deep Canyon, Riverside County, California, April 1-2, 1973, in EDR.

DIAGNOSIS: Males distinguished by small, blade-like dorsal process peaked over distal end of fondal notch on fixed cheliceral finger which is nearly straight ectally; a smoothly rounded to weakly bilobed anterior process on movable cheliceral finger; a broad but distinct ventral notch on movable cheliceral finger; 4 long slender ctenidia.

Females distinguished by elongate, mesally undulate, anterior lobes of opercula, nearly straight lateral margins of posterior opercular notch, and wide bowed vulvular openings that extend to posterior margin of opercular area.

DESCRIPTION: Coloration pale to dusty yellow with dusky purplish markings. Palpi pale yellow basally on femora and dusty yellow distally on femora and other segments with tarsi and apical ends of metatarsi darker yellow. Legs pale to dusty yellow throughout. Propeltidium pale with dark to dusky anterior and lateral margins and faint submarginal posterior band (fig. 67). Abdominal terga dusky; pleura pale. Allotype more dusty yellow than pale yellow with abdominal terga and pleura both pale. Sterna pale.

Males (4) moderate sized; CP varying from 8.5-10.5 (mean 9.4). Legs long; A/CP varying from 6.9-7.4 (mean 7.3). Fondal notch slightly longer than wide; length/width ratio varying from 1.0-1.2 (mean 1.1) (fig. 68). Mesal tooth of movable finger indistinct. There are 3-5 (mean 4) long ctenidia (fig. 69).

Female allotype moderate sized; CP 11.0. Legs long; A/CP 7.1. Mesal tooth of movable cheliceral finger indistinct or missing. Opercula 1.6 times wider than long with anterior lobes elongate and undulate mesally; posterior opercular notch with straight or lightly

concave lateral margins and occupying about 30% of opercula (figs. 70-71).

DISTRIBUTION: Known from 8 males and 5 females from 2 localities in San Bernardino County and 3 localities in Riverside County, California, 3 males from Clark Co., Nevada, and 2 males from St. Grover, Utah.

REMARKS: Collection records indicate maturity in March and April.

Eremobates gracilidens Muma
Figures 72 to 76

Eremobates gracilidens Muma, 1951, p. 66; Muma, 1970, p. 17 (male).

TYPES: Male holotype from Twentynine Palms, California, March-April, 1945 (Jefferson H. Branch), in AMNH. Female allotype from 9 mi. w. Lone Pine, Inyo Co., CA, VII-19-61, at light, by P. D. Hurd and J. Powell, also in AMNH.

DIAGNOSIS: Males distinguished by blade-like to subtriangular process peaked distad of fondal notch of fixed cheliceral finger, the rounded anterior process on movable cheliceral finger, and at least 6 long ctenidia on the first post-stigmatic abdominal sternite.

Female allotype described here, distinguished by pale coloration; elongate anterior lobes of opercula; undulate mesal margins of opercular notch; and wide bowed, vulvular opening extending to posterior ends of posterior opercular lobes.

DESCRIPTION: Species pale yellow in color with dusky purplish markings. Palpi and legs pale on all segments. Propeltidia narrowly dusky along anterior margin and faintly dusky laterally (fig. 76). Mesopeltidia, metapeltidia, and abdominal terga pale to faintly dusky with pleura pale. Sterna pale.

Males (7) remarkably uniform in size; CP varies from 8.2-9.5 (mean 8.9). Legs long; A/CP varies from 7.1-7.7 (mean 7.3). Fondal notches slightly narrower than base of fixed finger and almost as long as wide; length/width ratio varies from 0.8-1.00 (mean 0.9) (fig. 72). No mesal tooth on movable cheliceral finger. Two males have slight indentation on rounded anterior lobe of movable cheliceral finger. Minimal number of ctenidia 6 (fig. 73), maximum 8 (mean 7); 2 or 3 specimens have spurious ctenidia.

Female allotype has CP of 10.8; legs short, A/CP 5.7. Mesal tooth of movable cheliceral finger is missing. Opercula 2.1 times wider than long; anterior lobes elongate but not enlarged distally; posterior opercular notch sinuate laterally and occupying 33% of opercula (figs. 74-75).

DISTRIBUTION: This species was described from Twentynine Palms, California and recorded from the Argus Mountains of Inyo County, California by Muma (1951). The female allotype is from Lone Pine, Inyo County, California. We have also examined 6 males and 1 female from Riverside County, 9 males and 2 females from San Bernardino County, and 1 female from Kern County in California. To date this species is known only from southern California. Our collection records indicate a long period of maturity, from March through July. See Plate XX.

Muma (1951) erroneously referred the Argus Mountains to Arizona.

REMARKS: The relationship of this species to others of the series must remain obscure until more females of other species are collected. It should be pointed out, however, that the opercula of this species are very similar to those of *spissus* new species, an apparently distantly related form.

Eremobates pyriflora Muma and Brookhart new species
Figures 77 and 78

TYPES: Male holotype from Pear Blossom, San Bernardino County, California, May 11, 1974, David E. Bixler, deposited in FSCA.

DIAGNOSIS: Male distinguished by blade-like or subtriangular dorsal process peaked above distal third of fondal notch of fixed cheliceral finger; fondal notch only slightly narrower than base of the fixed cheliceral finger and equal in length and width; intermediate teeth of movable cheliceral finger crowded between principal tooth and anterior lobe; 10 long slender ctenidia. Female unknown.

DESCRIPTION: Species pale yellow in color with only anterior margin of propeltidium lightly dusky purple, and with faint, indistinct, dusky markings on anterior 2/3 of sclerite. Palpi and legs pale. Mesopeltidia, metapeltidia, and abdominal terga lightly dusky purple, with pleura paler.

Male CP 9.8; A/CP 7.3; fondal notch length/width ratio 1.0 (fig. 77); indistinct mesal tooth; and 10 ctenidia (fig. 78).

DISTRIBUTION: This species is known only from San Bernardino County, California. See Plate XX.

REMARKS: Affinities with other species cannot be determined until females have been identified.

Eremobates kraepelini Muma
Figures 79 to 87

Eremobates mormonus (Roewer), Muma, 1951. p. 67; not Roewer, p. 561. (misplacement).

Eremobates kraepelini Muma, 1970, p. 18. (males and females).

TYPES: Male holotype from Dry Canyon, 14 miles southeast of Monterey, Monterey Co., Calif., E. F. Ricketts, in AMNH.

DIAGNOSIS: Males distinguished by blade-like to subtriangular dorsal process peaked at or near distal end of fondal notch on fixed cheliceral finger; widely spaced intermediate teeth and distinctly rounded anterior process on movable cheliceral finger; and 4 short post-stigmatic abdominal ctenidia.

Females distinguished by abruptly enlarged almost capitate anterior lobes of opercula, moderate-sized almost straight sided posterior opercular notch, and wide, bowed vulvular openings extending to posterior ends of posterior opercular lobes.

DESCRIPTION: Species pale yellow in color with dusky purplish markings. Palpi pale on all segments (fig. 79). Legs pale with occasional specimens having femoral-tibial unions of leg IV or legs III and IV faintly to distinctly dusky. Propeltidia with margins

dark to light, anterior submarginal area and rest of sclerite lightly to distinctly dusky with a narrow longitudinal pale median stripe (fig. 80). Mesopeltidia, metapeltidia, and abdominal terga dusky; pleura pale dorsally. Sterna pale.

Males (10) somewhat variable in size; CP varies from 8.0-11.2 (mean 9.6). Legs long; A/CP varies from 6.7-7.4 (mean 6.9). Fondal notches slightly narrower than base of fixed cheliceral finger and almost as long as wide; length/width ratio varies from 0.8-1.0 (mean 0.9). Mesal tooth of movable cheliceral finger is either indistinct or missing. One or both intermediate teeth of movable cheliceral finger may be missing and anterior process is occasionally subquadrate or conical (fig. 81). Both mean and modal number of short post-stigmatic abdominal ctenidia is 4 (fig. 81), but occasional specimens have 5 or 6.

Females (6) also somewhat variable in size; CP varies from 9.3-11.2 (mean 10.6). Legs short; A/CP varies from 5.2-5.6 (mean 5.4). Mesal tooth of movable cheliceral finger either indistinct or missing (figs. 83-84). Opercula 1.9 times wider than long with anterior lobes strongly enlarged distally; posterior opercular notches with either straight or indistinctly convex lateral margins and occupying 33-41% of opercula (mean 38) (figs. 85-86).

DISTRIBUTION: This species was described from Monterey County, California and we have examined 17 males and 6 females from Mercury, Nevada, 16 males and 6 females from 7 southern California counties, and 1 male from Kingman, Arizona, so Muma's records under the name *E. mormonus* (Roewer) from central and southern California, and western Arizona, are probably valid. However, his eastern Arizona, Utah, New Mexico, and Texas records are questionable. Collection records for the species indicate a long maturity period, from February through June. See Plate XX.

REMARKS: The relationship of this species to other members of this series cannot be ascertained with certainty until the females of *pyriflora* have been identified. However, it should be noted that the male of *kraepelini* has a dorsal process of the fixed cheliceral finger similar to those of *pallidus*, *gracilidens*, *titschacki*, *pyriflora*, and *otavonae*, and the female opercula are similar to those of *titschacki* and *otavonae*.

It should also be noted that the opercula of this species is very similar to or identical with the opercula cited as a female of *tuberculatus* Kraepelin, by Roewer (1934) and copied by Muma (1951) and here shaded (fig. 87), for comparison with figures 85 and 86. Roewer probably had a female of this species, not that of *tuberculatus*.

Eremobates titschacki (Roewer)

Figures 88 to 93

Eremoseta titschacki Roewer, 1934, p. 569. (male)

Eremobates affinis (Kraepelin), Muma, 1951, p. 65. (misplacement).

Eremobates titschacki (Roewer), Muma, 1970, p. 21. (male)

TYPES: Male type from California (no locality), 1900, N. Banks, Roewer No. 8485, deposited in ZSM.

DIAGNOSIS: Males distinguished by small, rounded, but blade-like dorsal process on fixed cheliceral finger peaked at or near distal end of fondal notch; fondal notch

much narrower than base of fixed cheliceral finger and slightly wider than long; mesal tooth of movable cheliceral finger indistinct; intermediate teeth of movable cheliceral finger crowded between principal tooth and somewhat elevated, rounded, anterior lobe; and 8 long, slender, post-stigmatic, abdominal ctenidia.

Females distinguished by broad, elongate but not distinctly enlarged anterior lobes of opercula; undulate mesal margins of opercular notch; and wide, bowed, vulvular openings both of which tend to be irregular.

DESCRIPTION: Species pale to dusty yellow in color with dusky purplish markings. Palpi dusty yellow to faintly dusky except paler basally on femora, and dorsally on tarsi, and slightly darker on metatarsi and tarsi. Legs pale to slightly dusty yellow except paler basally on femora and dorsally on tarsi and slightly darker on metatarsi and tarsi. Legs pale to slightly dusty yellow except faintly dusky apically on leg IV femora and tibiae (fig. 88). Propeltidium lightly dusky with narrow pale median stripe and sometimes dark along anterior margin (fig. 89). Mesopeltidium, metapeltidium, and abdominal terga dusky; pleura pale. Sterna pale.

Males (9) remarkably uniform in size and structural ratios; CP 8.5 for all 3 specimens measured; A/CP 6.7; fondal notch length/width 0.9 (fig. 90); mesal tooth none or indistinct; and 8 long ctenidia (fig. 91).

Females (2) recorded here also uniform in size and structure; CP varies from 9.3-10.0; A/CP from 5.0-5.5; mesal tooth distinct and opercula 1.6 times wider than long with broad elongate anterior lobes, opercular notches undulate on mesal margins and occupying 37% of opercula (figs. 92-93).

DISTRIBUTION: Although the type vial carries no locality notation, our male records, 1 from Marin Co., 3 from the San Francisco area, 5 from San Benito Co., 1 from San Luis Obispo Co., 1 from Santa Barbara, and 2 females, Pinnacles National Monument, San Benito Co., indicate that the species has a central to north central California range along the Pacific coast. Muma's (1951) records under the name *E. affinis* (Kraepelin) are probably valid. The species has been collected only during May and June. See Plate XX.

REMARKS: This species obviously has affinities with both *gracilidens* and *kraepelini* but seems to be more closely allied with *kraepelini* and *otavonae*.

Roewer's (1934) discussion and illustration of 2 flattened, plumose setae in the male, cheliceral, flagellar complex, must be an error; all of our specimens have only 1 flattened, plumose flagellar seta.

Eremobates otavonae Muma and Brookhart new species
Figures 94 to 98

TYPES: Male holotype, male paratype, and female allotype all from Novato, Marin County, California; holotype, June 10, 1965, M. A. Rentz; paratype, May 30, 1957, Frank Crimmers; allotype, July 25, 1960, E. L. Kessel, all deposited in the CAS.

DIAGNOSIS: Males distinguished by short rounded, blade-like, dorsal process

peaked over distal fourth of fondal notch; fondal notch much narrower than base of fixed cheliceral finger and distinctly wider than long; closely spaced intermediate teeth of movable cheliceral finger with abruptly elevated anterior lobe; 7-12 long, slender, post-stigmatic ctenidia.

Female distinguished by gradually enlarged distal ends of anterior opercular lobes, small convex-sided posterior opercular notch and wide, irregularly bowed, vulvular opening extending to posterior ends of posterior opercular lobes.

DESCRIPTION: Species pale to dusty yellow in color with extensive dusky purplish markings. Palpi dusky on all segments except femora basally and tarsi above. Legs pale except dusky on ectal 1/2 to most of femora and most to all of tibiae (fig. 94). Propeltidium (fig. 95), dusky with paler median ovate area, and narrow pale median stripe. Mesopeltidium, metapeltidium, and abdominal terga dark with paler pleura. Sterna palest.

Males (3) variable in size; CP varies from 7.1-10.4 (mean 8.2). Legs short; A/CP varies from 5.7-6.00 (mean 5.9). Fondal notches only about half width of base of fixed cheliceral finger and wider than long; fondal length/width ratio varies from 0.73-0.75 (mean 0.74). Either no or an indistinct mesal tooth on movable cheliceral finger which also has an indistinct ventral notch from lateral view (fig. 95); holotype has 12 long slender post-stigmatic ctenidia (fig. 97), one paratype has 11, another 9, and another only 7, slightly shorter ctenidia (mean 9.7).

Female allotype CP 13.5; A/CP 4.89, no mesal tooth on movable cheliceral finger. Opercula 2.2 times wider than long with anterior lobes distinctly enlarged distally; posterior opercular notch convex along mesal margins and occupying 28% of opercula (fig. 98).

DISTRIBUTION: This species is known only from Marin and Napa Counties in northcentral California. Our limited records, 4 males and 1 female, were taken during May, June, and July. See Plate XX.

REMARKS: The relationships of this species to others of the series will be uncertain until the females of *pyriflora* have been identified.

This variable sized species may prove to be two or more species when more collections are available from northern California.

Scopulatus Series

DIAGNOSIS: Males with palpal scopula; when scopula is present only on metatarsi it is basal in position. Males with dorso-ectal process of fixed cheliceral finger a short rounded to elongate blade or blade-like process; posterior intermediate tooth of movable cheliceral finger located at base of principal tooth, and anterior tooth nearly normal or modified into a tooth-like flange, an angulate flange, a round flange, a low ridge or a bipartite process; mesal tooth missing (0) or indistinct (1); fondal notch narrower than width of base of fixed cheliceral finger, and usually as wide as or wider than long.

Known females have typical opercula, varying from 1.4-2.0 times as wide as long with opercular notch occupying 21-38% of opercular area and anterior opercular lobes

broad, but not usually distinctly enlarged at distal end.

REMARKS: There are 16 known species of this series that are distributed in California, Arizona, Nevada, and Utah with one questionable record from New Mexico. Nine are previously described and 7 are described here.

Most are small to moderate sized, well-marked species, that vary from blackish-brown species with dark palpal tarsi and pale leg metatarsi and tarsi, to pale species with palpal tarsi that are distinctly pale or with a pale spot above, and pale leg metatarsi and tarsi.

There are 2 dark brown species with a bipartite process on the movable finger of the males, *girardi* and *williamsi*. The remaining 14 species are paler and somewhat variable in both color patterns and morphological structures. Five of these are known from unique, single males that do not seem to be closely related to any other species. Nine species, 3 known only from males, 1 known only from females, and 5 known from both sexes, appear to be related to one or more other species of the series.

The species of this series are very difficult to identify and place, either because of the paucity of material or because of intraspecific variation. For these reasons the tabular key (Table 5) to the species included here may not function adequately in the identification of every collected specimen; a series of specimens may be required for accurate placement.

Eremobates girardi (Putnam)

Figure 99

Datames girardii Putnam, 1883, p. 257. (male).

Eremobates girardi, Kraepelin, 1901, p. 128; Roewer, 1934, p. 575; Muma, 1951, p. 65; Muma, 1970, p. 17. (male).

TYPES: Male type was supposed to be in Academy of Natural Sciences, Philadelphia, Pa. but if it was deposited there it has been lost or destroyed. It may be in the city museum in Davenport, Iowa, which was the hometown of J. D. Putnam.

