

A new species of *Entomobrya* from China (Collembola, Entomobryidae)

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Abstract

A new species of *Entomobrya* from an urban park in the surroundings of Beijing, China is described. For the differentiation of *Entomobrya cheni* n. sp. the set of characters proposed by Jordana and Baquero (2005) has been used and compared with all described species. This character set is compared to that of other species belonging to the genus *Entomobrya*.

Key words: morphological characters, chaetotaxy, new species, *Entomobrya cheni*

1. Introduction

The identification of the species of *Entomobrya* has traditionally involved examination of colour pattern and longitudinal or transversal colour stripes. Christiansen in 1958 and the paper on nearctic species by Christiansen & Bellinger (1980) considered, in addition to the colour pattern, characters such as retractile bulb (apical vesicle) of the fourth antennal segment, chaetae type 'type five', relative size (length and width) of the head, length of the external chaetae of the labial appendage, mesonotum length, chaetae morphology of the male genital plate, shape of the labral papillae, antennal length. Some characteristics, such as the colour pattern, have been shown to be variable among specimens from a single population (Jordana & Baquero, 1999). Some morphological characters change with development, while others are constant but difficult to see: labial chaetae triangle, male genital plate, fourth antennal segment (frequently missing), etc. The set of characters proposed by Jordana & Baquero (2005), based on constant and relatively easily visible morphological characters and dorsal macrochaetotaxy, has been demonstrated to be a simple, yet reliable system useful for the identification of the species of the genus *Entomobrya*. This combination of characters has been used for the description of a new species from Beijing.

So far, 15 species of *Entomobrya* have been found in China (Tab. 1), and only two species from Beijing.

Abbreviations: Abd = abdominal segment, Ant = antennal segment, Mc = macrochaeta, Th = thoracic segment

2. Material and Methods

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 a Zeiss Axio Imager.A1 with differential interference contrast (DIC). For the measurements, a UDA drawing attachment Universal Infinity System (UIS) and a scale calibrated with a Graticules Ltd. slide (1 mm/0.01 div) were used.

Tab. 1 Species of *Entomobrya* described from China.

Entomobrya species	References	Distribution in China (Provinces)	Biogeographic regions from www.collembola.org (Bellinger et al. 2010)
<i>E. aino</i> Matsumura & Ishida, 1931	(3)	Zhejiang	Sino-Japanese (3a)
<i>E. cheni</i> n. sp.	this paper	Beijing	China (3a)
<i>E. chungseensis</i> Baquero & Jordana, 2008	(9)	Tibet	China (3a)
<i>E. corticalis</i> Nicolet, 1842	(1)	Shanxi	Palaeartic (2a, 2b, 3a, 4)
<i>E. dorsosignata</i> Stach, 1964	(3), (8)	Beijing and Yunnan	China (3a)
<i>E. fjellbergi</i> Baquero & Jordana, 2008	(9)	Tibet	China (3a)
<i>E. griseoolivata</i> Packard (1873)	(4), (8)	Shanghai and Yunnan	Nearctic (7a, 7b, 8), Hawaiian (20), Caribbean (24) and China (3a)
<i>E. hortensis</i> Stach, 1963	(2)	Hebei	China (3a)
<i>E. huangi</i> Chen & Ma, 1998	(7)	Tibet	China (3a)
<i>E. imitabilis</i> Stach, 1963	(2)	Hebei	China (3a)
<i>E. karlstetterae</i> Baquero & Jordana, 2008	(9)	Tibet	China (3a)
<i>E. marginata</i> Tullberg, 1871	(3), (4), (8), (9)	Hebei, Guangdong, Yunnan and Tibet	Palaeartic (1, 2a, 2b, 4, 5, 6, 3a), Oriental (18), Australian (22, 32, 34)
<i>E. mieheorum</i> Baquero & Jordana, 2008	(9)	Tibet	China (3a)
<i>E. pekinensis</i> Stach, 1963	(2)	Beijing	China (3a)
<i>E. retingensis</i> Baquero & Jordana, 2008	(9)	Tibet	China (3a)

(1) Uchida (1948); (2) Stach (1963); (3) Stach (1964); (4) Rusek (1971); (5) Lin (1985); (6) Zhao *et al.* (1997); (7) Chen & Ma (1998); (8) Yue (2000); (9) Baquero & Jordana (2008).

3. Results

Entomobrya cheni n. sp.

