



## FOUR NEW SPECIES OF SPRINGTAILS (HEXAPODA: COLLEMBOLA) FROM JHARKHAND, INDIA

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### INTRODUCTION

The first record of collembola was known from Ghatsila area of Jharkhand by the published work of Mandal & Hazra (2004). Thereafter, the present project was undertaken for extensive study of Collembola fauna of Jharkhand as per Annual Plan of Research Work of Apterygota section for the year 2012-2015. Mandal (2014a, b, c, 2015), Mandal & Hazra (2013) and Mandal & Suman (2014) published Collembola from different sanctuaries of Jharkhand.

### MATERIALS AND METHODS

#### The Sampling Area

Jharkhand is a state in eastern India, shares its border with the states of Bihar to the north, Uttar Pradesh and Chhattisgarh to the west, Orissa to the south, and West Bengal to the east. It is situated between 23.3500° N Latitude and 85.3300° E Longitude. The state is very rich in biodiversity and is the part of the Chhotanagpur plateau, province of the peninsula bio-geographic zone. The present study of collembolan fauna is based on collection made during 2012-2015, from different districts of Jharkhand, India.

Specimens were mounted under a coverslip in Hoyer's solution, and were studied under a Leica Digital Module (DM 2500) microscope. Photographs were taken under a Leica Digital Module R (DMR) microscope using a mounted Leica DFC 295 digital camera, and were enhanced with Photoshop CS4 (Adobe Inc.). Identification of specimen is done using a phase contrast compound microscope following Christiansen and Bellinger (1998).

All specimens are deposited in the Apterygota Section, Zoological Survey of India (ZSI), Kolkata.

*Abbreviations:* Abd = abdominal segment, Ant = antennal segment, m = mesochaeta, Mc = macrochaeta, Th = thoracic segment, ZSI = Zoological Survey of India, (Kolkata).

Family ENTOMOBRYIDAE Schaffer, 1896  
Subfamily LEPIDOCYRTINAE Wahlgren, 1906

Genus *Acanthurella* Börner, 1906

1906. *Acanthurella* Börner, *Mitt. Naturhist. Mus. Hamburg* 23: 147-188.

*Type species:* *Acanthurella braueri* Börner, 1906

Börner (1906) erected the genus *Acanthurella*, based on these characters: Body with scales. Head with 8 + 8 eyes. Mucro bidentate. Dental scales present. Dental spines present. Body scales all rounded and finely striate; macrochaetae rare on dorsal body except collar; scales hyaline; antenna without apical bulb. A total of eight species in this genus are known from the world. From India, this genus is first time recorded with new species.

1. *Acanthurella betlaensis* sp. nov.

(Images 1-15)

*Material examined:* HOLOTYPE: female on slide, India: Jharkhand: Betla National Park, Latehar district, Bairiya nulla, road no.4, 07.xii.2012, Lat & Long, 23°52'N and 84°11'E, collected by G.P. Mandal, Registration No. 1712/H14/ZSI. PARATYPE: 3 exs in ethyl alcohol, India: Jharkhand: Betla National Park, Latehar district, Bairiya nulla, road no.4, 07.xii.2012, Lat

& Long, 23°52'N and 84°11'E, collected by G.P. Mandal, Registration No. 1713/H14/ZSI.

**Description:** Body length up to 2.15 mm (excluding appendages).

**Colour pattern:** Ground colour pale yellow in alcohol (Image 1). Eyes patch darker blue-black. Light blue pigments distributed on head, lateral part darker than central. Antennae I devoid of pigment, Ant. II laterally bluish pigment, Ant. III & Ant. IV with bluish pigment. Blue pigment patch present on lateral margins of Th. II, III, each leg pigmented from pre coxa to femur. Abd. IV with light blue pigment patch present transversely, Abd. V and VI, bluish transverse band present.

**Head:** Antennae 1.8 times as long as cephalic diagonal. Ratio of segments of antennae I: II: III: IV = 1:1.8:1.6:2.9. Antennal apical bulb absent (Image 2). Eyes eight + eight, G and H smaller. Cephalic scales and setae are shown in Image 4. Prelabral and labral setae 4/5, 5, 4, all smooth. Lateral process of labial palp slightly curved, as thick as normal setae, with tip just reaching apex of labial papilla (Image 3).

