

A NEW SPECIES OF *ENTOMOBRYA* FROM NORTHERN ALGERIA (COLLEMBOLA: ENTOMOBRYIDAE)¹

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ABSTRACT: Two species of *Entomobrya* were found among 288 specimens of Collembola sampled in northern Algeria. The identification of the *Entomobrya* species requires some precautions and consideration of characters beyond color pattern. Preliminary identifications suggested the presence of *E. mauretanicus* Handschin, 1925 (new status) and *E. clitellaria* Guthrie, 1903, but a detailed examination of the specimens assigned to *E. clitellaria* showed that a new species was involved which is described here. *Entomobrya mauretanicus* has only been collected once before, was described inadequately, and is redescribed here.

KEY WORDS: Collembola, morphological characters, *Entomobrya*, color pattern variations

During fieldwork between 1999 and 2007 in the region of Constantine in Northern Algeria (Fig. 1), a large number of springtails were collected. These samples contained several species of Entomobryidae, including two rare species of *Entomobrya*.

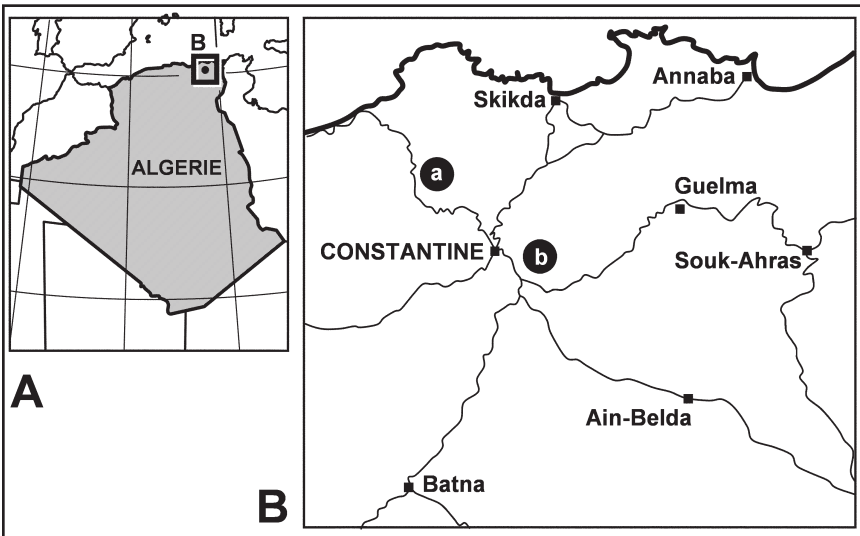


Fig. 1. Map showing collecting sites in northern Algeria.

¹ Received on December 20, 2007. Accepted on March 11, 2008.

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Traditionally *Entomobrya* species have been distinguished using only color pattern. However, color has been shown to be very variable in Entomobryidae, particularly in the genus *Entomobrya*, where individuals in a single species are variable even within a single population (Jordana and Baquero, 1999). In addition, the following morphological characters, which appear to be relatively constant, have been considered: labial triangle setae, labral papillae, male genital plate, fourth antennal segment (frequently missing), and mucronal shape. Together with the dorsal machochaetotaxy, a combination of these characters are here used to identify species of *Entomobrya*. A convergence in color pattern between the new species and the American species *E. clitellaria* Guthrie, 1903 is noted.

METHODS

Collecting localities (Fig. 1). **Bordj Sabat** (HKBS), North-East Constantine, Chene liège (*Quercus suber*, Fagaceae) litter, February 2007, 780 m alt. **Beni Haroun** (HKBH), wilaya of Mila, M'cid Aicha, commune of Hamala, March 2007, 139 m alt. Dominant vegetation (by order of predominance): *Pistacia lentiscus* (Anacardiaceae), *Olea europea* (Oleaceae), *Myrtus communis* (Myrtaceae), *Ceratonia siliqua* (Fabaceae), *Ulmus campestris* (Ulmaceae). **Boughareb** (HKBL), wilaya of Constantine, commune of Benbadis, February 2007, 963 m alt. Dominant vegetation (by order of predominance): *Ampelodesmos mauretanicus* (Poaceae), *Quercus coccifera*, *Pistacia terebinthus*, *Crataegus azarolus* (Rosaceae), *Chamaerops humilis* (Arecaceae), *Thymelaea* sp. and *Daphne gnidium* (Thymelaeaceae). **Kala Ghora** (HKK), Algerian Tunisian border, Chene Zen (*Quercus faginea*) litter, May 2007, 1180 m alt. **Kala Layoun** (HK), Algerian Tunisian border, Chene Zen (*Quercus faginea*) litter, May 2007, 750 m alt.