Type locality. China, Beijing, Behai Park, litter in a wooded area with grass mosaic, Coordinates 39°55'44" N, 116°22'48" E, altitude 50 m.

Type material. Holotype: one specimen male on slide labelled CHI0010-06, and Alotype female CHI0010-03, 12/05/1990, sample extracted in Berlese funnels, leg. Txuma Arbea, 10 paratypes, same data as for holotype, CHI0009 (1 specimen) and CHI0010 (9 specimens). Holotype, Alotype and seven paratypes deposited at the Museum of Zoology, University of Navarra (Spain), paratype number CHI0010-05 at Senckenberg Museum for Natural History Görlitz, two paratypes deposited in the private collection of Javier Arbea (Spain).

Description

Body length up to 3.1 mm excluding antennae (Holotype 2.2 mm). Body colour pattern as in Fig. 1A. A set of characters and their variations among specimens is given in Tab. 2.

Head: Eight eyes, GH smaller than EF. The antennae are broken in all specimens, so the length and shape of apical vesicle could not be observed. Labral chaetae formula 5, 5, 4 as in other *Entomobrya* species. Four labral papillae, each with a chaetae-like projection (Fig. 1B).

Body: Length Abd IV/III > 4 (between 4 and 5). Claw with four internal teeth: first pair at 60% of distance from base of claw; two unpaired teeth, first at 75% of distance from base, and the most distal one minute, dorsal tooth small and between the paired dorsal teeth and the claw basis. Empodium spike-like, with smooth inner edge on leg III (Fig. 1C). Length of manubrium and dens 1000 μm (between 720 and 1320). Manubrial plate with 3–5 chaetae and 2 pseudopores. Mucronal subapical teeth similar to the terminal one, and mucronal spine present.

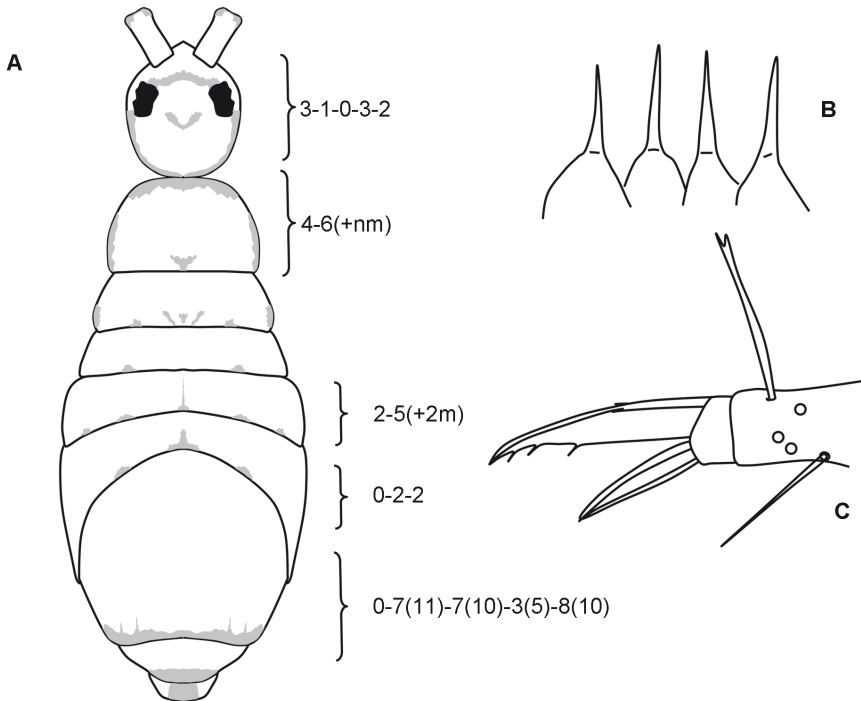


Fig. 1 *Entomobrya cheni* n. sp.; A: Colour pattern and simplified chaetotaxy formula (see Fig. 2A–D); B: labral papillae; C: claw.

Tab. 2 Set of characteristics of *Entomobrya cheni* n. sp.