DIAGNOSIS: According to Putnam's 1883 description and illustrations, the type is distinguished by dark, blackish brown color; scopula on both tibiae and metatarsi of palpi; pale coloration of metatarsi and tarsi of legs; tiny, deeper than wide fondal notch; a bipartite anterior process of movable cheliceral finger (fig. 99). Female not known.

DESCRIPTION: Until the species has been recollected no description beyond that of Putnam (1883), transcribed by Muma (1951) can be made.

DISTRIBUTION: The state of Arkansas is cited by Putnam as the collection area of the species but this is obviously in error. If or when the species is refound it will undoubtedly be in the arid southwest, probably Arizona or California.

REMARKS: This species is unique in the possession of a tibial scopula, and may represent a new species-group of *Eremobates* Banks. For the present it is left here, with another dark species.

Table 5. Tabular key to males of the *scopulatus* series of the *palpisetulosus* species-group of *Eremobates* Banks in the United States.

Species	Position Peak Dorsal Process Peak	Finger/Notch Width Ratio Mean (x)	CP Mean (x)	Number Ctenidia Mean (x)	Number Palpal Range	Papillae Scopula Mean (x)
<i>E. girardi</i> (Putnam)	Basal	?	11.0	?	?	?
<i>E. williamsi</i> new species	Distal 1/2	1.47	10.0	7.0	29-36	(36)
<i>E. kastonin</i> new species	Distal 1/2	1.38	9.5	5.6	19-54	(45)
<i>E. vicinus</i> Muma	Distal 1/2	1.48	8.8	6.9	26-124	(60)
<i>E. fagei</i> (Roewer)	Distal 1/2	1.90	10.0	7.0	77-81	(79)
<i>E. tejonus</i> Chamberlin	Distal 1/2	2.00	9.5	2.0	70-100	(85)
<i>E. tuberculatus</i> (Kraepelin)	Distal 1/2	1.12	7.7	0	?	(60)
<i>E. spissus</i> new species	Distal 1/3	1.29	8.1	6.0	10-59	(36)
<i>E. scopulatus</i> Muma	Distal 1/3	1.34	8.3	4.9	20-75	(46)
<i>E. villosus</i> Muma	Distal 1/3	1.39	8.5	6.7	82-132	(112)
<i>E. scopulatelus</i> new species	Distal 1/4	1.35	8.4	7.0	3-85	(33)
<i>E. nivis</i> new species	Distal 1/4	1.40	7.8	6.0	76-97	(87)
<i>E. papillatus</i> Muma	Distal 1/4	1.44	8.8	6.0	83-92	(88)
<i>E. leechi</i> new species	Distal end	1.33	7.0	10.0	22-45	(30)
<i>E. nanus</i> Muma	Distal of	2.50	5.7	5.0	?	(80)

Eremobates williamsi Muma and Brookhart new species
Figures 100 to 104

TYPES: Male holotype and female allotype from traps in burned chaparral in Wildcat Canyon, San Diego County, May 12, 1962, S. C. Williams, in CAS. Male paratype from San Diego area, July 19, 1965, in AMNH.

DIAGNOSIS: Males distinguished by large blade-like dorsal process on fixed cheliceral finger; fondal notch distinctly narrower than base of fixed cheliceral finger and about as wide as long; distinct anteriorly angulate, posteriorly rounded anterior process, and distinct ventral notch on the movable cheliceral finger from lateral view (fig. 100); 29-48 papillae in basal, metatarsal, palpal scopula and 6 long abdominal ctenidia on first post-stigmatic sternite.

Female allotype distinguished by opercula 1.5 times wider than long; broad anterior opercular lobes; and moderate sized posterior opercular notch with lightly convex lateral margins.

DESCRIPTION: Pale to dusty yellow in color with dark dusky purplish markings. Palpi dark on tarsi, metatarsi, tibiae, and apically on femora (fig. 103). Legs dark apically on femora, tibiae, basally on metatarsi, especially dorsally, and pale distally on metatarsi and tarsi (fig. 103). Propeltidia dark throughout with faint indications of paler median ovate area; holotype also has indications of pale, narrow median stripe (fig. 101), but allotype and male paratype have no stripe. Mesopeltidia, metapeltidia, and abdominal terga dark with pleura paler. Sterna paler. Male paratype somewhat lighter than holotype and allotype, but is similarly marked.

Males (2) moderate sized; CP varies from 9.5-10.5 (mean 10.0). Legs short; A/CP varies from 6.1-6.3 (mean 6.2). Fondal notches vary from 1.0 to 1.1 (mean 1.05). Mesal tooth indistinct. Palpal papillae vary from 29-48 (mean 36). Long abdominal ctenidia vary from 6 (fig. 102) to 7 (mean 6.5).

Female allotype CP 10.3 mm.; A/CP 5.33; an indistinct mesal tooth; and a posterior opercular notch that occupies 35% of opercular area (fig. 104).

DISTRIBUTION: This species is known only from San Diego County in extreme southern California. See Plate XX.

REMARKS: This dark species is apparently closely related to *girardi* (Putnam) but differs in having only a metatarsal palpal scopula, a less distinct bipartite process on the male movable cheliceral finger, and perhaps less blackish brown or purplish color.

Eremobates tejonus Chamberlin
Figures 105 and 106

Eremobates tejonus Chamberlin, 1925, p. 236; Muma, 1951, p. 70; Muma, 1970, p. 21. (male)

TYPES: Male type from stomach of *Bufo* sp. taken at Ft. Tejon, California, (no further data), in MCZ.

DIAGNOSIS: More data are needed than that from type. Species presently distinguished by fondal notch only 1/2 as wide as width of base fixed cheliceral finger and

1 1/2 times deeper than wide (fig. 105); scopula plus or minus 100 papillae on palpal metatarsus; and 2 long flattened ctenidia on first post-stigmatic abdominal sternite (fig. 106).

Females unknown.

DESCRIPTION: Coloration and markings discolored by toad, alcohol, and age but apparently similar to those of other species in the group and series.

DISTRIBUTION: Known only by type from central California.

Eremobates nivis Muma and Brookhart new species
Figures 107 and 108

TYPES: Male holotype from Snowline Camp, Eldorado County, California, July 11, 1948, J. W. MacSwain, in AMNH.

DIAGNOSIS: Male distinguished by moderate sized, blade-like dorsal process on fixed cheliceral finger; fondal notch much narrower than base of fixed cheliceral finger and slightly wider than long; blade-like anterior process peaks in distal 1/4 of fondal notch, no discernable mesal tooth, and distinct ventral notch from a lateral view on movable cheliceral finger (fig. 107); 76-97 papillae in basal scopula of palpal metatarsi and 6 long abdominal ctenidia (fig. 108).

Females unknown.

DESCRIPTION: Species similar in coloration and markings to *vicinus*, except it is darker.

Holotype CP 7.8; A/CP 6.8; fondal notch ratio 0.7; mean 87 papillae in scopula and 6 long abdominal ctenidia.

DISTRIBUTION: Some of Muma's (1951) records, under the name *E. tuberculatus* (Kraepelin), from Mendocino, Lake, Amador, and Eldorado Counties in northern California may be this species. It is a northern California species. See Plate XX.

REMARKS: This species varies in structure and coloration from all other California species of this series.

Eremobates tuberculatus (Kraepelin)
Figure 109

Datames tuberculatus Kraepelin, 1899, p. 241. (male)

Eremobates tuberculatus, Kraepelin, 1901, p. 122. (not *E. tuberculatus* (Kraepelin), Muma, 1951, p. 72).

Eremognatha tuberculatus (Kraepelin), Roewer, 1934, p. 567. (male)

Eremobates tuberculatus (Kraepelin), Muma, 1970, p. 21. (male)

TYPES: Male type from California, No. 2839 (Roewer No. 8374), in ZSM.

DIAGNOSIS: Type distinguished by short rounded dorsal process on fixed cheliceral finger; fondal notch slightly narrower than width of base of fixed cheliceral finger and slightly wider than deep; movable cheliceral finger with closely spaced intermediate teeth, angular anterior process, indistinct mesal tooth, ventral notch that is distinct in lateral view (fig. 109); no abdominal ctenidia.

Females unknown except for female whose opercula were illustrated by Roewer (1934). Roewer's illustration was copied by Muma (1951) and is copied again here (see *E. kraepelini* Muma).

DESCRIPTION: Male pale yellow with dusky purplish markings. Palpi pale with apical segments darker yellow. Legs pale. Propeltidium lightly dusky with pale median ovate area and smaller ovate area on each side of eye tubercle. Mesopeltidium, metapelidium, and abdominal terga mottled with dusky; abdominal pleura pale. Sterna pale.

Male small, CP 8.7; legs long, A/CP 7.7; fondal notch wider than long by length/width ratio of 0.9; mesal tooth small; palpal papillae 60 plus or minus in a basal group.

DISTRIBUTION: This species is known only by the type from California (no cited locality).

REMARKS: This species is not typical of the series because it lacks ctenidia, otherwise it is related to *villosus* or perhaps could be the male of *inyoanus* new species.

Female illustrated by Roewer (1934), discussed under *kraepelini* in this paper.

Eremobates leechi Muma and Brookhart new species
Figures 110 to 113

TYPES: Male holotype from 2350 ft. elevation, 28 mi. south of Livermore on Mines Road, Santa Clara County, California, May 29, 1971, Hugh B. Leech, deposited in AMNH.

DIAGNOSIS: Male holotype with moderate sized, blade-like dorsal process on fixed cheliceral finger peaked over distal end of fondal notch; fondal notch nearly as wide as base of fixed cheliceral finger and nearly as long as wide; distinctly elevated blade-like anterior process, and only 1 intermediate tooth on movable cheliceral finger, laterally distinct ventral notch of movable cheliceral finger (fig. 110); 27-45 papillae in basal metatarsal, palpal scopula; and 10 long ctenidia on first post-stigmatic abdominal sternum (fig. 111). Females unknown.

DESCRIPTION: Pale yellow with dusky purplish markings. Palpi dusky apically on femora, all of tibiae and metatarsi, and all except dorsally on tarsi (fig. 113). Legs IV pale except apically on femora, and all of tibiae (fig. 113). Propeltidium dark along anterior margin, lightly dusky over rest of the sclerite except for usual paler ovate area with each lateral margin pale marginally and submarginally, darker for about 1/4 of width of segment, and light spot on each exterior lobe (fig. 112). Mesopeltidium, metapeltidium, and abdominal terga dusky with pleura paler. Sterna pale.

Holotype small; CP 7.5. Legs long; A/CP 7.1. Fondal notch length/width ratio 0.9. Mesal tooth indistinct. Palpal metatarsal scopula varies from 27-45 in number of papillae (mean 36). First post-stigmatic abdominal sternite with 10 long ctenidia.

DISTRIBUTION: Known only from the type locality in Santa Clara County, northern California.

Eremobates nanus Muma
Figures 114 to 117

Eremobates nanus Muma, 1962. p. 4; Muma, 1970, p. 20. (male)

TYPES: Male holotype from Riverton, Eldorado County, CA, in AMNH.

DIAGNOSIS: Species distinguished by posteriorly rounded ridge-like dorsal process of fixed cheliceral finger abruptly tapered apically and peaked distal of fondal notch; fondal notch less than 1/2 width of base of fixed cheliceral finger, a length/width ratio of 0.9; movable cheliceral finger with only one intermediate tooth between principal tooth and low flattened but nearly normal appearing anterior tooth, and indistinct ventral notch from a lateral view (fig. 114); palpal scopula 80 plus or minus papillae on the basal 2/3 of metatarsus; 5 short, sub-linear ctenidia on the first post-spiracular abdominal sternite (fig. 115).

Females unknown.

DESCRIPTION: Type similar in color and markings to *scopulatus* except markings on femora and tibiae of palpi and legs dark and indistinct and palpal metatarsi and tarsi faintly dusky (fig. 117). Coloration and markings of propeltidium (fig. 116).

Male small, CP 7.1; legs short; A/CP 5.7; fondal notch length/width ratio, mesal tooth, palpal scopula, and ctenidia characterized above.

DISTRIBUTION: This species is known only by the type from Eldorado County in northeastern California.

REMARKS: This species could be related to *papillatus* but additional specimens of both species will have to be identified before the relationship can be confirmed.

Eremobates scopulatus Muma
Figures 118 to 130

Eremobates scopulatus Muma, 1951, p. 67. (males and females)

Eremobates purpusi (Roewer), Muma, 1970, p. 21; not Roewer, 1934, p. 561. (misplacement).

TYPES: Male holotype from Las Vegas, NM, in AMNH. Since all other records of this species are from Utah, Nevada, and California, we consider this a spurious record; it probably was collected in Las Vegas, Nevada. Female allotype from Las Vegas, Nevada, also in AMNH.

DIAGNOSIS: Males distinguished by moderate sized subtriangular but rounded dorsal process peaked in distal third of fondal notch; fondal notches distinctly narrower than width of base of fixed cheliceral finger and almost as long as wide; distinct rounded to bilobed anterior process of movable cheliceral finger (figs. 121-125); basal metatarsal palpal scopula of 21-75 papillae; and 4-6 long ctenidia on first post-stigmatic abdominal sternite (figs. 122-123).

DESCRIPTION: Pale to dusty yellow with dusky purplish markings. Palpi pale except dusty yellow to faintly dusky apically on femora, all of tibiae, and sometimes ventrally on tarsi (figs. 118-124). Legs pale except dusty yellow to faintly dusky apically on femora, tibiae, and occasionally basally on metatarsi (figs. 118-124). Propeltidia dusky with pale submarginal area laterally and posteriorly, paler median ovate area, and small paler area on each of the ocular tubercle, narrow pale median stripe, a pale spot on each exterior lobe (figs. 119-120). Mesopeltidia, metapeltidia, and abdominal terga

dusky, pleura paler to pale. Sterna pale. Females more distinctly marked than males.

Males (10) variable in size; CP varies from 7.3-9.0 (mean 8.1). Legs long; A/CP varies from 7.4-7.9 (mean 7.6). Fondal notches vary in length/width ratio from 0.8-1.1 (mean 1.0). Mesal tooth missing. Papillae in basal metatarsal palpal scopula vary from 21-75 (mean 35.9). Long abdominal ctenidia range from 2-8 (mean 5, mode 4-6).

Females (9) more variable in size than males; CP varies from 8.3-13.8 (mean 10.3). Legs short; A/CP varies from 5.4-5.8 (mean 5.6); chelicerae (fig. 126); mesal tooth missing (fig. 127); opercula range from 1.4 to twice as wide and long and posterior opercular notch occupies from 25-32% of opercular area (mean 28) (figs. 128, 129, 130).

DISTRIBUTION: We have closely examined 13 males and 15 females of this species; 3 males and 9 females from Mercury, Nevada, the type, allotype, male paratype and 5 males and 1 female from Anza Borrego State Park, San Diego County, California. We also have seen 3 females from Los Angeles, Riverside, and San Bernardino Counties. Muma's (1951) records are probably valid. Our records of the species indicate maturity during May, June, and July. See Plate XX.

REMARKS: This species, *vicinus*, and *scopulatellus* seem to be closely related but are distinguished by differences in coloration, details of the male chelicerae, number of ctenidia and papillae, and female opercula.

Although Muma (1970) synonymized this species with *Eremopus purpusi* (Roewer) and moved that species to the genus *Eremobates* Banks, we now believe that this species is distinct from but related to the Mexican species. Roewer's (1934) cited locality of *E. purpusi*, Talquilotepu, and Muma's (1970), Talquilohepec, cannot be found on any map of the country. Furthermore, Vazquez (1981) recorded Roewer's species from Isla Guadeloupe in Baja California Norte, Tecamachalaco in Puebla, and Ciudad Universitaria in Distrito Federal. All localities are believed to be much too far south in Mexico to be the present species.

Eremobates spissus Muma and Brookhart new species

Figures 131 to 136

TYPES: Male holotype from Frank Raines County Park, 12 mi. west of Patterson, Stanislaus County, California, E. 1200', March 21, 1970, S. C. Williams and others, deposited in the CAS. Female allotype and female paratype under cow dung from 7 miles west of Westley, Stanislaus County, California, June 19, 1975, M. H. Muma and J. O. Brookhart, deposited in FSCA.

DIAGNOSIS: Holotype distinguished by moderate sized blade-like rounded dorsal process on fixed cheliceral finger; fondal notch distinctly narrower than base of fixed cheliceral finger and slightly wider than long; indistinct mesal tooth, abruptly rounded anterior process and distinct ventral notch in lateral view on movable cheliceral finger (fig. 131) 57-59 papillae in basal scopula of palpal metatarsi; and 6 long ctenidia on first post-stigmatic abdominal sternite (figs. 132-133).

Females distinguished by opercula 1.5 times wider than long, with elongate, broad, anterior opercular lobes and moderate sized posterior opercular notches with undulate lateral margins.

DESCRIPTION: Coloration and markings similar to but darker than those of *fagei* and similar to but paler than those of *villosus* (figs. 134-135).

Males (3) CP varying from 6.5-9.8 (mean 8.1); A/CP varying from 6.4-6.5 (mean 6.5); fondal notch ratio 0.8; number of palpal papillae varies from 10-59 (mean 36); mesal tooth indistinct; number of abdominal ctenidia varying from 5-8 (mean 6.3).

