

A NEW SPECIES OF *EUKOENENIA* (PALPIGRADI, EUKOENENIIDAE) FROM MOROCCO

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ABSTRACT. The new species *Eukoenia maroccana* is described from six specimens (two males, two females and two immatures) collected in Kef Aziza Cave, Morocco, and is distinguished from all other *Eukoenia* species by the presence of thickened opisthosomal glandular setae in males on sternites IV–VI. The genitalia and chaetotaxy of both adult sexes show differences from other species of *Eukoenia* and are discussed in this paper.

RESUMEN. Se describe *Eukoenia maroccana* a partir de seis ejemplares (dos machos, dos hembras y dos inmaduros) capturados en la gruta de Kef Aziza, Marruecos. Lo más destacable y del todo singular de esta nueva especie es la particular presencia de setas glandulares esternales engrosadas del macho, la genitalia y resto de chaetotaxia de ambos sexos.

Keywords: *Eukoenia maroccana*, taxonomy, North Africa, morphology

Two species of Palpigradi have been previously reported from Morocco (Harvey 2003). The endogenous species *Eukoenia mirabilis* (Grassi & Calandruccio 1885) has been collected from a range of locations (Rémy 1952a, 1956b, 1957), which were summarized by Harvey et al. (2006, fig. 2). A second endogenous species, *Eukoenia hanseni* (Silvestri 1913), was recorded by Condé (1951) [see also Rémy (1952a, 1957)]. Canals & Viñas (1960) captured a specimen within Kef Aziza (also named Kef Aziza) cave, which was identified as *Koenuia* sp., but this material has not been restudied and is now lost (Condé 1984, 1996). The study of a recent collection of several palpigrade specimens from Kef Aziza cave has revealed the presence of a previously undescribed species.

The specimens examined in this study are deposited in the National Museum of Natural Sciences, Madrid, Spain (MNCN) and the University of Almería, Almería, Spain (UAL). All measurements are expressed in micrometers and were taken using an ocular micrometer with a compound microscope. The following abbreviations were utilized: L, total length of body (without flagellum which is lost in all specimens); B, length dorsal shield; P, pedipalpus; I and IV, legs I and IV; ti, tibia; bta1, basitarsus 1; bta2, basitarsus 2; bta3, basitarsus 3; bta4, basitarsus 4; ta1, tarsus 1; ta2,

tarsus 2; ta3, tarsus 3; a, width of basitarsus IV at level of seta *r*; *er*, distance between base of basitarsus IV and insertion of seta *r*; *grt*, length of tergal seta; *gla*, length of lateral seta; *r*, length of stiff seta; *t/r*, ratio between length of basitarsus IV and stiff seta length; *t/er*, ratio between length of basitarsus IV and distance to insertion of stiff seta; *gla/grt*, ratio between lengths of lateral and tergal setae; B/bta, relation between lengths of prosomal shield and basitarsus IV; bta/ti, ratio between lengths of basitarsus IV and tibia IV. Setal nomenclature follows Condé (1974, 1971, 1984, 1988, 1989, 1992, 1993, 1994).

TAXONOMY

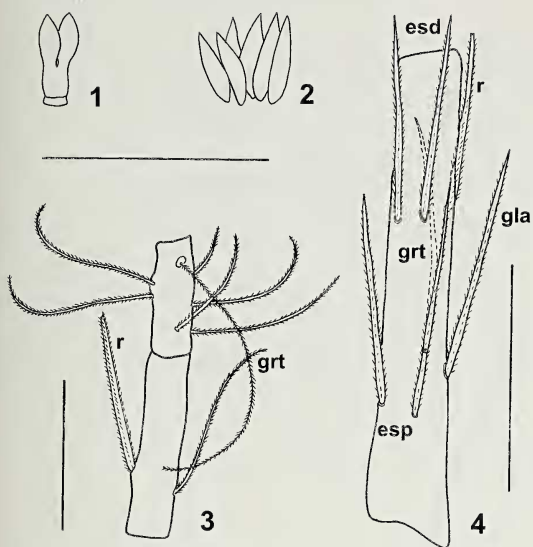
Family Eukoeneniidae Petrunkevitch 1955
Genus *Eukoenia* Börner 1901

Koenuia Grassi & Calandruccio 1885:165 [junior primary homonym of *Koenuia* Beushausen 1884 (Mollusca: Bivalvia)].