**Thorax and legs:** Dorsal macrosetae (m) on collar shown in Image 5. Legs with multilaterally ciliate macrosetae present. Coxa with straight multilaterally ciliate macrosetae present (Image 6). Trochanteral organ with about 40 smooth spiny setae present (Image 7). Tibiotarsus with inner differentiated setae ciliate, the distal one smooth. Tibiotarsal inner outstanding macrochaetae acuminate but tapered only at tip. Unguis with one outer and two inner teeth. Unguiculus slender

and acuminate (Image 8). Tenent hair clavate and shorter than unguis.

**Abdomen:** Abd. IV 7 times as long as Abd. III along dorsal midline. Dorsal macrochaetotaxy (Mc) shown in Image 9. Tenaculum with four + four teeth and large macrosetae. Furcal segment ratio of manubrium to dens plus mucro = 1:1.08. Manubrium ventrally covered with scales and setae (Image 10). Dens with multiple rows of numerous spines and scales (Image 11). Smooth portion of dens shorter than mucro in length. Mucronal apical tooth smaller than subapical one. Mucronal basal spine short with tip reaching apex of sub apical tooth (Image 12).

**Body scales:** Scales rounded and finely striate (Image 13) Scales present on head and body, Ant. I and II (Image 14), whole leg, ventral side of furcula. Scales on manubrium all rounded. Scales on dens ventrally distinctly narrower (Image 15).

**Ecology:** Found under a moist nullah of the Betla National park where leaf-litter of moist deciduous forest of trees like, Sal, Shegun and Arjun were present.

**Etymology:** The new species is named after the type locality.

**Discussion:** The new species from Betla National Park, Jharkhand, India can easily distinguished from other known *Acanthurella* species by the colour pattern and dorsal chaetotaxy. It is close to *Acanthurella javana* in having colour pattern of Antennae and legs, two inner teeth in unguis but clearly differs from *Acanthurella javana* in the characteristics given in Table 1.

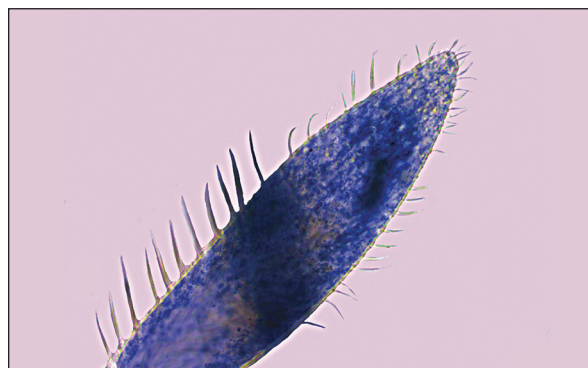
**Table 1.** The differences between *Acanthurella javana* and *Acanthurella betlaensis* sp. nov.

Characters	<i>Acanthurella javana</i>	<i>Acanthurella betlaensis</i> sp. nov.
Pigment patch present on Th. II, III.	absent	blue pigment patch present on lateral margins of Th. II, III, which extend up to femur.
Abd. IV, V and VI, with transverse band or pigment patch.	absent	Abd. IV with light blue pigment patch present transversely, Abd. V and VI, with bluish transverse band.
Dorsal macrosetae on collar	absent	9-10 macrosetae present on collar
Coxa with multilaterally ciliate macrosetae	absent	coxa with multilaterally ciliate macrosetae present.
Rows of dental spine	single	multiple rows of dental spines present.
Apex of Tenent hair	clavate	strongly clavate
Body length	2.60 mm	2.15 mm

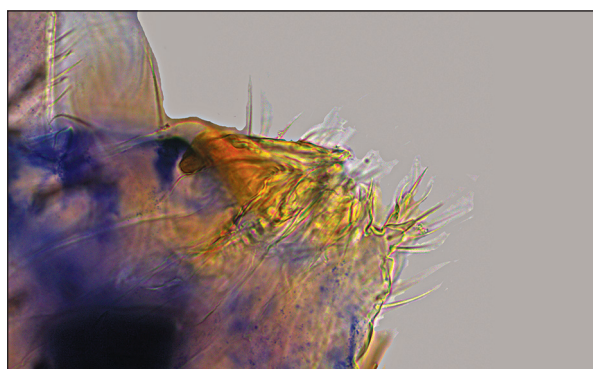
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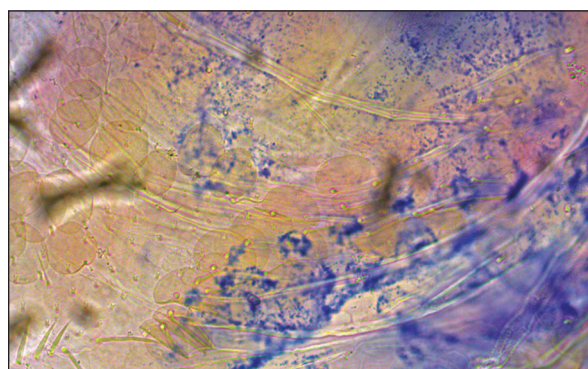
**Image 1.** *Acanthurella betlaensis* sp. nov.