Females, allotype and paratype, CP 9.0; legs short, A/CP varies from 5.0-5.2 (mean 5.1); mesal tooth indistinct, opercula 1.5 times wider than long with opercular notches occupying 27-28% (mean 27.5) (fig. 136) of opercular area.

DISTRIBUTION: This species is known from the male and female types taken in Stanislaus County, northern California; a male from Lake County, a male from Napa County, and a female from Monterey County. All specimens were taken from March through June.

REMARKS: The unusual female opercula distinguishes it from most other species of this series. However, the opercula of this species is very similar to those of *gracilidens*, a species of the *kraepelini* series, and *inyoanus*, a species of this series.

Eremobates vicinus Muma

Figures 137 to 148

Eremobates vicinus Muma, 1963, p. 3; Muma, 1970, p. 21. (male)

TYPES: Male holotype from Mercury, Nye County, Nevada, May 16, 1961, in AMNH.

DIAGNOSIS: Males distinguished by small to moderate sized, rounded, blade-like, dorsal process on fixed cheliceral finger; fondal notch slightly to distinctly narrower than base of fixed cheliceral finger and slightly longer than wide; slightly bilobed anterior process, no discernable mesal tooth, and a distinct ventral notch on movable cheliceral finger from lateral view (figs. 137, 138, and 143), 26-124 papillae in basal scopula of palpal metatarsi and 5-9 moderate to long abdominal ctenidia (figs. 139, 144, and 145). Females distinguished by small pentagonal opercular notches.

DESCRIPTION: Species pale to dusty yellow with dusky purplish markings. Palpi pale to dusty yellow; slightly darker on basal segments, (figs. 140-148). Legs pale to dusty yellow; slightly darker apically on femora and all of tibiae (figs. 140-148). Propeltidium lightly dusky, darker laterally with pale median ovate area, smaller pale ovate area on each side of eye tubercle, a narrow pale median stripe (figs. 141, 146, 147). Mesopeltidia, metapeltidia, and abdominal terga dusky with pleura paler. Sterna pale.

Variable sized males (10) have CP that varies from 6.8-10.6 (mean 8.8); A/CP 6.4-7.5 (mean 7.0); fondal notch ratio 1.0-1.1 (mean 1.0); palpal scopula 26-124 (mean 60) papillae and 5.9 (mean 6.9) moderate to long ctenidia that are longer than 1/2 width of succeeding sternite.

A female from Reno, Nevada has CP of 12.0; A/CP of 5.3; mesal tooth indistinct or

missing; opercula 1.5 times wider than long, and opercular notch that occupies 27% of opercular area that is pentagonal in outline (fig. 142).

DISTRIBUTION: The species is known from the holotype from Mercury, Nye County, Nevada; six males and 3 females from Washoe, Humboldt, Pershing, and Lincoln Counties, Nevada; and 13 males from Merced, Kern, San Bernardino, and Riverside counties in southern California. All dated records indicate maturity during May, June, and July.

REMARKS: *E. vicinus* seems to be closely related to *scopulatus*. The ranges of the two species are nearly coincident in Nevada and California but *vicinus* is a larger, more distinctly marked species, with a greater number of ctenidia and papillae on the males, and more readily identified opercula on the females. The two species are maintained separately for the present.

Eremobates kastoni Muma and Brookhart new species
Figures 149 to 157

TYPES: Male holotype from San Diego, CA, May 9, 1969 by B. J. Kaston; female allotype from San Diego, CA, pit traps, June 1971 by B. J. Kaston, both deposited in FSCA.

DIAGNOSIS: Males distinguished by large triangular to rounded, blade-like dorsal process on fixed cheliceral finger peaked over distal half of fondal notch; fondal notch much narrower than width of base of fixed cheliceral finger and slightly wider than deep; distinct rounded to subquadrate anterior process on movable cheliceral finger; unusually distinct ventral notch of movable cheliceral finger from lateral view (fig. 149); 17-58 papillae in basal palpal, metatarsal scopula; and 6 short to long abdominal ctenidia on first post-stigmatic sternite (figs. 150-151).

Females distinguished by opercula twice as wide as long; short to long, broad, anterior, opercular lobes; small posterior opercular notch with slightly convex lateral margins; a wide, bowed, vulvular opening located near posterior margin of opercula (figs. 154, 155, and 156).

DESCRIPTION: Pale to dusty yellow in color with dusky purplish markings. Palpi lightly to distinctly dusky on all segments except pale basally on femora (fig. 157). Legs IV dusty yellow to lightly dusky with pale metatarsi and tarsi with irregular, narrow to wide submarginal band (fig. 157). Propeltidia dusky to dark; anterior margin dark; with an irregular broad to narrow pale median stripe (figs. 152-153). Mesopeltidia, metapeltidia, and abdominal terga dusky with pleura dark but lighter than tergites. Venters pale. Allotype paler than others.

Males (6) slightly variable in size; CP varies from 9.25-9.75 (mean 9.50). Legs moderately long; A/CP; varies from 6.33-6.47 (mean 6.36). Fondal notches vary from 0.78-0.89 (mean 0.82). Mesal tooth absent or indistinct. Short abdominal ctenidia vary from 5-6 (mean 5.6). Number of papillae in basal palpal metatarsal scopula varies 17-58 (mean 41.6). One male from Los Angeles County lacked a scopula.

Female allotype has a CP of 10.0; A/CP of 5.0, indistinct mesal tooth, and posterior opercular notch occupies 27% of opercular area and is more or less triangular in outline.

DISTRIBUTION: We have examined 11 males and 3 females from 4 localities in Los Angeles County, Hesperia in San Bernardino County, and San Diego County most in extreme southwestern California. Most collections were made during May, June, and July; we have one record during September from San Diego, California.

REMARKS: Although this species seems to have some affinities with the *scopulatus-vicinus* complex, it is most closely related to *E. scopulatellus*, which tends to be a more northern form, with distinctively different markings.

Eremobates scopulatellus Muma and Brookhart new species
Figures 158 to 165

TYPES: Male holotype collected in pit trap, Winchester, Riverside County, CA on April 26, 1968 and female allotype collected in pit trap, Winchester, Riverside, CA on May 30, 1968, by W. Icenogle, both in FSCA.

DIAGNOSIS: Males distinguished by moderate-sized subtriangular to blade-like dorsal process peaked in ectal fourth of fondal notch; fondal notches slightly narrower than width of base of fixed cheliceral finger and almost as long as wide; a low rounded to bilobed anterior process of movable cheliceral finger; laterally distinct ventral notch on movable cheliceral finger (figs. 158-159); basal metatarsal palpal scopula of 3-124 papillae; and 5-9 long ctenidia on first post-stigmatic abdominal sternite (figs. 160-161).

Females distinguished by opercula that vary from 1.3 to twice as wide as long with broad elongate anterior lobes, and moderate sized posterior opercular notches that have mesally convex to nearly straight lateral margins, and wide, bowed vulvular openings that occur nearly at posterior end of opercula (figs. 164-165).

DESCRIPTION: Pale to dusky yellow with dusky purplish markings. Palpi dusty yellow to dusky apically all of femora through tarsi which are pale above with some specimens darker apically on metatarsi and tarsi (fig. 163). Legs IV dusky apically on femora, all of tibiae, and basally on metatarsi, otherwise pale (fig. 163). Propeltidia dusky, dark along anterior margin with pale median ovate area, small elongate pale ovate area on each side of ocular tubercle, narrow pale median stripe and pale spot on each exterior lobe (fig. 162). Mesopeltidia, metapeltidia, and abdominal terga dusky, pleura paler to pale. Sterna pale. Females more distinctly marked than males. Some specimens have evanescent pale yellow stripe on propeltidium.

Males (10) quite variable in size; CP varies from 6.0-10.2 (mean 8.6). Legs moderately long; A/CP varies from 6.1-7.1 (mean 6.7). Fondal notches vary in length to width ratio from 0.6-1.3 (mean 0.9). Mesal tooth absent. Papillae in basal metatarsal palpal scopula vary from 3-124 (mean 42.1). Long abdominal ctenidia range from 5-9 (mean 6.8).

Females (10) less variable in size than males; CP varies from 8.3-10.5 (mean 9.4). Legs short; A/CP varies from 5.2-5.8 (mean 5.4). Mesal tooth indistinct to none. Opercula

range from 1.3 to twice as wide as long and opercular notch occupies 30-36% of opercular area (mean 32).

DISTRIBUTION: This species ranges through southcentral, California. We have carefully studied 10 males and 10 females from a collection of 26 males and 12 females taken at Winchester, Riverside County, California by Icenogle. We have also studied 23 males from 2 localities in Kern County, and miscellaneous single collections from San Bernardino and Riverside Counties. There are also 4 records of 5 males from Alameda, Merced, and Tulare Counties. These collections were all made from March through June, and indicate a long maturity period.

REMARKS: This species seems to be closely related to *scopulatus* and *vicinus* but actually has more affinities with *kastoni*.

Eremobates fagei (Roewer)
Figures 166 to 170

Eremopus fagei Roewer, 1934, p. 563. (female)

Eremobates purpusi, Muma, 1951, p. 70. (in part, males and females from Fresno and San Benito Counties)

Eremobates villosus Muma, 1970, p. 21. (in part, males and females from Fresno and San Benito Counties)

Eremobates fagei, Muma, 1970, p. 16. (female)

TYPES: Female type and young from California (no further data), Roewer No. 9134, in MNHN.

DIAGNOSIS: Males distinguished by small blade-like dorsal process of fixed cheliceral finger peaked over distal half of fondal notch; fondal notch narrower than width of base of fixed cheliceral finger and longer than wide; flat topped more or less angular anterior process, indistinct mesal tooth, and laterally very distinct ventral notch of movable cheliceral finger (fig. 166); basal metatarsal palpal scopula of 77-81 papillae; 6 short ctenidia on first post-stigmatic abdominal sternite (fig. 167).

Females distinguished by opercula about 1.5 times as wide as long, with broad elongate anterior lobes, moderate sized opercular notches with strongly convex lateral margins, and wide, bowed, vulvular openings occurring at posterior end of opercula (figs. 168-169).

DESCRIPTION: Pale to dusty yellow with dusky purplish markings. Palpi pale yellow, or pale yellow except dusty yellow apically on femora, tibiae, metatarsi, and ventrally on tarsi. Legs pale yellow or pale yellow except dusty yellow on apical ends of femora and all of tibiae. Propeltidia either dusty yellow with dark margins or dusky with darker margins and pale centrally but without narrow pale stripe (fig. 170). Mesopeltidia, metapeltidia, and abdominal terga dusky; pleura pale. Sterna pale.

Male allotype with a CP of 10.0; A/CP of 6.5; fondal notch ratio of 1.2; indistinct mesal tooth; basal, metatarsal, palpal scopula varying in number of papillae from 77-81 (mean 79); 6 ctenidia, the outer 4 of which are longer than 1/2 width of succeeding abdominal sternite.

Females (2) with CP varying from 7.4-10.0 (mean 8.7); A/CP varying from 5.5-6.2 (mean 5.9); indistinct mesal tooth. Opercula 1.5-1.8 times wider than long with opercular notches occupying 34-38% (mean 36) of opercular area.

DISTRIBUTION: In addition to type, we have examined a male and female from Fresno in central California. It is possible that Muma's (1951) records of *villosus*, under *E. purpusi*, from Pacific Grove and San Benito County are this species. We have also studied a male from Cima, San Bernardino County that we also place here. There are insufficient records to indicate maturity.

REMARKS: Male and female from Fresno are either identical with or so closely allied with *fagei* that we hesitate placing them elsewhere at the present time.

This species is closely related to *villosus* and *papillatus*. It is much paler than *villosus* and the allotype has fewer papillae and ctenidia. It is much larger than *papillatus* with a larger opercular notch, and to date has been found only in central California.

Eremobates papillatus Muma
Figures 171 to 175

Eremobates tuberculatus (Kraepelin), Muma, 1951, p. 72; not Kraepelin, 1899, p. 241 or Roewer, 1934, p. 568. (misplacement)

Eremobates papillatus Muma, 1970, p. 20. (males)

TYPES: Male holotype from Mount Palomar State Park, San Diego County, California, in AMNH.

DIAGNOSIS: Males distinguished by a moderate sized, blade-like dorsal process on fixed cheliceral finger; fondal notch much narrower than base of fixed cheliceral finger and as deep as wide; low rounded anterior process of movable cheliceral finger; laterally distinct ventral notch of movable cheliceral finger (fig. 171); 83-92 papillae in basal scopula of palpal metatarsus; 6 long abdominal ctenidia (fig. 172).

Females distinguished by opercula 1.7 times wider than long, with short wide anterior opercular lobes, moderate sized opercular notches with strongly convex lateral margins, and wide, bowed, vulvular openings occurring near distal end of opercula (fig. 173).

DESCRIPTION: Pale to dusty yellow in color with dusky purplish markings. Palpi lightly dusky except basally on femora and dorsally on tarsi as in *scopulatellus* and *leechi*. Legs IV pale except dusky apically on femora, all of tibia and basally above on metatarsi as in the above species. Propeltidium dark along anterior margin and dusky for most of sclerite with a pale median ovate area behind eyes, a smaller pale ovate area on each side of eye tubercle, pale spot on each exterior lobe, pale narrow median stripe, and narrow, pale posterior submarginal band. Mesopeltidium, metapeltidium, and abdominal terga dusky; pleura paler. Sterna pale. The females included here much paler than holotype (figs. 174-175), but otherwise seem to be conspecific.

Male holotype with CP of 8.8; A/CP of 7.0; fondal notch ratio of 1.0; no mesal tooth; minimum number of 83-91 (mean 87.5) papillae in scopula; 6 long ctenidia.

Females (3) moderate to large in size with CP varying from 9.0-12.5 (mean 10.4). Legs moderately long, A/CP varies from 5.5-6.3 (mean 5.8). Mesal tooth indistinct or missing. Opercula about 1.7 times wider than long with short, wide anterior lobes and posterior opercular notches occupying 24-32% (mean 27) of opercular area.

DISTRIBUTION: Known only from male holotype from northern San Diego County, CA, 2 females from southern San Diego County, 1 female from Los Angeles County, and 1 female from Baja California Norte, Mexico.

REMARKS: This species and the following 2 have somewhat similar coloration and markings, indicating a close relationship but additional males and females must be collected before the relationships can be determined.

Muma's (1951) records of *villosus* under *purpusi* represent 3 species; his San Diego County records are almost certainly this species. A maturity period cannot be deduced from the limited records.

Eremobates inyoanus Muma and Brookhart new species
Figures 176 and 177

TYPES: Female holotype from Saline Valley, Inyo County, California, June 14, 1960, Station 18, B. Banta, deposited in CAS.

DIAGNOSIS: Males unknown.

Females distinguished by opercula about twice as wide as long with short, broad, anterior lobes, small opercular notches with distinctly undulate lateral margins and wide, bowed vulvular openings varying in position from posterior half of opercular notches to nearly end of opercula.

DESCRIPTION: Pale to dusty yellow with dusky, purplish brown markings. Palpi and legs pale to dusty yellow on all segments, with palpi occasionally darker on tarsi and metatarsi and legs IV occasionally dusky on tibiae and apically on femora. Propeltidia dusky as shown for *papillatus* females (fig. 174). Mesopeltidia, metapeltidia, and abdominal terga dark with pleura pale. Sterna pale.

Females CP varying from 9.8-10.5 (mean 10.3); A/CP varying from 5.5-6.0 (mean 5.8); indistinct mesal tooth. Opercula 1.6-2.0 times wider than long (mean 1.9), opercular notches occupying 20-27% (mean 24) of opercular area (figs. 176-177).

DISTRIBUTION: The holotype female and 3 female paratypes are all from Saline Valley in Inyo County, California and were collected during May and June.

REMARKS: Females of *gracilidens*, *titschacki*, and *spissus* also have undulate lateral margins on the opercular notches, but *inyoanus* has much shorter and broader anterior opercular lobes and the lateral margins of the opercular notches are much more distinctly undulate.

Eremobates villosus Muma
Figures 178 to 183

Eremobates purpusi (Roewer), Muma, 1951, p. 70; not Roewer, 1934, p. 561. (misplacement)

Eremobates villosus Muma, 1970, p. 21 (males and females)

TYPES: Male holotype and female allotype from Point McCloud Campground, Shasta Lake, Shasta County, California, in AMNH.

DIAGNOSIS: Males distinguished by moderate sized, rounded to blade-like dorsal process on fixed cheliceral finger peaked over distal third to end of fondal notch; fondal notches narrower to slightly wider than base of fixed cheliceral finger and distinctly wider than long; flat topped, angular, anterior process of movable cheliceral finger; laterally distinct ventral notch of movable cheliceral finger (fig. 178), 90-110 papillae in basal scopula of palpal metatarsi and 5-8 moderate sized abdominal ctenidia (fig. 179).

Females distinguished by opercula twice as wide as long, with moderately long, broad, anterior opercular lobes; and small, posterior, opercular notches with a combination of convex to linear-convex lateral margins, and wide, bowed, vulvular openings that vary in position from middle of opercular notches to posterior end of opercula (figs. 182-183).