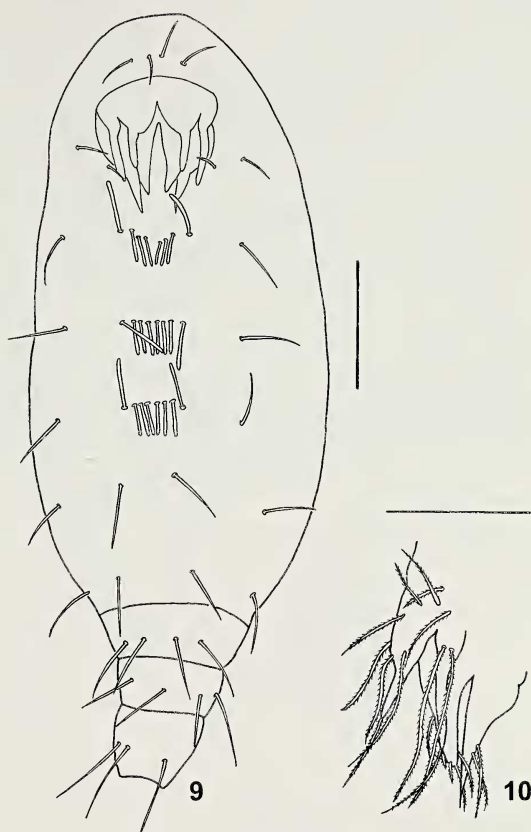
Koenuia (*Eukoenia*) Börner 1901:551.

Type species.—*Koenuia mirabilis* Grassi & Calandruccio 1885, by monotypy.

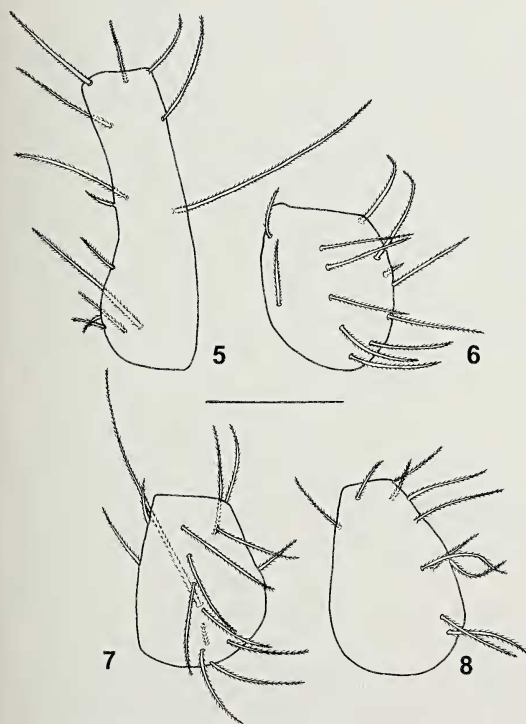
Remarks.—*Eukoenia* includes 60 species and is the most diverse genus of Palpigradi (Harvey 2002, 2003; Mayoral & Barranco 2002a). It is cosmopolitan with 25 species in Europe, 21 in Africa, 14 in Asia, 9 in America and 2 in Australia; some of them appear on different continents. Most species



Figures 1–4.—*Eukoenenia maroccana* new species: 1. Frontal organ, dorsal view; 2. Lateral organ, dorsal view; 3. Basitarsus 3–4 of leg I; 4. Basitarsus IV. Scale bars 100 μ m.



Figures 9–10.—*Eukoenenia maroccana* new species: 9. Opisthosoma of male, ventral view; 10. Male genitalia, lateral view. Scale bars 100 μ m.



Figures 5–8.—*Eukoenenia maroccana* new species: 5. Coxa I; 6. Coxa II; 7. Coxa III; 8. Coxa IV. Scale bar 100 μ m.

are found in soil, but 27 are from caves. New species have been described recently (Mayoral & Barranco 2002b; Montaño & Francke 2006). The distribution of some endogean species suggests human intervention (Savory 1974; Condé 1986; Harvey et al. 2006).

