

Five new species of *Entomobrya* Rondani, 1861 (Collembola, Entomobryidae) from sacred forests of *Juniperus tibetica* near Lhasa (NW China)

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Abstract

The taxonomic identification of Collembola collected from two plant species, *Juniperus tibetica* and *Rosa serica*, in two sacred juniper forests near Lhasa (NW China), has allowed us to describe five new species of *Entomobrya* Rondani, 1861.

Only 10 species of the genus *Entomobrya* have previously been recorded from China, and only one species (*E. huangi* Chen & Ma, 1998) from Tibet.

Keywords: taxonomy

Zusammenfassung

Eine Determinierung von Collembola, die in zwei Heiligen Wäldern in der Nähe von Lhasa (NW China) von *Juniperus tibetica* und *Rosa serica* gesammelt wurden, hat zur Beschreibung von fünf neuen *Entomobrya*-Arten geführt.

Bisher waren lediglich 10 Arten der Gattung *Entomobrya* aus China bekannt, davon nur eine (*E. huangi* Chen & Ma, 1998) aus Tibet.

1. Introduction

During a joint expedition in 2003, a team from Tibet University, Lhasa, P.R. China and University of Marburg, Germany, carried out research related to the juniper forests of southern Tibet. During a few days in September many specimens of arthropods were shaken down from the vegetation and preserved in alcohol. The samples were later sorted into higher taxonomic groups by Dr T. Solhøy at the University of Bergen, Norway. 56 samples containing numerous specimens of Collembola were determined to genera or groups by Dr Arne Fjellberg, Norway, and distributed to different collembologists. The specimens of *Entomobrya* were received by the Department of Zoology and Ecology at the University of Navarra, resulting in the description of five new species.

Chen & Ma (1998) reported only 10 species from China: *E. corticalis* Nicolet, 1842, *E. marginata* Tullberg, 1871, *E. griseoolivata* Packard, 1873, *E. aino* Matsumura & Ishida, 1931, *E. hortensis* Stach, 1963, *E. imitabilis* Stach, 1963, *E. pекinensis* Stach, 1963, *E. dorsosignata* Stach, 1964, *E. dianbaiensis* Lin, 1985 and *E. huangi*, considering the references of Stach (1963) and Yosii (1971) and their description of a new species. The five new species increase the number of species of the genus, contributing to the knowledge of the Collembola of China.

2. Materials and methods

The research work with arthropods was supported by Georg and Sabine Mieke (University of Marburg, Germany), and the collecting was done by Maria (Maya) Karlstetter. The sampling procedure was to knock on the branches of several juniper trees (two samples of each tree to compare the intra-individual differences with inter-individual differences), and collect the insects falling off the branches. The specimens were placed into small glasses filled with high-percentage alcohol. Additionally, some insects from rose shrubs were collected to compare the fauna on different plant species.

Sampling localities (Fig. 1)

Reting – 65 km NNW of Lhasa, 30°18'N, 91°31'E, 4300 m, south-facing open forest of old *Juniperus tibetica* trees of a sacred forest around the Buddhist monastery of Reting, samples collected on 23 September 2003.

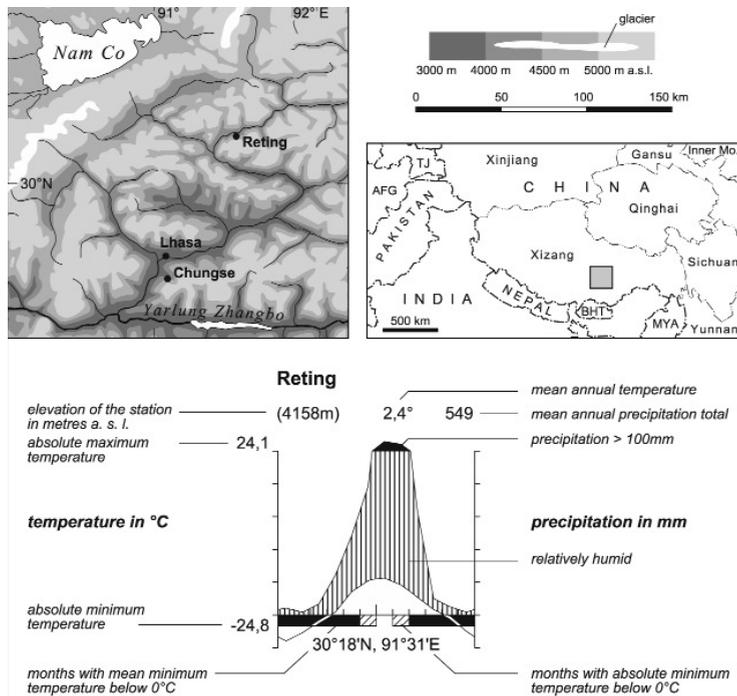


Fig. 1 Localisation of the sample stations and climatogram (after data from Meteor. Serv. China).

Chungse – 36 km SW of Lhasa, Quxu County, 29°27'N, 91°01'E, 4300 – 4480 m, south-facing shrubberies of *Rosa*, *Spiraea*, *Lonicera* and coppice re-growth of *Juniperus tibetica* around the Buddhist monastery of Chungse, samples collected 8 – 10 September 2003.

The climate of both sites is characterised by summer rain (Reting receives ca 500 mm during summer). Convective clouds prevail with thunderstorms in the afternoon. Radiation is usually strong and regularly exceeds the solar constant in summer. Fog does not occur. Snow occurs between late September and April and melts away within hours or days. Between June and April mean monthly temperatures exceed 10 °C, yet frost occurs even in July and September; only August is without frost. Winter temperatures may drop to –5 °C. In January the mean monthly temperature is –8 °C.