DESCRIPTION: Pale to dusky yellow with dusky to dark purplish markings. Palpi dusky to dark except basally on femora and dorsally on tarsi (fig. 181). Legs dusky to dark on femora and tibiae but pale on metatarsi and tarsi; on leg IV dark marking extends onto metatarsi basally (fig. 181). Propeltidia dusky to dark for 4/5 of length and pale posteriorly and laterally with dark anterior and posterior margins; paler longitudinal ovate area behind eyes, two small paler ovate areas, one beside each eye; narrow pale median stripe; and pale spot on each exterior lobe (fig. 183). Mesopeltidia, metapeltidia, and abdominal terga dusky to dark with pleura only slightly paler. Sterna pale. Holotype dark, but male from Placerville, California just slightly dusky, and allotype much lighter than holotype.

Males (6) variable in size; CP varies from 8.0-10.0 (mean 8.5). Legs moderately long; A/CP varies from 6.5-6.9 (mean 6.6). Fondal notch ratios vary from 0.7-1.04 (mean 0.92). Mesal tooth indistinct or missing. Scopula of palpal metatarsi ranging from 82-132 (mean 112) papillae. Abdominal ctenidia varying from 5-8 (mean 6.7) that are equal to or shorter than 1/2 width of succeeding abdominal sternite.

Females (3) variable in size; CP varies from 11.0-13.5 (mean 11.8); A/CP varying from 3.4-5.5 (mean 5.4); indistinct mesal tooth. Opercula twice as wide as long, and opercular notches occupy 25-36% (mean 31) of opercular area.

DISTRIBUTION: We have seen the types, and 8 males and 5 females of this species from Shasta Lake, Napa, Eldorado, and Tuolumne Counties in northern California. Muma's (1951) records of this species from northern California are probably valid. To date all specimens have been collected during June and July.

REMARKS: This species, *fagei*, and *papillatus* are very closely related: *inyoanus* may also be related to these species.

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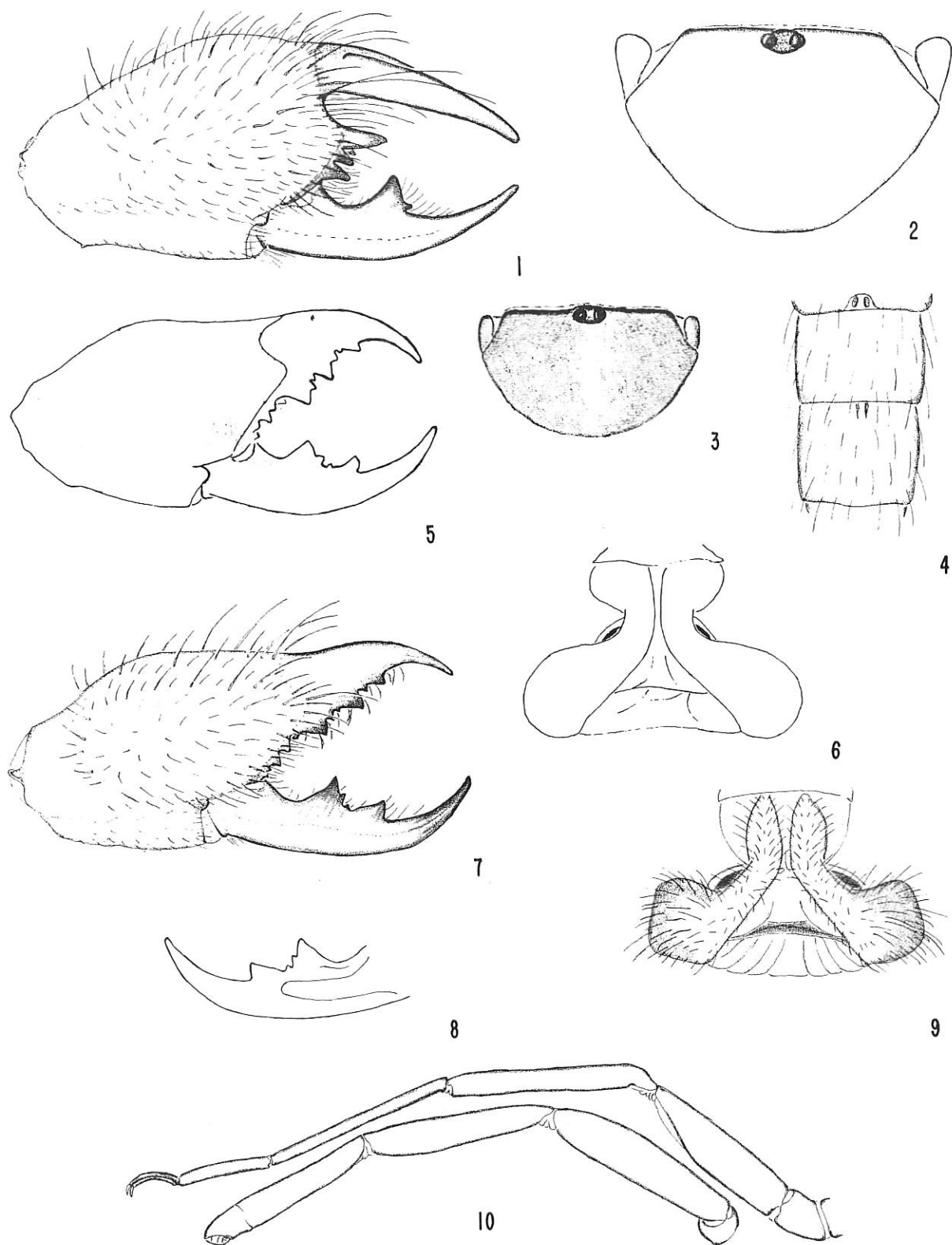


Plate II. Figures 1 to 10. *Eremobates nodularis* Muma. 1. Ectal view of typical, right, male chelicera. 2. Dorsal view of typical, male propeltidium. 3. Dorsal view of atypical, male propeltidium from southeastern Arizona. 4. Ventral view of typical, male, abdominal ctenidia from southwestern New Mexico. 5. Ectal view of allotype, right chelicera. 6. Ventral view of allotype opercula. 7. Ectal view of typical, female, right chelicera from southwestern New Mexico. 8. Mesal view of movable, cheliceral finger of typical female with indistinctly peaked, mesal ridge. 9. Ventral view of most common variation of female opercula in southwestern New Mexico. 10. Mesal view of right, male palpus and ectal view of right, leg IV of typical male from southwestern New Mexico.

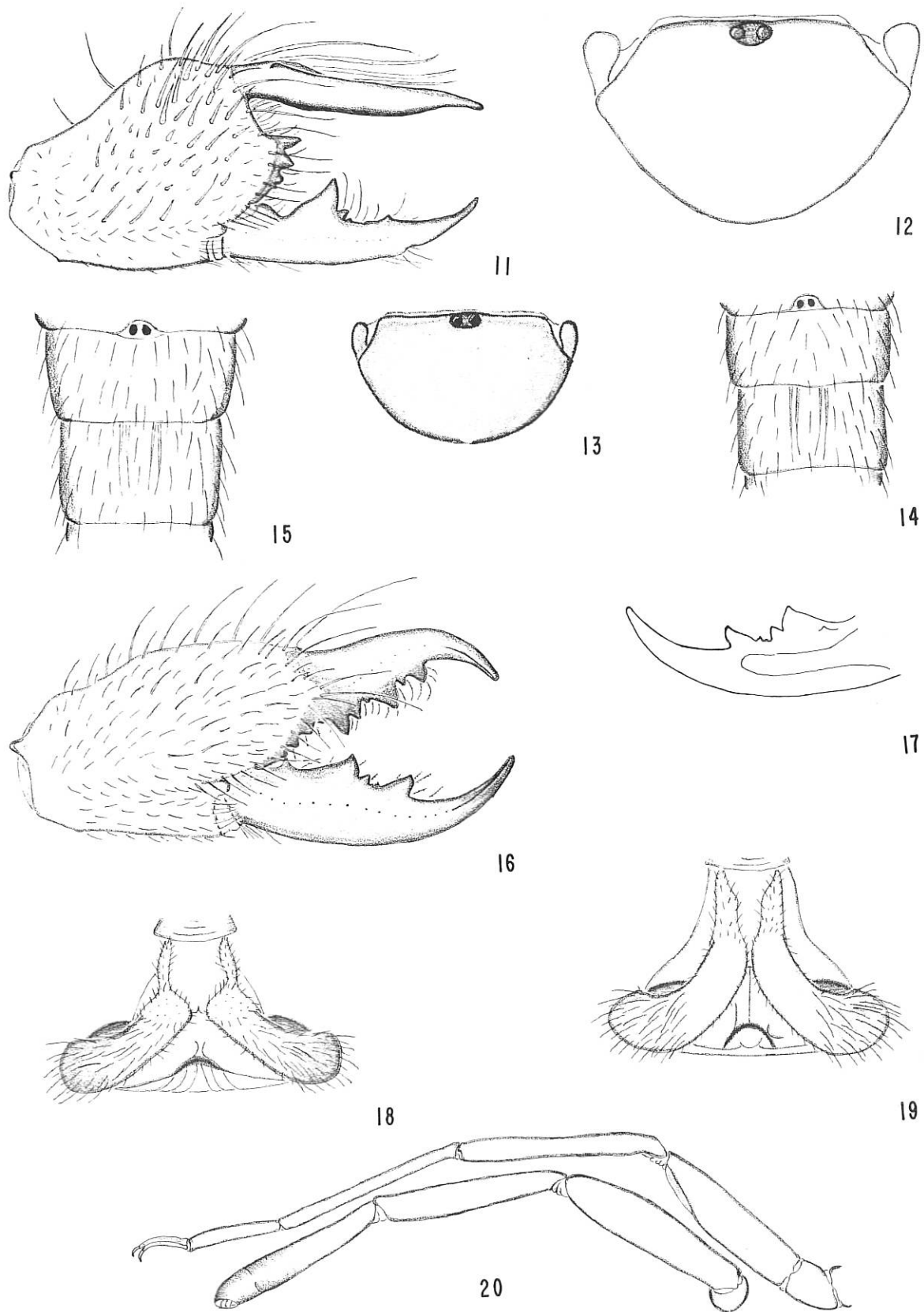


Plate III. Figures 11 to 20. *Eremobates palpisetulosus* Fichter. 11. Ectal view of right, male, cotype chelicera. 12. Dorsal view of male, cotype propeltidium. 13. Dorsal view of dusky, male propeltidium. 14. Ventral view of ctenidia of a male from Boone, Colorado. 15. Ventral view of cotype ctenidia. 16. Ectal view of typical, female, right chelicerae. 17. Mesal view of movable, cheliceral finger. 18. Ventral view of most common variation of female opercula in Colorado. 19. Ventral view of typical female opercula in Colorado. 20. Mesal view of right, male palpus and ectal view of right, leg IV of typical male from southern Colorado.

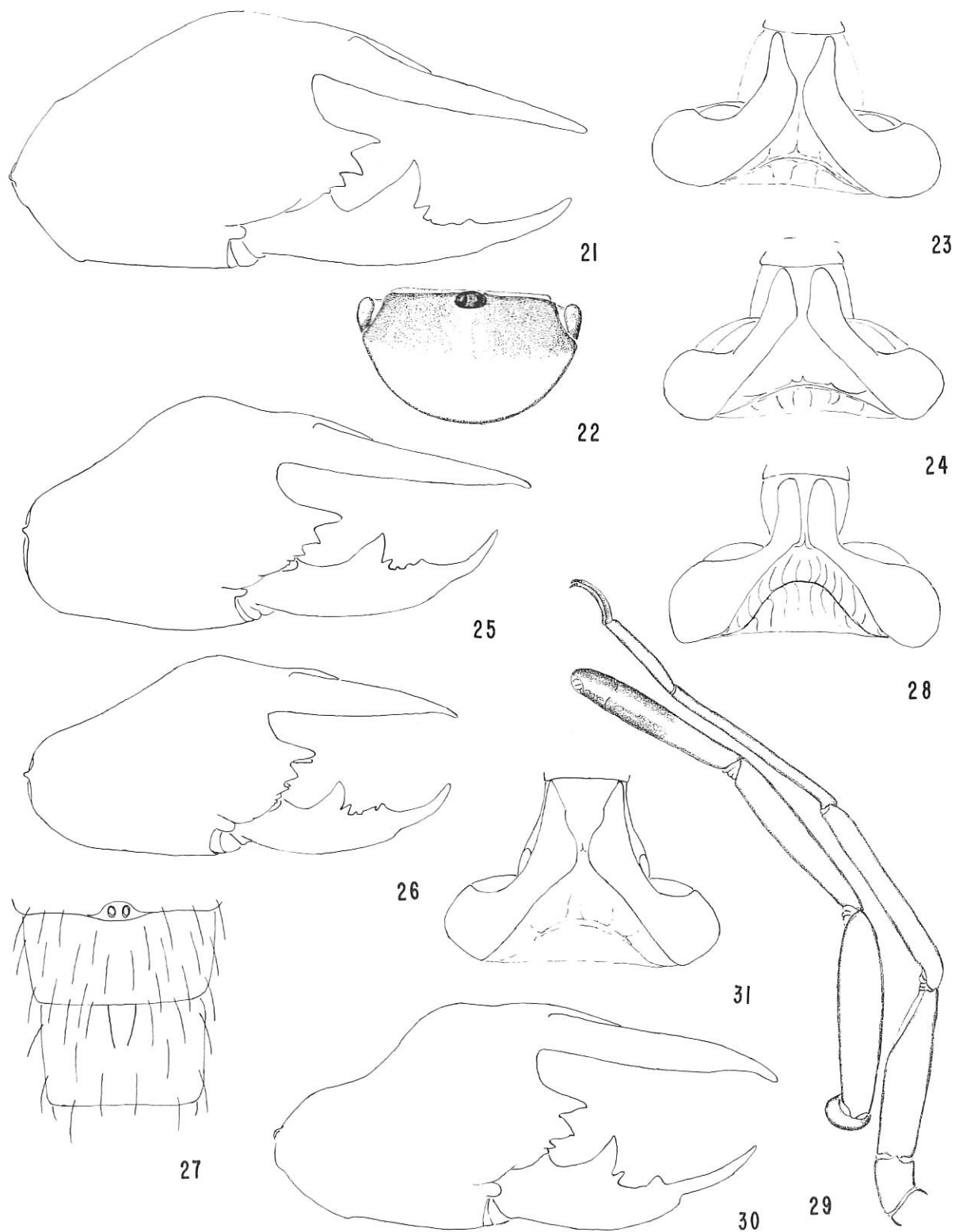


Plate IV. Figures 21 to 24. *Eremobates bajadae* new species. 21. Ectal view of right, male, holotype chelicera. 22. Dorsal view of propeltidium, male from Portal, Arizona. 23. Ventral view of most common variation of female opercula in southwestern New Mexico. 24. Ventral view of least common variation of female opercula in southwestern New Mexico. Figures 25 to 29. *Eremobates marathoni* Muma. 25. Ectal view of typical, male, right cheliceral from Laredo, Texas. 26. Ectal view of male, holotype, right chelicera from Marathon, Texas. 27. Ventral view of male, abdominal ctenidia from Big Bend National Park, Texas. 28. Ventral view of female, allotype opercula. 29. Mesal view of right, male palpus and ectal view of right, leg IV of male from Davis Mountains, Texas. Figures 30 and 31. *Eremobates norrisi* new species. 30. Ectal view of right, male chelicera, paratype from Silver City, New Mexico. 31. Ventral view of female, allotype opercula.