Specimens Examined. **MZNA** (Museum of Zoology, University of Navarra). *E. mauretanicus*: 3 specimens on slides (Codes MZNA-ARG03-P01, P06 and P07) from ALGERIA, labeled as "HK B L. Bet. Algeria, Boughareb Constantine, *Pistacia terebinthus* (Arabic name: Bettoum) litter," Hamra-Kroua leg. Geographical Coordinates: 36°16.767' N; 6°50.412' E; new species of *Entomobrya*: 5 specimens on slides (Codes MZNA-ARG02-P01, P05, P06, and P07) from ALGERIA, labeled as "HK BH LCS. Argelia, Beni Haroun (north Constantine), *Ceratonia siliqua* litter," and 2 specimens in ethyl alcohol (Code MZNA-ARG02-T01) with the same locality data, Hamra-Kroua leg. Geographical Coordinates: 36°36.095' N; 6°16.974' E. **INHS** (Illinois Natural History Survey). *E. clitellaria*: 2 specimens on slides from USA labeled as "Ames, Iowa. 7. V.1929 to 8.VIII.1929," no collector data.

Preparation. The specimens were mounted in Hoyer medium, sometimes cleared with Nesbitt solution. Observation of the slides was done under an Olympus BX51-TF microscope with a multi-viewing system and phase contrast, and an Olympus BX50-F4 with differential interference contrast (DIC). For the measurements, a U-DA drawing attachment UIS (Universal Infinity System) and a scale calibrated with a slide of Graticules Ltd. (1 mm/0.01 div) were used.

SYSTEMATIC ENTOMOLOGY

The total number of Collembola specimens captured was 288 (Table 1), but specimens of *Entomobrya* were only obtained from localities HKBH and HKBL. Identification of this material, using the set of characteristics published by Jordana and Baquero (2005), indicate that two species are present.

Entomobrya mauretanic Handschin, 1925 NEW STATUS

Figs. 2A, 3A-3D

Entomobrya multifasciata var. *mauretanic* Handschin, 1925

Entomobrya multifasciata mauretanic; Salmon, 1964

Type Locality: MOROCCO, Tamalett, over stones. 7. IV.1923. Handschin's original description (p. 166, Pl. XXX, figs. 4a-b) is insufficient to differentiate between species of *Entomobrya*. Only some measurements and description of the color pattern can be used:

“La variété se distingue de la forme principale par la forte extension latérale des dessins foncés. Les taches intermédiaires manquent presque totalement sur Th. II et Abd. I. Par contre, elles sont très développées sur Abd. II et III, où elles entrent en communication avec les bandes latérales et, par ce fait, avec la bande ectomarginale. Au lieu d'une bande antérieure, l'Abd. IV porte deux paires de taches latérales isolées. La bande transversale postérieure est presque intacte, tandis que la ligne médiane fait défaut. Dans les autres caractères, la forme s'accorde entièrement avec *multifasciata* Tullb.” Handschin, 1925.

Handschin does not give the number of specimens he studied nor the depository of the material. The specimens under study share enough characters with the original description to be considered co-specific, and a detailed description of the species follows. Ground colour pale yellow with blue bands as in the Figure 2A. Length of body without head: 1.4 mm. Eight eyes, GH<EF. Antennae slightly longer than twice head diagonal (ratio 1:2.24). Measurements of antennal segments (in micrometers): 80:160:180:230. Apical vesicle bilobed. Head bothriotrichum present. As in all other *Entomobrya* species, labrum with 5, 5, 4 smooth setae. Labral papillae wrinkled or corrugated, with some projections. Thoracic tergite II with dense anterior collar of macrochaetae. Abdominal IV/III ratio: 3.30. There are no differentiated setae on the tibiotarsus, except for the smooth seta on the metathoracic legs characteristic of the family. Claw with four inner teeth: basal pair at midpoint of inner claw and two unpaired teeth (the first at two-thirds of distance from base to tip); dorsal tooth at the level of the basal pair. Unguiculus lanceolate, with smooth outer edge on leg III. Macrochaetotaxy as in Tables 2 and 3 (Figs. 3A-3D). Simplified formula: 3-1-0-3-2/3-4/2-2/1-2-1/0-3-3-2-2 (head areas: H1-H5/thoracic tergite II: T1-T2/abdominal tergite II: A1-A2/abdominal tergite III: A3-A5/abdominal tergite IV: A6-A10). M₅ on T2 is a mesochaeta or macrochaeta. Manubrial plate with three setae and one pseudopore.