Samples were collected from two isolated juniper forests in southern Tibet (Xizang, A.R., China) in the framework of a multidisciplinary research scheme on the biodiversity and ecology of forest islands in Southern Tibet. Both sites probably belong to a formerly more-or-less continuous belt of Cupressaceae forest of the Yarlung Zhangbo valley and its tributaries, which has been cleared over the millennia (Miehe et al. 2006, 2008). Sacred groves, close to monasteries, were religiously protected. They have been seriously damaged and partly destroyed during the political unrest between 1959 and the late 1970s. Reting forest is one of the few sacred forests, and certainly the most famous, and has only been partly damaged, whereas the juniper trees of Chungse had been clear cut. Yet the *Juniperus* in Chungse has recovered with coppice re-growth now forming, nearly 30 years after the destruction, globular bushes of 1.5 to 3 m in height. They grow together in thickets of *Rosa*, *Spiraea*, *Lonicera* and *Potentilla fruticosa* and straggling lianas of *Clematis*.

Traditionally, works pertaining to the genus *Entomobrya* (Christiansen 1958, Stach 1963) have considered morphological characteristics that are easily visible: retractile bulb (apical vesicle) in fourth antennal segment, kind of 'type-five' chaetae (following Christiansen 1958, plate 14), relative size – length and width – of head, length of the external chaetae of labial appendage, mesonotum lengthening, chaetal morphology of male genital plate, shape of labral papillae, antennal length, and longitudinal or transversal colour stripes. In this work, the parameters used to determine the identity of the species has been the combination of the colouration, some morphological features and the dorsal macrochaetotaxy, following the set of 39 characters designed by Jordana & Baquero (2005), presented in Tab. 1.

Tab. 1 (see Jordana & Baquero 2005). Comparative set of characteristics for the new species. Legend: Character, Place, Description, Value.

Ch.1, H1, An2-An3, 1-6; Ch.2, H2, A5-A7, 1-3; Ch.3, H3, S'0, 0-1; Ch.4, H4, S1-S3-S4, 0-3; Ch.5, H5, Ps2-Ps3-Ps5, 0-3; Ch.6, Labral papilla, "simple and smooth papilla (1); wrinkled or with some projections (2); a projection chaetae like (3)", 1-3; Ch.7, eyes G&H size, = E&F (1), <E&F (2), 1-2; Ch.8, Antennal vesicle, "no bulb (0), lobule simple (1), ; bilobulate (2), trilobulate (3)", 0-3; Ch.9, Ratio Ant./Head, > or = 3 (1), > or = 2 < 3 (2), < 2 (3), 1-3; Ch.10, Thoracic tergite II mane MS, with Ms type 1 (1), without Ms or type 2 (2), 1-2; Ch.11, T1, m1-m2-m2i-m2i2; >4 (5), 0-5; Ch.12, T2, a5-m4-m4i-m5; >8 (9), 0-9; Ch.13, Smooth chaetae on tibiotarsi, not or 1 in TtIII = 0, double file = 1, 0-1; Ch.14, Claw internal teeth, 1(1), 2(2), 3(3), 4(4), 1-4; Ch.15, Claw dorsal tooth, basal =1, internal teeth level = 2, 1-2; Ch.16, Claw internal edge, without ciliation (0), with ciliation (1), 0-1; Ch.17, External empodium, smooth (0), serrate (1), 0-1; Ch.18, A1 Abd. II, a2-a3, 0-2; Ch.19, A2 Abd. II, m3 series, 0-7; Ch.20, A3 Abd. III, a1, 0-1; Ch.21, A4 Abd. III, above m2, 0-3; Ch.22, A5 Abd. III, m3-m4 series, 0-4; Ch.23, A6 Abd. IV, a1-a5 (A1-D1); >8 (9), 0-9; Ch.24, A7 unpaired chaeta, ma0 (A03), 0-1; Ch.25, A7 Abd. IV, ma1-ma4 (A2-E1); >9 (10), 0-10; Ch.26, A8 unpaired chaeta, m0 (A04), 0-1; Ch.27, A8 Abd. IV, m1-m3 (A4a-C2a); >5 (6), 0-6; Ch.28, A9 unpaired chaeta, mp0 (A05), 0-1; Ch.29, A9 Abd. IV, mp1-mp3 (A5-B5); >6 (7), 0-7; Ch.30, A10 Abd. IV, p1a-p3 (A6-B6); >5 (6), 0-6; Ch.31, A11 Abd. IV, T1(ma4e) as trichobothrium, 0-1; Ch.32, A12 Abd. IV, T2(m4) as trichobothrium, 0-1; Ch.33, A13 Abd. IV, T4(mp4) as trichobothrium, 0-1; Ch.34, A14 Abd. IV, T6 (p4) as trichobothrium, 0-1; Ch.35, Ratio Abd.IV/Abd.III, 2 < R < 4 (1), R > 4 (2), 1-2; Ch.36, Manubrial plate, chaetae number; >10 (11), 0-11; Ch.37, Manubrial plate, pseudopores 1-2, 1-2; Ch.38, Mucro, sub-apical tooth without(0), normal (1), big (2), 0-2; Ch.39, Mucro, basal spine, 0-1.

