



Revision of the camel spider genus *Eremocosta* Roewer and a description of the female *Eremocosta gigas* Roewer (Arachnida, Solifugae)

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Abstract

A recent phylogenetic analysis demonstrated that the solifuge genus *Eremocosta* (Eremobatidae), although not monophyletic, formed a strongly supported group, rendered paraphyletic by the exclusion of *E. acuitlapanensis*, which we herein determine is misplaced in this genus. We revise the taxonomy of the genus *Eremocosta*. Nine species of the 13 currently placed in the genus are retained, *E. bajaensis* (Muma 1986), *E. calexicensis* (Muma 1951), *E. formidabilis* (Simon 1879), *E. gigas* Roewer 1934, *E. gigasella* (Muma 1970), *E. spinipalpis* (Kraepelin 1899), *E. striata* (Putnam 1883), and *E. titania* (Muma 1951). *Eremocosta fusca* (Muma 1986) and *E. montezuma* (Roewer 1934) are returned to the genus *Eremorhax* along with *E. arenarum*. *Eremocosta hystrix* and *Eremocosta acuitlapanensis* (Vázquez & Gaviño-Rojas 2000) are transferred to *Eremobates*. We re-evaluated *E. nigrimana* (Pocock 1895) and determined that, since the type shows the ventrodistal concavity (VDC) diagnostic for the genus *Eremocosta*, it should be retained in that genus; however, because the type locality is identified as Afghanistan, far outside the range of any Eremobatidae, its status and placement remain uncertain. *Eremocosta robusta* (Roewer 1934) was designated *nomen dubium* by Muma and we maintain this designation. We provide a key to the species of *Eremocosta* and provide a description of the female of *E. gigas*.

Key words: Solifugid, taxonomy

Introduction

The molecular phylogeny of Cushing *et al.* (2015) demonstrated that the genus *Eremocosta* was rendered paraphyletic by a single species, *E. acuitlapanensis*, which we now believe is misplaced in that genus. Based upon the support of *Eremocosta* as well as diagnostic morphology established by Roewer (1934) and Muma (1951, 1970) for members of this genus, it is clear that *Eremocosta* needs to be revised. Collection of more specimens has given us a better idea of the distribution and morphological variation of each species in the genus. In this paper we attempt to clarify the status of the genus *Eremocosta* and add to Muma's (1951) detailed descriptions of *E. calexicensis*, *E. gigasella*, *E. striata*, and *E. titania*, which may have been based on specimens that were misidentified at the time. In addition we provide the first description of the female of *E. gigas*. We also provide a key to species of *Eremocosta*. We follow the definitions of cheliceral characters found in Bird *et al.* (2015).

Taxonomic history of the genus. The genus *Eremocosta* was erected by Roewer (1934) with the male of *Eremocosta gigas* designated as the type species. At that time he also included the female *Datames geniculatus* (Simon 1879) in the genus as *Eremocosta geniculata* (Simon 1879). Roewer (1934) in his description of the male described the genus as having “a flagellum complex consisting of a row of bristles on the medial-dorsal side of the immovable finger...the latter in the apical third with a ventral, deep depression, which is sharply delimited” (translated from Roewer 1934).

Roewer (1934) also described the genus *Eremacantha*, designating *Eremacantha robusta* as the type species. *Eremorhax* was made the type genus of the subfamily Eremorhaxinae. This subfamily was later synonymized under Eremobatinae Kraepelin 1899 by Muma (1951). Muma (1951) synonymized Roewer's *Eremopus* and *Eremocosta* under *Eremorhax* and moved Roewer's *Eremocosta geniculata* to the genus *Eremobates*. He later (Muma 1970) synonymized this species with *Eremobates mormonus* (Roewer 1934). Muma (1951) divided

Eremorhax into two species groups: the *magnus* and the *striatus* groups based upon the shape of the mesoventral groove on the cheliceral fixed finger. Muma (1970) included a third species group, the *montezuma* group in the genus *Eremorhax*. He included only the species *E. montezuma* in the latter group; the *magnus* group included *E. formidabilis* (Simon 1879), *E. latus* Muma 1951, *E. magnus* (Hancock 1888), *E. puebloensis* Brookhart 1965, and *E. pulcher* Muma 1963; the *striatus* group included *E. calexicensis* Muma 1951, *E. gigas* (Roewer 1934), *E. gigasellus* Muma 1951, *E. spinipalpis* (Kraepelin 1899), *E. striatus* (Putnam 1883), and *E. titania* Muma 1951 (Muma 1970). Muma (1970) recognized that the specimens he referred to as *E. gigas* in his 1951 publication actually represented the species he named *E. gigasellus* in the 1970 publication. He designated *Eremorhax robusta* (described by Roewer as *Eremacantha robusta*) as *nomen dubium* because the type was immature and lacked sexual characters that would allow proper placement. Muma (1989) included *Eremorhax formidabilis* in the key to the *striatus* species group of the genus *Eremorhax* rather than in the *magnus* group, where he had previously placed this species. In an unpublished revision of the Eremobatidae Muma proposed placing all members of the *striatus* group in the genus *Eremocosta* (unpublished manuscript in the library of JOB). In 1989 Muma resurrected Roewer's *Eremopus* to include both the *Eremorhax striatus* group as well as the *Eremorhax montezuma* group.

Harvey (2002) noted that the genus *Eremopus* Roewer 1934 is a junior homonym of the copepod genus *Eremopus* Brady 1910 and selected *Eremocosta* Roewer 1934 as the valid name for *Eremopus* (Solifugae) since it was one of two junior synonyms (along with *Eremacantha*) in the original publication (Roewer 1934). The type species of *Eremocosta*, *E. gigas*, was well defined by Roewer (1934) and the holotype is in the Forschungsinstitut und Naturmuseum Senckenberganlage, Frankfurt, Germany. Harvey (2002) considered *Eremocosta* the preferred replacement name for *Eremopus* instead of *Eremacantha* since the type species of the latter genus, *Eremacantha robusta*, was an immature specimen (Muma 1970) not displaying useful characters for species identification. Harvey (2002) placed all species previously in the *Eremorhax magnus*, *striatus*, and *montezuma* species groups in the genus *Eremocosta* Roewer 1934 including: *E. acuitlapanensis* (Vázquez & Gaviño-Rojas 2000), *E. bajaensis* (Muma 1986), *E. calexicensis* (Muma 1951), *E. formidabilis* (Simon 1879), *E. fusca* (Muma 1986), *E. gigas* Roewer 1934, *E. gigasella* (Muma 1970), *E. montezuma* (Roewer 1934), *E. nigrimana* (Pocock 1895), *E. robusta* (Roewer 1934), *E. spinipalpis* (Kraepelin 1899), *E. striata* (Putnam 1883), and *E. titania* (Muma 1951).

Harvey's (2002) nomenclatural change from *Eremopus* to *Eremocosta* added members of the *Eremopus montezuma* group to *Eremocosta* as well as the enigmatic *Eremorhax nigrimana* whose type locality was listed as "probably Meshed, Afghanistan" and had been formerly included in the *magnus* group of *Eremorhax*. Based on morphology, members of the *Eremocosta montezuma* group (*E. montezuma* and *E. fusca*) are misplaced as is *E. arenarum* (Ballesteros & Francke 2007). Harvey's decisions led later researchers to include two other species in the genus *Eremocosta*: *E. acuitlapanensis* (Vázquez-Rojas & Gaviño-Rojas 2000) and *E. hystrix* (Mello-Leitão 1942) (Vázquez-Rojas *et al.* 2014). Examination of these species led us to revise their generic placement. We revise the genus *Eremocosta sensu stricto* and formally remove species that do not belong in this genus.

Materials and methods

We examined specimens from the following collections: American Museum of Natural History, New York, New York, USA (AMNH); British Natural History Museum, London, England (BNHM); California Academy of Science, San Francisco, California, USA (CAS); Denver Museum of Nature & Science, Denver, Colorado, USA (DMNS); Bohart Museum of Entomology, University of California, Davis, California, USA (UCD); Instituto de Biología Universidad Nacional Autónoma de México (IBUNAM); Forschungsinstitut und Naturmuseum Senckenberganlage, Frankfurt, Germany (SMF); United States Geological Survey, San Diego, California, USA (USGS) [USGS specimens now housed at DMNS]; United States National Museum of Natural History, Smithsonian, Washington, D. C., USA (USNM). Data from all specimens housed in the DMNS arachnology collection are available online in the SCAN Symbiota data portal (<http://symbiota4.acis.ufl.edu/scan/portal/index.php>). We examined the holotypes of *E. acuitlapanensis*, *E. arenarum*, *E. bajaensis*, *E. calexicensis* (as well as the female allotype), *E. gigas*, *E. gigasella*, and *E. titania* (as well as the female allotype). We also reviewed photographs of the types of *E. fuscus* housed at the CAS, *E. nigrimana* housed at the BNHM, and *E. montezuma* housed at the Naturhistorisches Museum in Wien, Austria.

We used the measurements described in Muma (1951), Brookhart & Muma (1981, 1987), Muma & Brookhart

(1988), Brookhart & Cushing (2004), and Cushing & Brookhart (2016). We recorded the following measurements either directly from the specimens or using an Olympus SZX12 microscope: total length of the body; total length of pedipalp, leg I (LI), and leg 4 (LIV); length of pedipalp tarsus and metatarsus; length and height of chelicera; height of base of fixed finger; and length of propeltidium. All measurements are in millimeters. Ratios used previously by Brookhart & Cushing (2002, 2004) were computed. These ratios are as follows: A/CP: the sum of the lengths of pedipalp, LI, and LIV divided by the sum of length of chelicera and length of propeltidium indicating length of appendages in relation to body size. Long-legged species have larger A/CP ratios. FFH/FNH (Fixed Finger Height/Fondal Notch Height; see Cushing & Brookhart 2016) indicates whether the fixed cheliceral finger of the male is thin or robust in relation to the size of the chelicera. FNL/FNH (Fondal Notch Length/Fondal Notch Height) indicates the degree of invagination of the fondal notch. We also calculated a new ratio: FFH/CH of the male (Fixed Finger Height/Cheliceral Height), which gives the relative height of the fixed finger in comparison to that of the chelicera. Cheliceral measurements are illustrated in fig. 2 of Cushing & Brookhart (2016).

We use the terminology of Bird *et al.* (2015) in referencing prolateral cheliceral setae and cheliceral dentition, particularly the RFA (retrofondal apical teeth, Bird *et al.* 2015). Bird *et al.* (2015) renamed Muma's (1951, 1970, 1989) mesal ventral groove (or MVG), the "flagellar groove" although several genera lack a flagella. In the case of *Eremocosta*, what may be a homologous structure is the ventrodiscal concavity, or VDC (Fig. 1; Bird *et al.* 2015).

Abbreviations as follows: CL—chelicera length; CH—chelicera height; FNL—fondal notch length; FNH—fondal notch height; FFH—fixed finger height; LI—first leg length; LIV—fourth leg length; other legs designated as LII, LIII; PPL—propeltidium length; PL—pedipalp length; PMT—palpal metatarsus length; PT—palpal tarsus length; TL—total length measured from distal tip of chelicera to posterior edge of the abdomen, although total length is skewed depending on distension of the abdomen (Muma & Brookhart 1988); VDC—ventrodiscal concavity of the male fixed finger. Cheliceral tooth character abbreviations are: FD—fixed finger, distal tooth; FM—fixed finger, medial tooth; FP—fixed finger, proximal tooth; FSD—fixed finger, subdistal tooth/teeth; FSM—fixed finger, submedial tooth; MM—movable finger, medial tooth; MD—movable finger, distal tooth; MP—movable finger, proximal tooth; MSM—movable finger, submedial tooth; MPL—movable finger, prolateral series teeth; RFA—retrofondal apical teeth; RF—retrofondal teeth. Bird *et al.* (2015) does not define or illustrate what we call the MD, but such a tooth, or ridge, is clearly visible on the movable finger of some male *Eremocosta* species (see arrows, Figs. 2K, O & S).

In describing fondal teeth dentition, we maintain Muma's (1951) use of Roman numerals designating the location and relative size of fondal teeth since this designation is less cumbersome and more adequately expresses relative size than the terminology proposed by Bird *et al.* (2015).

Cheliceral setal pattern as illustrated by Bird *et al.* (2015): *mpd*—movable finger, prodorsal setae are setae lining the dorsal margin of the setose area on the movable finger ventral to the asetose area (plates 12A, 13A, and 14A in Bird *et al.* 2015); *pvd*—proventral distal setae are rows of usually plumose setae lining the proventral margin of the fixed finger from the base to the apex (Bird *et al.* 2015, plate 73 D); *sfc*—setiform flagellum complex.