Character	Location	Description	Range within the genus							
			juv	male	sub	fem	sub	fem	male	
Ch. 1	H1 (Head)	An ₂ -An ₃	1-6	3	3	3	3	3	3	3
Ch. 2	H2	A ₅ -A ₇	1-3	1	1	1	1	1	1	1
Ch. 3	H3	S ^c ₀	0-1	0	0	0	0	0	0	0
Ch. 4	H4	S ₁ -S ₃ -S ₄	0-3	3	2 ⁽³⁾	3	3	3	3	3
Ch. 5	H5	Ps ₂ -Ps ₃ -Ps ₅	0-3	2	2	2	2	2	2	2
Ch. 6	Labral papillae	simple and smooth papillae (1)								
Ch. 7	Eyes G&H size	= E&F (1), <E&F (2)	1-2	2	2	2	2	2	2	2
Ch. 8	Apical antennal retractile bulb	no bulb (0), lobe simple (1),								
Ch. 9	Ratio Ant/Head	> or = 3 (1), > or = 2 < 3 (2), < 2 (3)	1-3	-	-	-	-	-	-	-
Ch. 10	Anterior dorsal mane	Th II Mc with Mc type 1 (1), without Mc or type 2 (2)	1-2	1	1	1	1	1	1	1
Ch. 11	T1	chaetae number m1-m ₂₁₂ or >4 (5)	0-5	4	4	4	4	4	4	4
Ch. 12	T2	chaetae number a ₃ , m ₄ -m ₃ or >8 (9)	0-9	6 ⁽¹⁾	6 ⁽²⁾	6 ⁽³⁾	6 ⁽⁴⁾	6 ⁽²⁾	6 ⁽³⁾	6
Ch. 13	Smooth chaetae on tibiotarsi	not or 1 in tibiotarsi III = 0, double file = 1	0-1	0	0	0	0	0	0	0
Ch. 14	Unguis internal teeth	1(1), 2(2), 3(3), 4(4)	1-4	4	4	4	4	4	4	4
	Paired teeth of claw	distance from claw base, in %	65	60	55	55	60	60	60	-
	First unpaired teeth of claw	distance from claw base, in %	81	75	72	70	80	80	80	-
Ch. 15	Unguis dorsal tooth	basal = 1, internal teeth level = 2	1-2	-	-	-	2	2	2	-
Ch. 16	Unguis internal edge	without ciliation (0), with ciliation (1)	0-1	0	0	0	0	0	0	0
Ch. 17	External unguiculous	smooth (0), serrate (1)	0-1	0	0	0	0	0	0	0

Ch.18	A1 Abd II	a_2 - a_3	0-2	2	2	2	2	2	2	2	2	2	2
Ch.19	A2 Abd II	m_3 series chaetae number	0-7	5	5	5	5 ⁽⁶⁾	5	5	5	6	7	7
Ch.20	A3 Abd III	a_1	0-1	0	0	0	0	0	0	0	0	0	0
Ch.21	A4 Abd III	above m_2 chaetae number	0-3	2	2	2	2	2	2	2	2	2	2
Ch.22	A5 Abd III	m_3 - m_4 series chaetae number	0-4	2	2	2	2	2	2	2	2	2	2
Ch.23	A6 Abd IV	a_1 - a_5 (A_1 - D_1) chaetae number; >8 (9)	0-9	0	0	0	0	0	0	0	0	0	0
Ch.24	A7 unpaired seta	ma_0 (A_{03})	0-1	0	0	0	0	0	0	0	0	0	0
Ch.25	A7 Abd IV	ma_1 - ma_4 (A_2 - E_1) chaetae number; >9 (10)	0-10	7	9	8	9	4	9	4	9	11-7	11-7
Ch.26	A8 unpaired seta	m_0 (A_{04})	0-1	0	0	0	0	0	0	0	0	0	0
Ch.27	A8 Abd IV	m_1 - m_3 (A_4 - C_{2a}) chaetae number; >5 (6)	0-6	5	9-7	8	8	8	8	10	10-9	10-9	10-9
Ch.28	A9 unpaired seta	mp_0 (A_{05})	0-1	0	0	0	0	0	0	0	0	0	0
Ch.29	A9 Abd IV	mp_1 - mp_3 (A_5 - B_3) chaetae number; >6 (7)	0-7	2	3-5	6	4	5	5	5	4-3	4-3	4-3
Ch.30	A10 Abd IV	P_{1a} - P_3 (A_6 - B_6) chaetae number; >5 (6)	0-6	6	8	9	9	9	9	9	9	7-10	7-10
Ch.31	A11 Abd IV	T_1 (ma_{4c}) as trichobothrium	0-1	0	0	0	0	0	0	0	0	0	0
Ch.32	A12 Abd IV	T_2 (m_4) as trichobothrium	0-1	1	1	1	1	1	1	1	1	1	1
Ch.33	A13 Abd IV	T_4 (mp_4) as trichobothrium	0-1	1	1	1	1	1	1	1	1	1	1
Ch.34	A14 Abd IV	T_6 (p_4) as trichobothrium	0-1	0	0	0	0	0	0	0	0	0	0
	N^{st} chaetae Abd IV		40	58	62	60	52	66	66	61	61	61	61
Ch.35	Ratio Abd IV/Abd III	$2 < R < 4$ (1), $R > 4$ (2)	1-2	2	2	2	2	2	2	2	2	2	2
	Manubrium and dens	total length	720	880	1120	1320	900	1090	1090	1090	1090	1090	1090
Ch.36	Manubrial plate	chaetae number; >10 (11)	0-11	3(4)	5	-	-	4	-	-	-	-	-
Ch.37	Manubrial plate	pseudopores 1-2	1-2	2	2	-	-	2	-	-	-	-	-
Ch.38	Mucro	sub-apical tooth, without (0), normal (1), big (2)	0-1	1	1	1	1	1	1	1	1	1	1
Ch.39	Mucro	basal spine, absent (0), present (1)	0-1	1	1	1	1	1	1	1	1	1	1