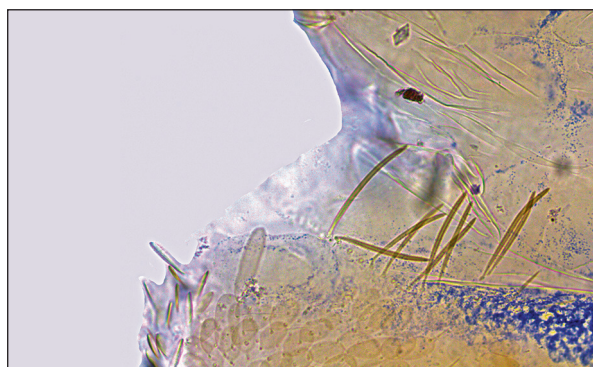
**Image 2.** Antennae IV



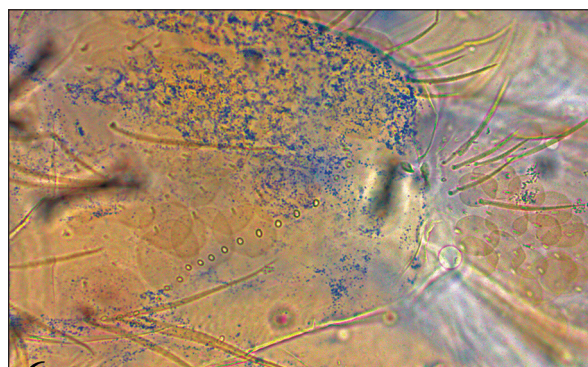
**Image 3.** Mouthparts



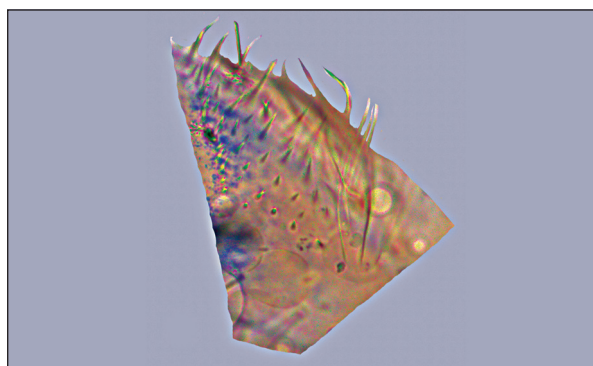
**Image 4.** Cephalic scales & setae



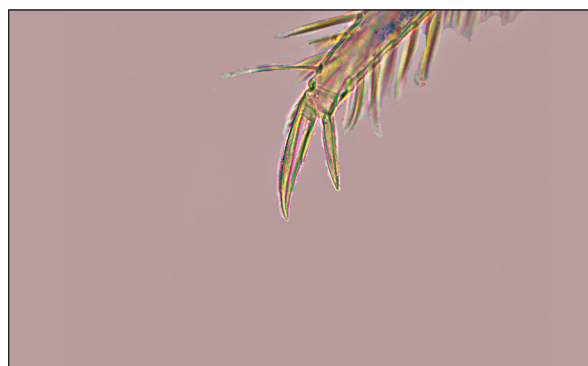
**Image 5.** Macrochaetae on Th.I



**Image 6.** Setae & scales on base of legs

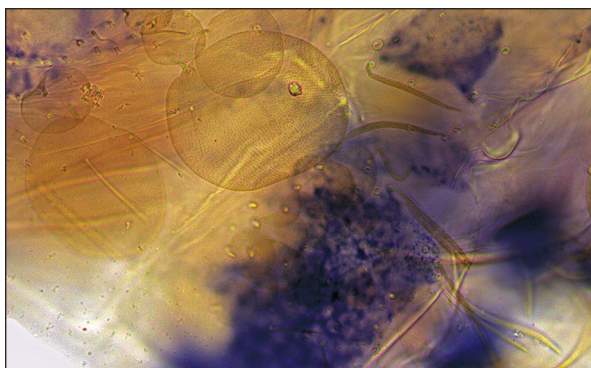


**Image 7.** Trochanteral organ



**Image 8.** Unguis, unguiculus & tenent hair

## IMAGES



**Image 9.** Abd. VI setae



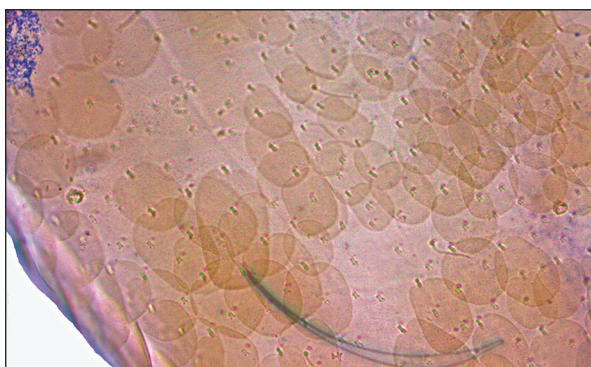
**Image 10.** Manubrial scale



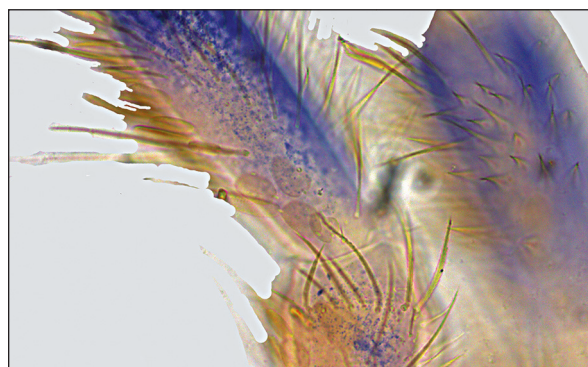
**Image 11.** Dental spine



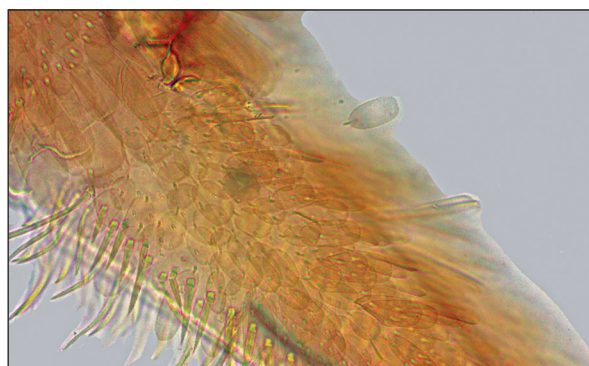
**Image 12.** Mucro



**Image 13.** Abdominal scale



**Image 14.** Antennal scale



**Image 15.** Dental scale

Subfamily CYPHODERINAE Börner, 1913,  
Sensu Soto-Adames, 2008

Genus *Cyphoderus* Nicolet, 1842

1842. *Cyphoderus* Nicolet, *Neue Denkschr. Allg. Schweiz. Ges. Naturwiss.* 6(3): 1-88.

*Type species: Cyphoderus albinos* Nicolet, 1842.

The genus *Cyphoderus* is characterized by furca with setae between large scales on dorsum of dens. Head less than 2 times as long as distance from dorsum to tip of buccal cone. Males without lateral projection on second antennal segment. Mandibles present with or without molar plate. Mouth cone projecting forward. Unguis without filamentous projection on inner teeth. Unguis apical teeth at most 3. A total of six species in this genus are known from India. There are 65 species of *Cyphoderus* known from the world.

2. *Cyphoderus indicus* sp. nov.  
(Images 1-2; Figs. 1-10)

*Material examined:* HOLOTYPE: female on slide, India: Jharkhand: Bokaro Forest near

sector -I, Bokaro district, 02.i.2015, Lat & Long, 23.66N and 86.15E, collected by G.P. Mandal, Registration No. 1714/H14/ZSI. PARATYPE: 12 exs in ethyl alcohol, India: Jharkhand: Bokaro Forest near sector -I, Bokaro district, 02.i.2015, Lat & Long, 23.66 N and 86.15E, collected by G.P. Mandal, Registration No. 1715/H14/ZSI.