Species	Ch.1	Ch.2	Ch.3	Ch.4	Ch.5	Ch.6	Ch.7	Ch.8	Ch.9	Ch.10
<i>Entomobrya chungseensis</i> n. sp.	4	1	0	2	2	1	2	1	2	1
<i>Entomobrya mieheorum</i> n. sp.	4	2	0	2	2	2	2	1	2	1
<i>Entomobrya fjellbergi</i> n. sp.	5	1	0	2	1	2	2	2	2	1
<i>Entomobrya karlstetterae</i> n. sp.	5	1	1	2	3	2	1	2	2	1
<i>Entomobrya retingensis</i> n. sp.	4	2	0	2	2	2	2	2	2	1
Species	Ch.11	Ch.12	Ch.13	Ch.14	Ch.15	Ch.16	Ch.17	Ch.18	Ch.19	Ch.20
<i>Entomobrya chungseensis</i> n. sp.	0	1	0	4	2	0	1	1	2	0
<i>Entomobrya mieheorum</i> n. sp.	0	1	0	4	1	0	0	1	3	1
<i>Entomobrya fjellbergi</i> n. sp.	0	1	0	4	2	0	0	2	3	0
<i>Entomobrya karlstetterae</i> n. sp.	0	2	0	4	1	0	0	2	4	0
<i>Entomobrya retingensis</i> n. sp.	0	2	0	4	1	0	1	2	6	0
Species	Ch.21	Ch.22	Ch.23	Ch.24	Ch.25	Ch.26	Ch.27	Ch.28	Ch.29	Ch.30
<i>Entomobrya chungseensis</i> n. sp.	1	1	0	0	0	0	3	0	2	2
<i>Entomobrya mieheorum</i> n. sp.	1	2	1	0	1	0	3	0	2	2
<i>Entomobrya fjellbergi</i> n. sp.	2	2	1	0	2	0	3	0	2	2
<i>Entomobrya karlstetterae</i> n. sp.	2	1	0	0	4	0	3	0	2	2
<i>Entomobrya retingensis</i> n. sp.	2	1	3	0	5	0	0	0	2	2
Species	Ch.31	Ch.32	Ch.33	Ch.34	Ch.35	Ch.36	Ch.37	Ch.38	Ch.39	
<i>Entomobrya chungseensis</i> n. sp.	0	1	1	0	2	4	2	1	1	
<i>Entomobrya mieheorum</i> n. sp.	0	1	1	0	2	3	2	1	1	
<i>Entomobrya fjellbergi</i> n. sp.	0	1	1	0	2	3 - 4	2	1	1	
<i>Entomobrya karlstetterae</i> n. sp.	0	1	1	0	2	8	2	1	1	
<i>Entomobrya retingensis</i> n. sp.	0	1	1	0	2	6	2	1	1	

3. Results

The total number of Collembola captured from the *Juniperus* trees and *Rosa* bushes was 2077 in 69 samples. The initial sorting was carried out by Arne Fjellberg, who found specimens of *Hypogastrura* sp. (1 specimen), two species of *Xenylla* (3 and 2 specimens respectively), *Uzelia* sp. (3 specimens), a possible new genus of Anurophorinae (1 specimen), *Isotoma* (s.str.) sp. (1 specimen), the five species of *Entomobrya*, including a species that seemed to be *Entomobrya marginata* (2064 specimens), and a species of *Sminthurides* (2 specimens). It is evident that the genus *Entomobrya* is the more frequent one within the vegetation, with the presence of other genera being merely accidental. The average number of specimens for each sample (for each group of knocks on the branches) was: 27 on *Juniperus* from Chungse, 37 on *Rosa* from Chungse, and 50 on *Juniperus* from Reting.

Some specimens of *Entomobrya* were sent to the Department of Zoology and Ecology, University of Navarra, while the other genera were sent to different institutions.

4. Descriptions of the new species

Entomobrya chungseensis n. sp. (Figs 2A – E, 3A – E)

Type locality: China (Tibet, Chungse). Sample obtained from *Juniperus* and *Rosa*. Leg. M. Karlstetter.

Type specimens: Holotype (female), slide labelled ‘Tibet 13-01’; 1 paratype (male) in a slide labelled ‘Tibet 13-02’ (clearing with Nesbit).

Material deposited: provisionally in MZNA (Museum of Zoology, University of Navarra).

Description: Body length up to 1.25 mm without antennae. Ground colour pale, with darker bands on lateral thoracic tergites II and III, posterior tergites II and III, abdominal tergites I-IV, and two rounded patches on lateral abdominal tergite V (Fig. 3A). Eight eyes, GH<EF, very small (Fig. 2A). Antennae long, between 2 and 3 times the length of the head, with simple apical vesicle. Dimensions of the different parts of the body of the holotype are given in Table 2. Head trichobothrium present. Labral chaetae formula 5, 5, 4, as in other *Entomobrya* species. Labral papillae smooth, with very minute projections. Labial chaetae formula: MRELL (R is half as long as M, but is ciliated). Thoracic tergite II with mane of macrochaetae. Metatrochanteral organ with 15 chaetae. Tibiotarsus sub-segmented (Fig. 3D), without differentiated chaetae (with exception of the presence of the smooth terminal chaetae on legs III characteristic for the genus). Claw with four internal teeth: first pair at 66 % from the claw base, and two impair teeth (the last very minute); dorsal tooth at paired internal level (Fig. 3E). Empodium spike-like, with serrated inner edge at the leg I and II (all legs III are broken). Manubrial plate with 4 chaetae and two pseudopores (Fig. 3C). Mucro as in figure 3b, with both teeth similar in size, and mucronal spine. Set of 39 characters in Tab. 1 (following Jordana & Baquero 2005). Figs 2A – E show the diagnostic macrochaetotaxy following Jordana & Baquero (2005). Macrochaetotaxy in Figs 2A – E, with simplified formula: 4-1(2)-0-2-2/0-1/1-2/0-1-1/0-0-3-2-2 (H1-H2-H3-H4-H5/T1-T2/A1-A2/A3-A4-A5/A6-A7-A8-A9-A10) (also see Tab. 3). The numbers in brackets are alternatives, frequently by presence of additional mesochaetae.