Table 1. Species captured in the study in relation to the five localities. Legend for localities: see "METHODS. Localities."

SPECIES	HKBS	HKBH	HKBL	HKK	HK	Total
<i>Bilobella aurantiaca</i> (Caroli, 1912)					2	2
<i>Ceratophysella gibbosa</i> (Bagnall, 1940)		1				1
<i>Cryptopygus</i> sp. juv.				1		1
<i>Hemisotoma thermophila</i> (Axelson, 1900)		2				2
<i>Cyphoderus yugoslavicus</i> Denis, 1933				4		4
<i>Entomobrya mauretanicus</i> Handschin, 1925			3			3
<i>Entomobrya numidica</i> n. sp.		7				7
<i>Heteromurus major</i> (Moniez, 1889)	2	22	26	80	25	155
<i>Heteromurus nitidus</i> (Templeton, 1835)				12	2	14
<i>Heteromurus</i> sp. juv.				1		1
<i>Hypogastrura</i> cf. <i>pityusica</i> Ellis, 1974		5				5
<i>Isotomidae</i> juv.	1					1
<i>Isotomiella minor</i> (Schäffer, 1896)				2		2
<i>Isotomurus palustris</i> (Müller, 1776)			1		8	9
<i>Lepidocyrtus</i> sp. 03			21	3	1	25
<i>Lepidocyrtus</i> sp. 02	2	12				14
<i>Lepidocyrtus</i> sp. juv.					2	2
<i>Lepidocyrtus</i> sp. 01	1					1
<i>Lepidocyrtus tellecheae</i> Arbea and Jordana, 1990	1					1
<i>Lipothrix bernardi</i> Delamare-Deboutteville, 1954					1	1
<i>Orchesella cincta</i> (Linnaeus, 1758)					4	4
<i>Parisotoma notabilis</i> (Schäffer, 1896)				7	1	8
<i>Protaphorura</i> sp.				1		1
<i>Protaphorura armata</i> (Tullberg, 1869)		1				1
<i>Protaphorura</i> sp. juv.					2	2
<i>Pseudachorutella asigillata</i> (Börner, 1901)					1	1
<i>Seira punica</i> Jacquemart, 1974	1					1
<i>Sminthurinus niger</i> (Lubbock, 1867)					2	2
<i>Sphaeridia pumilis</i> (Krausbauer, 1898)					1	1
<i>Sminthurinus niger</i> (Lubbock, 1867)					2	2
<i>Stenognathellus denisi</i> Cassagnau, 1953					1	1
<i>Tomocerus</i> sp. juv.				3		3
<i>Tomocerus vulgaris</i> (Tullberg, 1871)		8			2	10
<i>Xenylla maritima</i> Tullberg, 1869	1					1
Total						289

Mucro with the anteapical teeth similar in size to the apical, mucronal spine present. Additional descriptive characters (following Jordana and Baquero, 2005) are shown in Table 2.

This species had been recorded from Algeria previously by Handschin (1928) and Cassagnau (1963) (as *E. multifasciata*) in the checklist of the Algerian Collembola.

Entomobrya numidica NEW SPECIES

Figs. 2B, 4A-4D

Type Locality: ALGERIA (Beni Haroun). Sample obtained from *Ceratonia siliqua* litter.

Type Specimens: Holotype (male), slide labelled MZNA-ARG02-P01; 3 paratypes on slides (codes MZNA-ARG02-P05 to P07) and 2 paratypes in ethyl alcohol (code MZNA-ARG02-T01).

Material Deposited: MZNA.

