

Redescription of Baijal's *Entomobrya* species from Indian Himalayan Region (Collembola, Entomobryidae)

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Abstract

During preparation of 'Capbryinae & Entomobryini' (Jordana 2012) for the series Synopses on Palaearctic Collembola (Volume 7, Part 1), many specimens were studied from museums within and outside the study area. Even so some important collections could either not be found or borrowed at the time. One was the Baijal's collection, which was rediscovered in the Zoological Survey of India. In the present paper we present the results of our examination of paratypes of the four species of *Entomobrya* described by this author from the Indian Himalayan region. The original descriptions of these species were limited but adequate for that time, and the age of the specimens did not allow observation of all the details necessary for a complete description as currently required, including macrochaetotaxy. Here descriptions of these species are given in more detail, especially regarding the distribution of the macrochaetotaxy, currently considered necessary for the identification of species. The species studied are: *Entomobrya kultinalensis* Baijal, 1958, *Entomobrya longisticta* Baijal, 1958, *Entomobrya nigrita* Baijal, 1958 and *Entomobrya rohtangensis* Baijal, 1958.

Keywords original type material | chaetotaxy | paratypes

1. Introduction

During the revision of the genus *Entomobrya*, in the publication of the Entomobryini volume of 'Synopses on Palaearctic Collembola' (Jordana 2012), we studied many specimens of the genus *Entomobrya* both fresh material and slides from private collections and from other colleagues. We attempted to include as many specimens, both described and undescribed from the major museums in the Palaearctic area and other areas of the world. Later the type material used by Baijal (deposited at ZSI) of four species found in 1956 in the Himalayas was made available. The specimens had been preserved in ethyl alcohol, and permission was given to make slide preparations. The state of fixation, and the absence of some parts of the specimens, did not allow full descriptions. Nevertheless additions can be made to Baijal's (1958) original descriptions.

The combined use of colour and macrochaetotaxy characters allows the identification of the species and provides a useful description for future identification of the species. The set of characters proposed by Jordana & Baquero (2005), based on a constant and generally visible set of morphological characters (Christiansen 1958, Christiansen & Bellinger 1980), including the dorsal macrochaetotaxy, has proven very useful for the identification of species within the genus *Entomobrya* (Baquero et al. 2010, Jordana & Baquero 2010a, Jordana & Baquero 2010b).

Abbreviations: **Abd** – abdominal segment, **Ant** – antennal segment, **mes** – mesochaeta, **Mac** – macrochaeta, **psp** – pseudopore, **Omma** – ommatidium/ia, **Th** – thoracic segment, **ZSI** – Zoological Survey of India, (Kolkata) (following Jordana 2012).

2. Materials and methods

The specimens were received from ZSI in small vials with air bubbles removed in order to avoid damage to the specimens. One specimen of each species was cleared with Nesbitt's solution then mounted in Hoyer medium. An Olympus BX51-TF microscope with a multi-viewing