*Description:* Body length up to 1.12 mm (excluding appendages).

*Colour pattern:* Creamy white without any trace of pigment (Image 1).

*Head:* Antennae 1.7 times as long as cephalic diagonal. Ratio of segments of antennae I: II: III: IV = 1:2:1.2:3. Eyes absent. Ant. IV without end bulb, but curving sensory setae present beside usual ciliated setae (Fig. 1). Such sensory setae are present also Ant. II, III and IV. Labrum with setae arranged as 4, 6, 4 (Fig. 2).

*Thorax and legs:* Ratio of segments of Thorax II: III = 2:1. Unguis stout, with a pair of inner teeth and no distal paired teeth, outer strong proximal slender tooth present. Unguiculus lanceolate with



Image 1. *Cyphoderus indicus* sp. nov.

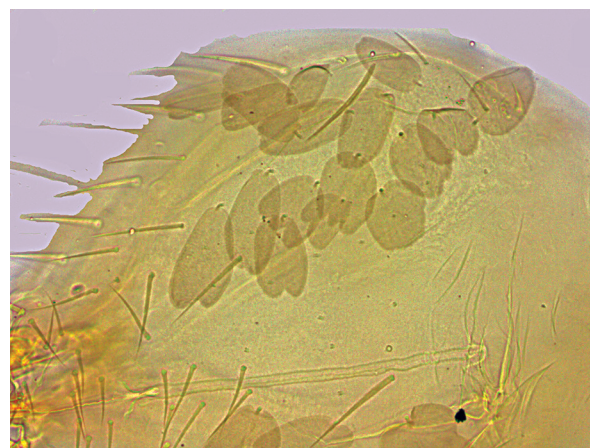


Image 2. Head scales.