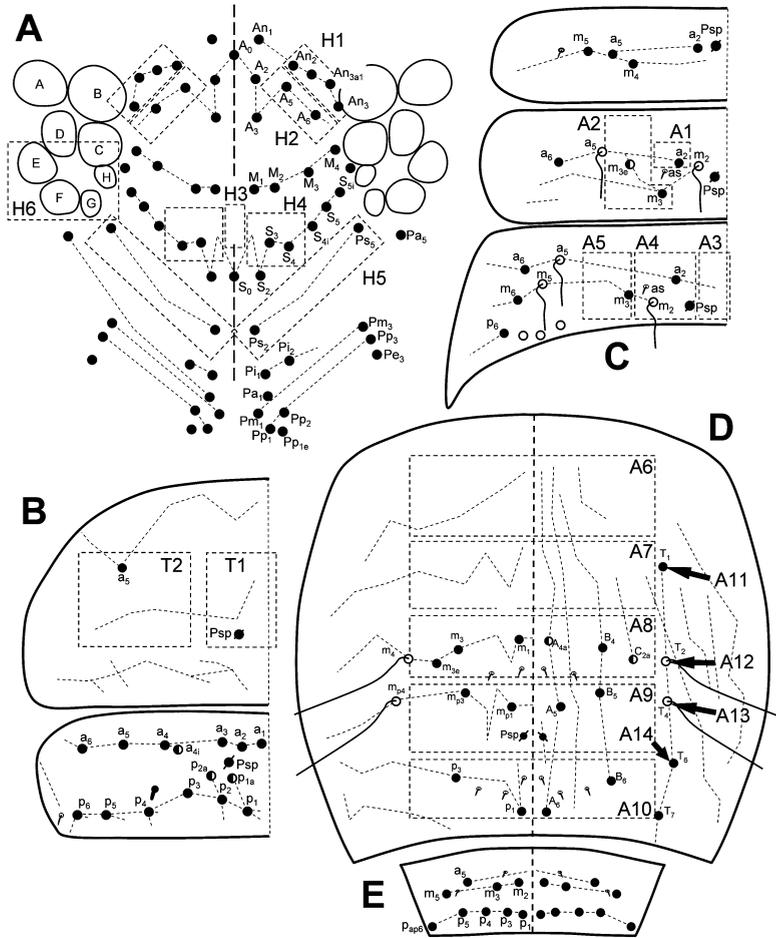


Fig. 2 *Entomobrya chungseensis* n. sp. Chaetotaxy: A: head; B: thoracic tergites II – III; C: abdominal tergites I – III; D: abdominal tergite IV (the arrows point to the trichobothrium insertions); E: abdominal tergite V.

Tab. 2 Measurements of some specimens from the type series, in micrometres

	<i>Entomobrya chungseensis</i> n. sp.	<i>Entomobrya mieheorum</i> n. sp.	<i>Entomobrya fjellbergi</i> n. sp.		<i>Entomobrya karlstetterae</i> n. sp.	<i>Entomobrya retिंगensis</i> n. sp.
	Tibet 13-01	Tibet 56-02	Tibet 41-01	Tibet 41	Tibet 47-01	Tibet 54-01
Antennal segment I	90	140	170	190	160	260
Antennal segment II	150	270	380	380	360	410
Antennal segment III	150	270	360	370	340	450
Antennal segment V	220	300	380	390	370	410
Antenna (total)	610	980	1290	1330	1230	1530
Head	310	400	470	510	520	620
Antenna/head ratio	2	2.5	2.7	2.5	2.9	2.5
Thorax II	180	270	290	300	310	400
Thorax III	90	180	230	220	200	250
Abdominal segment I	80	130	130	140	140	190
Abdominal segment II	110	220	190	190	150	290
Abdominal segment III	70	130	130	130	100	140
Abdominal segment IV	370	550	600	670	700	780
Abdominal segment IV/III	5.3	4.2	4.6	5.2	7.0	5.6
Abdominal segment V	70	130	130	130	100	180
Abdominal segment VI	50	70	50	60	70	80
Body	1250	2080	2103	2350	2290	2930
Manubrium	260	370	450	490	590	700
Dens	340	430	550	560	590	700
Claw	40	50	60	60	65	70
Empodium	22	35	40	-	35	40
Tenent hair	38	60	70	-	50	65

Discussion: The presence of more than 3 chaetae on area H1 (head) is a frequent character in the species of the Asian area. The colouration of the new species is similar to *E. marginata* (Tullberg, 1871) and possibly has been confused with *E. regularis* Stach, 1963 and with *E. atrocincta* Schött, 1896 (female) (Ramel et al. 2008). The macrochaetotaxy of these species is very different (Tab. 3). This new species is different from *E. huangi* in the colouration (without body colour) and *E. hortensis* (with a very distinctive colouration). In addition, these three species differ in several dorsal macrochaetotactic characters (Tab. 3).

Derivatio nominis: This species has been named after the Buddhist monastery of Chungse.

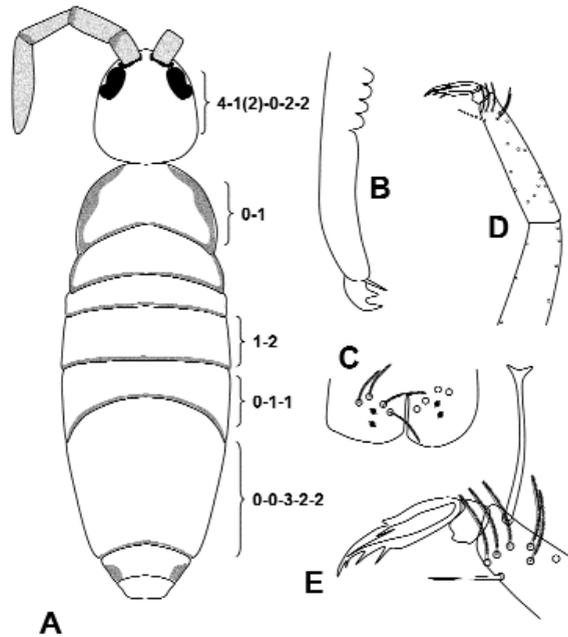


Fig. 3 *Entomobrya chungseensis* n. sp. A colour pattern; B tip of dentes and micro; C manubrial plate; D tip of tibiotarsus of leg I, showing the subsegmentation; E claw of leg III.