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

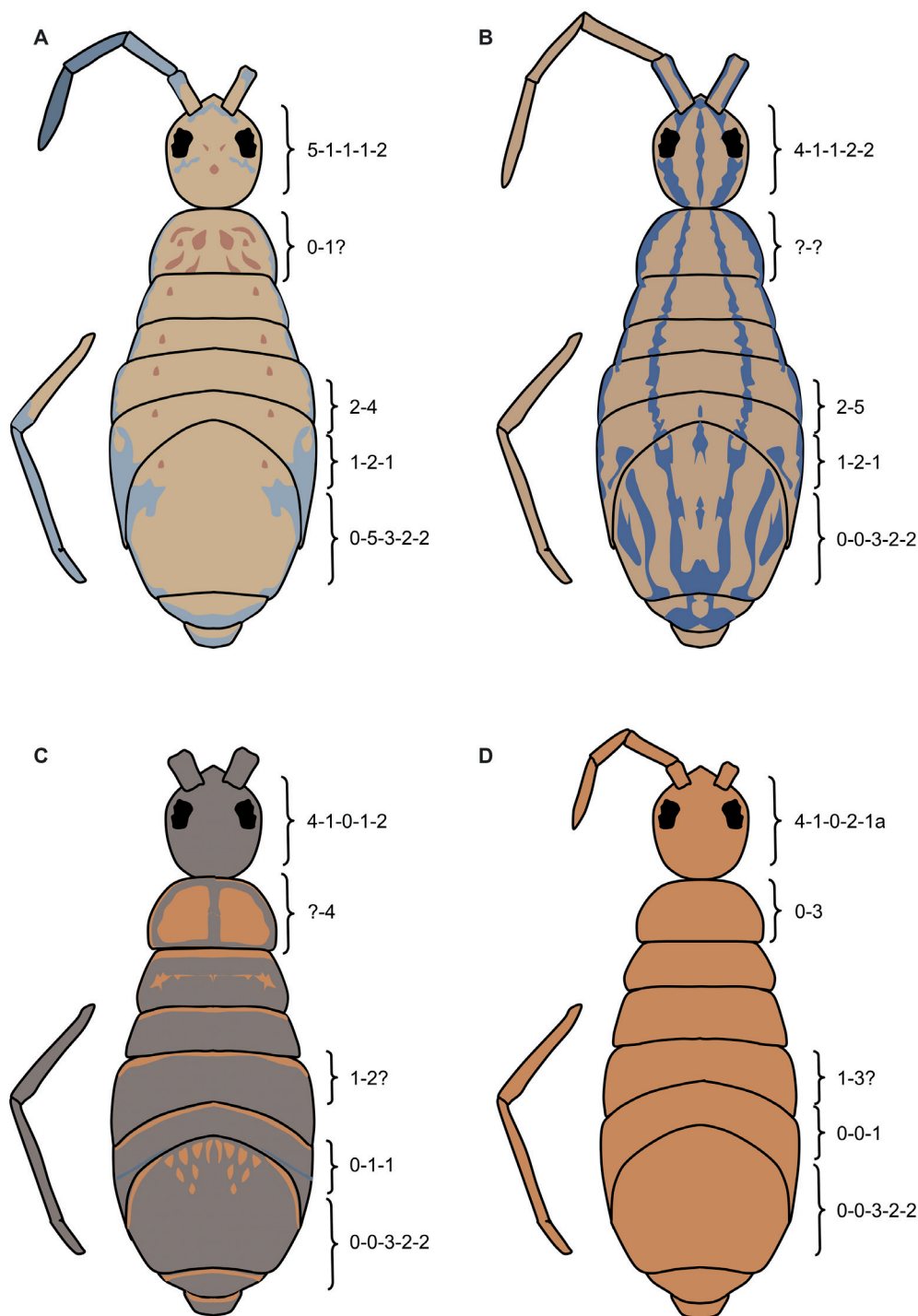


Figure 1. Colour pattern of the species redescribed: *E. kulturalensis* (A), *E. longisticta* (B), *E. nigrita* (C), *E. rohtangensis* (D).

3. Redescriptions

Entomobrya kultinalensis Baijal, 1958

(Figs 1A, 2A–D)

Type locality: India, Kulti Nal, south slope of Himalaya.

Type material observed: Paratype on slide (mounted from ethyl alcohol), labelled as '*Entomobrya kultinalensis* Baijal, 1958. Loc. Kultinal, South slope of Himalaya. Alt. 3540 mt. Date: 6.vi.1956. 1 ex.', Kulti Nal after Baijal (1958) original description. Deposited at ZSI.

Description. Body length up to 2.0 mm excluding antennae (Table 1). Body colour brownish or yellowish, with a characteristic brown and blue pattern, as in Fig. 1A.

Head: Eight Omma, GH smaller than EF, $\frac{1}{3}$ smaller than AB. Antennal length 1010 μ m, 2.1 times the length of the head, Ant IV with bilobed apical vesicle. Relative length of Ant I/II/III/IV = 1/2.0/2.23/2.51 (n = 1, Paratype). Labral papillae wrinkled, with small projections.

Body: Length ratio of Abd IV/III = 4.5 (Tab. 1). The legs are partially broken in the studied paratype. Tibiotarsus sub-segmented, without differentiated chaetae, with exception of the presence of the smooth terminal chaetae on legs III, characteristic for the genus. Claws not visible. Length of manubrium and dentes unknown (missing).

Chaetotaxy: Simplified mac formula: 5-1-1-1-2/0-1/2-4/1-2-1/0-5-3-2-2 (Fig. 1A, Tab. 2).

Head chaetotaxy as in Fig. 2A. Thorax chaetotaxy: T1 without mac; T2 area on Th II with 1 mac (a_5) (Fig. 2B). Abdomen chaetotaxy (Figs 2C–D): A1 area on Abd II with 2 mac (a_2 , a_3) and A2 area on Abd II with 4 mac (m_3 , m_{3ep} , m_{3ea} and m_{3ei}); Abd III with 2 mac on area A4 and 1 on areas A3 and A5; Abd IV macrochaetotaxy as in Fig. 2D.

Biology: Unknown.

Discussion. This species has a brownish-yellowish ground colour with a pigmentation pattern not found in other species of *Entomobrya*. In addition, the macrochaetotaxy pattern does not match any of the hitherto known *Entomobrya* species. Using as a basis the set of characters of Jordana & Baquero (2005), and selecting the characters easily visible and often known to all described species of *Entomobrya* (in this case: Omma size, Ant/head ratio, Abd IV/Abd III ratio, and some areas of the dorsal macrochaetotaxy), this species is clearly differentiated. Five species have no mac on T1 area (Th II) and only 1 mac (a_5) on T2 area: *E. chungseensis* Baquero & Jordana, 2008, *E. fjellbergi* Baquero & Jordana, 2008, *E. mieheorum* Baquero & Jordana, 2008 from Tibet and *E. subarctica* Stach, 1962, but among these only *E. kultinalensis* has the macrochaetotaxy formula 2-4/1-2-1 on Abd II and III. Five species share with *E. kultinalensis* the macrochaetotaxy formula on Abd II and III: *E. arvensis* Latzel, 1918, *E. mesopotamica* Rusek, 1981,