Taxonomy

Family Eremobatidae Kraepelin 1899

Subfamily Eremobatinae Kraepelin 1899.

Genus *Eremocosta* Roewer 1934.

Eremopus Roewer 1934: 561 [Junior homonym of *Eremopus* Brady 1910 (Crustacea, Copepoda)], Muma 1989: 4.

Eremocosta Roewer 1934: 569 (synonymized by Muma 1951: 41).

Eremocantha Roewer 1934: 571 (synonymized by Muma 1970: 9).

Type species. Of *Eremopus*: *Eremopus montezuma* Roewer 1934, by original designation. Of *Eremocosta*: *Eremocosta gigas* Roewer 1934, by original designation. Of *Eremocantha*: *Eremocantha robusta* Roewer 1934, by original designation.

Revised diagnosis. *Eremocosta* species are relatively large; ranging from 26 to 50 mm in length. Color patterns of the body and pedipalps are variable. The diagnostic synapomorphy of *Eremocosta* is the male fixed finger with a deep VDC (Figs. 1A–G). Neither Roewer (1934) nor Muma (1951, 1970) described the carina running inside this cavity that is evident in some species (Figs. 1B–F, arrows). The fixed finger of males lacks median dentition (Fig. 2). The movable finger of males has a large MP, one to two MSM, and one MM teeth (Fig. 2). The MP tooth is large and distinct. In *E. gigas*, *E. gigasella*, and *E. striata* the movable finger has what we here call a distal tooth of the movable finger (MD) (Figs. 2K, O & S, arrows). The fondal notch ranges from obscure to distinct (Fig. 2), and ordinarily has two to four RFA in the fondal notch and in some species one to three RFA on the ventral side of the fixed finger (Fig. 3). Pro- and retrolateral fondal teeth vary in gradation among the species (Fig. 3). The retrolateral IV is tiny in some species. Male cheliceral setal formation (*sfc*) consists of tubular setae dorsally, two rows of tubular setae prolaterally with the inner mesal row being plumose and extending dorsally to and sometimes above fondal tooth I. The prodorsal setae (*mpd*) consist of a proximal patch in all species except *E. gigasella* which has a linear row extending to MM. The proventral distal setae (*pdp*) consist of three robust setae and one proximal thin seta. The female chelicera fixed finger has a large FP, one to two FSM, a large FM, small FSD, and distinct FD (Fig. 2). The female movable finger has a large MP, one or two MSM, and one MM teeth. MPL tooth distinct on males and females (Fig. 2). *Eremocosta* females demonstrate typical eremobatid female cheliceral setal pattern with *pvd* and *mpd* setae forming a continuous plumose row from the FD to the MM teeth. The arms of the genital operculum of *Eremocosta* are alate and widely separated posteriorly (Fig. 4 and Muma 1989). The genital operculum is largely species-specific with some possessing thin arms with club like wings; others recurved, bent laterally at their posterior ends with no distinct external pits. No palpal papillae or ctenidia are present.

***Eremocosta bajaensis* (Muma 1986)**

Figs. 1A, 2A–D, 3A, 4A, 5A

Eremorhax bajaensis Muma 1986: 4–5, figs. 8–12.

Eremopus bajaensis (Muma 1987): Muma 1989: 5.

Eremocosta bajaensis (Muma 1986): Harvey 2002: 451.

Type material. Male holotype from Baja California Norte, México, 2 miles east of Ranch San Salvador along road to Valle Trinidad from Ensenada; 21 June 1973; coll. S.C. Williams & K.B. Blair, SCW # 314(4) (CAS). Female allotype from 10.2 km north of Santa Maria, Baja California, México (CAS). Examined male holotype but was unable to examine female allotype.

Other specimens examined. *Males* (11). MÉXICO: Baja California Norte, 2 August 2002, coll. Rcho [sic] & Enriques (2 males: IBUNAM no number); USA: California, Riverside County, Santa Rosa Mountains, Highway 74, 1 mile W Pinyon Pines [fire station], N 33.58947°, W 116.47021°, 4000 m elev., 19 July 2005, coll. Wendell Icenogle, one male (collected near a female) on highway in car headlights at 01:30 hr (DMNS ZA.36272); USA: California, San Diego County, Alpine at home, N 32.83505°, W 116.76641°, 579 m elev., 3 July 2001, coll. D. Stokes (DMNS ZA.15433); USA: California, San Diego County, Rancho Jamul Ecological Reserve, N 32.683°, W 116.81836°, 249 m elev., 21 July 2005, coll. Dustin A. Woods, pitfall trap (DMNS ZA.16321); USA: California, San Diego County, Hollenbeck Canyon Wildlife Area, N 32.728°, W 116.815°, 524 m elev., July 2003, coll. USGS, pitfall trap (DMNS ZA.16323); USA: California, San Diego County, Rancho Jamul, N 32.683°, W 116.81836°, 249 m elev., July 2007, coll. USGS (RAJ), pitfall trap (DMNS ZA.19091); USA: California, San Diego County, San Diego Wild Animal Park [San Diego Zoo Safari Park], N 33.08983°, W 116.98668°, 201 m elev., 9–13 August 2010, coll. USGS, pitfall trap (DMNS ZA.33088); USA: California, San Diego County, San Diego Wild Animal Park [San Diego Zoo Safari Park], N 33.09153°, W 116.98241°, 20–24 July 2009, coll. USGS, pitfall trap (DMNS ZA.33089); USA: California, San Diego County, San Diego National Wildlife Refuge, N 32.72446°, W 116.94318°, 107 m elev., 3–7 August 2009, coll. USGS, pitfall trap (2 males: DMNS ZA.33091).

Females (5). MÉXICO: Baja California Norte, 2 August 2002, coll. Rcho [sic] & Enriques (IBUNAM no number); USA: California, Riverside County, Santa Rosa Mountains, Highway 74, 1 mile W Pinyon Pines [fire station], N 33.58947°, W 116.47021°, 4000 m elev., 19 July 2005, coll. Wendell Icenogle, one female (collected near a male) on highway in car headlights at 01:30 hr (DMNS ZA.36272); USA: California, San Diego County,

San Diego Wild Animal Park [San Diego Zoo Safari Park], N 33.09761°, W 116.98011°, 235 m elev., 12 September–16 January 2011, coll. USGS, pitfall trap (DMNS ZA.33051); USA: California, San Diego County, San Diego Wild Animal Park [San Diego Zoo Safari Park], N 33.09761°, W 116.98011°, 235 m elev., 17–21 August 2009, coll. USGS, pitfall trap (DMNS ZA. 33090); USA: California, San Diego County, Alpine area, N 32.8305°, W 116.76641°, 562 m elev., 15 September 2003, coll. unknown (DMNS ZA.36271).

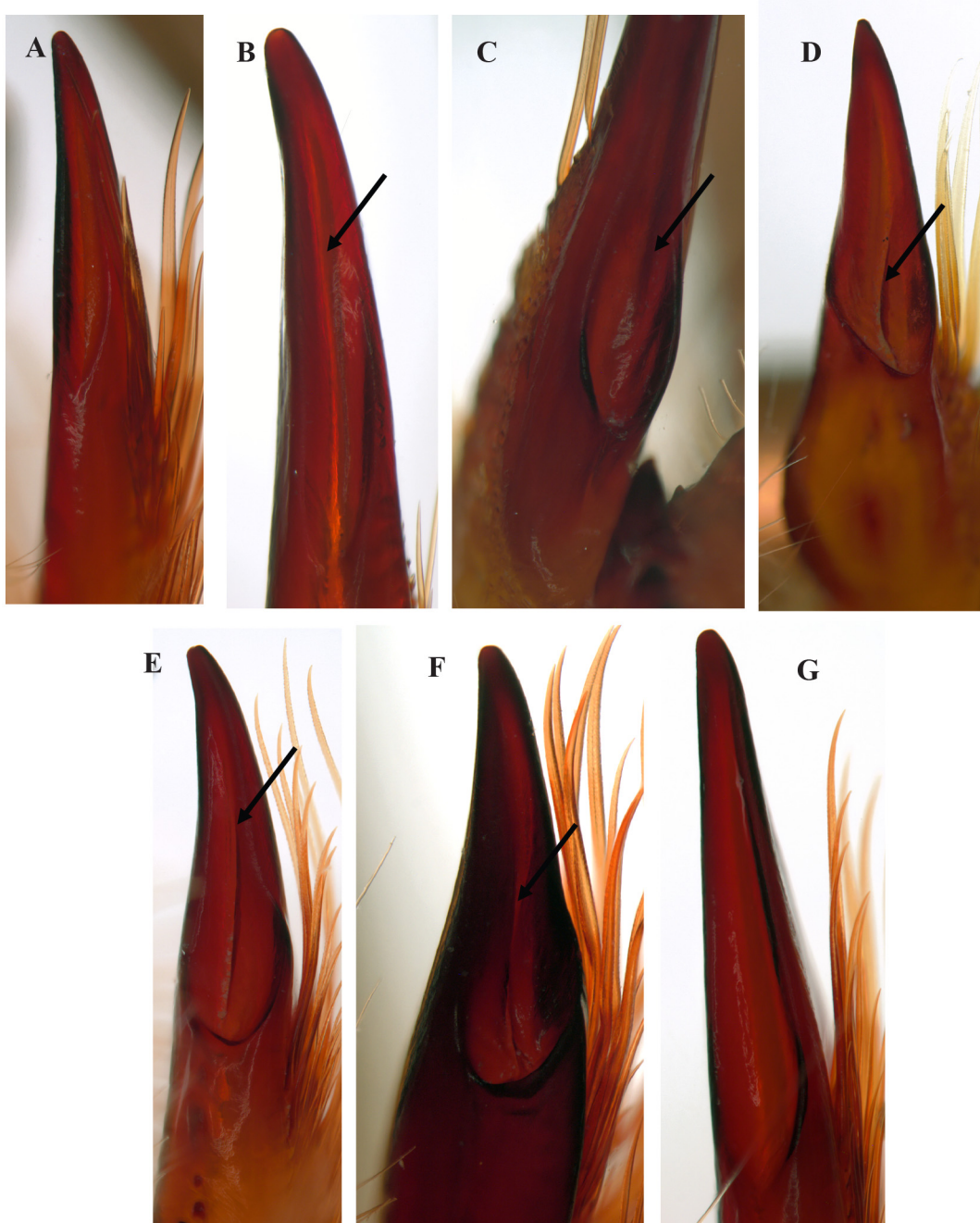


FIGURE 1. VDC on the fixed finger of the right chelicera of male *Eremocosta*. Refer to Figure 2 for scale. A) *Eremocosta bajaensis* (holotype from CAS). B) *Eremocosta calexcicensis* (holotype from USNM). C) *Eremocosta formidabilis* (IBUNAM). Note the more proximal location of the VDC on the fixed finger of this species. D) *Eremocosta gigas* (holotype from SMK). E) *Eremocosta gigasella* (DMNS ZA.35465). F) *Eremocosta striata* (DMNS ZA.21079). G) *Eremocosta titania* (DMNS ZA.15427). Arrows point to an internal carina in the VDC of some species.