Description. Body length up to 2.3 mm without antennae (maximum length of *E. clitellaria* described in the literature as 2.25 mm). Color pattern, as in figure 2B, similar to some color morphs of *E. clitellaria*. The yellow pigment is present on the posterior 3/4 of abdominal segment IV. Eight eyes, GH<EF. Antennae long, 3 times the length of the head (ratio 1:3.05), with bilobed apical vesicle. Measurements of antennal segments (in micrometers): 200:310:330:380. Head bothriotrichum present. Labral setae formula 5, 5, 4, as in other *Entomobrya* species. Labral papillae wrinkled or corrugated with minute projections. Thoracic tergite II with dense anterior collar of macrochaetae. Abdominal IV/III: 3.00. Tibiotarsi without differentiated setae (with exception of the smooth terminal setae on legs III characteristic for the family). Unguis with four internal teeth. Manubrial plate with four setae and two pseudopores. Mucro with both teeth similar in size, mucronal spine present. Additional characters described in Table 3. Macrochaetotaxy as in Tables 2 and 3 (Figs. 4A-4D). Simplified formula: 3-1-0-3-3/2-3/2-3/1-2-1/0-2-3-2-2.

Etymology. The specific name makes reference to the Mountains of Numidie, or "Monts de Constantine," collection site of the new species.

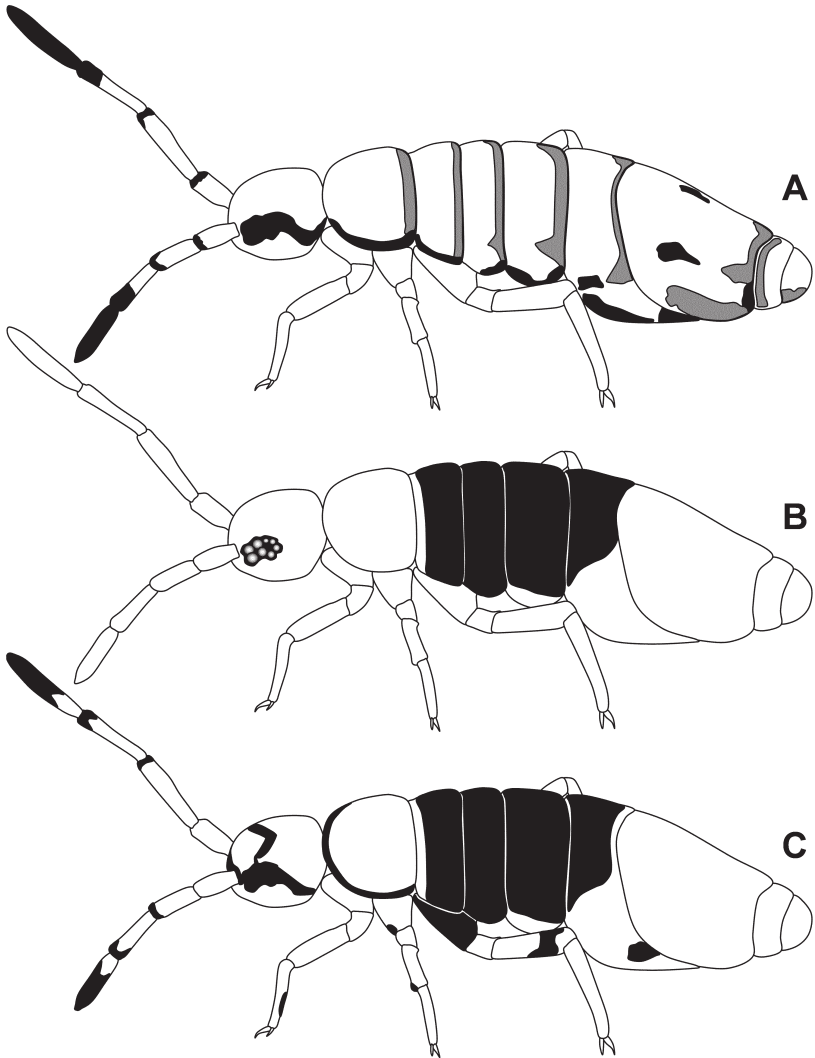


Fig. 2. Color pattern of the species of *Entomobrya* studied: A, *E. mauretunica* from Algeria (MZNA); B, *E. numidica* n. sp. from Algeria (MZNA); C, *E. clitellaria* from USA (drawing from T. Murray in <http://bugguide.net/node/view/111413/bgpage>).

Table 2. Comparative set of characters for species of *Entomobrya* studied. Number of specimens examined for each species follows in parentheses: *Entomobrya mauretunica* (3); *E. numidica* n. sp. (4); *E. clitellaria* (2). Characters marked with an asterisk, “*”, taken from Christiansen and Bellinger (1998). Differences between *E. clitellaria* and *E. numidica* n. sp. marked in bold. Dark border represents characters included in the simplified formula (see text, next page).