Table 1. Measurements of the studied specimens, in micrometers. ‘-’: n

	<i>E. kultinalensis</i>	<i>E. longisticta</i>	<i>E. nigrita</i>	<i>E. rohtangensis</i>
Ant I	130	180	-	40
Ant II	260	250	-	110
Ant III	290	290	-	100
Ant IV	330	360	-	190
Antenna	1010	1080	-	440
Head	480	380	340	260
Ant/head ratio	2,1	2,8	-	1,57
Th II	260	220	200	130
Th III	110	150	170	110
Abd I	80	100	120	110
Abd II	140	140	140	100
Abd III	130	100	100	110
Abd IV	590	580	370	300
Abd IV/III ratio	4,53	5,8	3,7	2,72
Abd V	10	120	80	70
Abd VI	80	70	60	40
Body	1880	1860	1580	1230
Manubrium	-	400	240	250
Dens	-	480	340	230
Claw	-	42	-	-
Empodium	-	24	-	-
Tenent hair	-	50	-	-

E. palmensis Jordana & Baquero, 2010, *E. rohtangensis* Baijal, 1958, sensu Yosii 1990 and *E. tuvinica*, Jordana, Potapov & Baquero, 2009, but all of these species can be distinguished from *E. kultinalensis* by the dorsal macrochaetotaxy pattern of other segments.

***Entomobrya longisticta* Baijal, 1958**

(Figs 1B, 3A–C)

Type locality: India, Kulti Nal, south slope of Himalaya.

Type material observed: Paratype on slide (mounted from ethyl alcohol), labelled as '*Entomobrya longisticta* Baijal, 1958. Loc. Kultinul, South slope of Himalaya. Alt. 11,600 ft. Date: 9.vi.1956. 01 ex.', Kulti Nal after Baijal (1958) original description. Deposited in ZSI.

Description. Body length up to 1.86 mm excluding antennae (Tab. 1). Body colour pattern as in Fig. 1B, with a longitudinal pattern of stripes, not always continuous: three on head, four from Th II to Abd IV, and some shorter only on Abd IV.

Head: Eight Omma, GH smaller than EF, $\frac{1}{3}$ than AB. Antennal length 1080 μm , almost three times the length of the head (2.8), Ant IV with bilobed apical vesicle, and subapical organite rod-like. Relative length of Ant I/II/III/IV = 1/1.38/1.61/2.0. Labral papillae wrinkled or with some projections.

Body: Length ratio of Abd IV/III = 5.8 (Tab. 1). Tibiotarsus sub-segmented, without differentiated chaetae, with exception of presence of the smooth