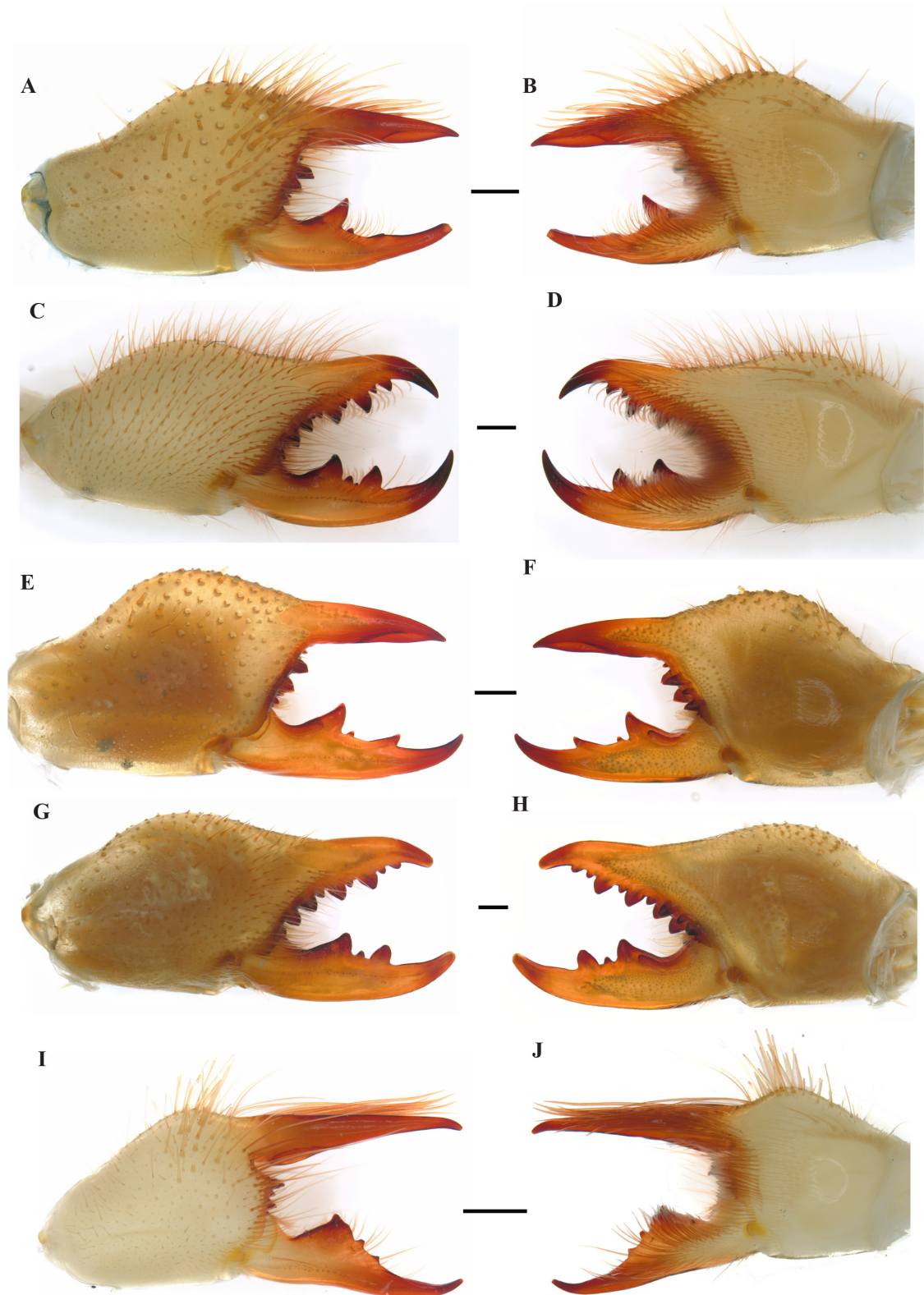


FIGURE 2. Retrolateral (left) and prolateral (right) cheliceral views of the right chelicera of *Eremocosta* species. Scale bars = 1.0 mm. See text for collection abbreviations. A & B *Eremocosta bajaensis* male (holotype from CAS). C & D *Eremocosta bajaensis* female (IBUNAM). E & F *Eremocosta calexicensis* male (holotype from USNM). G & H *Eremocosta calexicensis* female (allotype from USNM). I & J *Eremocosta formidabilis* male (IBUNAM). K & L *Eremocosta gigas* male (holotype from SMK). M & N *Eremocosta gigas* female (IBUNAM CNAN Sol00114). O & P *Eremocosta gigasella* male (DMNS ZA.35465). Q & R *Eremocosta gigasella* female (DMNS ZA.17350). S & T *Eremocosta striata* male (DMNS ZA.21079). U & V *Eremocosta striata* female (DMNS ZA.25451). W & X *Eremocosta titania* male (DMNS ZA.15427). Y & Z *Eremocosta titania* female (DMNS ZA.36256). Arrows in K, O, and S point to MD tooth (see text).

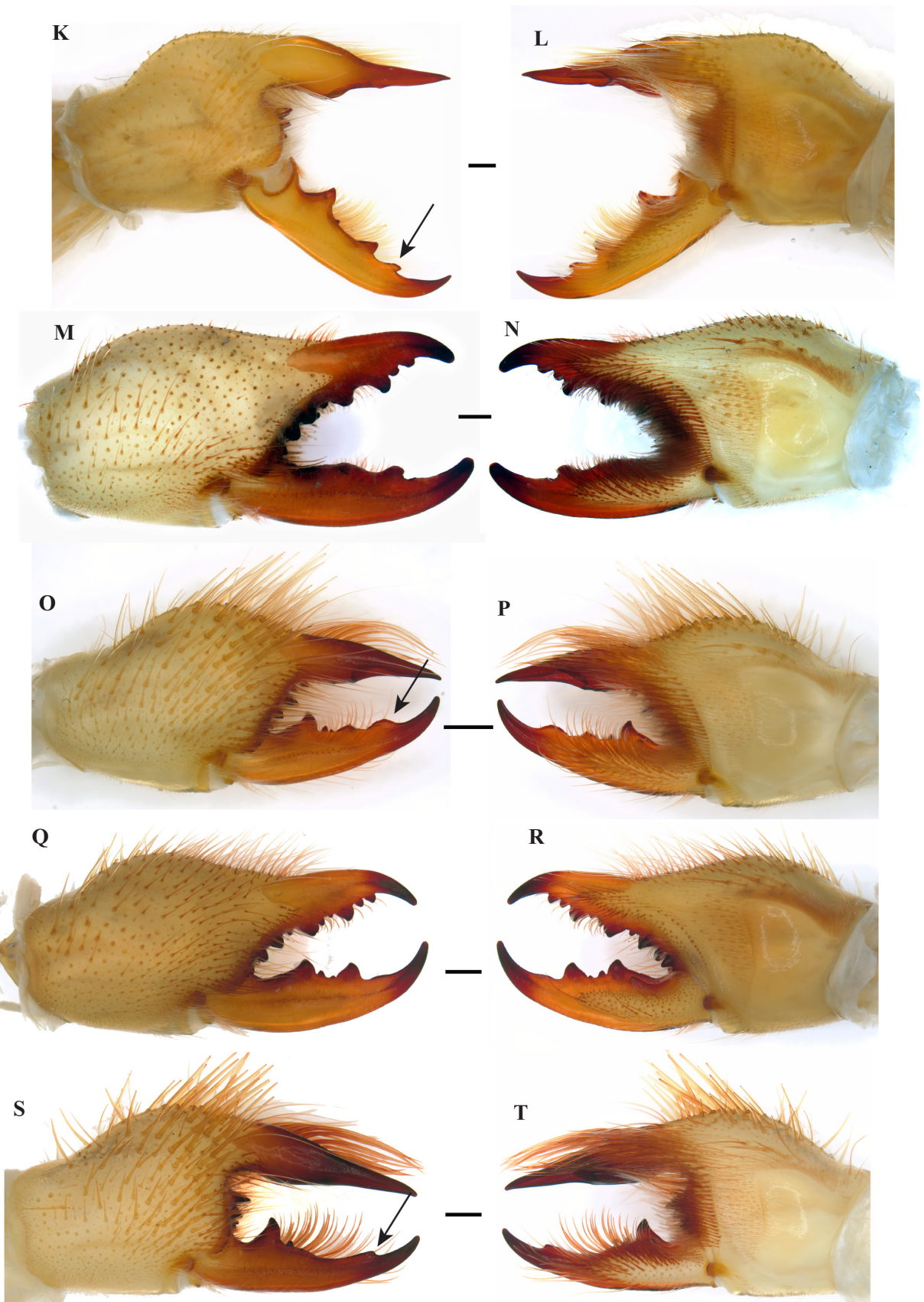


FIGURE 2. (Continued)



FIGURE 2. (Continued)

Diagnosis. *Eremocosta bajaensis* male chelicera is similar to that of *E. calexcensis*. It is distinguished by the much smaller and more ridge-like (rather than tooth-like) MM of the movable finger of *E. bajaensis* (compare Fig. 2A and E), a short but distinct fondal notch; color pattern of propeltidium (compare Fig. 5A and B), with *E. bajaensis* having a darker anterior edge; and color of appendages. Female genital operculum wings thin and curved (Fig. 4A) and very different from that of *E. calexcensis* (Fig. 4B).

Measurements. *Male holotype.* TL 21.0; CL 5.5; CH 2.3; FNL 0.3; FNH 0.6; FFH 0.9; PL 19.2; PT 1.8; PMT 7.0; LI 16.0; LIV 25.0; PPL 4.2; A/CP 6.2; FNL/FNH 0.5; FFH/FNH 1.5.

Males (n = 11). TL 27.0–34.0; CL 7.5–9.1; CH 3.4–4.5. FNL 0.3–1.0; FNH 0.4–1.0; FFH 0.8–1.0; PL 21.0–34.0; PT 1.9–4.0; PMT 4.0–7.9; LI 14.5–23.0; LIV 26.0–37.0; PPL 3.4–5.0; A/CP 5.1–7.3; FNL/FNH 0.5–1.0; FFH/FNH 0.8–2.1; FFH/CH 0.2–0.3.

Females (n = 5). TL 30.0–40.0; CL 8.9–12.1; CH 5.0–5.0; PL 21.0–30.0; PT 1.4–2.1; PMT 6.4–6.9; LI 18.0–21.5; LIV 30.0–35.0; PPL 4.9–6.4; A/CP 4.4–5.5.

Description. *Male holotype. Coloration.* Overall dusky yellow, appendages the same; propeltidium lightly reticulate brownish-violet with dark anterior edge (Fig. 5A). Pale oval behind eye tubercle (Fig. 5A). No distinct abdominal coloration. Malleoli white.

Chelicera. Male. VDC deep, occupying approximately half the length of fixed finger (Fig. 1A), narrower than *E. calexcensis* (Fig. 1B). Thin, straight fixed finger with no median dentition; movable finger: MP-MSM-MM (a tiny medial tooth or ridge); MPL distinct (Figs. 2A & B). Fondal notch short; three RFA; fondal teeth graded II, I, III, IV retrolaterally and I, III, II, IV prolaterally (Fig. 3A).

Setation. Male. Typical male setation. Palp with long, thin setae scattered throughout. A pair of long thin setae just proximal to the tibia-femur joint. A few scattered bacilli on the coxa of LII, LIII, and LIV.

Coloration. Female. As in males but slightly lighter.

Chelicera. Female. Fixed finger: FP-2 FSM (posterior being larger)-FM-smaller FSD-FD; Movable finger: MP-2 MSM-MM; MPL distinct (Fig. 2C & D). Two RFA proximal to FP; fondal teeth graded II, I, III, tiny IV retrolaterally and I, III, II, IV prolaterally.

Setation. Female. Typical.

Genital Operculum. All of the females examined match Muma's illustration (1987, p. 25, fig. 12) with long, curved anterior arms widening at the posterior wing (Fig. 4A). None had the pits on the anterior arms as illustrated in Muma's fig. 11.

Distribution. *Eremocosta bajaensis* appears to occupy an area extending from coastal southern California west of the Peninsular Ridge into Baja de Norte, México. This is the species identified as *E. spinipalpis* by Cushing *et al.* (2015). A male and female were also collected as far inland as the Santa Rosa Mountains in Riverside County, California. Collections by USGS, San Diego found *E. bajaensis* from April to September numbering 6 males and 4 females. Muma's (1951) list of *E. calexicensis* from coastal California, San Diego Co. may have been this species.