Character No. Character	Description	Value	<i>E. mauretanicus</i>	<i>E. numidica</i> n. sp.	<i>E. citellaria</i> (USA, Iowa)
1 H1 (Head)	An ₂ -An ₃	1-6	3	3	3
2 H2	A ₅ -A ₇	1-3	1	1	2
3 H3	S ₀	0-1	0	0	0
4 H4	S ₁ -S ₃ -S ₄	0-3	3	3	3
5 H5	Ps ₂ -Ps ₃ -Ps ₅	0-3	2	3	3
6 Labral papillae	simple and smooth papillae (1) wrinkled or with some projections (2) a setae-like projection (3)	1-3	2	2	3*
7 eyes G&H size	= E&F (1), <E&F (2)	1-2	2	2	2
8 apical antennal retractile bulb	no bulb (0), lobe simple (1), bilobate (2), trilobate (3)	0-3	2	2	2*
9 Ratio Ant./Head	> or = 3 (1), > or = 2 < 3 (2), < 2 (3)	1-3	2	1	2*
10 anterior dorsal collar Th II Ms	with Ms type 1 (1), type 2 or without Ms (2)	1-2	1	1	1*
11 T1	setae number m ₁ -m _{2j2} or >4 (5)	0-5	3	2	1
12 T2	setae number a ₅ , m ₄ -m ₅ or >8 (9)	0-9	4	3	8
13 Smooth setae on tibiotarsi	not or 1 in tibiotarsi III = 0, double file = 1	0-1	0	0	0
14 Unguis internal teeth	1(1), 2(2), 3(3), 4(4)	1-4	4	4	4*
15 Unguis dorsal tooth	basal = 1, internal teeth level = 2	1-2	1	1	1*
16 Unguis internal edge	without ciliation (0), with ciliation (1)	0-1	0	0	0*
17 External unguiculus	smooth (0), serrate (1)	0-1	0	0	0*
18 A1 Abd. II	a ₂ -a ₃	0-2	2	2	2
19 A2 Abd. II	m ₃ series setae number	0-7	2	3	5
20 A3 Abd. III	a ₁	0-1	1	1	0
21 A4 Abd. III	above m ₂ setae number	0-3	2	2	2
22 A5 Abd. III	m ₃ -m ₄ series setae number	0-4	1	1	1
23 A6 Abd. IV	a ₁ -a ₅ (A ₁ -D ₁) setae number; >8 (9)	0-9	0	0	0
24 A7 unpair seta	ma ₀ (A ₀₃)	0-1	0	0	0
25 A7 Abd. IV	ma ₁ -ma ₄ (A ₂ -E ₁) setae number; >9 (10)	0-10	3	2	2
26 A8 unpair seta	m ₀ (A ₀₄)	0-1	0	0	0
27 A8 Abd. IV	m ₁ -m ₃ (A _{4a} -C _{2a}) setae number; >5 (6)	0-6	3	3	2
28 A9 unpair seta	mp ₀ (A ₀₅)	0-1	0	0	0
29 A9 Abd. IV	mp ₁ -mp ₃ (A ₅ -B ₅) setae number; >6 (7)	0-7	2	2	1
30 A10 Abd. IV	p _{1a} -p ₃ (A ₆ -B ₆) setae number; >5 (6)	0-6	2	2	2
31 A11 Abd. IV	T ₁ (ma _{4e}) as thrichobotrium	0-1	0	0	1
32 A12 Abd. IV	T ₂ (m ₄) as thrichobotrium	0-1	1	1	1
33 A13 Abd. IV	T ₄ (mp ₄) as thrichobotrium	0-1	1	1	0
34 A14 Abd. IV	T ₆ (p ₄) as thrichobotrium	0-1	0	0	0
35 Ratio Abd.IV/Abd.III	2 < R < 4 (1), R > 4 (2)	1-2	1	1	?
36 Manubrial plate	setae number; >10 (11)	0-11	3	4	4
37 Manubrial plate	pseudopores 1-2	1-2	2	2	?
38 Mucro	sub-apical tooth without (0), normal (1), big (2)	0-1	1	1	1*
39 Mucro	basal spine	0-1	1	1	1