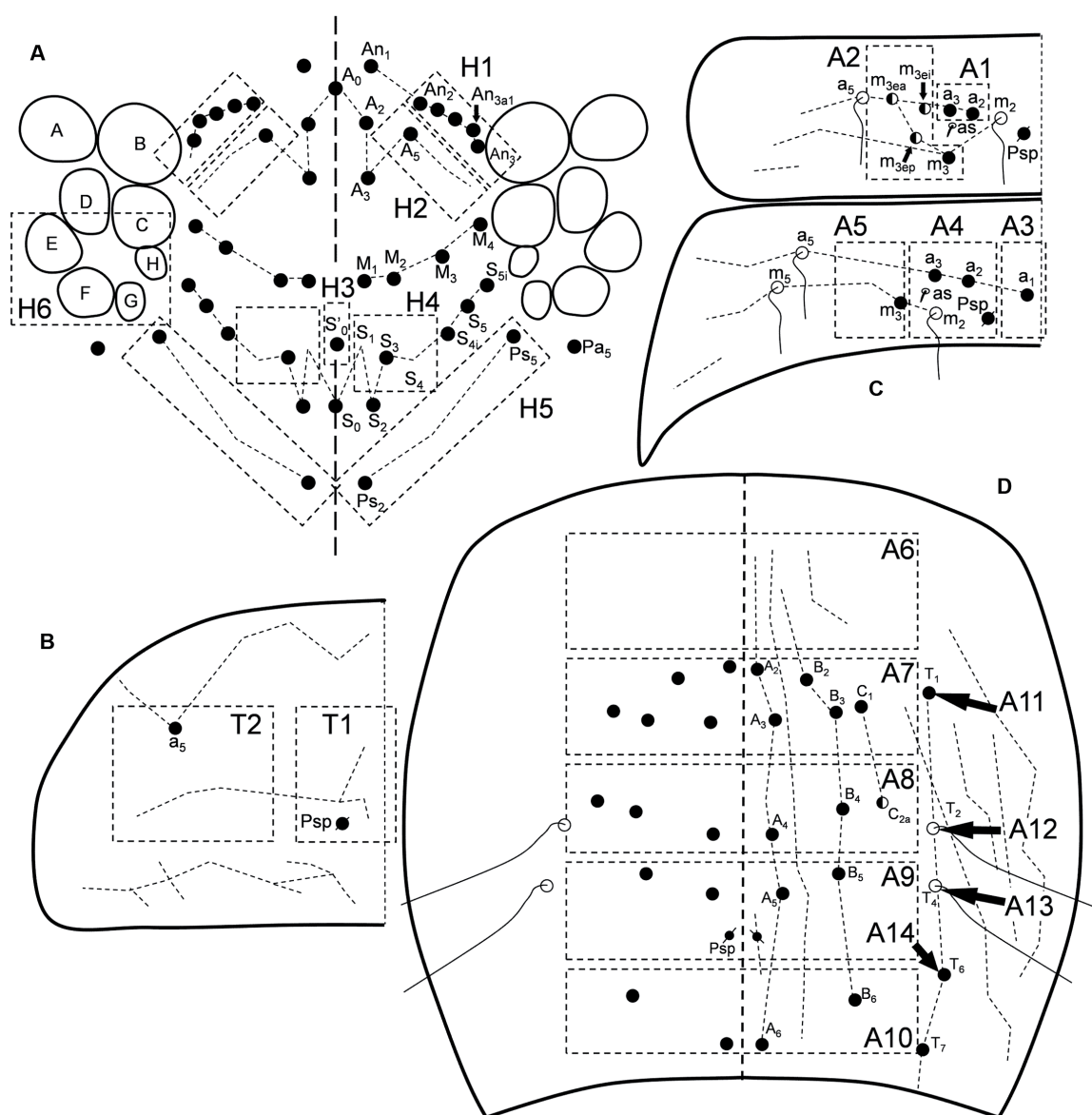


Figure 2. *Entomobrya kultinalensis* macrochaetotaxy: head (A), Th II (B), Abd II–III (C), Abd IV (D) (the arrows point to the trichobothria insertions).

terminal chaetae on legs III, characteristic for the genus. Claw with 4 internal teeth: first pair at 60% of distance from base of claw; 2 unpaired teeth, first at 75% of distance from base and the most distal one minute (at 90%); dorsal and lateral teeth at 50% of distance from base of claw. Empodium spike-like, slightly serrated on external edge of leg III. Length of manubrium and dentes 880 μm . Unringed part of dens twice as long as the mucro. Mucronal subapical tooth in size similar to terminal one and mucronal spine present.

Chaetotaxy: Simplified formula: 4-1-1-2-2/?-2-5/1-2-1/0-0-3-2-2 (Fig. 1B, Tab. 2).

Head chaetotaxy as in Fig. 3A. Thorax chaetotaxy not visible in the Paratype. Abdomen chaetotaxy (Figs 3B–C): A1 area on Abd II with 2 mac (a_2, a_3) and A2 area on

Abd II with 5 mac ($m_3, m_{3e}, m_{3ep}, m_{3ea}$ and m_{3ei}); Abd III with 2 mac on area A4 and 1 on areas A3 and A5; Abd IV macrochaetotaxy as in Fig. 3C.

Biology: Unknown.

Discussion. *E. longisticta* is one of the few species of *Entomobrya* with dark longitudinal stripes as in *E. handschini*, *E. indica*, *E. iraquensis*, *E. koreana*, *E. lawrencei*, *E. maroccana* and *E. quinquelineata*, but is easily differentiated by many other characters (Tab. 3). As some oriental species has four setae on H1 (head), while the mentioned species have only three. The labral papillae are either wrinkled or with some projections, while in the other species they are smooth or have a seta-like projection. *E. longisticta* shares the dorsal macrochaetae formula for Abd IV only with *E. maroccana*.