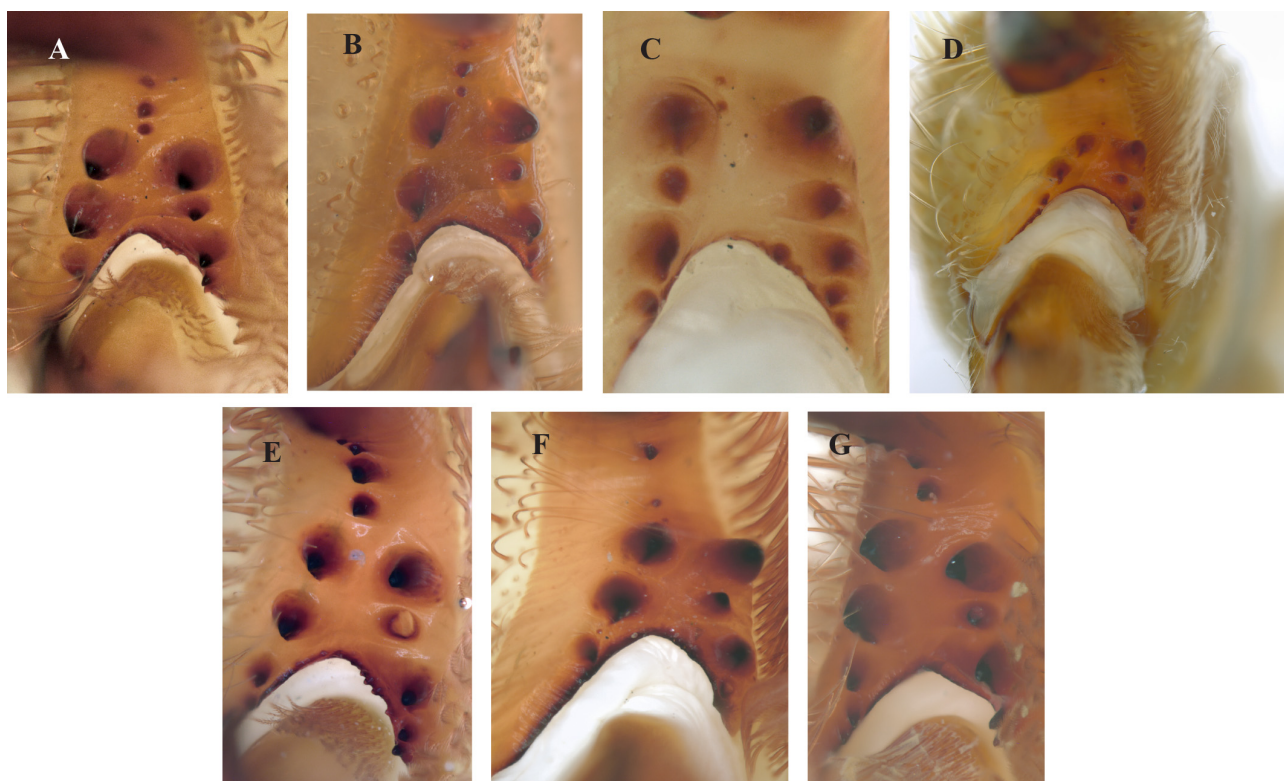


FIGURE 3. Fondal teeth on right fixed fingers of male specimens illustrated in Fig. 2. See Fig. 2 for scale. A) *Eremocosta bajaensis* (holotype from CAS). B) *Eremocosta calexicensis* (holotype from USNM). C) *Eremocosta formidabilis* (IBUNAM). D) *Eremocosta gigas* holotype from SMK). E) *Eremocosta gigasella* (DMNS ZA.35465). F) *Eremocosta striata* (DMNS ZA.21079). G) *Eremocosta titania* (DMNS ZA.15427).

***Eremocosta calexicensis* (Muma 1951)**

Figs. 1B, 2E–H, 3B, 4B, 5B

Eremorhax calexicensis Muma 1951: 50–51, figs. 39–43.

Eremopus calexicensis (Muma 1989): 6.

Eremocosta calexicensis (Muma 1951): Harvey 2002: 451.

Type material. Male holotype, female allotype and male paratypes from Calexico, California, USA, coll. M.G. Armstrong, no date (USNM 2073704). We were able to examine male and female types.

Other specimens examined. *Males* (13). MÉXICO: Baja California Norte, Bahía de los Ángeles, 29 August 1964, coll. N Vidal (IBUNAM CNAN-S00180); USA: Arizona, Maricopa County, 7 miles S. Gila Bend on BLM land, N 32.862222°, W 112.691667°, 284 m elev., 3 August 2008, coll. Paula E. Cushing & Anja Klann, at lantern light (DMNS ZA.19985); USA: California, Imperial County, Ogilby Rd. N of Highway 8, N 32.76967°, W 114.83682°, 71 m elev., 2002, coll. Dustin A. Wood (DMNS ZA.16319); USA: California, Imperial County, Salton Sea, N 33.2038°, W 115.8407°, -68 m elev., April 2002, coll. USGS, pitfall trap (DMNS ZA.16326); USA: California, Riverside County, Palm Canyon Dr. at junction with Bogert Trail, N 33.776°, W 116.545°, 165 m elev., 31 August 2005, coll. Wendell Icenogle, crawling on pavement below street light (DMNS ZA.17214); USA: California, Riverside County, Coachella Valley, NE edge of Palm Springs, junction Airport Tachevah Dr. just E junction Highway 111, N 33.83772°, W 116.50958°, 137 m elev., 2 September 2006, coll. Wendell Icenogle, netted (DMNS ZA.17222); USA: California, Riverside County, Mesa, N 33.96211°, W 116.6692°, 914 m elev., August 2000, coll. USGS, pitfall trap (DMNS ZA.19159); USA: California, Riverside County, Mesa, N 33.96211° W 116.6992°, 856 m elev., August 2000, coll. USGS (DMNS ZA.19162); USA: California, Riverside County, Blythe, 21 June 1978 (UCD no number); USA: California, Riverside County, Blythe, 18 July 1980 (UCD); USA: California, San Bernardino County, Wonder Valley Amboy Rd., 8.5 mi E Twenty Nine Palms (at Adobe Rd. junction), N 34.1657° W 115.9037° 487, m elev., coll. Wendell Icenogle, 17 May 2007, on or near building with lights (3 males: DMNS ZA.25457).

Females (7). MÉXICO: Baja California Norte, Bahía de Los Ángeles, 19 August 1964, no collector (IBUNAM +CNAN-Sol00076); USA: California, Imperial County, Salton Sea, N 33.1974°, W 115.8374°, -66 m elev., September 2001, coll. USGS, pitfall trap (DMNS ZA.16324); USA: California, Imperial County, off California 78, 7/10 mile west of junction with California 86, N 33.12582°, W 115.86887°, -49 m elev., 7 September 2010, coll. Wendell Icenogle, on highway in car headlights, feeding on dead male (DMNS ZA.36261); USA: California, Imperial County, Algodones Dunes, 7.5 km n. Glamis, N 33.033333°, W 115.133333°, 80 m, coll. R & L Kimsey & T.J. Zavortink, pitfall at black light (DMNS ZA.37394); USA: California, Riverside County, Santa Rosa Mountains, west rim of canyon, Pinyon Crest area, 1 mile north of California 74 and Carrizo Road junction, N 33.615735°, W 116.412535°, 945 m elev., 13 July 2013, coll. Wendell Icenogle, on ground at base of yellow floodlight beside gate (DMNS ZA.36257); USA: California, Riverside County, San Jacinto Mountains, on road to Palm Springs Tramway, 2 7/10 mi W. of Highway 111, N 33.844832°, W 598 m elev., coll. Wendell Icenogle, on road w/ car headlights (DMNS ZA.36899); USA: California, San Diego County, 7/10 mile south of center of Borrego Springs, N 33.25218°, W 116.37521°, 183 m elev., 12 September 2008, coll. Wendell Icenogle, on pavement below light at motel (DMNS ZA.36262).

Diagnosis. *Eremocosta calexicensis* is closely related to *E. titania*. The two species can be separated by the length of the fixed finger of the male, shape of the VDC, and relative length of the VDC. Most males of *E. calexicensis* have the fixed finger somewhat shorter than the movable finger. The edge of the VDC, when viewed from the retrolateral surface (Fig. 2E) is slightly convex compared to the same view of the VDC of *E. titania*. The VDC of *E. calexicensis* also extends only ½ or less the length of the fixed finger whereas the VDC of *E. titania* typically extends more than ½ the length of the fixed finger (compare Fig. 2E & W). Males of *E. calexicensis* are also generally larger than males of *E. titania*. The female genital operculum is also distinct from *E. titania*. The wings of the genital operculum of *E. calexicensis* are shaped like hockey sticks with the inner margins more or less parallel to one another (Fig. 4B), whereas the inner margins of the wings quickly diverge in *E. titania* (Fig. 4F).

Measurements. *Male holotype.* TL 37.0; CL 10.4; CH 4.0; FNL 0.3; FNH 0.5; FFH 1.0; PL 42; PT and PMT NA (pedipalps of male disassociated in vial and damaged); LI 31.0; LIV 56.0; PPL 5.2; A/CP 8.3; FNL/FNH 0.6; FFH/FNH 2.0.

Males ($n = 13$). TL 25.0–43.0; CL 6.5–13.6; CH 3.0–9.6; FNL 0.2–0.9; FNH 0.4–1.0; FFH 0.6–1.1; PL 24.0–43.0; PT 1.3–4.0; PMT 7.0–10.1; LI 12.0–31.5; LIV 26.0–47.0; PPL 3.0–6.4; A/CP 4.4–8.2; FNL/FNH 0.2–1.7; FFH/FNH 0.9–2.0; FFH/CH 0.1–0.3.

Female allotype. TL 42.0; CL 13.8; CH 6.1; PL 41.0; PT and PMT NA (pedipalps of female disassociated in vial and damaged); LI 30.0; LIV 49.0; A/CP 6.1.

Females ($n = 7$). TL 28.0–48.0; CL 9.0–15.7; CH 4.0–6.5; PL 26.0–37.0; PT 1.2–3.1; PMT 7.9–10.0; LI 17.0–34.0; LIV 34.0–43.0; PPL 4.0–6.0; A/CP 4.0–6.3.

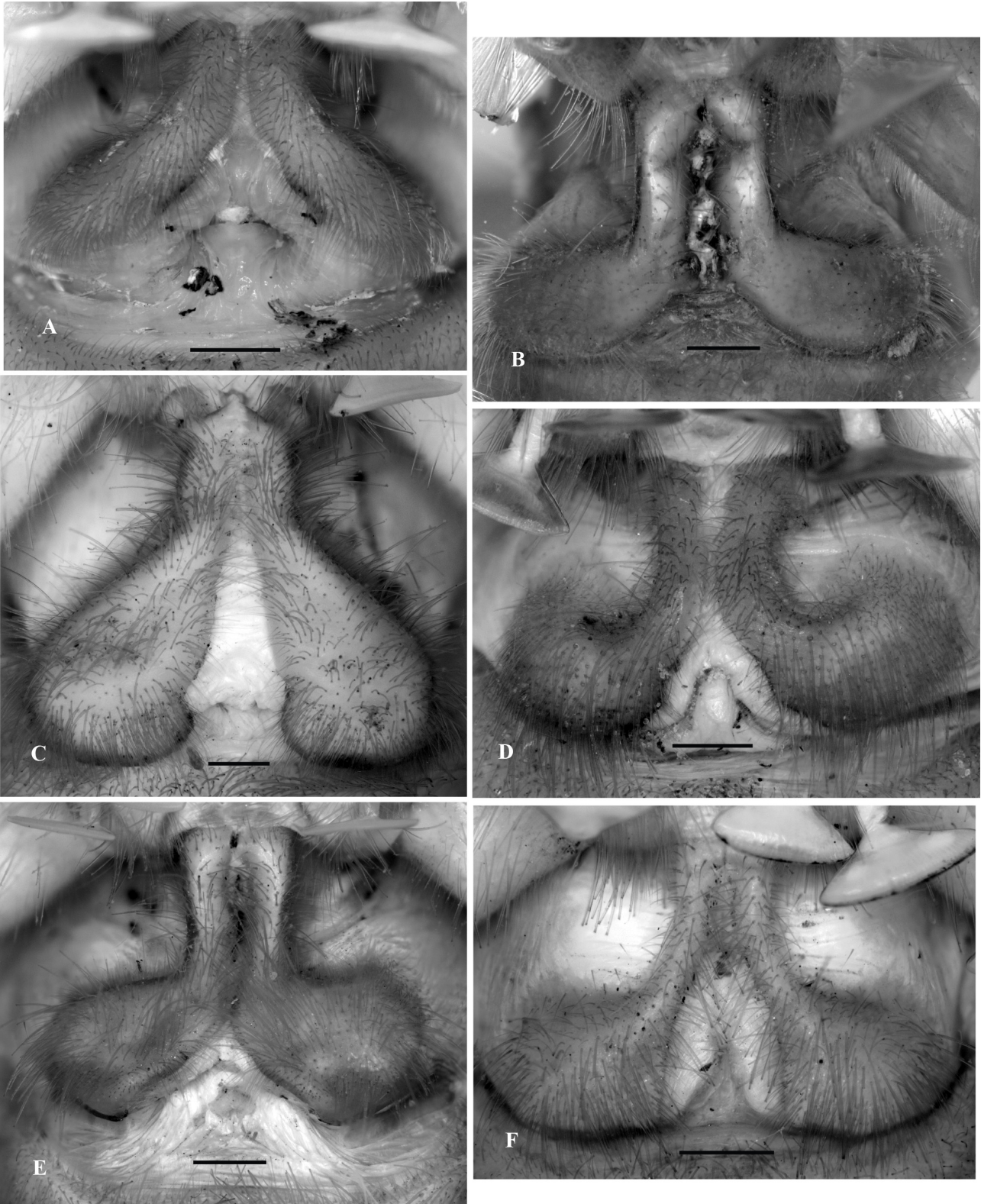


FIGURE 4. Genital opercula of females. Same specimens as illustrated in Fig. 2. Scale bars = 1.0 mm. A) *Eremocosta bajaensis* (IBUNAM). B) *Eremocosta calexcensis* (allotype from USNM). C) *Eremocosta gigas* (IBUNAM CNAN Sol00114). D) *Eremocosta gigasella* (DMNS ZA.17350). E) *Eremocosta striata* (DMNS ZA.25451). F) *Eremocosta titania* (DMNS ZA.36256).