The genus *Eukoenenia* is characterized by the absence of ventral sacs in opisthosomal sternites IV–VI, and segment IX is narrower than VIII, but larger than XI (Monniot 1966).

Eukoenenia maroccana new species

Figs. 1–13

Material examined.—MOROCCO: *Errachidia*: Holotype adult male, Kef Aziza cave, Tazougerte, Bouclenib [32°01'46"N, 03°47'17"W, 1040 m], July 1997, C. Hernando (MNCN 20.02/14845). Paratypes: MOROCCO: *Errachidia*: 1 adult male, same locality and collector (UAL-Pp-022), 2 adult females, same locality and collector (UAL-Pp-023, MNCN 20.02/14846); 2 immature females,

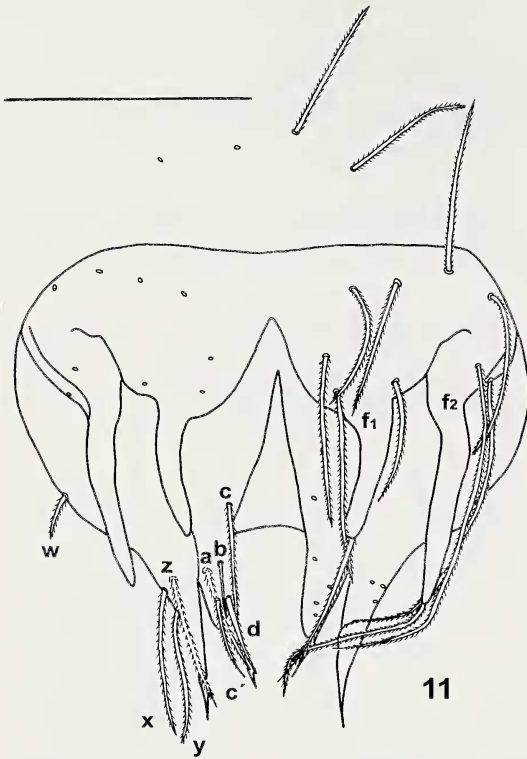


Figure 11.—*Eukoenia maroccana* new species: male genitalia. Scale bar 100 μ m.

(type A), same locality and collector (UAL-Pp-024, MNCN 20.02/14847).

Diagnosis.—This species differs from all other species of the genus by the combination of the presence of six lateral organs and the characteristic chaetotaxy and genitalia: males with 4 + 4 thickened secretory setae (a) and only one seta (s) on sternites IV–VI; different ventral opisthosomal chaetotaxy in both sexes; the presence of strongly developed fusules on very long dilated digitiform processes in male genitalia; and the shape of genitalia in females.

Description.—*Male: Prosoma:* frontal organ with 2 expanded granulate branches, blunt apically and each over 2.8 times longer than wide (Fig. 1). Lateral organ with 6 pointed blades, each 6 times longer than wide (Fig. 2). Dorsal shield with 10 + 10 short setae. Free segment of opisthosoma with 3 + 3 setae (t_1 , t_2 , t_3), all of similar length. Chelicerae with 9 teeth on each side of chelicera and with 6 dorsal and 1 ventral setae. Four deuto-tritosternal seta in linear arrangement. Chaetotaxy of coxae I–IV: 13, 13, 15 and 11 (Figs. 5–8). Basi-

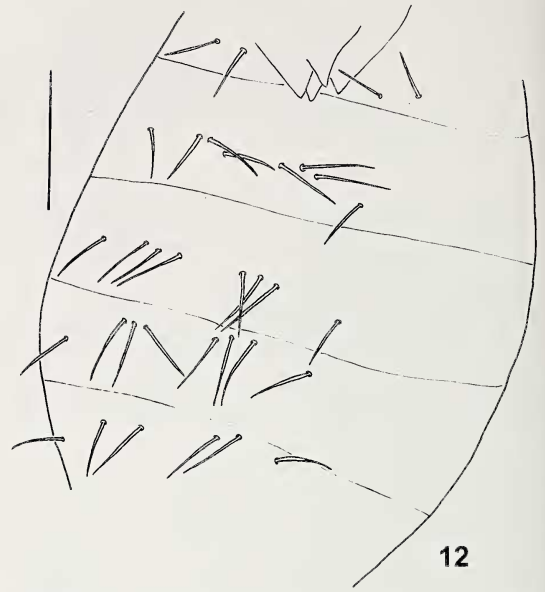


Figure 12.—*Eukoenia maroccana* new species: opisthosoma of female, ventral view. Scale bar 100 μ m.