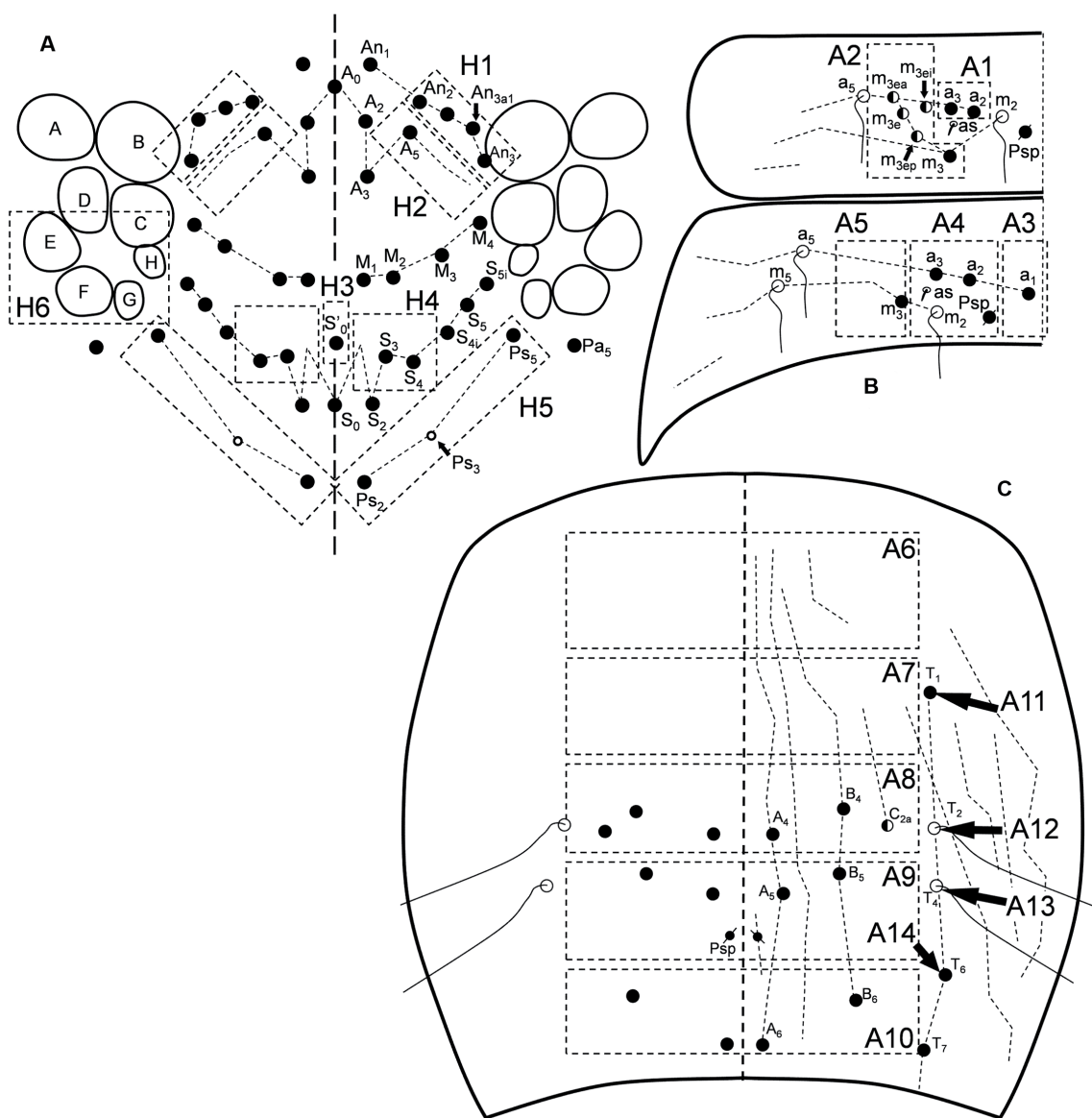


Figure 3. *Entomobrya longisticta* macrochaetotaxy: head (A), Abd II–III (B), Abd IV (C).

Table 2. Comparative set of character between specimens of the different *Entomobrya* species redescribed in this paper. ‘-’, means ‘no data’.

Character	Location	Description	Value	<i>E. kaltinallensis</i>	<i>E. longisticta</i>	<i>E. nigrita</i>	<i>E. rohrtangensis</i>
Ch.1	H1 (Head)	An ₂ -An ₃	1-6	5	4	4	4
Ch.2	H2	A ₅ -A ₇	1-3	1	1	1	1
Ch.3	H3	S ₀	0-1	1	1	0	0
Ch.4	H4	S ₁ -S ₃ -S ₄	0-3	1	2	1	2
Ch.5	H5	Ps ₂ -Ps ₃ -Ps ₅	0-3	2	2	2	1a/2
Ch.6	labral papillae	simple and smooth papillae (1), wrinkled or with some projections (2), a chaeta-like projection (3)	1-3	2	2	1	2
Ch.7	Omma G&H size	= E&F (1), <E&F (2)	1-2	2	2	2	2
Ch.8	apical antennal retractile bulb	no bulb (0), lobe simple (1), bilobate (2), trilobate (3)	0-3	2	2	-	2
Ch.9	ratio Ant/Head	> or = 3 (1), > or = 2 < 3 (2), <2 (3)	1-3	1	2	-	3
Ch.10	anterior dorsal mane Th II mac	with mac type 1 (1), without mac or type 2 (2)	1-2	1	1	1	1
Ch.11	T1	chaetae number m ₁ -m ₂₁₂ or >4 (5)	0-5	0	?	?	0
Ch.12	T2	chaetae number a ₅ , m ₄ -m ₅ or >8 (9)	0-9	1	?	4	3
Ch.13	smooth chaetae on tibiotarsi	not or 1 in tibiotarsi III = 0, double file = 1	0-1	0	0	0	0
Ch.14	claw internal teeth	1(1), 2(2), 3(3), 4(4)	1-4	3-4	4	4	4
	paired teeth of claw	distance from claw base, in %	-	-	60	25	-
	first unpaired teeth of claw	distance from claw base, in %	-	-	75	75	-
Ch.15	claw dorsal tooth	basal = 1, internal teeth level = 2, between pair teeth and basis = 3	1-3	-	-	1-2	-
Ch.16	claw internal edge	without ciliation (0), with ciliation (1)	0-1	0	0	0	0
Ch.17	external empodium	smooth (0), serrate (1)	0-1	-	1	0	-
Ch.18	A1 Abd II	a ₂ -a ₃	0-2	2	2	1	1
Ch.19	A2 Abd II	m ₃ series chaetae number	0-7	4	5	2	3?
Ch.20	A3 Abd III	a ₁	0-1	1	1	0	0
Ch.21	A4 Abd III	above m ₂ chaetae number	0-3	2	2	1	0
Ch.22	A5 Abd III	m ₃ -m ₄ series chaetae number	0-4	1	1	1	1
Ch.23	A6 Abd IV	a ₁ -a ₅ (A ₁ -D ₁) chaetae number; >8 (9)	0-9	0	0	0	0
Ch.24	A7 unpair chaeta	ma ₀ (A ₀₃)	0-1	0	0	0	0
Ch.25	A7 Abd IV	ma ₁ -ma ₄ (A ₂ -E ₁) chaetae number; >9 (10)	0-10	5	0	0	0
Ch.26	A8 unpaired chaeta	m ₀ (A ₀₄)	0-1	0	0	0	0
Ch.27	A8 Abd IV	m ₁ -m ₃ (A _{4a} -C _{2a}) chaetae number; >5 (6)	0-6	3	3	3	3
Ch.28	A9 unpaired chaeta	mp ₀ (A ₀₅)	0-1	0	0	0	0
Ch.29	A9 Abd IV	mp ₁ -mp ₃ (A ₅ -B ₅) chaetae number; >6 (7)	0-7	2	2	2	2
Ch.30	A10 Abd IV	p _{1a} -p ₃ (A ₆ -B ₆) chaetae number; >5 (6)	0-6	2	2	2	2
Ch.31	A11 Abd IV	T ₁ (ma _{4e}) as trichobothrium	0-1	0	0	0	0
Ch.32	A12 Abd IV	T ₂ (m ₄) as trichobothrium	0-1	1	1	1	1
Ch.33	A13 Abd IV	T ₄ (mp ₄) as trichobothrium	0-1	1	1	1	1
Ch.34	A14 Abd IV	T ₆ (p ₄) as trichobothrium	0-1	0	0	0	0
Ch.35	ratio Abd IV/III	2 < R < 4 (1), R > 4 (2)	1-2	1	2	1	1
	manubrium and dens	total length	-	?	800	580	-
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), smaller (3)	0-1	1	1	1	1
Ch.39	mucro	basal spine, absent (0), present (1)	0-1	1	1	1	1