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

Characters	Species						
	<i>E. mieheorum</i> <i>m</i> <i>n. sp.</i>	<i>E. hortensis</i>	<i>E. huangi</i>	<i>E. chungseensis</i> <i>n. sp.</i>	<i>E. regularis</i>	<i>E. marginata</i>	<i>E. atrocincta</i> (female)
Head (H1, H2, H4, H5)	4222	413?	412?	4122	4132	3223	3122
Thoracic tergite II (T1-T2)	1	3?6	2	1	24	24	23
Abdominal tergite II (A1-A2)	13	26	13	12	23	12	12
Abdominal tergite III (A3-A5)	112	31	12	11	21	101	111
Abdominal tergite IV (A6-A10)	11322	8m1234	222	322	23323	222	2322

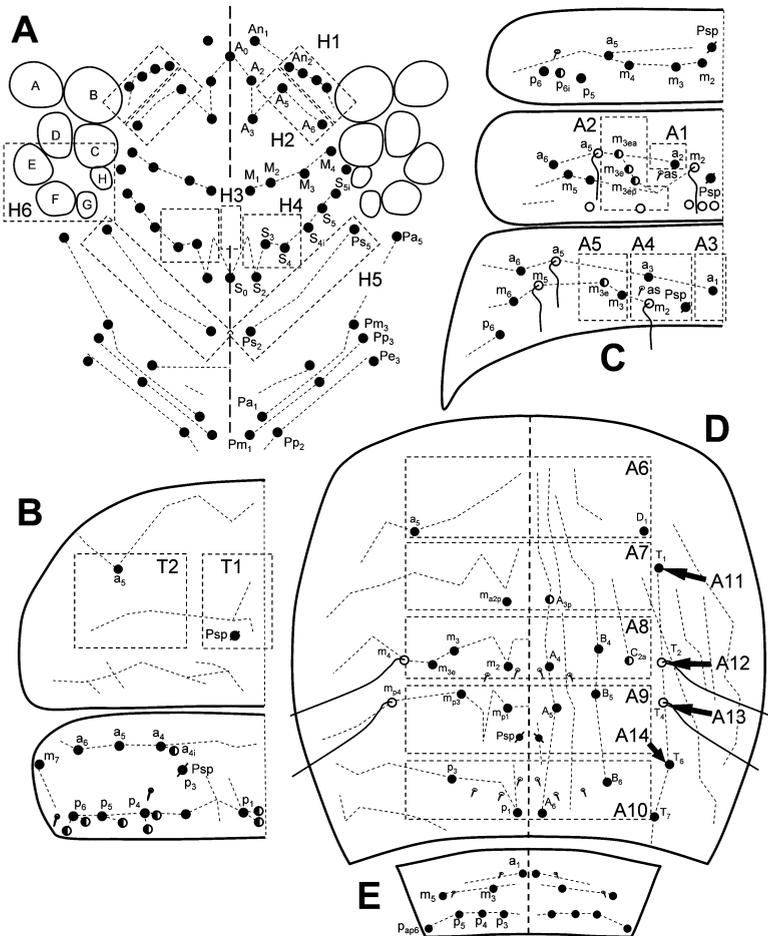
***Entomobrya mieheorum* n. sp.** (Figs 4A – E, 5A – E)**Type locality:** China (Tibet, Reting), sample obtained from *Juniperus*. Leg. M. Karlstetter.**Type specimens:** Holotype (male, sub-adult) in a slide labelled ‘Tibet 56-01’; 1 paratype (male, sub-adult) in a slide labelled ‘Tibet 56-02’ (clearing with Nesbit); 19 paratypes in ethyl alcohol.**Material deposited:** provisionally in MZNA (Museum of Zoology, University of Navarra).

Fig. 4 *Entomobrya mieheorum* n. sp. Chaetotaxy: A: head; B: thoracic tergite II – III; C: abdominal tergites I – III; D: abdominal tergite IV (the arrows point to the trichobothrium insertions); E: abdominal tergite V.

Description: Body length up to 2.08 mm without antennae. Ground colour pale, with bands slightly darker on distal antennal segments I – III, thoracic tergites II – III, and abdominal tergites I – III and VI, four patches on anterior part of abdominal tergite V, and an oblique line on lateral abdominal tergite III (Fig. 5A). Eight eyes, $GH < EF$ (Fig. 4A). Antennae long, between 2 and 3 times the length of the head, with simple apical vesicle. Dimensions of the different parts of the body of three specimens are given in Tab. 2. Head trichobothrium present. Labral chaetae formula 5, 5, 4, as in other *Entomobrya* species. Labral papillae with some projections (Fig. 5C). Thoracic tergite II with mane of macrochaetae. Mesotrochanteral organ with 11 chaetae. There are no differentiated chaetae on tibiotarsus, with exception of the presence of the smooth terminal chaetae on legs III characteristic for the genus. Claw with four internal teeth: first pair at 55 % from the claw base, and two impair teeth; dorsal tooth not basal, before the 50 % of claw. Empodium spike-like, with smooth inner edge (Fig. 5E). Manubrial plate with 3 chaetae and two pseudopores (Fig. 5D). Mucro as in figure 5b. Macrochaetotaxy in figures 4a – e, with simplified formula: 4-2-0-2-2/0-1/1-2(3)/1-1-2/1-1-3-2-2. The position of the pseudopores at thoracic tergites III is more lateral than in other species (see Fig. 4B).

Discussion: The colouration of this species is very similar to that of *E. chungseensis* n. sp., but the species is different in the macrochaetotaxy described in Tab. 3.

Derivatio nominis: This species has been dedicated to Georg and Sabine Miehe.