(1) 2-4 additional mesochaetae next to m_{4i} and m_{4ip} ; (2) 3 additional mesochaetae next to m_{4i} and m_{4ip} ; (3) 5 additional mesochaetae next to m_{4i} and m_{4ip} ; (4) 4 additional mesochaetae next to m_{4i} and m_{4ip} .

Chaetotaxy: Simplified formula of the chaetotaxy (Head-Abd III): 3-1-0-3-2/4-6/2-5 (6-7)/0-2-2 (for chaetae identification, see Fig. 2A–C). Abd IV plurichaetotic, some females asymmetrically (left) with first trichobothrium (T2) in a more advanced position than in males (right) (Fig. 2D).

Head chaetotaxy as in figure 2A. Thorax chaetotaxy: T1 area on Th II with four macrochaetae (m_1 , m_2 , m_{2i1} and m_{2i2} present, sometimes 3 additional mesochaetae), T2 area on Th II with six macrochaetae (a_5 , m_{4p} , m_{4p} , m_{4i} and m_{4ip} ; 2–4 mesochaetae can be present) (Fig. 2B). Abdomen

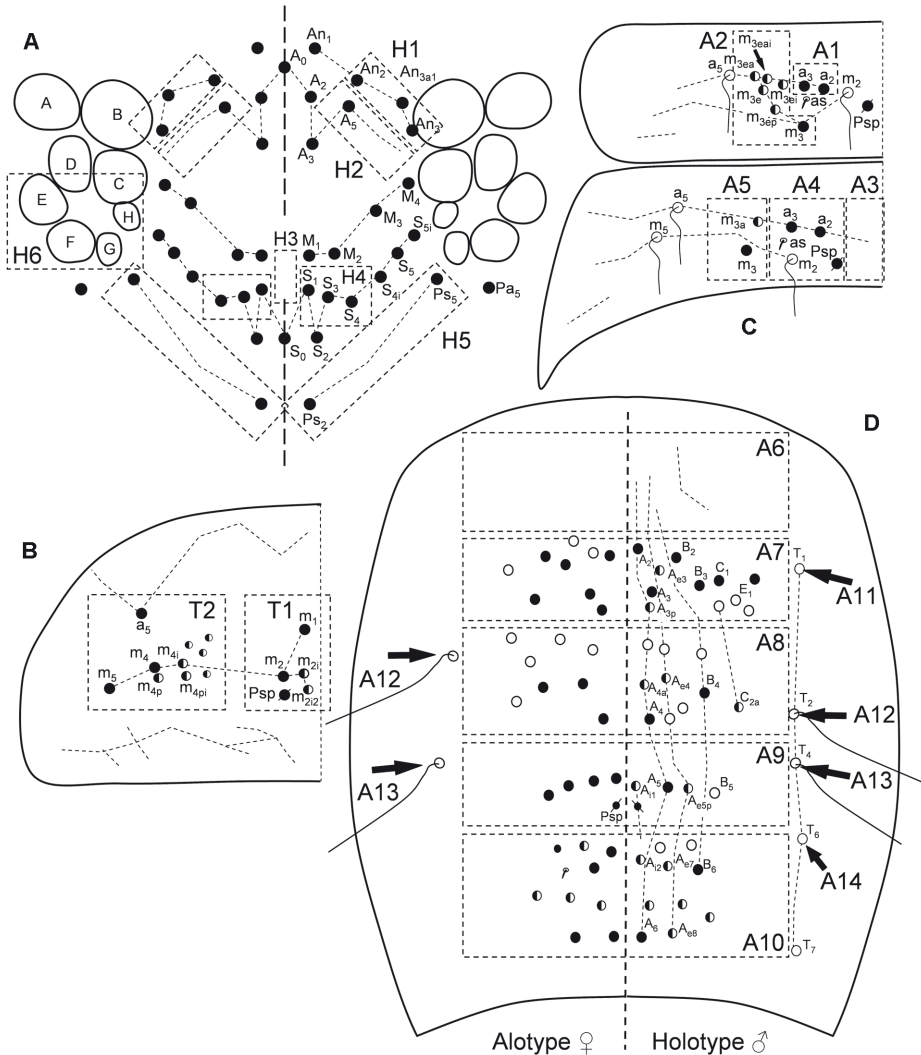


Fig. 2 *Entombrya cheni* n. sp. macrochaetotaxy. A: Head (H1–H5): areas defined by Baquero & Jordana, 2005 for the chaetotaxy simplified formulae; B: Th II (T1–T2): 4 and 6 macrochaetae in simplified formula for this tergite; C: Abd II–III (A1–A5): chaetae present on these areas for the simplified formula; D: plurichaetotic Abd IV, the arrows point to the trichobothria insertions on male (right) and female (left).

chaetotaxy (Figs 2C–D): A1 area on Abd II with two macrochaetae (a_2 and a_3) and A2 area on Abd II with five to seven macrochaetae. Abd III with two macrochaetae on areas A4 (a_2 and a_3) and A5 (m_3 and m_{3a}). Abd IV with 60 to 64 dorsal macrochaetae.

Biology: Unknown.

4. Discussion