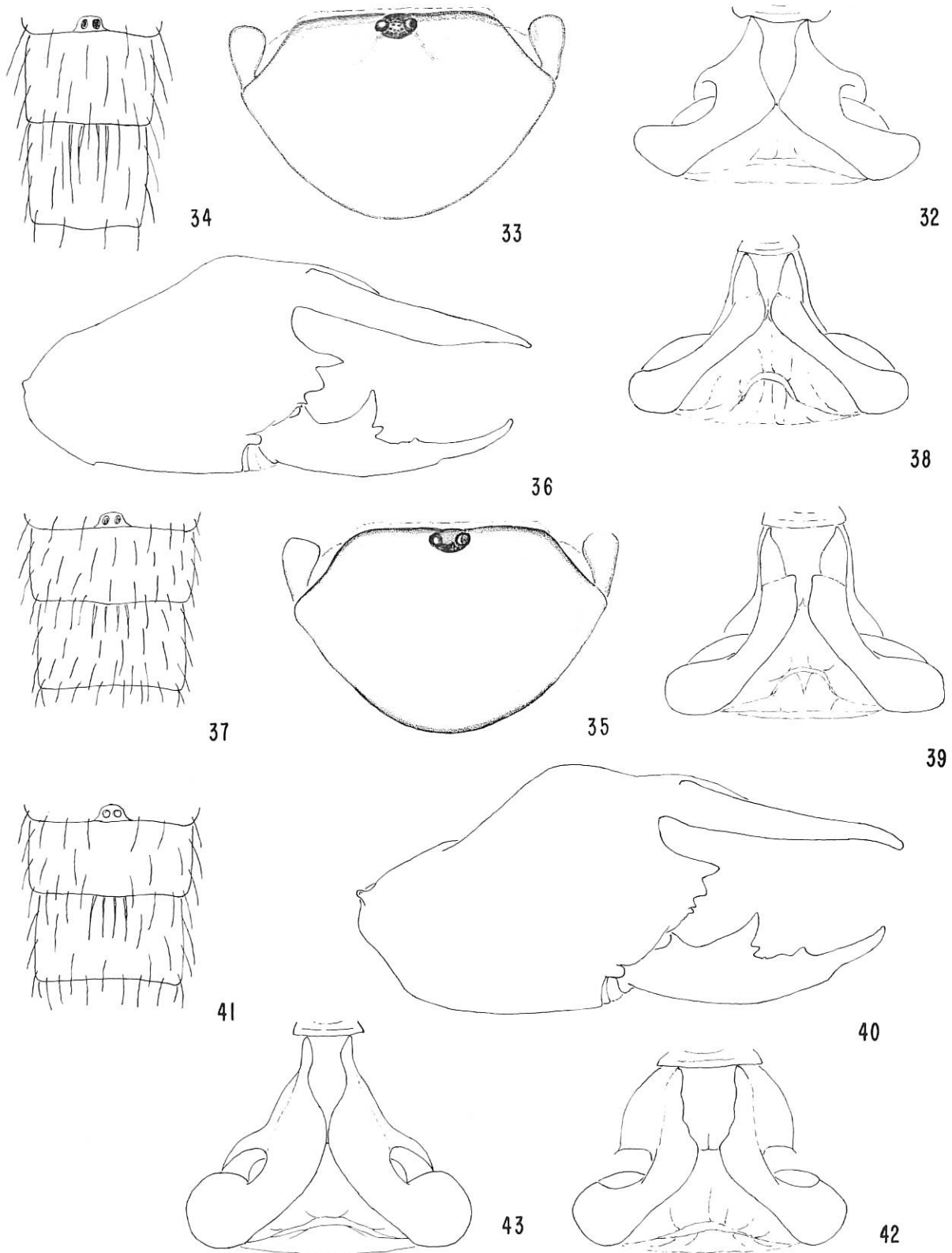


Plate V. Figures 32 to 34. *Eremobates norrisi* new species. 32. Ventral view of a common variation of female opercula in Silver City, New Mexico. 33. Dorsal view of a dusky propeltidium from Silver City, New Mexico. 34. Ventral view of male, holotype ctenidia. Figures 35 to 39. *Eremobates kiseri* new species. 35. Dorsal view of dusky, male propeltidium. 36. Ectal view of right, male, holotype chelicera. 37. Ventral view of typical, male ctenidia. 38. Ventral view of most common variation of female opercula. 39. Ventral view of least common variation of female opercula. Figures 40 to 43. *Eremobates texanus* new species. 40. Ectal view of right, male, holotype chelicera. 41. Ventral view of typical, male ctenidia. 42. Ventral view of most common variation of female opercula. 43. Ventral view of a variation of female opercula from Alpine, Texas.

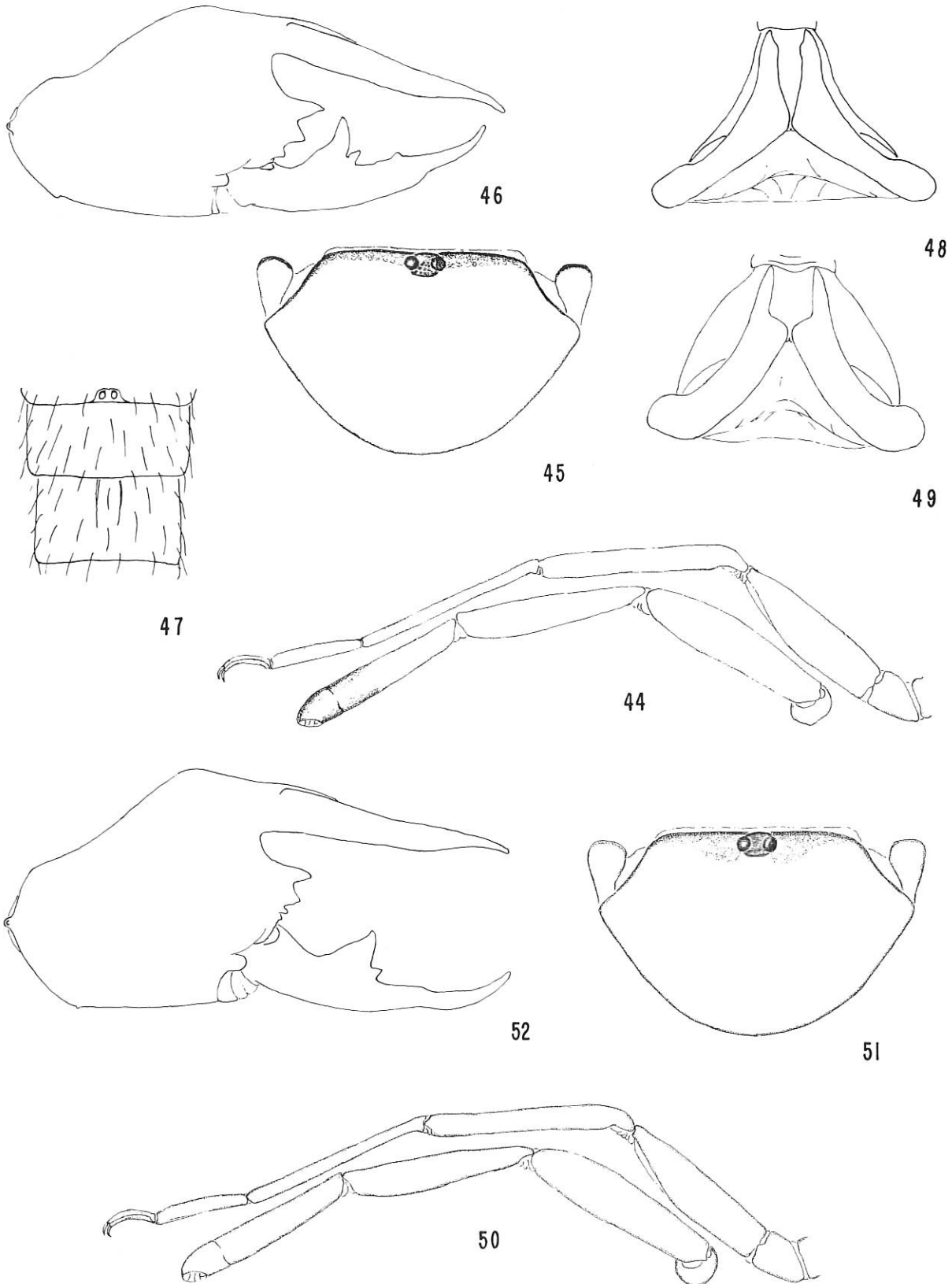


Plate VI. Figures 44 to 49. *Eremobates bantai* Brookhart. 44. Mesal view of right, male, holotype palpus and ectal view of right, male, holotype, leg IV. 45. Dorsal view of male propeltidium, paratype from Phantom Canyon, Colorado. 46. Ectal view of right, male, holotype chelicera. 47. Ventral view of male ctenidia, paratype from Phantom Canyon, Colorado. 48 and 49. Ventral views of only known variations of female opercula. Figures 50 to 52. *Eremobates polhemusi* new species. 50. Mesal view of right palpus and ectal view of right leg IV, holotype. 51. Dorsal view of holotype propeltidium. 52. Ectal view of right, holotype chelicera.

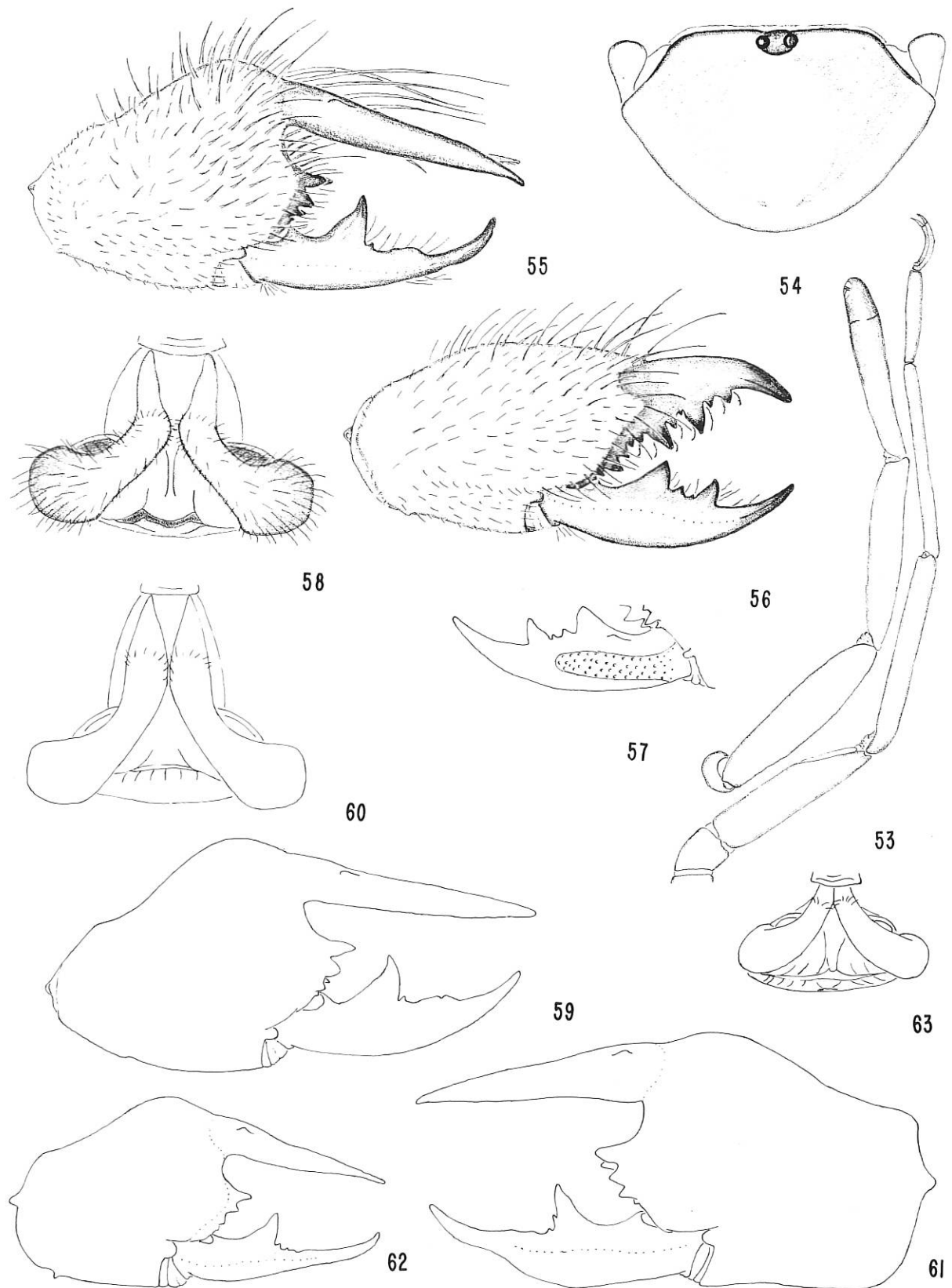


Plate VII. Figures 53 to 58. *Eremobates ajoanus* new species. 53. Mesal view of right palpus and ectal view of right, leg IV of male holotype. 54. Dorsal view of typical, male propeltidium. 55. Ectal view of right, male chelicera, holotype. 56. Ectal view of right, female chelicera, allotype. 57. Mesal view of typical, right, female, cheliceral, movable finger. 58. Dorsal view of typical, female opercula. Figures 59 and 60. *Eremobates bixleri* new species. 59. Ectal view of right chelicera of male holotype. 60. Ventral view of only female opercula. Figures 61 to 63. *Eremobates affinis* (Kraepelin). 61. Ectal view of left chelicera of holotype. 62. Ectal view of right chelicera of male paratype. 63. Ventral view of opercula of female paratype.

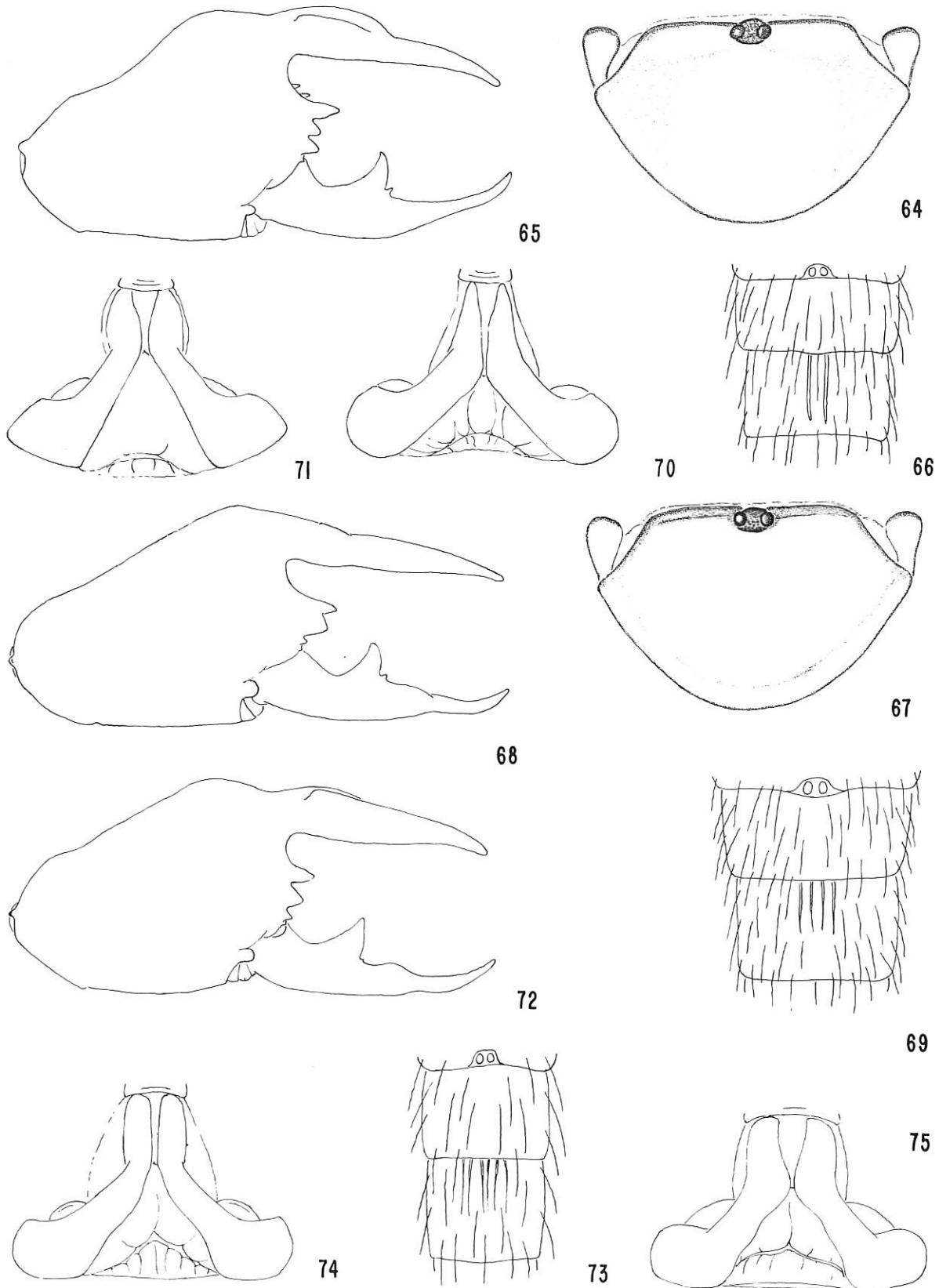


Plate VIII. Figures 64 to 66. *Eremobates pimanus* new species. 64. Dorsal view of male, holotype propeltidium. 65. Ectal view of right, male, holotype chelicera. 66. Ventral view of male, holotype ctenidia. Figures 67 to 71. *Eremobates pallidus* new species. 67. Dorsal view of male, holotype propeltidium. 68. Ectal view of right, male, holotype chelicera. 69. Ventral view of male, holotype ctenidia. 70 and 71. Ventral view of most common variations of female opercula. Figures 72 to 75. *Eremobates gracilidens* Muma. 72. Ectal view of typical, right, male chelicera. 73. Ventral view of typical, male ctenidia. 74 and 75. Ventral view of 2 variations of female opercula.