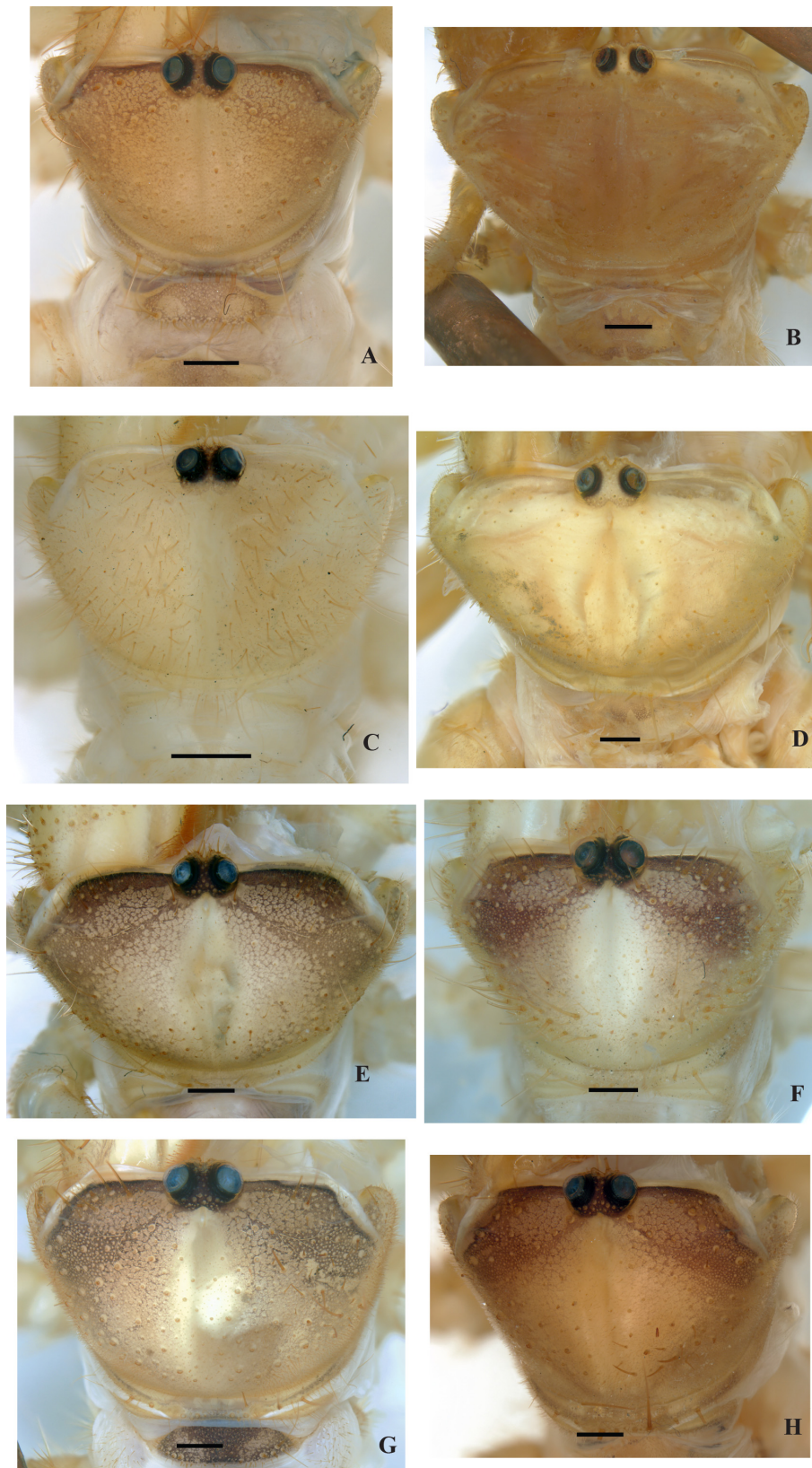


FIGURE 5. Propeltidia of specimens illustrated in Fig. 2. Scale bars = 1.0 mm. A) *Eremocosta bajaensis* male (holotype from CAS). B) *Eremocosta calexcensis* male (holotype from USNM). C) *Eremocosta formidabilis* male (IBUNAM). D) *Eremocosta gigas* male (holotype from SMK). E) *Eremocosta gigas* female (IBUNAM CNAN Sol00114). F) *Eremocosta gigasella* male (DMNS ZA.35465). G) *Eremocosta striata* male (DMNS ZA.21079). H) *Eremocosta titania* male (DMNS ZA.15427).

Description. *Coloration. Male.* Pale yellow overall. Appendages slightly darker at distal end of femur and proximal end of tibia. Propeltidium pale (Fig. 5B). Abdomen typical with dark, violet-brown rectangles on each segment that give the appearance of a stripe; ventral grey-cream.

Chelicera. Male. Chelicera as in Muma (1951, p. 49, fig. 40). VDC deep, cup-shaped occupying approximately one-third to one-half the length of fixed finger with a slight prolateral orientation (Fig. 1B). Fixed finger with no median dentition. Movable finger: large, acute MP-small MSM-small MM; large MPL. (Figs. 2E & F). Fondal notch tiny. Sometimes 1–3 RFA on the ventral edge of the fixed finger as well as 2–3 in the fondal notch (Fig. 3B). Muma graded the fondal teeth I, II, III, IV but we suggest they might be II, I, III, IV since I and II are about equal in size, tiny or absent IV retrolaterally and I, III, II, tiny serrate IV prolaterally (Fig. 3B). FNH smaller than the FFH.

Setation. Male. Typical *Eremocosta* flagellum complex. Prolateral setal complex typical, plumose *pvd* extend to base of fondal tooth I, *mpd* a proximal patch. Numerous long, thin palpal setae. No ctenidia or palpal papillae.

Coloration. Female. Coloration as in the males. Pedipalps dusky on femur as well as tibia, tarsus, and metatarsus. Propeltidium pale with dark anterior margin.

Chelicera. Female. Typical. Fixed finger: FP-FSM-FM-small FSD-FD. Movable finger: MP-MSM-MM; MPL distinct (Figs. 2G & H). One large RFA; fondal teeth II, III, I, tiny IV retrolaterally; I, III, II, IV prolaterally.

Setation. Female. Typical eremobatid female prolateral setal pattern. Outer tubular, inner plumose from FD to MM. Pedipalps typical with numerous short, thin setae, paired seta at the base of tibia. Few or no bacilli on coxa.

Genital operculum. Female genital operculum as in Muma (1951, fig. 43) with long anterior arms, club-like wings with two tiny outgrowths/knobs on the interior margin (Fig. 4B).

Distribution. *Eremocosta calexicensis* ranges from at least Bahía de los Ángeles on the east coast of Baja California Norte through the Santa Rosa Mountains of California, USA where it is sympatric with *E. titania* in the southern part of that species' range. In fact, a male *E. titania* from Imperial County, California USA (DMNS ZA.23484) was captured with the carcass of a male *E. calexicensis* adjacent to it; presumably the *E. titania* had been eating the *E. calexicensis*.

Discussion. Because of the morphological similarity between *E. calexicensis* and *E. titania* and because the ranges are partly sympatric, there may be instances of hybridization between the two species. Cushing *et al.* (2015) demonstrated no significant molecular differences between the two specimens used to represent *E. calexicensis* and *E. titania* in the phylogenetic analysis. Upon re-examination of these specimens, it was clear that they both represented *E. titania*. Muma's (1951) designation of specimens from Arizona are probably *E. striatus* and those from coastal California are probably *E. bajaensis*. In his 1951 descriptions of both *E. calexicensis* and *E. titania* Muma noted variance that probably reflects these misidentifications.

***Eremocosta formidabilis* (Simon 1879)**

Figs. 1C, 2I & J, 3C, 5C

Datames formidabilis Simon 1879: 136–138, figs. 17–19, 25–26.

Datames affinis Kraepelin 1899 (misidentification in part, see *Eremobates affinis* (Kraepelin 1899a): 242–243, figs. 20a–b.

Datames *cf.* *formidabilis* Simon 1879: Kraepelin 1899b: 378.

Eremobates formidabilis (Simon 1879): Banks 1900: 427.

Eremoperna formidabilis (Simon 1879): Roewer 1934: 561, figs. 322b, 323c, 324d.

Eremorhax formidabilis (Simon 1879): Muma 1970: 4–5, figs. 1–2.

Eremopus formidabilis (Simon 1879): Muma 1989: 5.

Eremocosta formidabilis (Simon 1879): Harvey 2002: 451.

Type material. Male type from Guanajuata, México, No. 1805 (Roewer No. 9130), deposited in Muséum National d'Histoire Naturelle, Paris, France. The female and young with the type are not conspecific (Muma 1970). Muma's examination of types found a female paratype labeled "Arkansas" in Zoologisches Staatsinstitut und Zoologisches Museum in Hamburg, Germany he thought to be conspecific. The locality is apparently incorrect. If it refers to a locality in the United States then it is unlikely to be the female of *E. formidabilis*. The female chelicera is illustrated as fig. 2, p. 13 in Muma (1970) but no description is provided (see Muma 1970, p. 16). It is not a typical *Eremocosta* female dentition. We were not able to examine the type of *E. formidabilis* but were able to examine

males of this species from localities near the type locality: male from San Luis Potosi, México (Texas Tech University) and a male from Durango, México and San Luis Potosi, México (IBUNAM).

Specimens examined. *Males* (2). MÉXICO: Durango, Ciudad de Durango, DAO, N 24.051000°, W 104.610200°, 1890 m elev., 15 February 2005, no coll. (IBUNAM CNAN no number); MÉXICO: San Luis Potosí, Salinas, N 22.627610°, W 101.716498°, 2077 m elev., 20 June 1970, coll. G. Carlos (IBUNAM +CNAN-Sol00006).

Diagnosis. *E. formidabilis* is easily distinguished from all other *Eremocosta* by the location of the VDC which lies proximally instead of distally on the ventral edge of the male fixed finger (Fig. 1C). It is also smaller than others and the dark tips of the pedipalps are also distinctive.

Measurements ($n = 2$). TL 22.0, 30.0; CL 6.6, 10.0; CH 2.8, 4.7; FNL 0.3, 0.5; FNH 0.3, 0.5; FFH 0.8, 1.3; PL 17.0, 23.0; PT 1.4, 2.7; PMT 5.7, 11.5; LI 11.0, 13.0; LIV 16.5, 16.5; PPL 4.0, 4.3; A/CP 4.2; FNL/FNH 1.0, 1.0; FFH/FNH 2.8, 2.8; FFH/CH 0.3, 0.3.

Description. *Coloration.* Overall coloration pale, palpal tarsus, metatarsus, and inner surface of tibia dark brown; LIII and LIV with similar but lighter coloration on tibia-femur joint area; propeltidium coloration pale (Fig. 5C).

Chelicera. Chelicera as in Muma (1970, p. 13, fig. 1–2). VDC proximally located (Fig. 1C). Neither Roewer (1934) nor Muma (1970) mentioned or illustrated this unique position of the VDC. Fixed finger with no median dentition. Movable finger: large MP-three MSM attached to MP; distinct MPL (Figs. 2I & J). Fondal notch narrow, longer than wide (Fig. 2I). Two tiny RFA; fondal teeth I, III, II, IV prolaterally and retrolaterally (Fig. 3C).

Setation. Dorsal setal complex typical tubular; *pvd* extend to top of fondal tooth I; *mpd* a proximal patch. A few, tiny, scattered bacilli on coxa of LI. Pedipalps with scattered, long, thin setae, and shorter, thicker setae. Palpal tibia with a series of strong setae basally on the mesal surface. No visible paired setae.

Distribution. This is a Chihuahuan Desert inhabitant whose range includes Guanajuato, San Luis Potosi, and Durango, México.

Discussion. Putnam's (1883), Roewer's (1934), and Muma's (1970) descriptions are adequate. Two tiny RFA in fondal notch (Fig. 3C). Roewer (1934) indicates 4 ctenidia but Muma (1970), in examining the type, found no ctenidia. The two males that we examined had no ctenidia.

***Eremocosta gigas* Roewer 1934**

Figs. 1D, 2K–N, 3D, 4C, 5D & E

Eremocosta gigas Roewer 1932 (*nomen nudum*): figs. 127a–b.

Eremopus gigas (Roewer 1934): Muma 1989: 5.

Not *Eremorhax gigas* (Roewer 1934): Muma 1951 (misidentified): 48, figs. 32–33.

Eremocosta gigas (Roewer 1934): Harvey 2002: 451.