tarsus 3 of leg I slender, 4 times longer than broad, with 2 setae: stiff (r) and (grt) (Fig. 3), r shorter than the segment ($120/95$, $t/r = 1.26$), inserted in proximal half and surpassing hind edge ($32.5/112.5$, $s/er = 0.29$). Basitarsus IV with 7 setae (2 esd , 2 esp , gla , grt , and r) (Fig. 4), $btalti$ 0.89. Stiff seta r 2.60 times shorter than tergal edge of article ($t/r = 2.60$) and inserted in its distal third ($t/er = 1.66$) very close to both grt . Both esd proximally inserted, followed by gla and grt , more or less at same level, all of them in proximal third.

Opisthosoma: tergites II–VI with 3 + 3 dorsal setae, 2 pair of setae (t_1 , t_3) between both slender seta (s), 2 + 2 on VII and VIII, only t seta present, and without s . Sternites II–III with 2 + 2 setae. Sternites IV–VI with 4 + 4 thickened setae in middle of opisthosoma (a_1 , a_2 , a_3 , a_4), outer ones (a_4 , 71) longer than others (a_1 – a_3 , 52.5). In addition, only one normal seta (s) present on each side, as long as a_4 . Sternites with VII–VIII 2 + 2 setae (Fig. 9). Chaetotaxy of segments IX–XI each with 8 setae.

Genitalia: 3 lobes present, with 44 setae; first lobe with deep medial indentation that separates two sides with a subtrapezoidal aspect, 13 + 13 setae (including 2 + 2 fusules). Fusules inserted on a dilated digitiform base, external fusules longer, reaching past distal