Table 3. Comparative selection of the set of character for *Entomobrya* species with longitudinal stripes in the coloration pattern. *E. indica* is not included because the macrochaetotaxy is unknown.

Species	Ch1	Ch2	Ch3	Ch4	Ch5	Ch6	Ch11	Ch12	Ch18	Ch19	Ch20	Ch21	Ch22	Ch23	Ch25	Ch26	Ch27	Ch29	Ch30
<i>E. handschini</i> Stach, 1922	3	1	0	3	2	4	4	5-6	2	5	0	2	2	0	3-4	0	3-4	3	2
<i>E. iraqensis</i> Jordana & Baquero, 2009	3	1	0	3	2	2	3	2	2	4	0	2	2	0	3	1	4	1	3
<i>E. koreana</i> Yosii, 1965	U	U	U	U	U	4	4	4	2	4	0	2	1	0	4	0	4	3	2
<i>E. lawrencei</i> Baquero & Jordana, 2008	3	1	0	2	2	2	2	3	2	2	1	0	1	0	2	0	2	2	2
<i>E. longisticta</i> Baijal, 1958	4	1	1	2	2	3	U	U	2	5	1	2	1	0	0	0	3	2	2
<i>E. maroccana</i> Baquero & Jordana, 2008	3	1	0	2	2	2	2	3	2	3	1	2	1	0	0	0	3	2	2
<i>E. quinquelineata</i> Börner, 1901	3	1	0	2	2	2	2-3	3	2	2	1	2	1	0	3-4	0	3-5	2	2

***Entomobrya nigrita* Baijal, 1958**

(Figs 1C, 4A–D)

Type locality: India, Kulti Nal, south slope of Himalaya.**Type material observed:** Paratype on slide (mounted from ethyl alcohol), labelled as '*Entomobrya nigrita* Baijal, 1958. Loc. Kulinul, South slope of Himalaya. Alt. 3540 mt. Date: 3.vi.1956. 1 ex.', probably Kulti Nal as above; two paratypes still in ethyl alcohol, same data as Holotype. Deposited at ZSI.**Description.** Body length up to 1.58 mm excluding antennae (Tab. 1). Body colour pattern as Fig. 1C.**Head:** Eight Omma, GH smaller than EF, ½ as small as AB. Paratype without antennae. Labral papillae smooth.**Body:** Length ratio of Abd IV/III = 3.7 (Tab. 1). 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 4 internal teeth: first pair basal, at 25% of distance from base of claw; 2 unpaired teeth, first (very small) at 60% of distance from base and the most distal one minute (75%); dorsal tooth at 25% from base of claw; lateral ones not visible. Empodium short, spike-like, with 3–4 teeth on external edge on leg III. Manubrium and dens length 580 µm. Mucronal apical tooth slightly greater in size than subapical one. Unringed part of dens 2.5 times the length of the mucro. Mucronal spine present.**Chaetotaxy:** Simplified formula of mac: 4-1-0-1-2/?-4/1-2/0-1-1/0-0-3-2-2 (Fig. 1C, Tab. 2).Head chaetotaxy as in Fig. 4A. Thorax chaetotaxy: T1 area on Th II not visible in Paratype (one mac: m_{212} ?); T2 area on Th II with 4 mac (a_5 , m_4 , m_{41} , and m_5 present) (Fig. 4B). Abdomen chaetotaxy (Figs 4C–D): A1 area on Abd II with 1 mac (a_3) and A2 area on Abd II with 2 mac(probably m_{3ep} and m_{3e}); Abd III with only 1 mac on areas A4 and A5 respectively; Abd IV macrochaetotaxy as in Fig. 4D.**Biology:** Unknown.**Discussion:** The colour pattern of this species is somewhat similar to dark coloured species of certain *Entomobrya*. The ground colour is brown, and the blue pigment allows this ground colour to be seen on two large areas on Th II, small patches on Th III, a narrow band on the anterior part of ThII–AbdVI and an anterior group of patches on Abd IV (as in Fig. 1C). There are only two species with dorsal macrochaetae formula for Abd II–III: 1-2/0-1-1, and with smooth labral papilla: *E. nigrita* and *E. obensis* Linnaniemi, 1919, but the latter has a mac formula for the head as 3-1-0-2-1, and 0-0-1-2-2 for the mac formula on Abd IV. *E. nigrita* is the only *Entomobrya* species with the internal pair of teeth at 25–30% of claw base.***Entomobrya rohtangensis* Baijal, 1958**