Type material. Male holotype from Tampico, México (SMF). Muma's 1951 designation was in error and was in fact the description of *E. gigasella* which he corrected in 1970 and added the description of *E. gigas* at that time. We were able to examine the type.

Other specimen examined. *Female* (1). (Previously undescribed.) MÉXICO: Durango, Dinamita, N 25.733333°, W 103.666667°, 1328 m elev., 29 July 2005, coll. O. Francke, H. Montaña, J. Ballesteros, C. Durán-Barrón, at night (IBUNAM +CNAN-Sol00114).

Diagnosis. *Eremocosta gigas* male is distinguished by its unique cheliceral shape with a sharp dagger-like fixed finger, a long thin fondal notch, and the presence of an acute distal tooth (MD) on the movable finger (Fig. 2K, arrow). The female genital operculum is also distinct with tear-drop shaped opercular wings that diverge distally (Fig. 4C).

Measurements. *Holotype Male.* TL 50.0; CL 10.4; CH 7.7; FNL 1.3; FNH 1.0; FFH 2.2; PL 47.0; PMT NA; PT 2.6; PMT 10.3; LI damaged; LIV 50.3; PPL 8.0; A/CP NA; FNL/FNH 1.3; FFH/FNH 2.2.

Female. TL 47.0; CL 14.0; CH 6.4; PPL 5.7; PL 39.5; PT 2.6; PMT 8.6; LI 28.5; LIV 40.5; A/CP 5.5.

Description. *Coloration. Male.* Overall pale yellow body and appendages. Propeltidium lightly mottled brownish-violet, darker on the anterior margin (Fig. 5D). Abdomen dusky.

Chelicera. Male. Typical ventrally located VDC with a thin carina inside the cavity (Fig. 1D, arrow) similar to

E. striata and *E. gigasella* (Figs. 1E & F). Fixed finger with no median dentition. Movable finger: prominent MP-one tiny MSM-small MM-small MD (the only *Eremocosta* to possess a distinct tooth-like MD); MPL prominent (Figs. 2K & L; tip of MPL tooth just visible in front of MP in Fig. 2L). Fondal notch distinct, narrow and rounded, greater than height; height of fixed finger larger than height of fondal notch (Fig. 2K). One very tiny RFA in fondal notch and one tiny RFA on ventral side of fixed finger; fondal teeth retrolaterally II, I, III, tiny IV; prolaterally I, III, II, IV (Fig. 3D).

Setation. Male. Cheliceral setal pattern, *pvd* setae typical; *mvd* a proximal patch of plumose setae. Typical setation of pedipalps. A few scattered bacilli on the coxae of LII and LIII. No scopula or ctenidia.

Coloration. Female. Basically cream-yellow, legs similar but a bit darker. Palp dusky on tarsus and metatarsus, LIV light violet at tibia-femur joint; propeltidium blotchy violet-brown, darker on anterior edge, creamy oval area behind ocular tubercle and smaller ovals on either side (Fig. 5E). Abdomen with typical dark, violet brown rectangles on each segment that give the appearance of a stripe; ventral grey-cream.

Chelicera. Female. Chelicera worn but apparently fixed finger: FP-2FSM-FM-FSD-FD. Movable finger: MP (very worn)-MSM if present, worn away-MM (Figs. 2M & N). MPL apparently missing but may just be worn away. One large RFA; fondal teeth I, III, II, IV (III almost the same size as I) retrolaterally and prolaterally.

Setation. Female. Typical with inner row of plumose bristle extending from FM on fixed finger to MM on movable finger. A row of thick bacilli on anterior edge of LIII coxa and a row of smaller bacilli on anterior edge LIV coxa.

Genital Operculum. Genital operculum tear-drop shaped with slender anterior arms, posterior wing rounded with inner edge slightly notched posteriorly. No visible pits laterally (Fig. 4C).

Distribution. MÉXICO: Veracruz. Biome: Chihuahuan Desert.

Discussion. We place the female from Dinamita, Durango, México in this species because of the overall similarity in body size and color pattern. However, without females collected from the type locality and without males collected from the new site we may find this placement either refuted or supported as more specimens are examined from México.

***Eremocosta gigasella* (Muma 1970)**

Figs. 1E, 2O–R, 3E, 4D, 5F

Eremorhax gigas (Roewer 1934): Muma 1951 (misidentification): 48, figs. 32–33.

Eremorhax gigasella Muma 1970: 8.

Eremopus gigasella (Muma 1989): 5.

Eremocosta gigasella (Muma 1970): Harvey 2002: 451.

Type material. Male holotype from Boquillas, Texas, USA, 7 June 1948, coll. C. and P. Vaurie (AMNH). We were able to examine the type.

Other specimens examined. Males (8). MÉXICO: Coahuila, Sierra San Marcos II, Cuatro Ciénegas, N 26.91326°, W 102.13757°, 761 m elev., no date, coll. E. González-S., B. Hendrixson, K. McWest, S. Grant, collected with UV light (IBUNAM +CNAN-Sol100007); MÉXICO: Coahuila, Saltillo, 27 May 1967, coll. M. Oyervides, no other data (IBUNAM +CNAN-Sol00204); USA: New Mexico, Eddy County, Carlsbad, N 32.45°, W 104.30°, 1012 m elev., 10 June 1940, coll. E.S. Deevey, on tent (DMNS ZA.17982); USA: Texas, Brewster County, Big Bend National Park, south of Camp De Leon turn-off, east side of Old Ore Rd., N 29.245°, W 103.01167°, 696 m elev., 11 June–8 July 2011, coll. David Footle, pitfall trap (3 males: DMNS ZA.35465); USA: Texas, Brewster County, Big Bend National Park, east of Terlingua Abajo Village sign, N 29.1975°, W 103.60194°, 673 m elev., 11 June–8 July 2011, coll. David Footle, pitfall trap in sandy flood plain behind Acacia thicket (2 males: DMNS ZA.35475).

Females (7). MÉXICO: Coahuila, Sierra San Marcos II, Cuatro Ciénegas, N 26.91326°, W 102.13757°, no date, coll. E. González-S., B. Hendrixson, K. McWest, S. Grant, collected with UV light; (2 females: IBUNAM +CNAN-Sol100007); USA: Texas, Brewster County, Big Bend National Park, south of Camp De Leon turn-off, east side of Old Ore Rd., N 29.245°, W 103.01167°, 696 m elev., 11 June–8 July 2011, coll. David Footle, pitfall trap (3 females: DMNS ZA.35465); USA: Texas, Brewster County, Big Bend National Park, east of Terlingua Abajo Village sign, N 29.1975°, W 103.60194°, 673 m elev., 11 June–8 July 2011, coll. David Footle, pitfall trap in sandy flood plain behind Acacia thicket (2 females: DMNS ZA.35475).

Diagnosis. *Eremocosta gigasella* is distinguished by the lack of a fondal notch on the male fixed finger (Figs. 2O & P). All other species in the genus have a moderate fondal notch to distinct fondal notch. On the male fixed finger, the relatively flattened MM is also distinctive as well as the presence of an apparent MD or a tooth-like structure at the distal location of the movable finger (Fig. 20, arrow). The female genital operculum is similar to that of *E. titania*; however, the two species can be easily distinguished with the posterior part of arms of *E. gigasella* more rounded and the inner edge slightly hooked (compare Figs. 4D & F).

Measurements. *Males* ($n = 8$). TL 28.0–42.0; CL 9.5–14.0; CH 4.0–6.0; FNL NA; FNH 0.5; FFH 1.0–1.3; PL 29.5–40.5; PT 1.7–4.0; PMT 5.4–9.0; PT 3.0–4.5; LI 20.0–28.0; LIV 33.0–43.0; PPL 35.0–43.0; A/CP 4.7–5.5; FNL/FNH NA; FFH/FNH NA; FFH/CH 0.2–0.3.

Females ($n = 7$). TL 39.0–50.0; CL 10.7–16.0; CH 4.3–6.0; PL 29.0–35.0; PT 1.7–3.5; PMT 7.0–7.9; LI 20.5–30.0; LIV 31.0–45.0; A/CP 4.6–5.0.

Description. *Coloration. Male.* Palpal tarsus, metatarsus faintly dusky violet-brown; LI, LII pale; LIII, LIV dusky violet-brown at the tibia-femur joint. Propeltidium mottled brownish violet anteriorly with a large pale yellow oval behind ocular tubercle, two smaller pale yellow ovals on either side of ocular tubercle (Fig. 5F). Abdomen dark dorsally, greyish ventrally.

Chelicera. Male. VDC occupies approximately half the length of fixed finger; deep, with a thin carina on the interior extending half the length of the cavity (Fig. 1E, arrow). Fixed finger broad proximally, sinuate dorsally with no median dentition. Movable finger: large MP-2 MSM the proximal larger-MM a long ridge with notch in the middle; MD also a ridge; MPL distinct (Figs. 2O & P). Fondal notch indistinct. Two distinct RFA in the notch and two tiny RFA on ventral edge of fixed finger; fondal teeth graded retrolaterally I & II (equal), III, tiny IV; prolaterally I, III, IV, tiny IV (Fig. 3E).

Setation. Male. Apical setal complex flat and plumose. No ventral series. Inner medial setal complex plumose setae to the top of fondal notch; *mpd* extend to the front of MM. This is the only *Eremocosta* that has a linear *mpd* as opposed to patchy configuration. Pedipalps with scattered long thin setae. No ctenidia. No palpal papillae. Scattered bacilli on anterior part of coxa of Leg 3.

Coloration. Female. Basically cream-yellow, legs similar but a bit darker. Palp dusky on tarsus and metatarsus, LIV light violet-brown at tibia-femur joint; propeltidium blotchy violet-brown, darker on anterior edge, creamy oval behind ocular tubercle and smaller ovals on either side. Abdomen with typical dark, violet brown rectangles on each segment that give the appearance of a stripe; ventral grey-cream.

Chelicera. Female. Fixed finger: FP-2 FSM-FM-FSD-FD. Movable finger: MP-2 MSM-MM; large MPL (Figs. 2Q & R). One large RFA; fondal teeth I, III, II, IV (III almost the same size as I) retrolaterally and prolaterally.

Setation. Female. Inner row of plumose bristle typical, extend from FD on fixed finger to MD on movable finger. A row of thick bacilli on anterior edge of LIII coxa and a row of smaller bacilli on edge LIV coxa.

Genital Operculum. Genital operculum club shaped with slender anterior arms, posterior rounded with inner edge slightly hooked posteriorly. No visible pits laterally. Genital operculum not as in fig. 31 in Muma (1951). More like *E. titania* fig. 38 in Muma (1951) but with wider, shorter anterior arms and larger more rounded club shape posteriorly (Fig. 4D).

Distribution. USA: New Mexico, Texas and México. Biome: Chihuahuan Desert.

Discussion. This species was described by Muma (1951) as *E. gigas*. This species is a Chihuahuan Desert inhabitant extending from New Mexico (Brookhart & Brantley 2000) into the Big Bend region of Texas and south into the Mexican states of Chihuahua, and Coahuila. The collection of this species by David Footle (personal comm.) from 20 pitfall arrays in Big Bend National Park resulted in 24 males, 24 females from April to August. They were collected in 5 of the 20 arrays set up by the collector in the park. Brookhart & Brantley (2000) identified this species as far north and west as Socorro, New Mexico, USA.

***Eremocosta ? spinipalpis* (Kraepelin 1899)**

Datames spinipalpis Kraepelin 1899a: 243–244.

Eremobates spinipalpis (Kraepelin 1899): Kraepelin 1901: 124.

Eremorhax spinipalpis (Kraepelin 1899): Muma 1970: 8.

Eremocosta spinipalpis (Kraepelin 1899): Harvey 2002: 451.

Type material. Female holotype from Santa Rosalio, Lower California, México, coll. S. Diguët, Number 33–97 in Muséum National d’Histoire Naturelle, Paris, France. Type not examined. Male unknown.

Diagnosis. Muma (1970) distinguishes *E. spinipalpis* from the related *E. striatus* by the lack of markings on the legs and palpi and the “curved lateral margins of the median caudal opercular notch.”

Measurements. From Muma (1970). TL 30; CL 10.2; CH 5.0; PL 31; PT 3.0; PMT 14.2; LI 18; LIV 30; PPL 4.6.

Distribution. Known from type only. MÉXICO: Baja California Sur. Biome: Sonoran Desert.

Discussion. Since Kraepelin (1899a) described the female only, the placement of this species is speculative as the presence of the male VDC is a critical criterion in determining this genus. The female genital operculum figured by Muma (1970) closely resembles that of *Eremocosta striata*. Its type locality on the southern Baja Peninsula would seem to separate it from *E. striata* but until further specimens are examined, the placement will remain in *Eremocosta*.