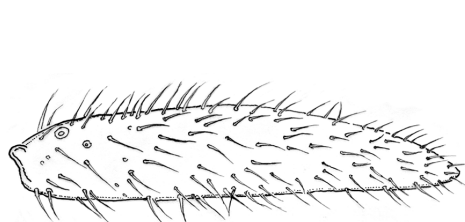


Fig. 1. Ant. IV



Fig. 2. Labrum

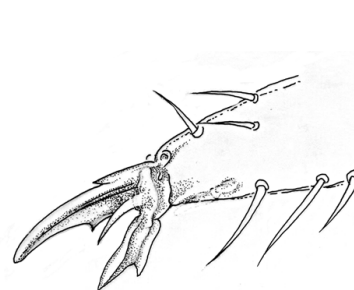


Fig. 3. Unguisulus and unguiculus



Fig. 4. Trochanteral organ

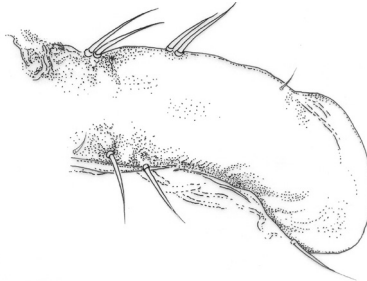


Fig. 5. Ventral tube

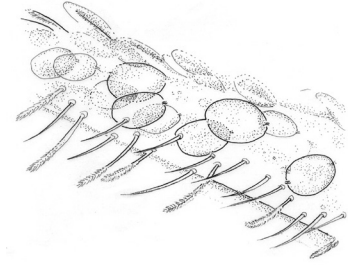


Fig. 6. Manubrial scales &amp; setae

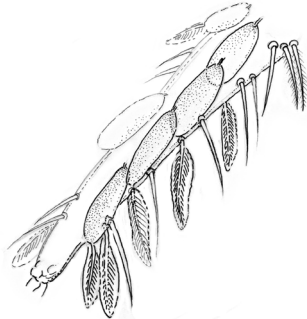


Fig. 7. Dental scales &amp; setae

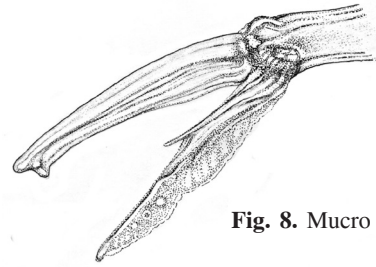


Fig. 8. Mucro

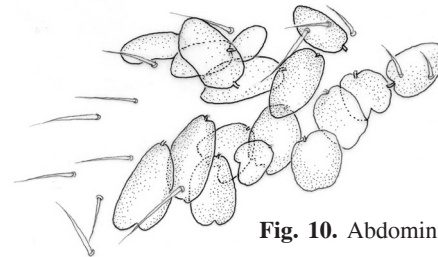


Fig. 10. Abdominal scales

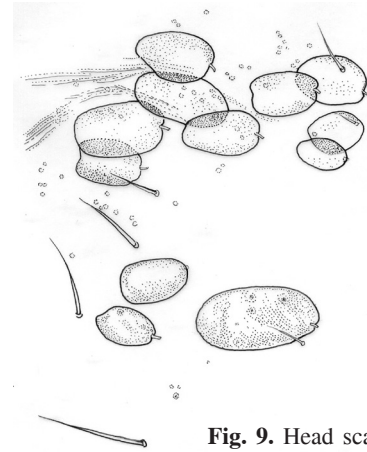


Fig. 9. Head scales

**Table 2.** The differences between *Cyphoderus javanus* and *Cyphoderus indicus* sp. nov.

Characters	<i>Cyphoderus javanus</i>	<i>Cyphoderus indicus</i> sp. nov.
Inner margin of unguis with paired- distal teeth	present	absent
Outer margin of unguis with teeth	absent	outer margin of unguis with strong proximal slender tooth present.
Trochanteral organ with setae	16 short setae in L-arrangement	10 short spine –like setae in V-arrangement
Dentes with outer and inner scale	dentes with 6 outer and 5 inner scales	dentes with 5 outer and 4 inner scales
Body length	1.7 mm	1.12 mm

a broad outer tooth (Fig. 3). Trochanteral organ is composed of about 10 short spine-like setae in V shape arrangement (Fig. 4). Ventral tube elongate, curving forwards distally. Anterior face with 6 (2+2+2) setae (Fig. 5).

**Abdomen:** Ratio of Abdomen I: II: III: IV: V: VI=1.5:1.9:2.2:8:2:1. Rami of tenaculi quadrate. Manubrium: dens: mucro= 4:2.7:1. Manubrium is ventrally scaled and without setae and dorsal side

with multilaterally ciliate setae (Fig. 6). Near the manubrial end there are 2 ciliated setae and one smooth setae. Dentes not converging distally with 5 outer and 4 inner broad, long scales (Fig. 7). Basally with one smooth and two ciliated setae and dorsal row with 4 smooth setae, 2 of which are attached to proximal scales. Mucro is sub equal to the distal outer scale in length, bidentate apically (Fig. 8).

**Body scales:** Scales present on head, thorax, abdomen, manubrium and dentes (Fig. 9 & 10; Image 2). Scales mostly smooth and finely striate. Dental scales slender, flattened, plumose type. Body covered with setae. Lasiotrichia present on Th. II, III, Abd. IV, V, multilaterally ciliated setae present on apex of Abd.VI.

**Ecology:** Found in leaf-litter of moist deciduous forest of trees like, Sal, Shegun and Arjun.

**Etymology:** The new species is named after the type locality, Jharkhand, India.

**Discussion:** The new species from Bokaro forest, Jharkhand, India can easily distinguished from other known species of *Cyphoderus* by the claw pattern and furcula structure. It is close to *Cyphoderus javanus* in having sub equal mucronal basal scale and shape of unguiculus but clearly differs from *C. javanus* in the characteristics given in Table 2.

### 3. *Cyphoderus jharkhandensis* sp. nov. (Images 1-2; Figs. 1-6)

**Material examined:** HOLOTYPE: female on slide, India: Jharkhand: Khajuria forest, Deoghar district, 01.ix.2013, Lat & Long, 24.32N and 86.43E, collected by G.P.Mandal, Registration No. 1716/H 14/ZSI. PARATYPE: 3 exs in ethyl alcohol, India: Jharkhand: Khajuria forest, Deoghar district, 01.ix.2013, Lat & Long, 24.32N and 86.43E, collected by G.P.Mandal, Registration No. 1717/H 14/ZSI; 1 ex on slide, India: Jharkhand: Khajuria forest, Deoghar district, 01.ix.2013, Lat & Long, 24.32N and 86.43E, collected by G.P.Mandal, Registration No. 1718/H 14/ZSI.