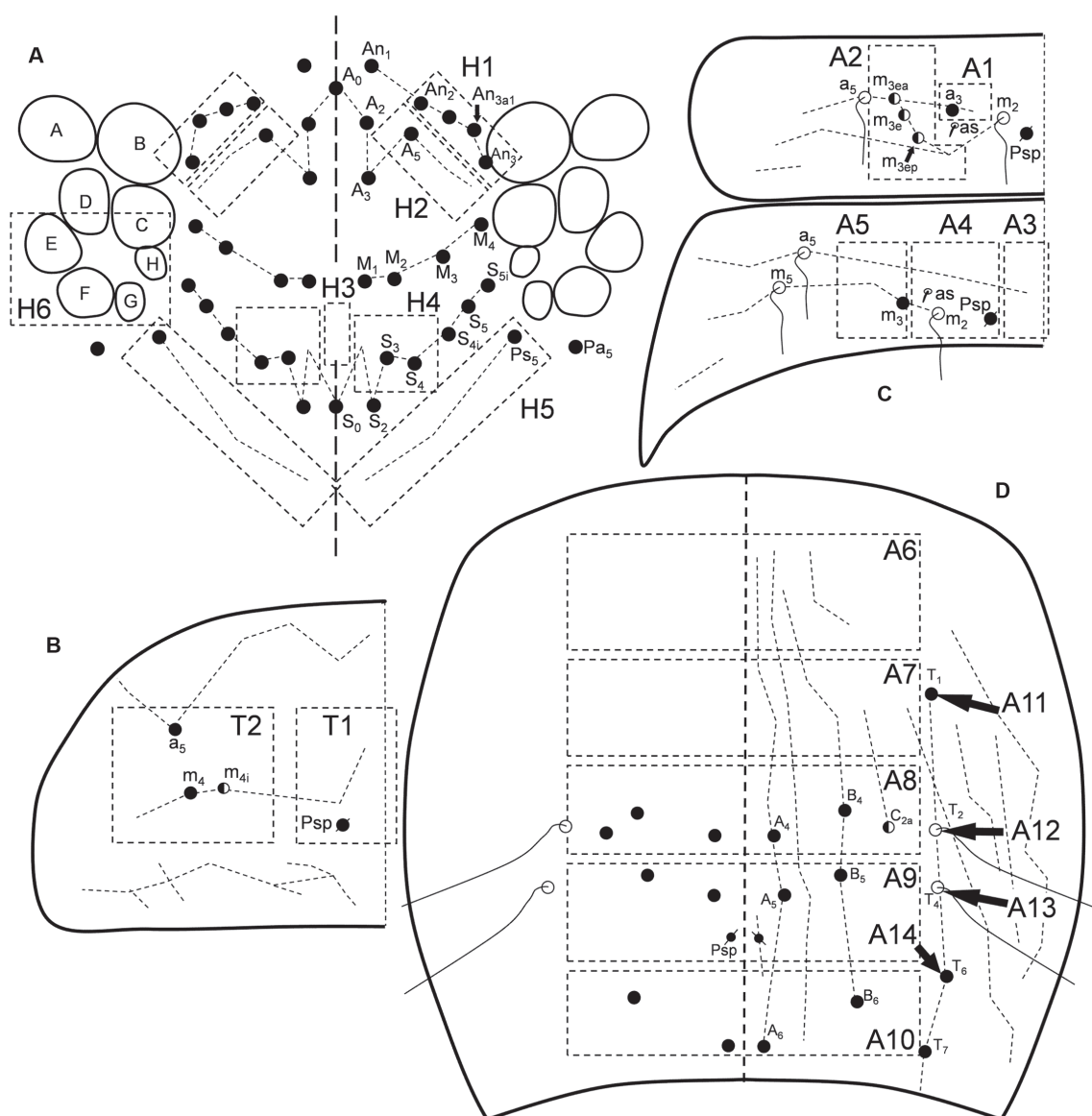
(Figs 1D, 5A–D)