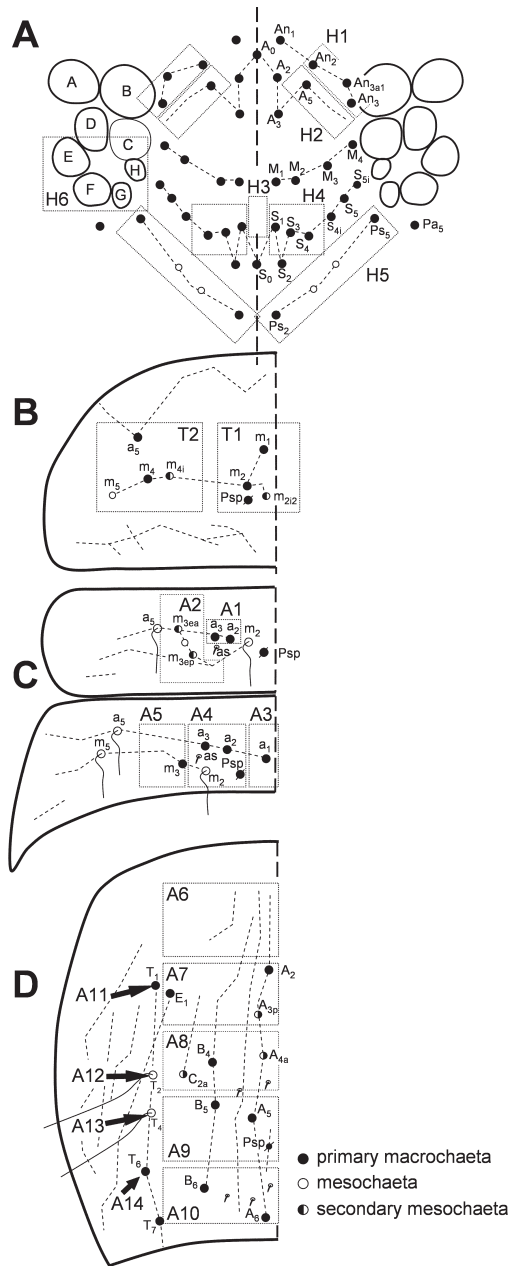


Fig. 3. Dorsal macrochaetotaxy of *E. mauretanicus*: A, head; B, thoracic tergite II; C, abdominal tergites II and III; D, abdominal tergite IV (arrows point to the bothriotricha insertions).

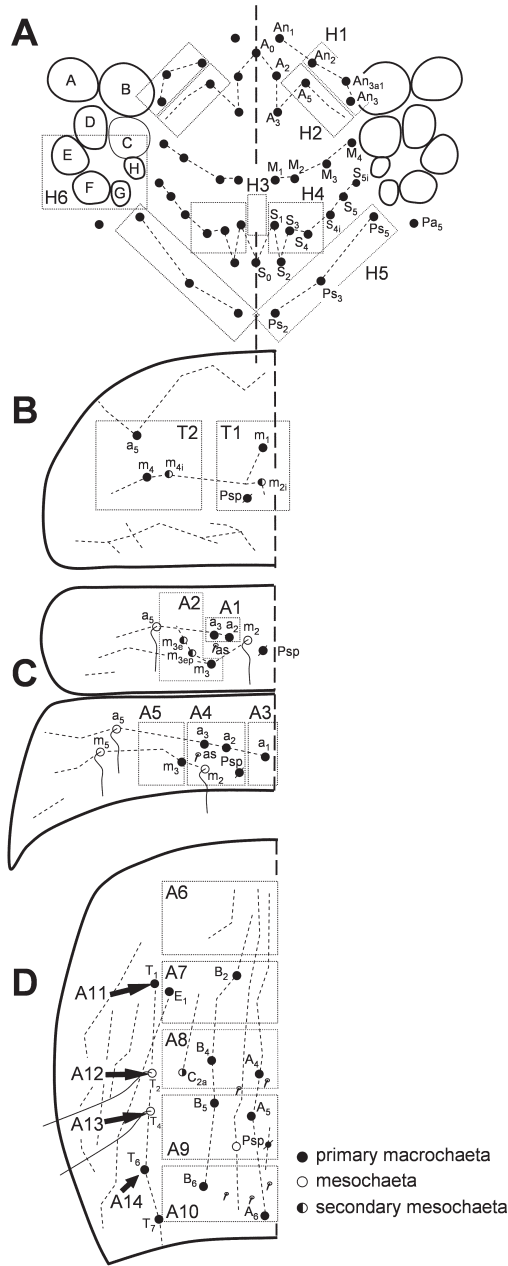


Fig. 4. Dorsal macrochaetotaxy of *E. numidica* n. sp.: A, head; B, disc of thoracic tergite II; C, abdominal tergites II and III; D, abdominal tergite IV.