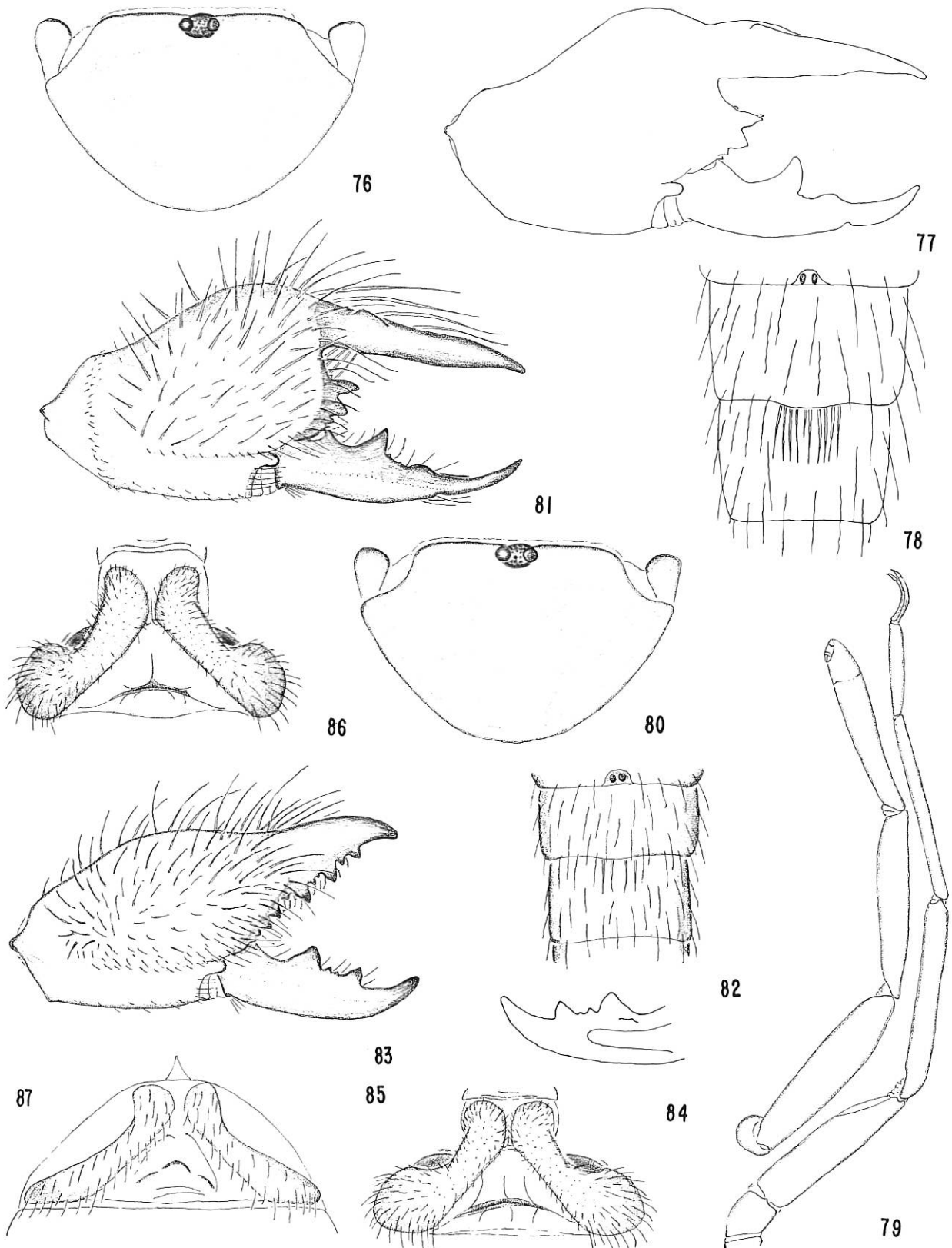


Plate IX. Figure 76. *Eremobates gracilidens* Muma, dorsal view of typical, male propeltidium. Figures 77 and 78. *Eremobates pyriflora* new species. 77. Ectal view of right, male, holotype chelicera. 78. Ventral view of male, holotype ctenidia. Figures 79 to 87. *Eremobates kraepelini* Muma. 79. Mesal view of typical, right, male palpus and ectal view of typical, right, male, leg IV. 80. Dorsal view of typical, male propeltidium. 81. Ectal view of typical, right, male chelicera. 82. Ventral view of male, holotype ctenidia. 83. Ectal view of typical, right, female chelicera. 84. Mesal view of right, female, cheliceral, movable finger. 85 and 86. Ventral view of most common variations of female opercula. 87. *Eremognatha tuberculata*, Roewer (1934) plate 324 fig. 0, female opercula, redrawn and shaded.

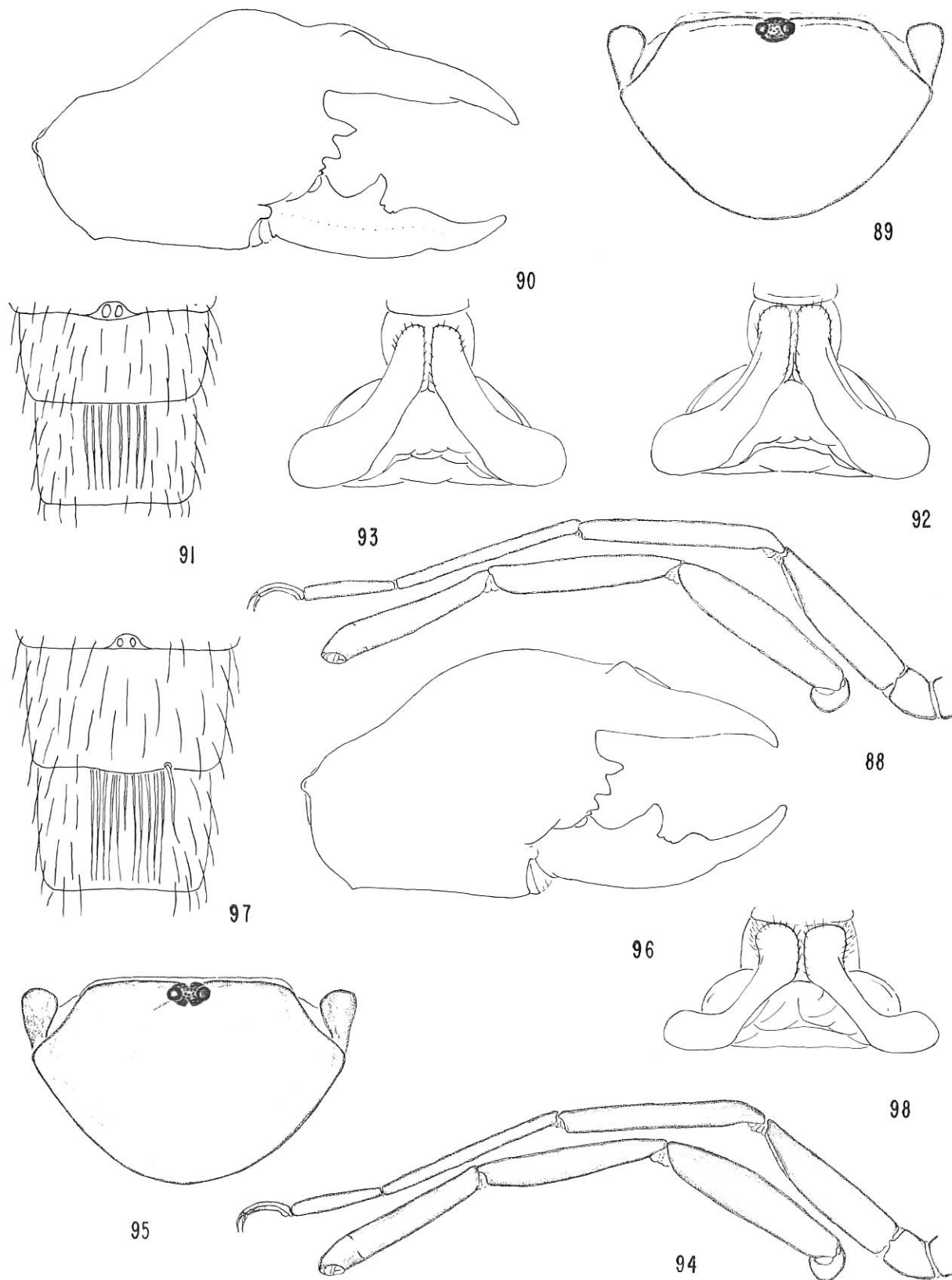


Plate X. Figures 88 to 93. *Eremobates titschacki* (Roewer). 88. Mesal view of typical, right, male palpus and ectal view of typical, right, male, leg IV. 89. Dorsal view of typical, male propeltidium. 90. Ectal view of typical, right, male chelicera. 91. Dorsal view of typical, male ctenidia. 92 and 93. Dorsal view of variations of female opercula. 94 to 98. *Eremobates otovonae* new species. 94. Mesal view of right, male, holotype palpus and ectal view of right, male, holotype, leg IV. 95. Dorsal view of typical, male propeltidium. 96. Ectal view of typical, right, male chelicera. 97. Ventral view of male, holotype ctenidia. 98. Ventral view of female, allotype opercula.

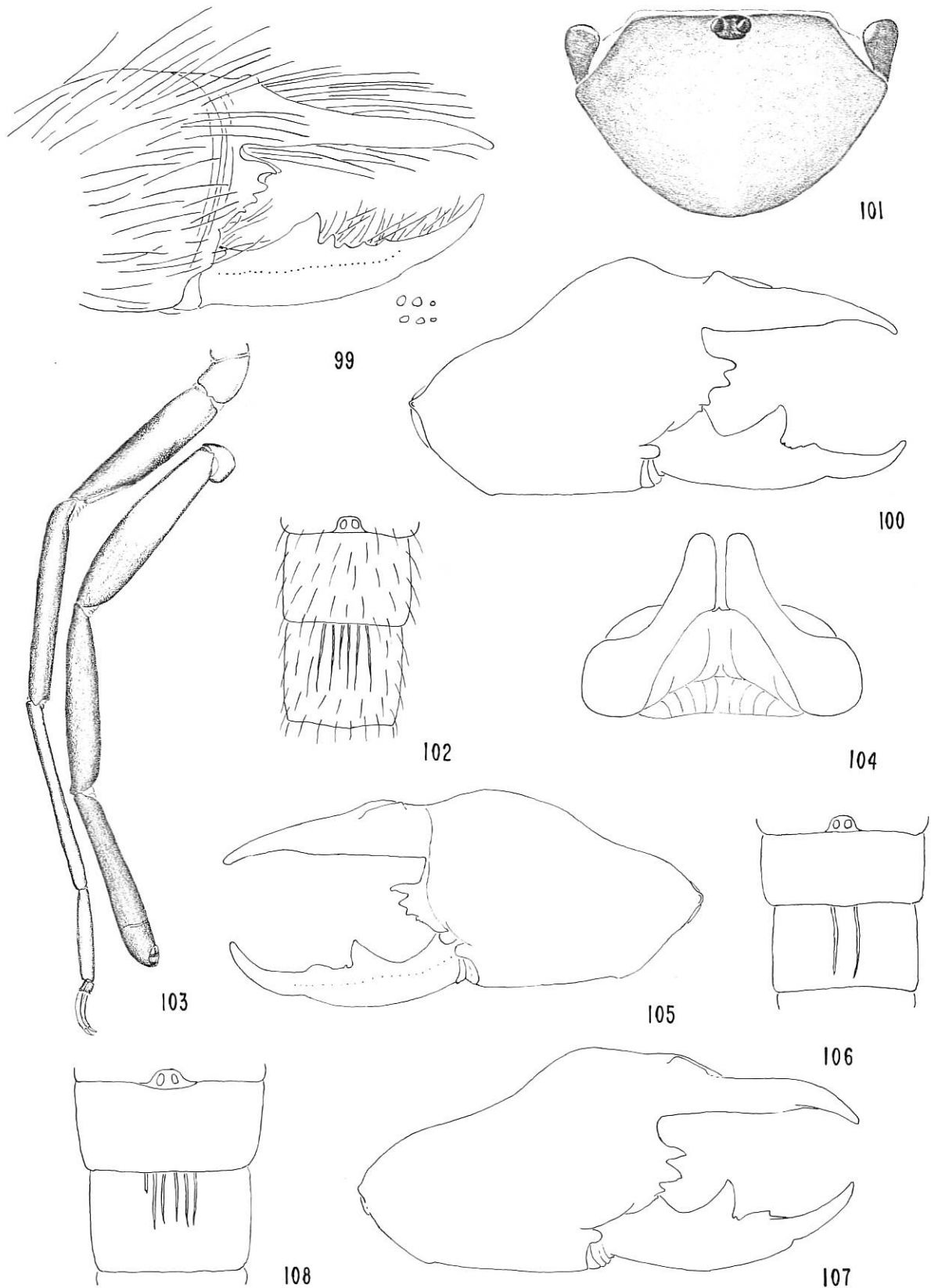


Plate XI. Figure 99. *Eremobates girardi* (Putnam), ectal view of right, male chelicera. Figures 100 to 104. *Eremobates williamsi* new species. 100. Ectal view of right, male, holotype chelicera. 101. Dorsal view of male, holotype propeltidium. 102. Ventral view of male, holotype ctenidia. 103. Mesal view of male, holotype, right palpus and ectal view of male, holotype, right, leg IV. 104. Ventral view of female, allotype opercula. Figures 105 and 106. *Eremobates tejonus* Chamberlin. 105. Ectal view of left, male, type chelicera. 106. Ventral view of male, type ctenidia. Figures 107 and 108. *Eremobates nivis* new species. 107. Ectal view of right, male, holotype chelicera. 108. Ventral view of male, holotype ctenidia.

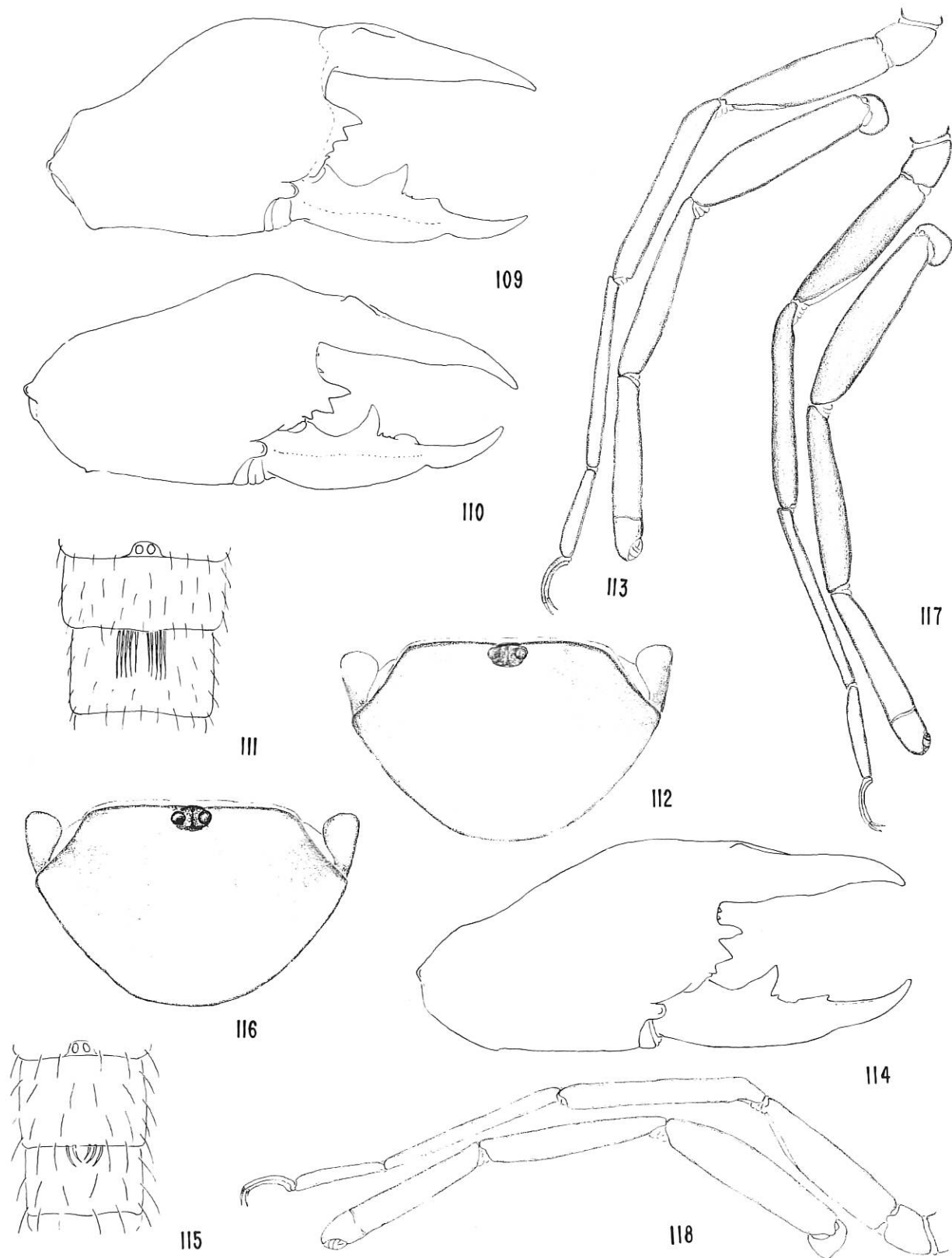


Plate XII. Figure 109. *Eremobates tuberculatus* Kraepelin, ectal view of right, male, type chelicera. Figures 110 to 113. *Eremobates leechi* new species. 110. Ectal view of right, male, holotype chelicera. 111. Ventral view of male, holotype ctenidia. 112. Dorsal view of male, holotype propeltidium. 113. Mesal view of right, male, holotype palpus and ectal view of right, male, holotype, leg IV. Figures 114 to 117. *Eremobates nanus* Muma. 114. Ectal view of right, male, holotype chelicera. 115. Ventral view of male, holotype ctenidia; redrawn from Muma, 1962 (all ctenidia are now missing). 116. Dorsal view of male holotype propeltidium. 117. Mesal view of male, palpus and ectal view of right, male, holotype, leg IV. Figure 118. *Eremobates scopulatus* Muma, mesal view of right, male, holotype palpus and ectal view of right, male, holotype, leg IV.