Type locality: India, Kulti Nal, south slope of Himalaya.**Type material observed:** Paratype on slide (mounted from ethyl alcohol), labelled as '*Entomobrya rohtangensis* Baijal, 1958. Loc. Kulinul. Alt. 11,600 ft. Date: 9.vi.1956. 1 ex.', Kulti Nal after Baijal (1958) original description; two paratypes still in ethyl alcohol, same data as Holotype. Deposited at ZSI.**Description.** Body length up to 1.23 mm excluding antennae (Tab. 1). Body colour pattern as in Fig. 1D.**Head:** Eight Omma, GH smaller than EF, 1/5 smaller than AB. Antennal length 410 µm, 1.57 times the length

final area of Abd IV, and narrow stripes on Th II to Abd III; *E. disjuncta* (Nicolet, 1842) Parona, 1895, sensu Bonet, 1934, *E. indica* (Baijal, 1955), *E. intermedia* Handschin, 1942 and *E. xerothermica* Stach, 1963 have patches of dark pigment on dorsal and lateral sides of body; *E. imitabilis* Stach, 1963, *E. miljevici* Palissa, 1968 and *E. spectabilis* Reuter, 1890 have transversal bands of dark pigment; *E. stenonyx* Börner, 1909 has large dark areas on head, Th II and Abd IV; *E. styriaca* Latzel, 1918 is 'brown-black, with extremely fine and dense cover of yellow dots' (Jordana, 2012); *E. villosa* Börner, 1909 was described (Börner 1909) with a colouration somewhat similar to *E. albocincta*, with variations. Only four species have 0–3 mac: *E. lampreyi*, *E. nigrina*, *E. pulchella* and *E. rohtangensis*. Only *E. nigrina* has

0-0-1 mac on Abd III, but it differs from *E. rohtangensis* in the chaetotaxy of the head and Abd II.

Entomobrya rohtangensis, Jordana (2012) now includes some of the characters from both the original description from Baijal (1958) and Yoshii (1990). We can now conclude that the descriptions are based on two different species. The specimens studied by Yoshii in 1990, from Nepal (Yala glacier, 5000 m) do not belong to the species *E. rohtangensis* as described by Baijal, as they are clearly different in colour: in Yoshii's description, the colouration is yellowish-white with only a slight dark pigment on antennal basis, and antennae are dark bluish, distally ever deeper. The head chaetotaxy as drawn by Yoshii does not match with the usual pattern for *Entomobrya*, although we can deduce from this



drawing that the species has 5 mac on H1. The antennae are proportionally much longer, and the macrochaetotaxy for Abd II–III is 2-4/1-2-1, clearly distinct from *E. rohtangensis* (Baijal's paratype). Finally, the Abd IV/III ratio is higher. Considering the macrochaetotaxy for Abd II–III, the shape of the labral papillae and the proportion of Abd IV/III, Yoshii's species is close to the species *E. kultinalensis*, *E. arvensis* Latzel, 1918 and *E. palmensis* Jordana & Baquero, 2010, but totally separated from these by coloration and geographical distribution in the latter two species (the Austrian Alps and Canary Islands, respectively). However, it is not possible to give a new name to this species because the characters are not sufficient enough to differentiate a new species and also because no type material was found in Yoshii's collection at Geneva.

4. Acknowledgements

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5. References

- Baijal, H. N. (1958): Entomological Survey of Himalaya. Part XXVIII, Nival Collembola from the North–West Himalaya. Section B, Part V. – Proceedings of the National Academy of Sciences. India, Allahabad **28B**(5): 349–360.
- Baquero, E., J. Arbea, & R. Jordana (2010): New species of Entomobryni from the Mediterranean Palaearctic (Collembola, Entomobryidae) and a new name for *Folsomia potapovi* (Collembola, Isotomidae). – Soil Organisms **82**(3): 285–300.
- Börner, C. (1909): Japans Collembolenfauna. (Vorläufige Mitteilung). – Sitzungsberichte der Gesellschaft Naturforschender Freunde zu Berlin **2**: 99–135.
- Christiansen, K. (1958): The Nearctic members of the genus *Entomobrya* (Collembola). – Bulletin of the Museum of Comparative Zoology **118**(7): 1–545.
- Christiansen, K. & P. Bellinger (1980): Family Entomobryidae. – The Collembola of North America North of the Rio Grande, Grinnell College, Iowa **3**: 785–1042.
- Jordana, R. (2012): Synopses on Palaearctic Collembola 7/1 - Capbryinae & Entomobryini. – Soil Organisms **84** (1): 1–390.
- 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.
- Jordana, R. & E. Baquero (2010a): A new species of *Entomobrya* from Iraq (Collembola, Entomobryidae). – Soil Organisms **82**(3): 351–356.
- Jordana, R. & E. Baquero (2010b): A new species of *Entomobrya* (Collembola, Entomobryidae) from La Caldera de Taburiente National Park (La Palma Island, Canary Islands) and its associated collembolan fauna. – Soil Organisms **82**(3): 357–365.
- Yoshii, R. (1990): Report on the cryophilous Collembola, collected by S. Kohshima. – Contributions from the Biologica Laboratory, Kyoto University **27**(4): 523–533.
- Yosii, R. (1942): Japanische Entomobryinen (Ins., Collemb.). – Archiv Fur Naturgeschichte **10**(4): 476–495.