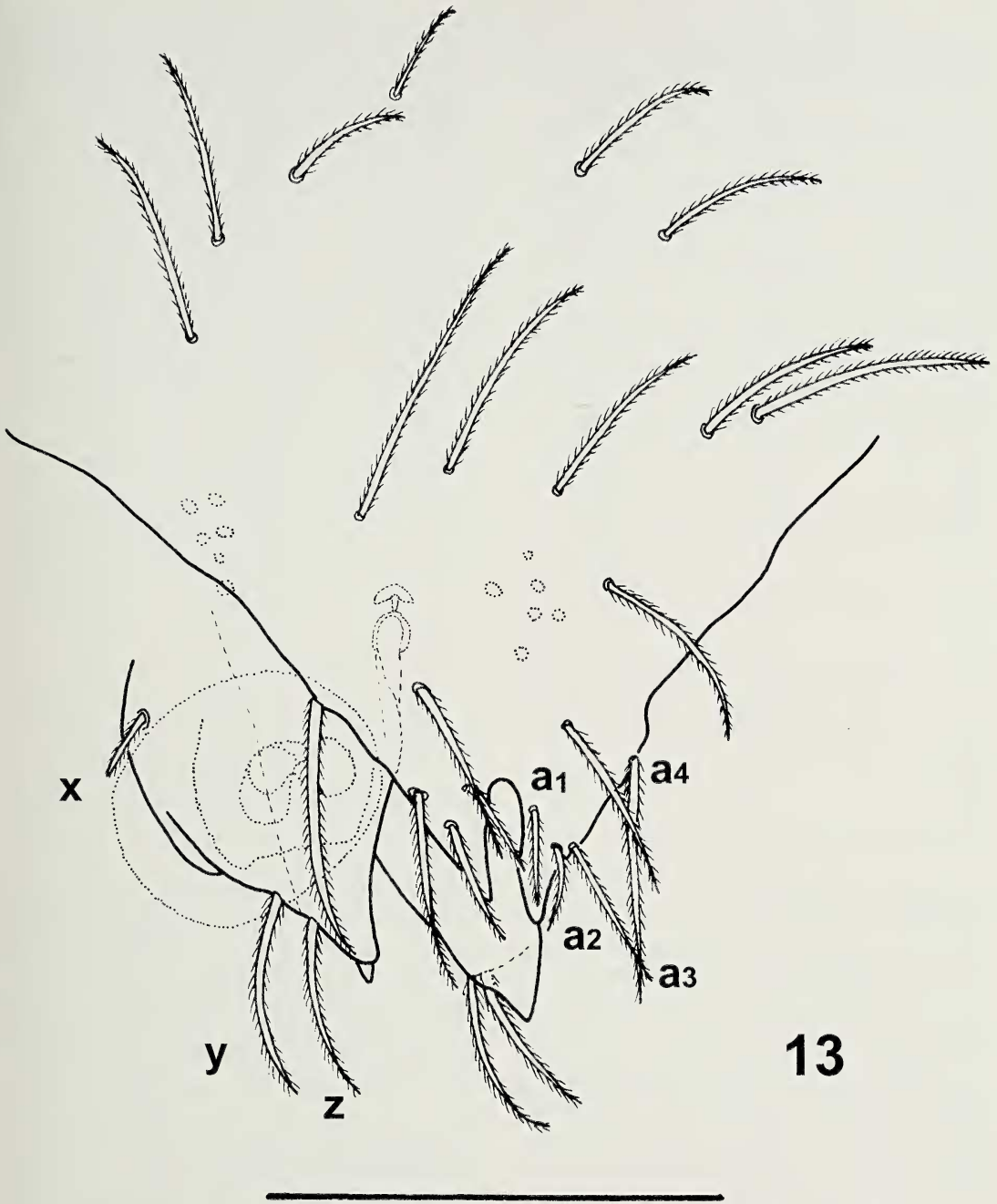


Figure 13.—*Eukoenia maroccana* new species: female genitalia. Scale bar 100 μ m.

margin of second lobe. Outer 4 subapical setae extremely long, reaching past apex of third lobe. Second lobe with a large, single and pointed apical part, with 5 + 5 setae (*a*, *b*, *c*, *c'*, *d*). Third lobe of similar shape, but with 4 + 4 setae (*x*, *y*, *z*, *w*) (Figs. 10, 11).

Female: generally similar to male but differing as follows:

Opisthosoma: 4 deuto-tritosternal seta in linear arrangement. Ventral setal formula: sternite III with 2 + 2 setae, sternites IV–VI with 3 + 3 setae (*a*₁, *a*₂, *a*₃) and a single *s* on each side; sternite VII with 2 + 2 setae (*a*₁, *a*₂) and one *s* on each side, sternite VIII with only 2 + 2, seta *s* absent (Fig. 12).

Genitalia: first lobe with 11 + 11 setae in

Table 1.—Measurements (μm) of selected body parts of *Eukoenia maroccana*.

Body part	Male 1, holotype	Male 2	Female 1	Female 2	Immature
L	1725	1604	1866	1115	936
B	584	605	697	605	—
Pti	205	207	220	210	158
Pbta1	68	70	70	73	53
Pbta2	80	90	88	93	73
Pta1	43	50	45	43	38
Pta2	55	53	68	65	53
Pta3	80	90	98	95	55
Iti	227	—	247	238	190
Ibta1 + 2	168	165	173	165	128
Ibta3	110	123	120	110	110
Ibta4	70	70	80	85	55
Ita1	50	50	53	43	38
Ita2	53	55	58	58	48
Ita3	188	190	200	190	163
IVbta	208	212	212	215	168
IVti	233	225	242	235	185
IVta1	85	70	75	70	70
IVta2	125	120	125	133	105
a	23	—	25	33	23
er	125	130	145	143	103
grt	93	100	103	—	80
gla	90	88	103	95	78
r	80	85	80	83	65
t/r	2.60	2.49	2.65	2.59	2.58
i/er	1.66	1.63	1.46	1.50	1.63
gla/grt	0.97	0.88	1.00	—	0.98
B/bta	2.81	2.85	3.10	2.81	—
bta/ti	0.89	0.94	0.88	0.91	0.91

5 transverse rows, 4 sternal 2 + 2, 2 + 2, 2 + 2, 1 + 1 and distal 4 + 4, of which a_1 and a_2 of same length (25) which are shorter than a_3 (42.5–48) and a_4 (55–58). Second lobe with 3 + 3 setae (Fig. 7); 5 glandular orifices. Spermathecae elliptical (Fig. 13).