Table 3. Macrochaetae present on the areas of taxonomic significance in the species of *Entomobrya* described in this paper. Number of specimens examined for each species follows in parentheses: *E. mauretanic* (3), *E. numidica* n. sp. (4), *E. clitellaria* (2). Notes: “#1”, 2 mesochaetae in this position; “#2”, moderated size mesochaetae; “#3”, an additional mesochaeta in this position; “*”, no chaetae present.

<i>Character No. (Location)</i>	<i>E. mauretanic</i>	<i>E. numidica</i> n. sp.	<i>E. clitellaria</i>	<i>Character No. Location</i>	<i>E. mauretanic</i>	<i>E. numidica</i> n. sp.	<i>E. clitellaria</i>			
1 (H1)	An ₂	An ₂	An ₂	18 (A1)	a ₂	a ₂	a ₂			
	An _{3a1}	An _{3a1}	An _{3a1}		a ₃	a ₃	a ₃			
	An ₃	An ₃	An ₃							
2 (H2)	A ₅	A ₅	A ₅	19 (A2)	m _{3ea}	m _{3e}	m _{3ea}			
			A ₆				m _{3eai}			
3 (H3)*				m _{3ep}	m _{3ep}	m ₃	m _{3ep}			
							m ₃			
4 (H4)	S ₁	S ₁	S ₁	20 (A3)	a ₁	a ₁				
	S ₃	S ₃	S ₃							
	S ₄	S ₄	S ₄							
5 (H5)	Ps ₂	Ps ₂	Ps ₂	21 (A4)	a ₂	a ₂	a ₂			
	Ps ₃ ^{#1}	Ps ₃ ^{#2}	Ps ₃				a ₃	a ₃	a ₃	
	Ps ₅	Ps ₅	Ps ₅							
11 (T1)	m ₁	m ₁	m ₁	22 (A5)	m ₃	m ₃	m ₃			
							m ₂	m _{2i}	A ₂	A ₃
12 (T2)	a ₅	a ₅ ^{#3}	a ₅	23 (A6)						
	m _{4i}	m _{4i}	m _{4i}							
	m ₄	m ₄	m ₄							
	m ₅	m ₅	m ₅							
							m _{4p} ^{#3}			
							m _{4p1} ^{#3}			

DISCUSSION

There is no doubt about the identity of the specimens referred to in this paper as *E. mauretana*, apparently found only for the second time in Algeria. *Entomobrya clitellaria*, with which the new species is similar in color, seems to be native to the Nearctic region (Christiansen and Bellinger, 1998), but is also cited from the Australian Region (Womersley, 1934). Superficially, the color pattern of these two species is similar, but the darker forms of *E. clitellaria* differ from *E. numidica* n. sp. in the color pattern on the antennae, dorsal head, thoracic tergite II, first pair of coxae, and some patches on lateral abdominal III (Figs. 2B, *E. numidica* n. sp.; 2C, *E. clitellaria*). The simplified dorsal macrochaetotaxy formula for *E. clitellaria* is 3-2-0-3-3/1-8/2-5/0-2-1/0-2-2-1-2 (Soto-Adames, per. comm.). Other differences (following Christiansen and Bellinger, 1998) are seen in the labral papillae, the ratio antennal length/head diagonal, and the position of bothriotricha (Table 2). The detailed comparison between these two species show again the importance of using features other than color pattern to distinguish between the species of *Entomobrya* on a worldwide scale.

ACKNOWLEDGMENTS

We wish to express our gratitude to Kenneth A. Christiansen (Grinnell College, Grinnell, Iowa, USA) and Felipe N. Soto-Adames (Illinois Natural History Survey, Section of Biodiversity, Illinois, USA) for their suggestions and corrections to the manuscript. Felipe N. Soto-Adames kindly contributed macrochaetotaxy characters for *E. clitellaria*, allowing the separation of *E. clitellaria* and *E. numidica* n. sp.

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