Kraepelin (1899a) described the palp as having spines “with width equal to height,” hence the name. *Eremocosta formidabilis* female also has some short, robust palpal setae that might be interpreted as spines. Muma’s (1987) *Eremocosta* key does not include *E. spinipalpis* but his unpublished manuscript (in library of JOB) does.

***Eremocosta striata* (Putnam 1883)**

Figs. 1F, 2S–V, 3F, 4E, 5G

Datames striatus Putnam 1883: 255–257.

Datames cinerea Putnam 1883: 260–261.

Eremobates cinereus (Putnam 1883): Kraepelin 1901: 124.

Eremorhax striatus (Putnam 1883): Muma 1951: 45–47, figs. 26–31.

Eremopus striatus (Putnam 1883): Muma & Muma 1988: 10–11, fig. 2.

Eremocosta striata (Putnam 1883): Harvey 2002: 451.

Type material. *Datames striatus*: Female holotype from Camp Grant, Arizona, USA (BNHM). *Datames cinerea*: Type locality of male holotype unknown (Academy of Natural Sciences, Philadelphia, Pennsylvania, USA). We did not examine the female holotype.

Specimens examined. *Males* (8). USA: Arizona, Graham County, 6 miles south of San Carlos, San Carlos Reservoir, N 33.24996°, W 110.44431°, 805 m elev., 5 August 1974, coll. Martin H. Muma (2 males: DMNS ZA.16329); USA: Arizona, Santa Cruz County, E. of Amado along Hopkins Mountain Rd., between the 2–5 Km signs, N 31.714°, W 111.009°, 1011 m elev., 30 July 2008, coll. Joe Warfel (DMNS ZA.21079); USA: Arizona, Santa Cruz County, Hopkins Mountain Rd., toward Whipple Observatory, N 31.67222°, W 110.90528°, 1753 m elev., 28 July 2009, coll. Joe Warfel, on roadway (DMNS ZA.25446); USA: Arizona, Santa Cruz County, Hopkins Mountain Rd., N 31.46139°, W 111.00417°, 1112 m elev., 28 July 2009, coll. Joe Warfel, on roadway at 21:28 hrs (DMNS ZA.25453); USA: Arizona, Pima County, 10 miles E Continental, 3 miles N Madera Canyon, 14–15 July 1989, K. Ribardo (2 males: CAS Casent 9033604).

Females (2). USA: Arizona, Santa Cruz County, Esplendor Resort, 1069 Camino Caralampi, Rio Rico, N 31.46194°, W 110.99746°, 1063 m elev., July 2009, coll. Lou Perrotti, caught in room (DMNS ZA.25451); MÉXICO: Sonora, 73.9 miles N. of Hermosillo, 5 August 1968, coll. T. Briggs (CAS Casent-9033697).

Diagnosis. The shape of the male chelicera with its slightly rounded fondal notch, a tiny MM, and a flattened ridge-like MD distinguishes this species from all other *Eremocosta*. Only *E. gigasella* has a ridge-like structure positionally homologous to the sharper distal ridge that might be a modified MD (see Figs. 2S & O, arrows). *Eremocosta gigas* has a distinctive MD tooth at that same position on the movable finger (Fig. 2K, arrow). The genital operculum of *E. striata* is most similar to that of *E. calexcensis*; however, the curved distal portions of the genital wings are more rounded than those of *E. calexcensis* (compare Figs. 4E & B).

Measurements. *Males* ($n = 8$). TL 31.0–50.0; CL 9.0–16.0; CH 3.4–5.6; FNL 0.3–2.0; FNH 0.4–0.9; FFH 1.0–1.6; PL 25.0–40.5; PT 7.0–8.0; PMT 1.7–3.0; LI 20.5–31.0; LIV 27.0–43.0; PPL 5.0–7.9; A/CP 4.3–5.6; FNL/FNH 0.5–2.5; FFH/FNH 1.3–2.3; FFH/CH 0.2–0.5.

Measurements. Females ($n = 2$). TL 34.5, 50.0; CL 9.0, 17.5; CH 4.0, 5.5; PL 22.0, 35.0; PT 7.5, 7.7; PMT 2.0, 2.9; LI 19.5, 26.0; LIV 34.5, 35.0; PPL 3.9, 4.0; A/CP 3.9, 4.0.

Description. *Coloration. Male.* Overall dusky yellow body and appendages; legs dusky violet-brown at tibia-femur joint. Propeltidium reticulate violet-brown with a longitudinal lighter stripe the width of the eye tubercle (Fig. 5G). Abdomen dark dorsally and lighter ventrally.

Chelicera. Male. VDC apical, oriented prolaterally, narrow, with thin carina (Fig. 1F, arrow). Fixed finger broad at the base narrowing at the apical third of the length in retrolateral view with no median dentition. Movable finger: prominent MP-two tiny MSM (some specimens with just one)-either a very small, but distinct, MM or just a slight ridge at that location (difficult to see in Fig. 2S)-a long ridge-like MD; distinct MPL (Figs. 2S & T). Fondal notch seemingly curved and distinct (Figs. 2S & T). Two tiny RFA; fondal teeth graded I, III, II, IV retrolaterally and I, II, III, IV prolaterally (Fig. 3F).

Setation. Male. Typical.

Coloration. Female. Coloration as in the males but sometimes markings are less distinct.

Chelicera. Female. Fixed finger: large FP-2 small FSM-FM-2 small FSD-smaller FD. Movable finger: large MP-two small MSM-medium MM; smaller but distinct MPL (Figs. 2U & V). Two RFA, proximal tiny; fondal teeth graded as in the male.

Setation. Female. Typical.

Genital operculum. Muma's illustration is accurate (1951, fig. 31, p. 46). Thin anterior arms; relatively large posterior wings (Fig. 4E).

Distribution. USA Arizona. MÉXICO: Sonora. Biome: Sonoran Desert.

Discussion. *Eremocosta striata* is a large species that can be seen by vehicle headlights scurrying across a road (pers. obs, JB). It seems to occupy the Sonoran region east of the Colorado River in Arizona and the state of Sonora, México.

***Eremocosta titania* (Muma 1951)**

Figs. 1G, 2W–Z, 3G, 4F, 5H

Eremorhax titania Muma 1951: 48–50, figs. 34–38.

Eremopus titania (Muma 1951): Muma & Muma 1988: 11–12.

Eremocosta titania (Muma 1951): Harvey 2002: 451.

Type material. Male holotype and 2 male paratypes from Twenty-nine Palms, California, USA (AMNH). Female allotype from 12 km northwest of Las Vegas, Nevada, USA (AMNH). We were able to examine the male holotype and female allotype.

Other specimens examined. *Males* (16). USA: California, Imperial County, Ogilby Rd. N. of Highway 8, N 32.77447°, W 114.83692°, 74 m elev., 2002, coll. Dustin A. Wood (DMNS ZA.16317); USA: California, Imperial County, Highway 534 (Ogilby Rd.) 3.7 mi S. junction Highway 78, N 33.03207°, W 114.90521°, 271 m elev., 22 May 2000, coll. Dustin A. Wood, collected at night while driving (DMNS ZA.16322); USA: California, Kern County, Dove Springs 1, N 35.4308°, W 118.0244°, 1017 m elev., March 2003, coll. USGS, pitfall trap (DMNS ZA.16315); USA: California, Kern County, Dove Springs 1, N 35.436°, W 118.0202°, 1081 m elev., June 2004, coll. USGS, pitfall trap (DMNS ZA.16316); USA: California, Kern County, Dove Springs 1, N 35.4378°, W 118.039°, 1057 m elev., June 2003, coll. USGS, pitfall trap (DMNS ZA.17170); USA: California, Riverside County, San Jacinto Mountains, Highway 74, Pinyon Pines Fire Station, N 33.88°, W 116.71°, 1219 m elev., 5 July 2005, coll. Wendell Icenogle, pavement near lighted building (DMNS ZA.17218); USA: California, San Bernardino County, 5 miles NW Sunshine Peak, 29 Palms Marine Base, N 34.678°, W 116.463°, 1007 m elev., 17 May 2004, coll. G. Pratt (DMNS ZA.15426); USA: California, San Bernardino County, 5 miles NW Sunshine Peak, 29 Palms Marine Base, N 34.678°, W 116.463°, 1007 m elev., 17 May 2004, coll. G. Pratt (DMNS ZA.16320); USA: California, San Bernardino County, Marine Corps Air Ground Combat Center, N 34.3033°, W 116.30°, 773 m elev., July 1999, coll. USGS (DMNS ZA.16327); USA: California, San Bernardino County, Joshua Tree National Park, N 33.90925°, W 115.85617°, 538 m elev., August 1999, coll. USGS, pitfall trap (DMNS ZA.19260); USA: Nevada, Nye County, N 36.661°, W 115.994°, 1158 m elev., 20 July 1965, coll. Martin H. Muma, on road (DMNS ZA.15427); USA: Nevada, Nye County, Mercury, N 36.65869°, W 115.99426°, 1149 m elev., 18 May 2010, coll. Paul Greger (DMNS ZA.26870); USA: Nevada, Nye County, Nevada Test Site, Mercury, Jackass Flats off Jackass Flats Rd., N 36.63619°, W 116.0756°, 878 m elev., 30 June–3 August 2011, coll. Paula E.

Cushing, pitfall trap (DMNS ZA.26887); USA: Nevada, Nye County, Nevada Test Site, Mercury, Bldg #23-652, N 36.6569°, W 115.99426°, 1149 m elev., 18 May 2010, coll. Paul Greger, in building (DMNS ZA.26888); USA: California, Riverside County, Blythe, 21 June 1978 (UCD no number); USA: California, Riverside County, Blythe, 18 July 1980 (UCD no number).

Females (17). USA: California, Imperial County, off California 78, 9 miles west of junction with California 86, N 33.13247°, W 115.98183°, 20 m elev., 7 September 2010, coll. Wendell Icenogle, on highway in car headlights (DMNS ZA.36259); USA: California: Inyo County, Saline Valley, May 1959, Sta. 63, coll. B. Banta (CAS Casent 9033224); USA: California: Inyo County, Saline Valley, 15 August 1989, coll. B. Banta (CAS Casent 9033229); USA: Inyo County, Saline Valley, 15 July 1959, coll. S. B. Banta (CAS Casent 9033644); USA: California: Kern County, Yermo (east of Barstow), 19 May 1973, coll. F. Ennik (CAS Casent 9033652); USA: California, Riverside County, Coachella Valley/Sky Valley, near junction of Dillon and Aurora roads, N 33.90343°, W 116.35964°, 331 m elev., 18 May 2009, coll. John Rajoa, inside building (DMNS ZA.36256); USA: California, Riverside County, east side of Palm Springs International Airport, on East Tachevah Dr., 1/10 mile west of California 111, N 33.83768°, W 116.5089°, 122 m elev., 2 September 2006, coll. Wendell Icenogle, on pavement near building with lights, 00:30 hr (DMNS ZA.36268); USA: California, Riverside County, Headquarters Salton Sea State Recreation Area, N 33.51062°, W 115.91995°, -64 m elev., 9 September 2004, coll. Wendell Icenogle, on concrete base of flood light feeding on insect at 24:00 hr (DMNS ZA.36900); USA: California, San Bernardino County, Amboy Rd. 8.5 miles east of 29 Palms (Adobe Rd.), N 34.15°, W 115.90°, 1600 m elev., 4 July 2010, coll. Wendell Icenogle, on pavement beside outbuilding with light (DMNS ZA.36270); USA: California, San Diego County, Ocotillo Wells ranger station, north of California 78, N 33.15354°, W 116.16731°, 47 m elev., 7 June 2008, coll. Wendell Icenogle, on ground near lights (DMNS ZA.36260); USA: California, San Diego County, 1.5 miles south of center of Borrego Springs, N 33.2384°, W 116.3759°, 183 m elev., 8 October 2012, coll. Wendell Icenogle, crawling slowly across road (DMNS ZA. 36269); USA: Nevada, Clark County, Las Vegas, 15 July 1987, coll. B. DePew (CAS Casent 9033514); USA: Nevada, Clark County, Kyle Canyon Rd., Spring Mountains, 16 July 1979, coll. L. DeLuca (CAS Casent 9033517); USA: Nevada, Clark County, Las Vegas, 9 June 1986, coll. R. Ramsay (CAS Casent 9033520); USA: Nevada, Clark County, Las Vegas, 1 August 1985, coll. E. Hamilton (CAS Casent 90335); USA: Nevada, Lyon County, Silver Springs, 17 July 1963, coll. L. Warren (CAS Casent 9033516); USA: Nevada, Nye County, Rock Valley, N 36.633°, W 116.313°, 853 m elev., 22 July 1965, coll. Martin H. Muma, kept alive until 3 August 1965 (DMNS ZA.15429).