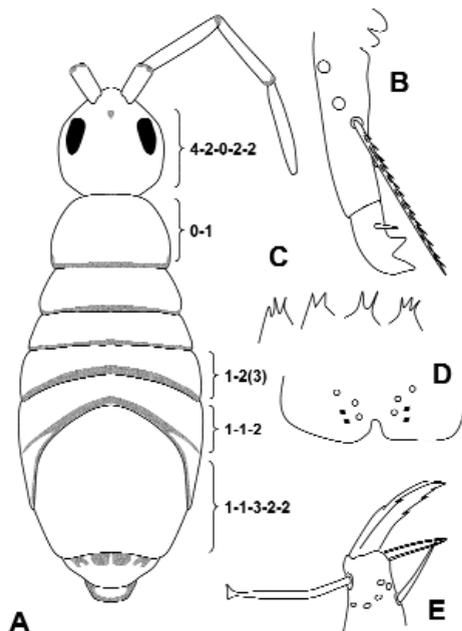


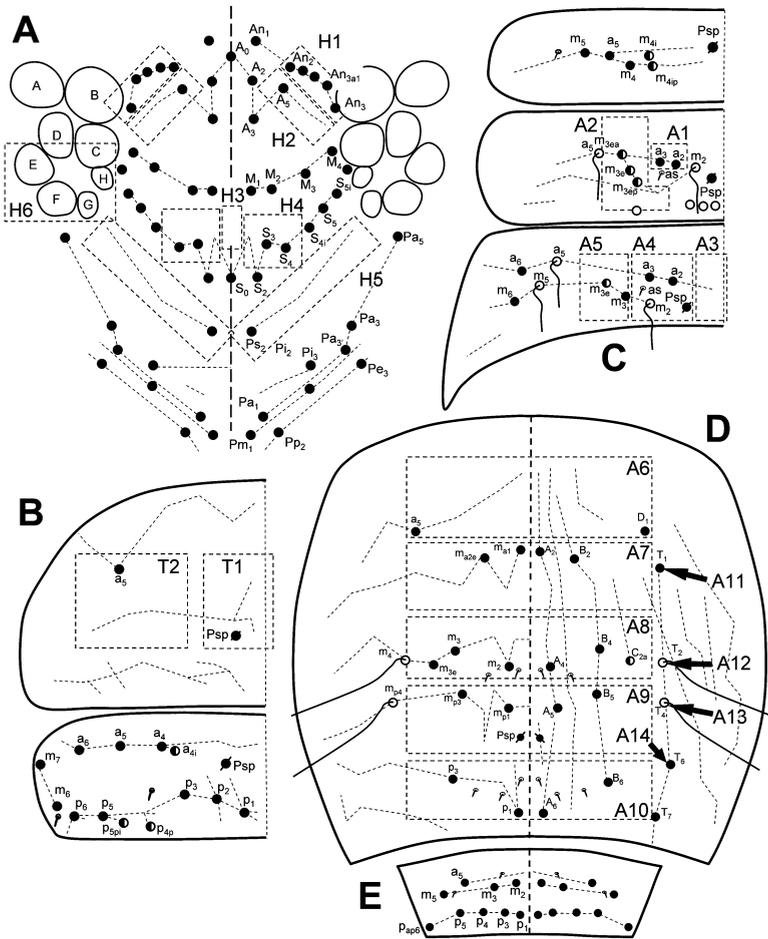
Fig. 5 *Entomobrya mieheorum* n. sp. A: colour pattern; B: tip of dentes and mucro; C: labral papillae; D: manubrial plate; E: claw of leg III.

Entomobrya fjellbergi n. sp. (Figs 6A – E, 7A – D)

Type locality: China (Tibet, Chungse). Sample obtained from *Juniperus*. Leg. M. Karlstetter.

Type specimens: Holotype (female) in a slide labelled ‘Tibet 41-01’; 1 paratype (female) in a slide labelled ‘Tibet 41-02’ (clearing with Nesbit); 42 paratypes in ethyl alcohol.

Material deposited: provisionally in MZNA (Museum of Zoology, University of Navarra).



Description: Body length up to 2.35 mm without antennae. Colouration as in Fig. 7A. Eight eyes, GH<EF (Fig. 6A). Antennae long, between 2 and 3 times the length of the head, with a big bilobulate apical vesicle. Dimensions of the different parts of the body of three specimens are given in Tab. 2. Head trichobothrium present. Labral chaetae formula 5, 5, 4, as in other *Entomobrya* species. Labral papillae with 2 – 4 minute projections (Fig. 7C). Thoracic tergite II with mane of macrochaetae. Tibiotarsus sub-segmented, without differentiated chaetae, with exception of the presence of the smooth terminal chaetae on legs III characteristic for the genus. Claw with four internal teeth: first pair at 55 % from the claw base and two impair teeth; dorsal tooth slightly anterior to paired teeth. Empodium spike-like, with smooth inner edge at leg III (Fig. 7D), but serrated at legs I and II. Manubrial plate with 3 – 4 chaetae and two pseudopores (Fig. 7B). Mucro with both teeth similar in size, with mucronal spine. Figs 6A – E show the diagnostic macrochaetotaxy, with simplified formula: 5-1-0-2-1/0-1/2-3/0-2-2/1-2-3-2-2.

Discussion: This new species has a characteristic colouration, similar in part to two other species from Tibet described below. Nevertheless, it is different in several morphological and chaetotactic characters (see Tab. 1).

Derivatio nominis: This species has been dedicated to Arne Fjellberg, Norwegian collembologist, who sent us the specimens.