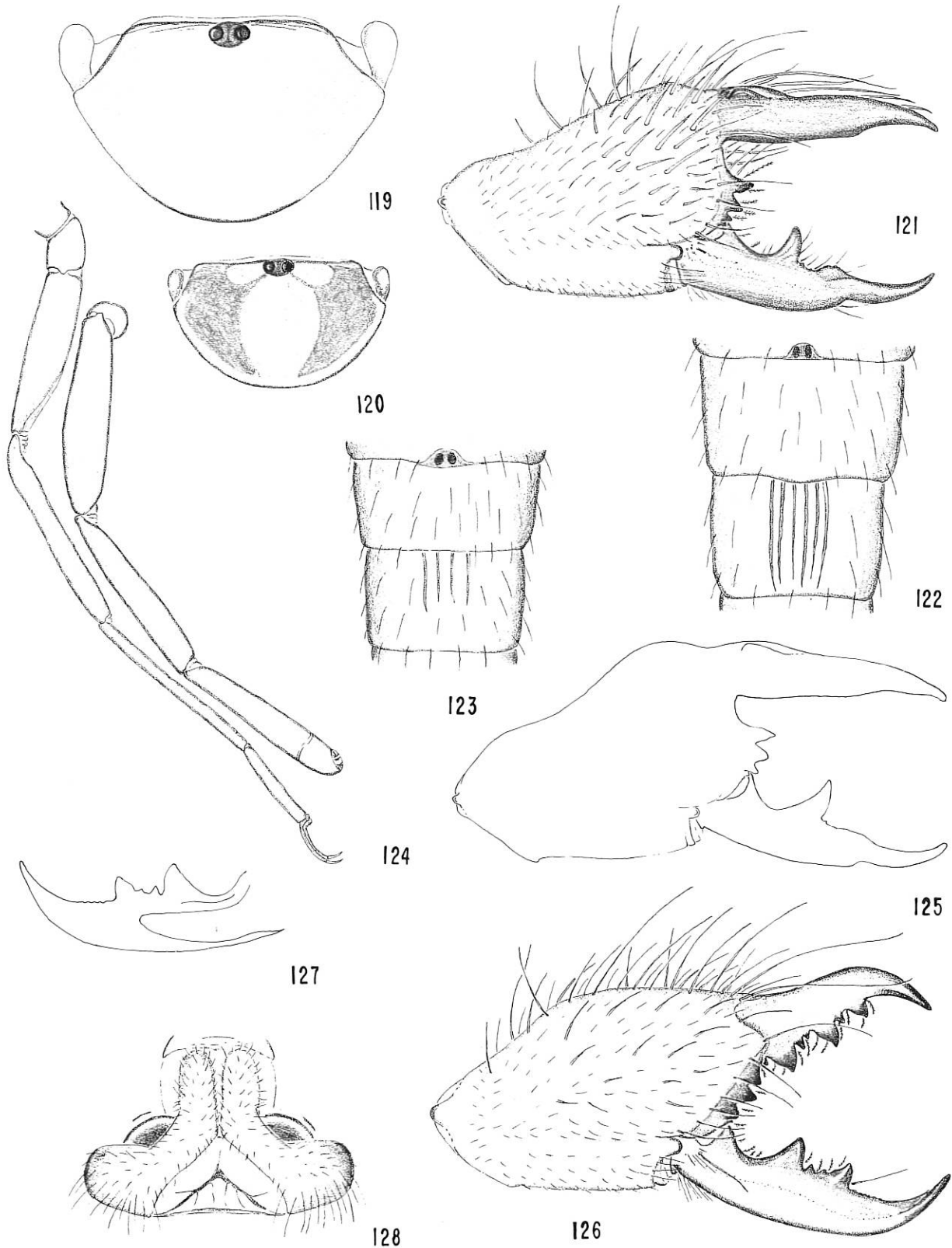


Plate XIII. Figures 119 to 128. *Eremobates scopulatus* Muma. 119. Dorsal view of typical, male propeltidium from Anza Borrego State Park, San Diego County, California. 120. Dorsal view of male, holotype propeltidium. 121. Ectal view of typical, male, right chelicera from Mercury, Nevada. 122. Ventral view of male, holotype ctenidia. 123. Ventral view of typical, male ctenidia from Mercury, Nevada. 124. Mesal view of right, male palpus and ectal view of right, male leg IV from Anza Borrego State Park, San Diego County, California. 125. Ectal view of typical, male, right chelicera from southern California. 126. Ectal view of right, female, allotype chelicera. 127. Mesal view of right, female, allotype, cheliceral, movable finger. 128. Ventral view of typical, female opercula from Mercury, Nevada.

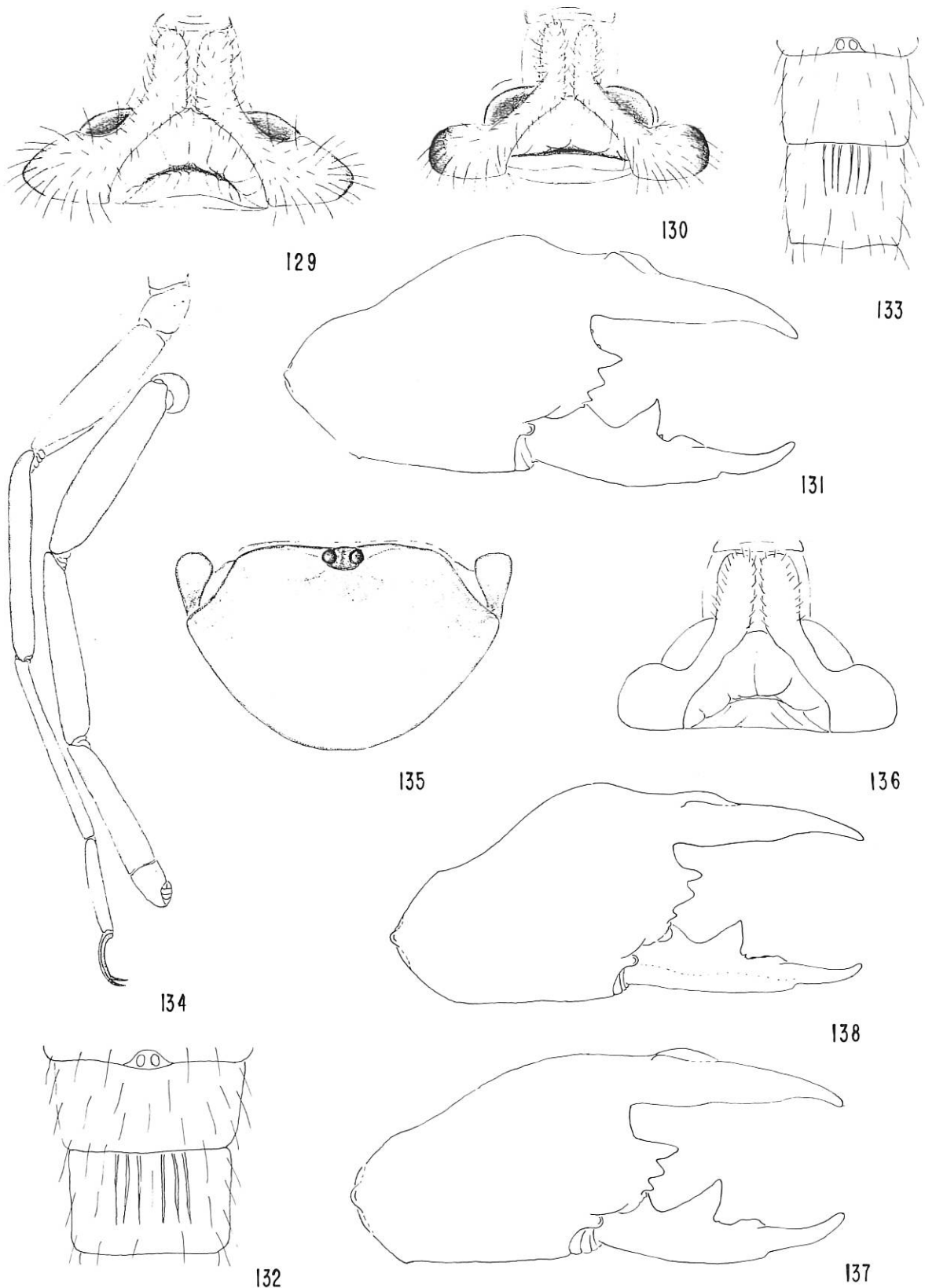


Plate XIV. Figures 129 and 130. *Eremobates scopulatus* Muma, ventral views of variations of female opercula. Figures 131 to 136. *Eremobates spissus* new species. 131. Ectal view of right, male holotype chelicera. 132. Ventral view of male, holotype ctenidia. 133. Ventral view of male, paratype ctenidia. 134. Mesal view of right, male, holotype palpus and ectal view of right, male, holotype, leg IV. 135. Dorsal view of male, holotype propeltidium. 136. Ventral view of female, allotype opercula. Figures 137 and 138. *Eremobates vicinus* Muma. 137. Ectal view of right, male, holotype chelicera. 138. Ectal view of typical, right, male chelicera from Reno, Nevada.

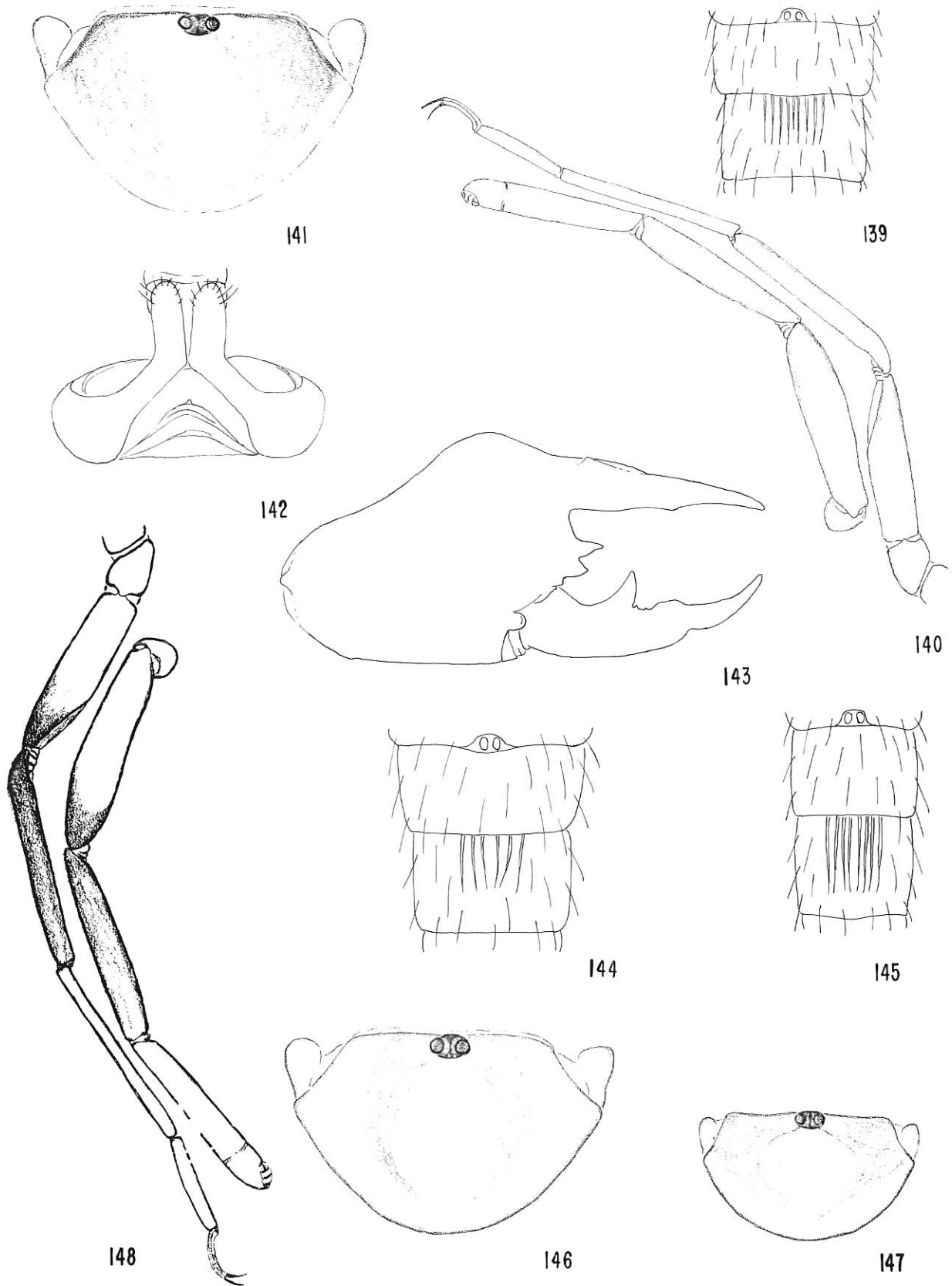


Plate XV. Figures 139 to 148. *Eremobates vicinus* Muma. 139. Ventral view of male, holotype ctenidia. 140. Mesal view of right, male, holotype palp and ectal view of right, male, holotype, leg IV. 141. Dorsal view of typical male propeltidium. 142. Ventral view of female opercula from Reno, Nevada. 143. Ectal view of typical, right, male chelicera from southern California. 144 and 145. Ventral views of variations of male ctenidia in southern California. 146 and 147. Dorsal views of variations of male propeltidia in southern California. 148. Mesal view of right, male palp and ectal view of right, male, leg IV from southern California.

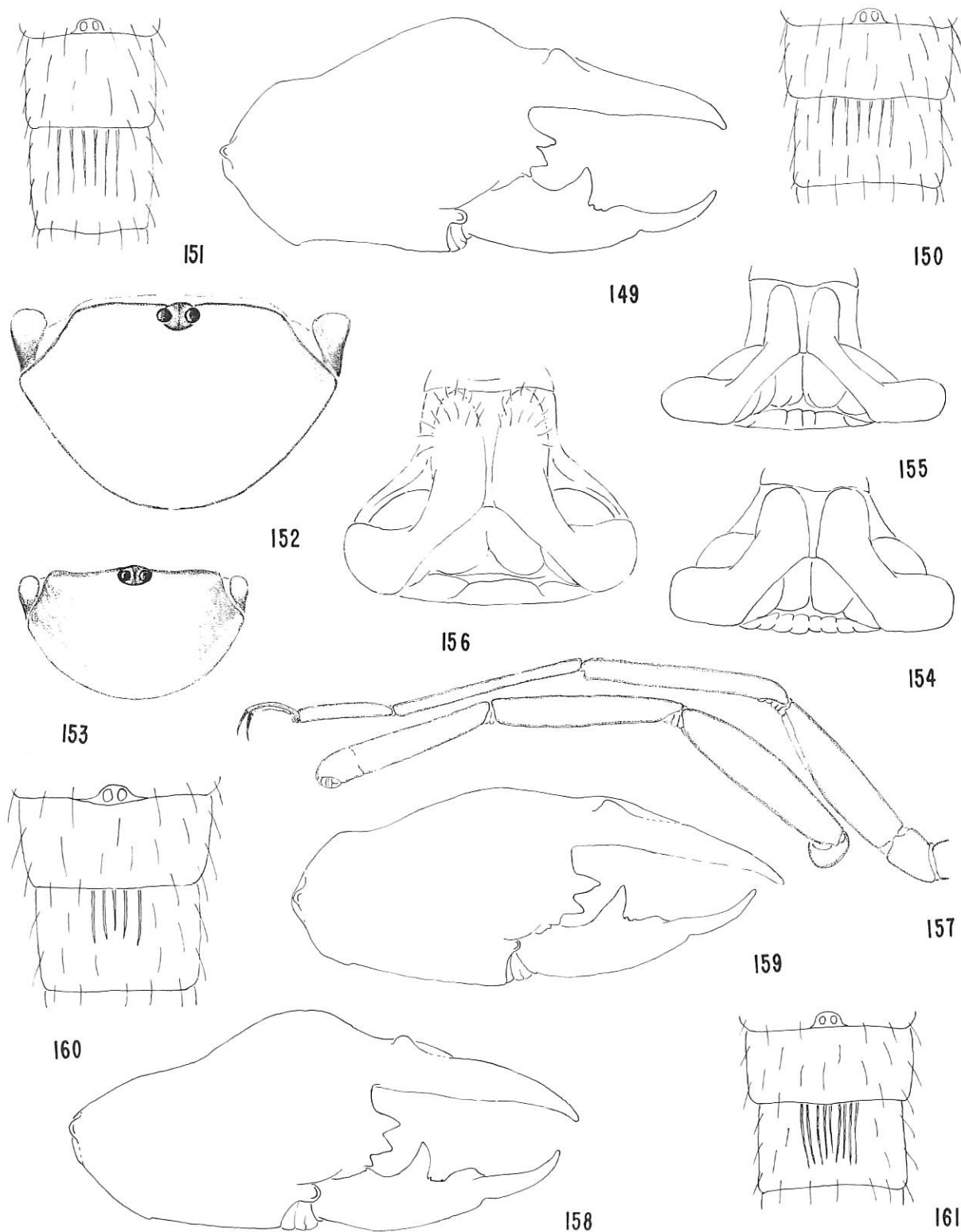


Plate XVI. Figures 149 to 157. *Eremobates kastoni* new species. 149. Ectal view of right, male, paratype chelicera; movable finger of the chelicera broken on holotype. 150. Ventral view of male, holotype ctenidia. 151. Ventral view of male ctenidia from Campo, California. 152. Dorsal view of male, holotype propeltidium. 153. Dorsal view of dark, male, paratype propeltidium. 154. Ventral view of female, allotype opercula. 155. Variation of female opercula from Campo, California. 156. Variation of female opercula from Hesperia, California. 157. Mesal view of right, male, holotype palp and ectal view of right, male, holotype, leg IV. Figures 158 to 161. *Eremobates scopulatellus* new species. 158. Ectal view of typical, right, male chelicera from Winchester, California. 159. Ectal view of typical, right, male chelicera from Sand Canyon near Tehachapi, California. 160. Ventral view of male ctenidia from Winchester, California. 161. Ventral view of male ctenidia from Sand Canyon near Tehachapi, California.