Fifteen species of *Entomobrya* have been reported from China: *E. corticalis* Nicolet, 1842 by Uchida, 1948; *E. hortensis* Stach, 1963, *E. imitabilis* Stach, 1963, and *E. pекinensis* Stach, 1963 by Stach, 1963, *E. aino* Matsumura & Ishida, 1931, *E. marginata* Tullberg, 1871 and *E. dorsosignata* Stach, 1964 by Stach, 1964; *E. griseoolivata* (Packard, 1873) by Rusek, 1971, *E. huangi* was described by Chen and Ma in 1998, finally *E. chungseensis* Baquero and Jordana, 2008, *E. mieheorum* Baquero and Jordana, 2008, *E. fjellbergi* Baquero and Jordana, 2008, *E. karlstetterae* Baquero and Jordana, 2008 and *E. retingensis* Baquero and Jordana, 2008 from Tibet. *E. dianbaiensis* is a *Homidia* (resume of the references and distribution in Tab. 1).

The colour pattern for the new species is characteristic, but due to its faded colour it could be confused with some Chinese species without stripes or other colour patches: *E. huangi*, *E. chungseensis*, *E. mieheorum* or, even with *E. hortensis*. The closest related species according to its chaetotaxy is *E. muscorum* (variable in size and chaetotaxy). Nevertheless, the macrochaetotaxy formula (following Jordana & Baquero, 2005) can be used to differentiate these species (Tab. 3).

Tab. 3 Comparative dorsal macrochaetotaxy (paired chaetae) for species of *Entomobrya* with similar colouration.

Characters	Species					
	<i>E. huangi</i>	<i>E. chungseensis</i>	<i>E. mieheorum</i>	<i>E. hortensis</i>	<i>E. muscorum</i> ¹	<i>E. cheni</i> n. sp.
Head (H1-H5)	4-1-0-3-3	4-1(2)-0-2-2	4-2-0-2-2	4-1-0-3-1	3-1-0-3-3	3-1-0-3-2
Th II (T1-T2)	0-2	0-1	0-1	3-6	4-6	4-6
Abd II (A1-A2)	1-3	1-2	1-2(3)	2-6	2-5	2-5(6-7)
Abd III (A3-A5)	0-1-2	0-1-1	1-1-1	0-3-1	0-1-1	0-2-2
Abd IV (A6-A10)	0-0-3-2-2	0-0-3-2-2	1-1-3-2-2	8m-1-2-3-4	5-6-4-2-2	0-7(11)-7(10)-3(5)-8(10)

¹ Minimum chaetotaxy. Differences in bold type.

Etymology

This species has been dedicated to Jian-Xiu Chen of Nanjing University.

5. References

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