Immature (type A, immature female): Generally similar to adults, but lateral organs with 4 blades; 3 deuto-tritosternal setae; and 8 cheliceral teeth. Basitarsus IV with 6 setae: 1 *esp* absent. Ventral and dorsal chaetotaxy as for female. One of the immatures was too damaged to be measured.

Dimensions (μm).—See Table 1.

Etymology.—The specific name *maroccana* refers to the country, Morocco, where the species was found.

Remarks.—The prosoma of *Eukoenia maroccana* bears six lateral organs, similar to that of *E. depilata* Remy 1960 (6), *E. remyi* Condé 1974 (4–6), *E. spelaea* (Peyerimhoff 1902) (5–6), *E. hanseni* (Silvestri 1913) (3–

6) and *E. cf. lyrifer* Condé 1974 (6). *Eukoenia maroccana* has 9 + 9 cheliceral teeth, while *E. depilata*, *E. remyi*, and *E. spelaea* have 8 + 8, *E. hanseni* has 7 + 7 and *E. cf. lyrifer* also has 9 + 9. *Eukoenia depilata*, *E. remyi* and *E. cf. lyrifer* are only known from females. The ventral chaetotaxy of *E. depilata* and *E. remyi* has only one secretory seta (*a*) on sternites IV–VI, three *s* setae, which are slightly thickened, on each side in *E. depilata* (Remy 1960), only two *s* setae in *E. remyi* (Condé 1974). Although Condé (1974) did not describe the chaetotaxy of *E. cf. lyrifer*, it is supposed that it is the same as that of *E. lyrifer*, which has two *a* and only one *s* setae. All of these species differ from the female of *E. maroccana* (with 1 + 3 + 3 + 1 and no thickened setae) and also the first lobe of the female genitalia is more rounded in these three species than in *E. maroccana*.

The ventral chaetotaxy in males of *E. maroccana* have 4 + 4 *a* setae, which is similar

to that of *E. spelaea*, *E. hansenii*, and *E. florenciae* (which have 3 lateral organs), *E. stri-natii* (4 lateral organs), *E. patrizii* (8–10 lateral organs), *E. maros* (4–5 lateral organs) and partially *E. bouillonii* (5 lateral organs), which has 5 + 5 secretory setae on sternite IV. All of these species have two *s* setae while *E. maroccana* has only one and none of them have the thickened secretory setae, which appears to be exclusively found in males of *E. maroccana*. These thickened setae are similar to those on the sternites V–VI in females of *E. paulinae* Condé 1994, which are present only on sternites IV and V (Condé 1994), and in *E. angolensis* (Remy 1956) and *E. hesperia* (Remy 1953) (Remy 1953, 1956a; Condé 1992, 1994). Other species with 5 lateral organs are *E. pyrenaica* and *E. naxos*, both with different sternal chaetotaxies, with two pair of *a* setae between a pair of *s* for the first one and 5 + 5 secretory setae in sternites V–VI between two *s* setae in *E. naxos*.

The presence of fusules on dilated processes is frequent in males of the genera *Euko-enenia* and *Koeneiodes* (Condé 1994). These processes can be only slightly developed, as in *E. fossati* Remy 1960, *E. brignolii* Condé 1979 and *E. gasparoi* Condé 1988 (Remy 1960; Condé 1979, 1988), moderately developed, as in *E. pauli* Condé 1979, *E. lawrencei* Remy 1987, *E. grassii* (Hansen 1901) and *E. janetscheki* Condé 1993 (Condé 1979, 1981, 1993), or strongly developed, as in *E. patrizii* (Condé 1956) and *E. maroccana*.

It is unusual to have different ventral opisthosomal chaetotaxy in both sexes of the same species. This situation is also seen in *E. janetscheki* Condé 1993 where the female has an additional secretory seta on sternites IV–VI (Condé 1993).

The mean value of B/bta in the four adults is 2.89, very far from the value of the cavernicolous species, which should be lower than 2, but it is similar to the values for endogenous species (3–4) (Condé 1998). This situation arises because the legs of *E. maroccana* are not elongated, although the specimens have the typical large size of cave dwelling species.

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