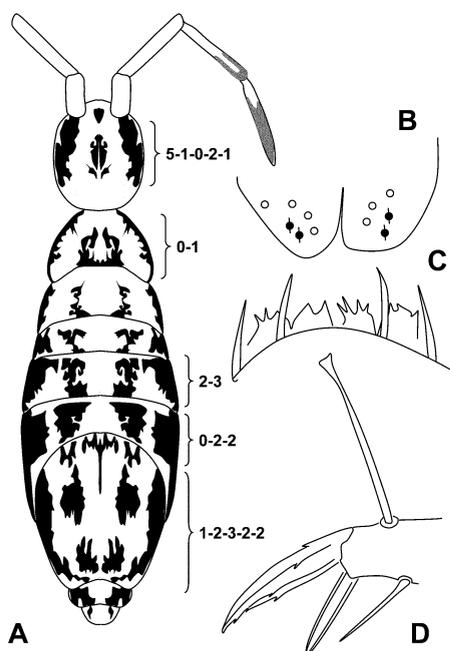


Fig. 7 *Entomobrya fjellbergi* n. sp. A: colour pattern; B: manubrial plate; C: labral papillae; D: claw of leg III.

Description: Body length up to 2.29 mm without antennae. Colouration as in Fig. 9. Eight eyes, GH similar in size to EF (Fig. 8A). Antennae long, between 2 and 3 times the length of the head, with bilobulate apical vesicle. Dimensions of the different parts of the body of three specimens are given in Tab. 2. Head trichobothrium present. Labral chaetae formula 5, 5, 4, as in other *Entomobrya* species. Labral papillae with some projections. Thoracic tergite II with mane of macrochaetae. Mesotrochanteral organ with 15 chaetae. There are no differentiated chaetae on tibiotarsus, with exception of the presence of the smooth terminal chaetae on legs III characteristic for the genus. Claw with four internal teeth: a pair and two impair teeth; dorsal tooth basal. Empodium spike-like, with smooth inner edge and minute serration on external edge at leg I (the legs III are broken). Manubrial plate with 7 – 8 chaetae and two pseudopores. Mucro with both teeth similar in size, with mucronal spine. Macrochaetotaxy in Figs 8A – E, with simplified formula: 5-1-1-2-3/0-2/2-4/0-2-1/0-4-3-2-2.

Discussion: This new species has a characteristic colouration, and is different in several morphological and chaetotactic characters of the Asiatic *Entomobrya* (see Tab. 1).

Derivatio nominis: This species has been dedicated to Maria Karlstetter, who collected the specimens.

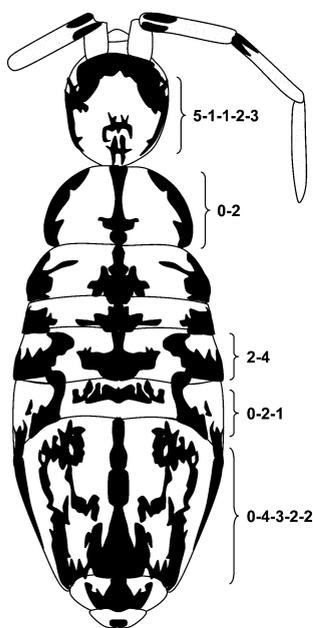


Fig. 9 *Entomobrya karlstetterae* n. sp. Colour pattern.

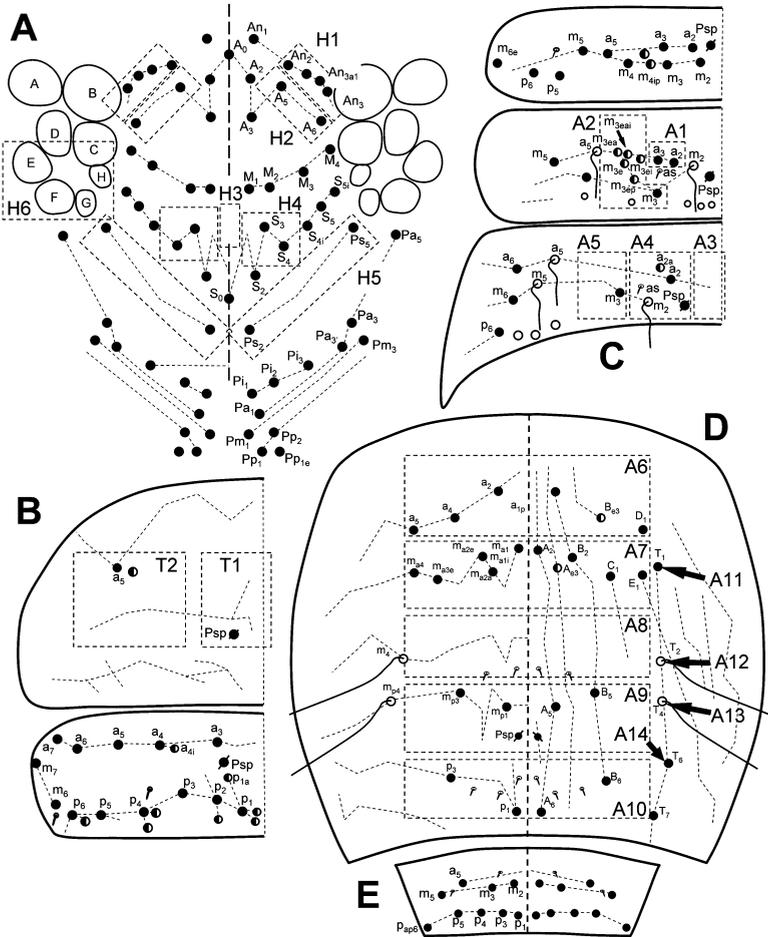
***Entomobrya retingensis* n. sp.** (Figs 10A – E, 11A – E)**Type locality:** China (Tibet, Reting). Sample obtained from *Juniperus*. Leg. M. Karlstetter.**Type specimens:** Holotype (female) in a slide labelled ‘Tibet 54-01’; 1 paratype (female) in a slide labelled ‘Tibet 54-02’; 22 paratypes in ethyl alcohol.**Material deposited:** provisionally in MZNA (Museum of Zoology, University of Navarra).