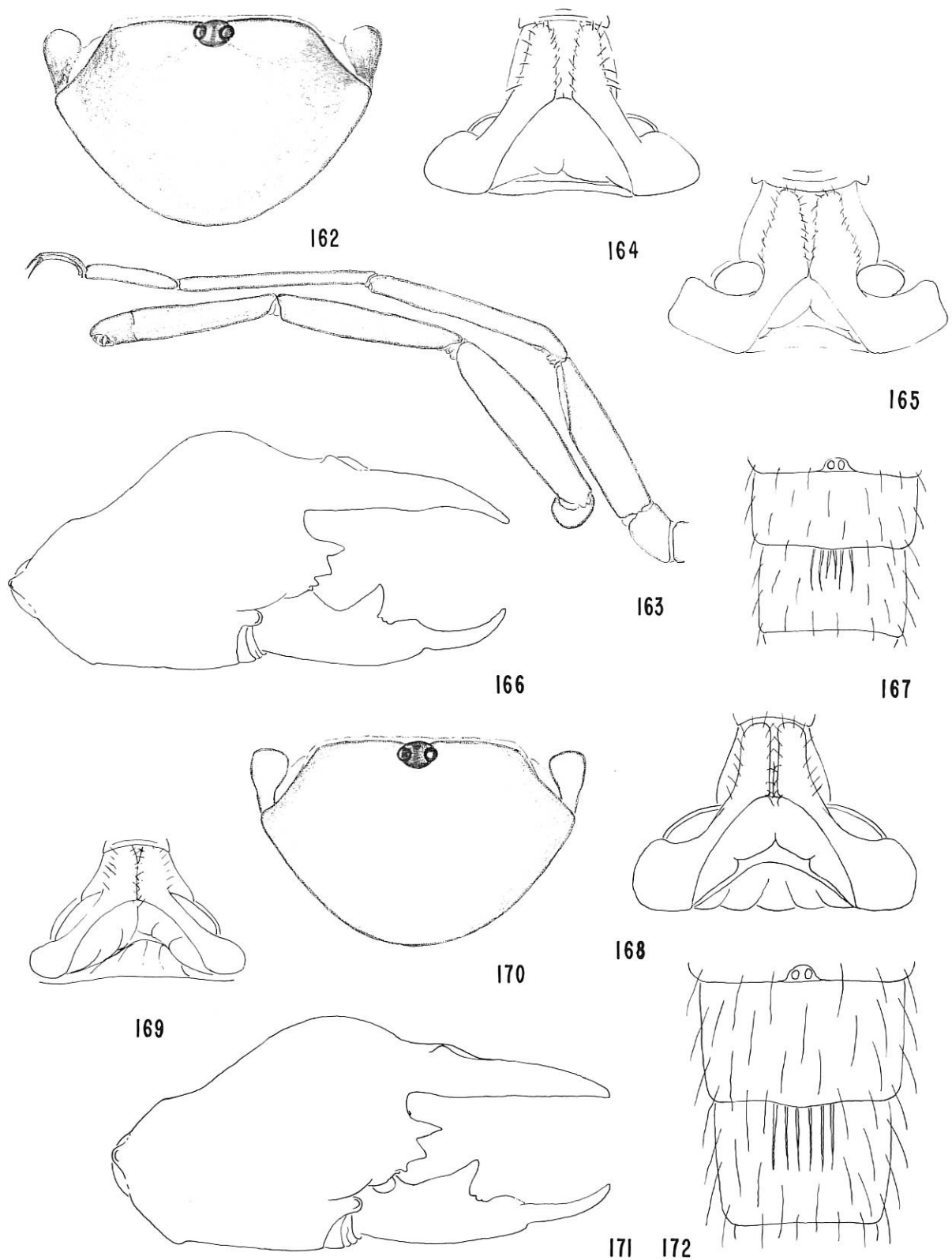


Plate XVII. Figures 162 to 165. *Eremobates scopulatellus* new species. 162. Dorsal view of typical, male propeltidium. 163. Mesal view of typical, right, male palpus and ectal view of typical right, male, leg IV from Ft. Tejon, California. 164 and 165. Ventral views of variations of female opercula from Winchester California. Figures 166 to 170. *Eremobates fagei* Roewer. 166. Ectal view of right, male chelicera from Fresno, California. 167. Ventral view of male ctenidia from Fresno, California. 168. Ventral view of female opercula from Fresno, California. 169. Ventral view of female holotype opercula. 170. Dorsal view of male propeltidium from Fresno, California. Figures 171 and 172. *Eremobates papillatus* Muma. 171. Ectal view of right, male, holotype chelicera. 172. Ventral view of male, holotype ctenidia.

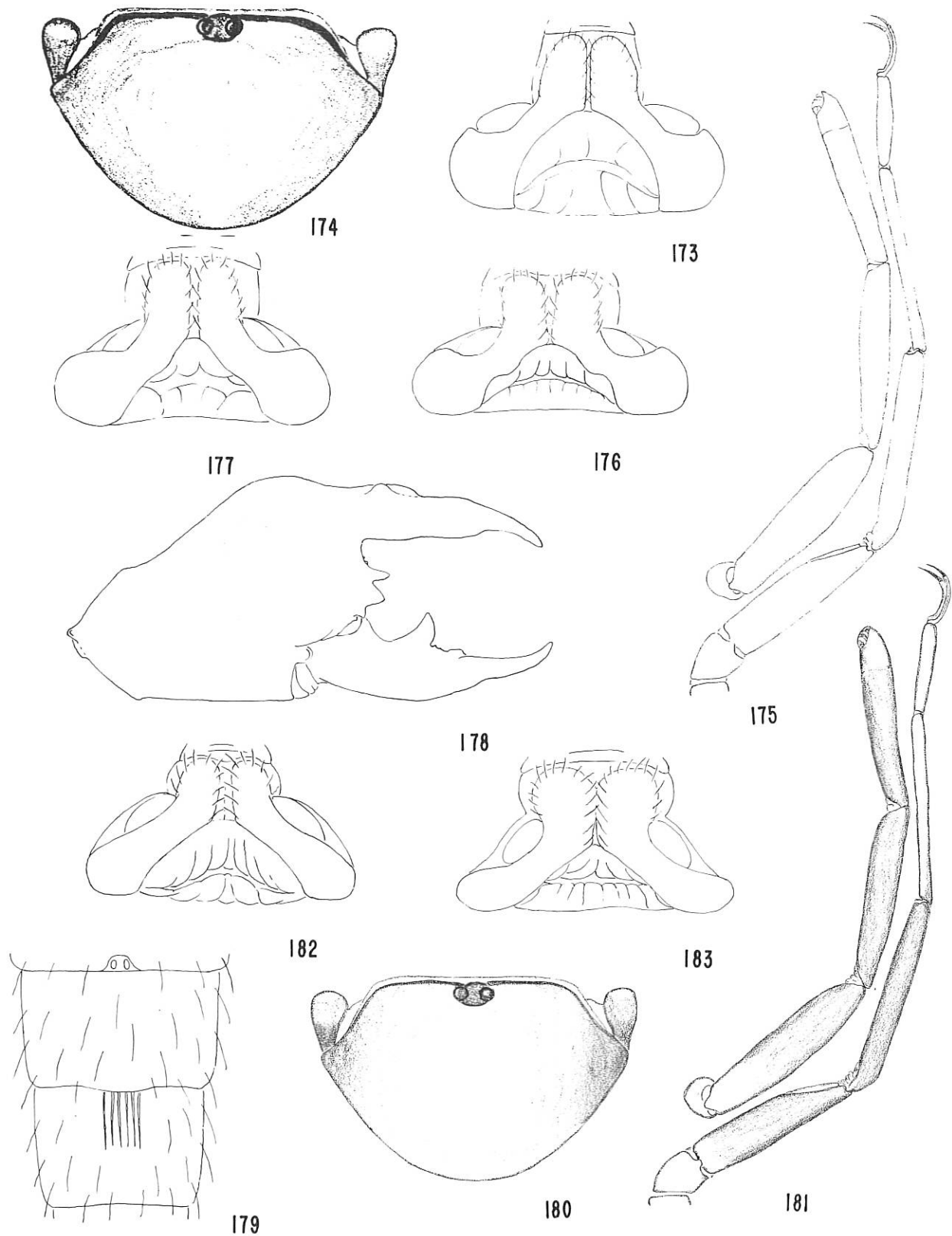
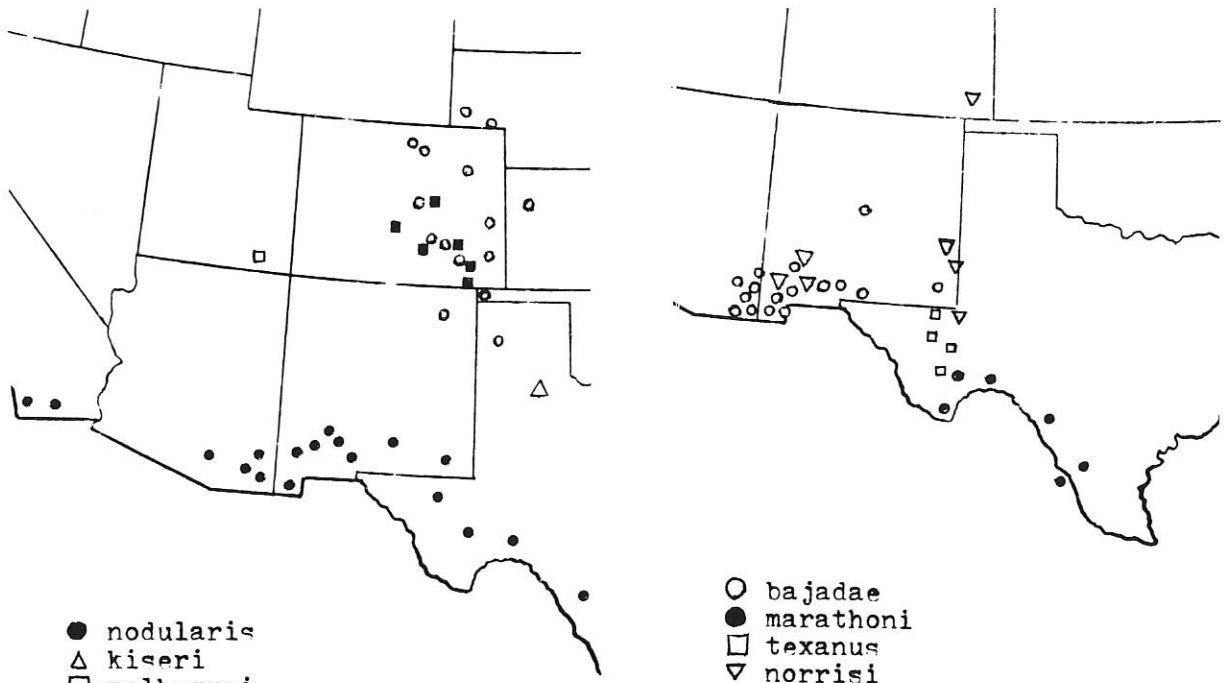
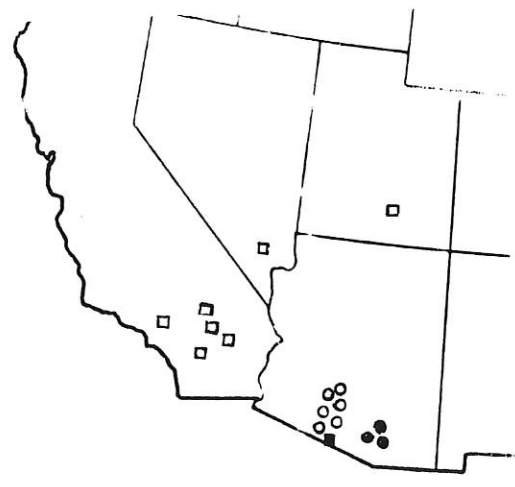


Plate XVIII. Figures 173 to 175. *Eremobates papillatus* Muma. 173. Ventral view of typical, female opercula. 174. Dorsal view of typical, female propeltidium. 175. Mesal view of typical, right, female palus and typical, right, female, leg IV. Figures 176 and 177. *Eremobates inyoanus* new species, ventral views of variations of female opercula. Figures 178 to 183. *Eremobates villosus* Muma. 178. Ectal view of right, male, holotype chelicera. 179. Ventral view of male ctenidia from Tuolumne County, California. 180. Dorsal view of male, holotype propeltidium. 181. Mesal view of right, male, holotype palpus and ectal view of right, male, holotype, leg IV. 182. Ventral view of female allotype opercula. 183. Ventral view of typical, female opercula from Tuolumne County, California.



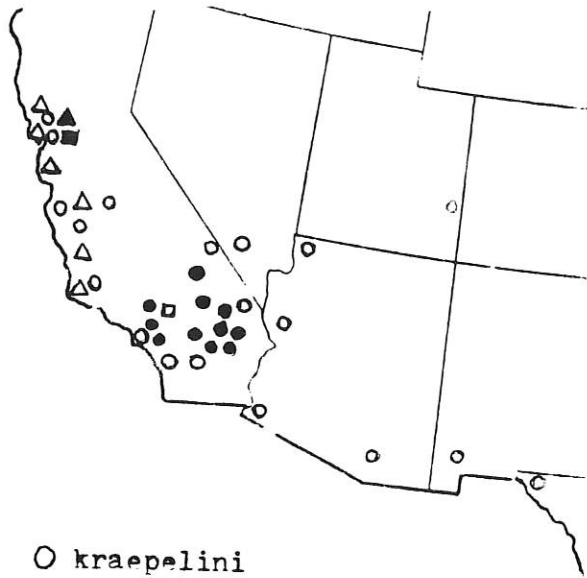
- nodularis
- △ kiseri
- polhemusi
- bantai
- palpisetulosus

- bajadae
- marathoni
- texanus
- ▽ norrisi

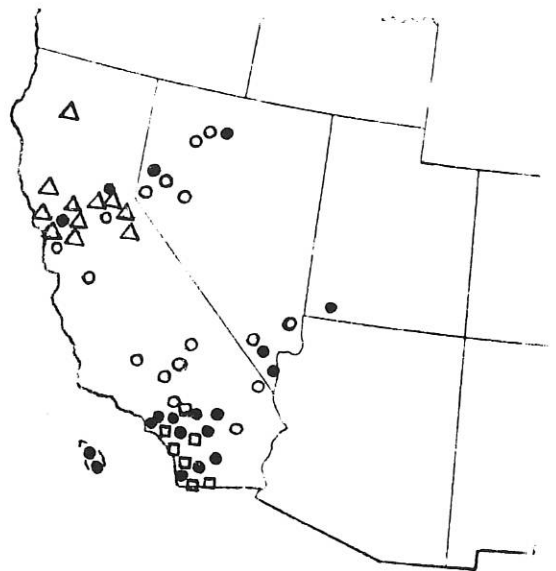


- ajoanus
- bixleri
- pimanus
- pallidus

Plate XIX. Distribution of *nodularis*, *palpisetulosus*, and *ajoanus* series, and 2 species of *kraepelini* series.



- kraepelini
- gracilidens
- △ titschacki
- pyriflora
- otavonae
- ▲ napaanus



- scopulatus
- vicinus
- △ villosus
- kastoni



- + spissis
- williamsi
- △ papillatus
- inyoanus
- ▲ nivis
- fagei
- scopulatellus

Plate XX. Distribution of 5 species of *kraepelini* series and *scopulatus* series.