Diagnosis. *Eremocosta titania* is related to *E. calexcensis* but differs in coloration, especially of appendages; fixed finger longer and narrower than *E. calexcensis*, MP of movable finger more robust as well (compare Figs. 2W & X with Figs. 2E & F). Male *E. titania* are also generally smaller than male *E. calexcensis*. Female genital operculum club-shaped with long arms; distinct from operculum of *E. titania*. See also diagnosis above under *E. calexcensis*.

Measurements. *Males* ($n = 16$). TL 24.0–33.5; CL 7.1–10.4; CH 3.0–6.2; FNL 0.3–0.5; FNH 0.4–0.7; FFH 0.6–0.9; PL 20.0–35.0; PT 1.0–4.1; PMT 5.1–10.0; LI 12.0–25.0; LIV 24.0–33.0; PPL 4.0–5.4; A/CP 4.1–7.8; FNL/FNH 0.5–1.0; FFH/FNH 1.0–2.0; FFH/CH 0.1–0.3.

Females ($n = 17$). TL 27.0–48.0; CL 8.6–13.9; CH 4.0–5.9; PL 20.0–37.0; PT 1.7–2.0; PMT 4.6–6.9; LI 12.0–24.5; LIV 25.5–41.0; PPL 3.9–6.4; A/CP 4.5–6.3.

Description. *Coloration.* *Male.* Overall light yellow; appendages a bit darker with distal ends of femur and proximal ends of tibia a light purple-violet. Anterior margin of propeltidium dusky violet (Fig. 5H).

Chelicera. *Male.* Deep VDC, similar to *E. calexcensis* but with slightly mesal orientation (Fig. 1G). Fixed finger slightly thicker than *E. calexcensis*, with no median dentition. Movable finger: MP-2 MSM-MM; distinct MPL (Figs. 2W & X). Fondal notch tiny with one RFA and two-three RFA on the ventral region of fixed finger; fondal teeth graded I, III, II, IV retrolaterally; I, II, III, IV prolaterally (Fig. 3G).

Setation. *Male.* Typical setation. L III, LIV with bacilli on anterior edge of coxa.

Coloration. *Female.* Overall slightly lighter than the male. Appendages the same as male.

Chelicera. *Female.* Fixed finger: FP-1 FSM-FM-FSD-FD. Movable finger: MP-2 MSM, proximal larger-MM; distinct MPL (Figs. 2Y & Z). One large RFA; fondal teeth graded II, I, III, IV retrolaterally, and I, II, tiny III, serrate IV prolaterally.

Setation. *Female.* Typical female cheliceral setation.

Genital operculum. Muma's illustration is accurate (1951, fig. 43). Club-shaped with long arms ending in oval shaped wings (Fig. 4F).

Distribution. USA California and Nevada. *Eremocosta titania* ranges from the northern Mojave Desert to the Sonoran Desert west of the Colorado River. It is sympatric in part of its range with the closely related *E. calexcensis*.

Discussion. Specimens from the more northern regions, Nevada, Northern California have a darker coloration than those found in regions of Southern California but male cheliceral dentition and female genital operculum remains relatively constant.

***Eremocosta nigrimana* (Pocock 1895)**

Gluvia nigrimanus Pocock 1895: 94–95, fig. 10.

Eremobates nigrimanus (Pocock 1895): Kraepelin 1901: 128.

Eremorhax magnus (Hancock 1888): Muma 1970: 5–6.

Eremorhax nigrimanus (Pocock 1895): Brookhart & Muma 1987: 1.

Eremocosta nigrimana (Pocock 1895): Harvey 2002: 451.

Type material. Male holotype labeled “? Probably Meshed, Afghanistan, Afghan Delimitation commission” but the specimen may be mislabeled as suggested by the “?” on the label (also see Muma 1970, 1976). Recorded specimens: known from type only (BNHM #1952.10.17.20). We were able to view photographs of the type specimen.

Discussion. The status of this species remains uncertain since no eremobatids are known from the Old World. The type specimen has the VDC diagnostic for the genus *Eremocosta*. Therefore, the placement in this genus seems to be correct. From the photos of the type, the specimen appears to have a VDC extending more than half the length of the fixed finger. The movable finger dentition can be described as MP-no MSM-MM; distinct MPL. If we are correct that the species belongs to *Eremocosta*, then it would be the only species lacking a MSM. Because the type has the VDC diagnostic for the genus, we leave it in *Eremocosta*; however, like Muma, we doubt the veracity of the locality. The “?” on the label also supports the uncertainty of the locale. It may represent a new species of *Eremocosta*. We leave the designation as is.

Eremocosta robusta* (Roewer 1934) *nomen dubium

Eremacantha robusta Roewer 1934: 571, figs. 320d, 320p, 324s.

Eremorhax robustus (Roewer 1934): Muma 1976: 15.

Eremocosta robusta (Roewer): Harvey 2002: 451.

Type material. Immature holotype from Santiago, México, deposited at Zoologisches Museum der Humboldt Universität (ZMHU, no. 996). Recorded specimens: known from type only. Type not examined.

Distribution. MÉXICO: Baja California Norte. Biome: Sonoran Desert.

Discussion. Muma (1970) considered this *nomen dubium* after examining the type which proved to be a juvenile. We agree with this designation.

Genus *Eremorhax*

***Eremorhax arenarum* (Ballesteros & Francke 2007) new combination**

Eremocosta arenarum (Ballesteros & Francke 2007): 61–68, figs. 1–6.

Type material. Dunas de Bilbao, Coahuila, México. Male holotype and six paratypes. The male holotype, one “putative” (probably immature female) paratype (Ballesteros & Francke 2007), an additional male, and one juvenile paratype at IBUNAM; three additional male paratypes are deposited at AMNH. Type examined.

Discussion. Ballesteros & Francke (2007) rightly considered placing *E. arenarum* in the genus *Eremorhax* based on the shallow flagellar groove that does not reach the base of the fixed finger (fig. 3, p.65: Ballesteros &

Francke 2007). This feature is quite different than the VDC present in all members of the genus *Eremocosta* males. Ballesteros & Francke (2007) pointed out the similarity of the flagellar groove with other members of the genus *Eremorhax* as well as the presence of ctenidia, lacking in the genus *Eremocosta*.

***Eremorhax fuscus* (Muma 1986) combination restored**

Eremorhax fuscus Muma 1986: 2–3, figs. 1–7

Eremocosta fuscus (Muma 1986): Harvey 2002: 451.

Type material. Male holotype from Tutla, Oaxaca, México. Collected 13 December 1948 by E.S. Ross. Deposited at CAS. Female paratype collected from 4 miles north Cuernavaca, Morelos, México, 8 December 1948, collected by E.S. Ross and also deposited in the collection of CAS. Photos of type examined.

Discussion. The shape of the flagellar groove and lack of a VDC (Muma, 1986: fig. 2, p. 25) places this species in the genus *Eremorhax*. Presence of ctenidia also differentiate it from *Eremocosta* (see Muma, 1986: fig. 4, p. 25).

***Eremorhax montezuma* (Roewer 1934) combination restored**

Eremopus montezuma Roewer 1934: 564, fig. 322d.

Eremorhax montezuma (Roewer 1934): Muma 1970: 6–7, figs. 3–4.

Eremocosta montezuma (Roewer 1934): Harvey 2002: 451.

Type material. México, Orizaba, Roewer No. 8076 in Naturhistorisches Museum, Wien, Austria. Known only from holotype male. Photos of type examined.

Description. Roewer (1934) described the flagellum complex as unfeathered, homogenous bristles, pictured a prolateral view of the male chelicera, p 559, fig. 322d, and described the coloration as pale-yellow with opisthosomal tergites having a dark median stripe. Muma (1970) added a description of the palpal setation, indicating cylinder bristles, spines and long whiplike setae, but no palpal papillae. Muma (1970) also indicated four short, thick, lance-like ctenidia. Roewer measured the type at 15 mm but Muma measured it at 29.5 mm. Photos sent of the type from the Naturhistorisches Museum, Wien indicate that the total length is 21.8 mm.

Discussion. The lack of a VDC and the presence of a wide, thin flagellar groove characteristic of the genus *Eremorhax*, as well as the presence of ctenidia returns *Eremocosta montezuma* to Muma's (1970) designation as *Eremorhax montezuma*.

Genus *Eremobates*

***Eremobates acuitlapanensis* (Vázquez & Gaviño-Rojas 2000) new combination**

Eremopus acuitlapanensis Vázquez & Gaviño-Rojas 2000: 227–228, figs. 1–9

Eremocosta acuitlapanensis (Vázquez & Gaviño-Rojas 2000): Harvey 2002: 451.

Type material. Holotype male from México: Guerrero, Acuitlapan; collected 13 October 1976; collected by Melgar, Novelo, and Chavarría. Deposited at IBUNAM. One male, one female paratype from same locale, also deposited at IBUNAM. Type examined.

Discussion. The shape of the flagellar groove (Vázquez & Gaviño-Rojas 2000, figs. 2–3, p. 229) and the presence of an apical plumose bristle places the species in the genus *Eremobates*. The molecular phylogeny of Cushing *et al.* (2015) supports the placement of this species outside the *Eremocosta* clade close to other species in *Eremobates*.

***Eremobates hystrix* Mello-Leitão 1942) combination restored**

Eremoperna hystrix Mello-Leitão 1942: 307–309, fig. 3.
Eremobates hystrix (Mello-Leitão 1942): Muma (1970): 28.
Eremocosta hystrix (Mello-Leitão 1942): Vázquez-Rojas *et al.* 2014: 1079–1084, figs. 1–10.

Type material. The male holotype was collected from the Distrito Federal, México and is deposited at the Museo Nacional Rio de Janeiro. Type not examined.

Discussion. The presence of a well-defined flagellar groove and apical plumose bristle places the species in the genus *Eremobates* (Vasquez & Gavino Rojas 2000, fig. 2, p. 1081).

Key to the species of *Eremocosta*

- 1 Fondal notch (male) deep and distinct (Figs. 2I, K, S) 2
- Fondal notch short and/or indistinct (Figs. 2A, E, O, W) 4
- 2 VDC (male) proximal on ventral edge of fixed finger (Figs. 1C, 2I, J) *E. formidabilis*
- VDC distal on ventral edge of fixed finger 3
- 3 Male fixed finger dagger-like (Fig. 2K) with distinct MM and distinct tooth-like MD (Fig. 2K, arrow). Female genital operculum as in Fig. 4C with wings tear-drop shaped. *E. gigas*
- Fixed finger not dagger-like, MM lacking or greatly reduced and MD present as a ridge (Fig. 2S, arrow). Female genital operculum with straight, parallel, narrow anterior arms broadening into distinct, rounded club-shaped wings, shaped like hockey sticks (Fig. 4E) *E. striata*
- 4 Male movable finger with quadrate MD (Fig. 2O, arrow), female genital operculum as in Fig. 4D with recurved anterior arms and recurved posterior margins *E. gigasella*
- Movable finger with no MD, female genital operculum not as above 5
- 5 Male fixed finger usually as long as or slightly longer than movable finger. Movable finger usually with two small MSM (sometimes only one) (Fig. 2W). Lower edge of VDC, when viewed from ectal side of chelicera, slightly concave (Fig. 2W). Female genital operculum with long straight anterior arms; posterior wings quadrate as in Fig. 4F. *E. titania*
- Fixed finger usually slightly shorter than movable finger. Movable finger usually with just one small MSM (Figs. 2A, 2E). Lower edge of VDC, when viewed from ectal side of chelicera, slightly convex (Figs. 2A, 2E). Female genital operculum as in Figs. 4A or B. 6
- 6 Male movable finger with small but distinct MM (Fig. 2E). Female genital operculum club-shaped with long anterior arms and a posterior knob, posterior wing ovate as in Fig. 4B *E. calxicensis*
- Movable finger with barely visible MM (sometimes a tiny ridge) (Fig. 2A). Wings of genital operculum thin and curved as in Fig. 4A. *E. bajaensis*

Discussion

Cushing *et al.* (2015) demonstrated the monophyly of the solifuge family Eremobatidae. That phylogeny provided a baseline analysis for informing taxonomic revisions of well supported clades such as the genus *Eremocosta* and the previously revised *Eremobates scaber* species group clade (Cushing & Brookhart 2016). Additional research and analysis is required to resolve less well-defined taxa such as the large polyphyletic genera *Eremobates*, *Eremochelis*, and *Hemerotrecha*. The time-calibrated phylogeny presented in Cushing *et al.* (2015) suggested that the Eremobatidae originated and diversified in conjunction with the appearance in North America of steppe and semi-desert habitats.

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