Fig. 10 *Entomobrya retingensis* n. sp. Chaetotaxy: A: head; B: thoracic tergite II – III; C: abdominal tergites I – III; D: abdominal tergite IV (the arrows point to the trichobothrium insertions); E: abdominal tergite V.

Description: Body length up to 2.93 mm without antennae. Colouration as in figure 11a. Eight eyes, GH<EF (Fig. 10A). Antennae long, between 2 and 3 times the length of the head, with bilobulate apical vesicle (Fig. 11D). Dimensions of the different parts of the body of three specimens are given in Tab. 2. Head trichobothrium present. Labral chaetae formula 5, 5, 4, as in other *Entomobrya* species. Labral papillae with some projections. Thoracic tergite II with mane of macrochaetae. Mesotrochanteral organ with 18 – 22 chaetae. There are no differentiated chaetae on tibiotarsus, with exception of the presence of the smooth terminal chaetae on legs III characteristic for the genus. Claw with four internal teeth: first pair at 66 % from the claw base, and two impair teeth; dorsal tooth basal. Empodium spike-like, with serrated inner edge (Fig. 11E). Manubrial plate with 10 chaetae and two pseudopores (Fig. 11C). Mucro as in Fig. 11B. Macrochaetotaxy in Figs 10A – E, with simplified formula: 4-2-0-2-2/0-2/2-6/0-2-1/3-5-0-2-2.

Discussion: This new species has a characteristic colouration, and is different in several morphological and chaetotactic characters of the Asiatic *Entomobrya* (see Tab. 1).

Derivatio nominis: This species has been named after the Buddhist monastery of Reting.

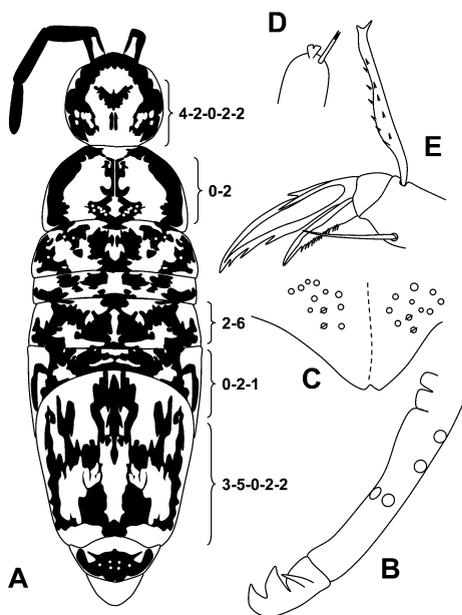


Fig. 11 *Entomobrya retingensis* n. sp. A: colour pattern; B: tip of dentes and mucro; C: manubrial plate; D: tip of antennae; E: claw of leg III.

5. General discussion

The Tibetan species described in this paper share with each other the presence of a sub-segmented tibiotarsus, also present in other species of *Entomobrya* s.l. for the Asiatic area, for example *E. makaluae* (Yosii, 1971). In addition, they have two more macrochaetae in the ocular line (Character H1). This character is shown by other species of *Entomobrya* described from China (personal observations from species of the Yosii Collection).

It must be noted that all the species identified from the samples taken on *Juniperus* and *Rosa* belong to the genus *Entomobrya*. Species belonging to this genus feed normally on fungi growing on plants (Jordana & Baquero 1999). Not surprisingly, they are frequently captured in Malaise traps as well, due to their tendency to climb up the vegetation (epiphytic species). The specimens captured in this project must have been feeding on fungi or lichens growing on the old trees that can be found in the surroundings of the monasteries.

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7. References

- Chen, J. & Y. Ma (1998): A new *Entomobrya* species (Collembola: Entomobryidae) from China. – *Entomotaxonomia* **20**(4): 235 – 238
- Christiansen, K. (1958): The Nearctic members of the genus *Entomobrya* (Collembola). – *Bulletin of the Museum of Comparative Zoology* **118**(7): 1 – 545, 24 pl.
- Jordana, R. & E. Baquero (1999): Redescription of *Entomobrya schoetti* (Collembola, Entomobryidae, Entomobryinae), third record to the world fauna. – *Boletín de Sanidad Vegetal Plagas* **25**(1): 99 – 105
- Jordana, R. & E. Baquero (2005): A proposal of characters for taxonomic identification of *Entomobrya* species (Collembola, Entomobryomorpha), with description of a new species. – *Abhandlungen und Berichte des Naturkundemuseums Görlitz* **76**(2): 117 – 134
- Mieke, G., S. Mieke, F. Schlütz, K. Kaiser & L. Duo (2006): Paleocological and experimental evidence of former forests and woodlands in the treeless desert pastures of Southern Tibet (Lhasa, A.R. Xizang, China). – *Palaeogeography, Palaeoclimatology, Palaeoecology* **242**: 54 – 67

- Miehe, G., S. Miehe, M. Will, L. Opgenoorth, L. Duo, T. Dorgeh & J. Liu (2008): An inventory of forest relics in the pastures of Southern Tibet (Xizang A.R., China). – *Plant Ecology* **194**: 157 – 177
- Ramel, G., E. Baquero & R. Jordana (2008): Biodiversity of the Collembola Fauna of Wetland Kerkini (N. Greece), with description of the sexual dimorphism of *E. atrocincta*. – *Annales de la Société Entomologique de France* (n.s.) **44**(1): 113 – 128
- Stach, J. (1963): The Apterygotan fauna of Poland in relation to the world-fauna of this group of insects. Tribe: Entomobryini. – *Polska Akademia Nauk, Kraków*: 126 pp., 43 pl.
- Yosii, R. (1971): Collembola of Khumbu Himal. – *Khumbu Himal, Ergebnisse des Forschungs-Unternehmens Nepal, Himalaya* **4**(1): 80 – 130

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