**Image 1.** *Cyphoderus jharkhandensis* sp. nov.

**Description:** Body length up to 1.2 mm (excluding appendages).

**Colour pattern:** White without any trace of pigment (Image 1).

**Head:** Antennae 1.73 times as long as cephalic diagonal. Ratio of segments of antennae I: II: III: IV = 1:2.3:1.3:3.6. Eyes absent. Ant. IV without end bulb, but covered with numerous ciliated setae (Fig. 1). Ant. I and II with scaled. Labrum with setae arranged as 4, 4, 4; prelabral setae smooth (Fig. 2). Ratio of Antennae / body = 2.7.

**Thorax and legs:** Ratio of segments of Thorax II: III = 1:1.19. Unguis stout, with a inner proximal tooth well developed and broad outline. Unguiculus lanceolate with a broad outer tooth (Fig. 3). Trochanteral organ is composed of about 10 short spines in V shape arrangement. Ventral tube clothed with short, smooth setae of uniform length on anterior face.

**Abdomen:** Ratio of segments of Abdomen I: II: III: IV: V: VI = 1.7:1.75:2.5:9.6:1.8:1. Rami of tenaculi quadrate and with a median seta on corpus. Manubrium: dens: mucro = 3.2:2.2:1. Manubrium is ventrally scaled and without setae and dorsal side with multilaterally ciliate setae. Dentes with 6 outer and 4 inner plumose scales and basally with one smooth and one ciliated setae (Fig. 4). 4 ciliated setae are present dorsally, 2 of which attached with plumose scales (Image 2). Mucronal length is double than distal outer scale, mucro bidentate apically (Fig. 5).



**Image 2.** Dental scale & setae.

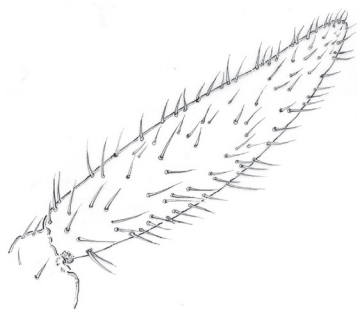


Fig. 1. Ant. IV

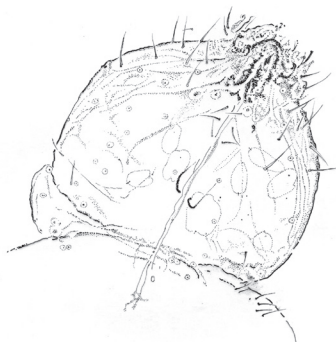


Fig. 2. Mouthparts

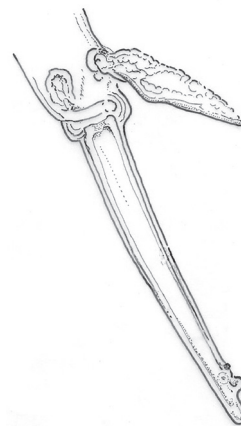


Fig. 5. Mucro

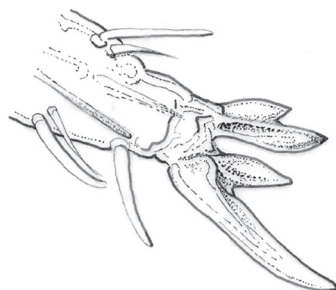


Fig. 3. Unguis &amp; unguiculus



Fig. 4. Dental scale



Fig. 6. Cephalic scale

**Table 3.** The differences between *Cyphoderus albinus* and *Cyphoderus jharkhandensis* sp. nov.

Characters	<i>Cyphoderus albinus</i>	<i>Cyphoderus jharkhandensis</i> sp. nov.
Inner proximal tooth of unguis	spiny in outline	broad shape
Trochanteral organ with setae	15 simple setae in L-shape	10 short spine-like setae in V-shape
Dentes with outer and inner scale	dentes with 6 outer and 5 inner scales	dentes with 6 outer and 4 inner scales
Mucro with distal outer scale	Mucro is sub equal to the distal outer scale	mucronal length is double than distal outer scale
Body length	0.9 mm	1.2 mm

**Body scales:** Scales present on head, Ant. I & II, thorax, abdomen, manubrium and dentes. Scales on head are broad & leaf-like, mostly smooth and finely striate (Fig. 6). Abdominal scales are smaller than head. Dental scales slender plumose type. Macrochaetae absent on the general surface of the body. Some long setae present on Head (1+1), Abd. IV(2+2).

**Ecology:** Found in leaf-litter of moist deciduous forest.

**Etymology:** The new species is named after the type locality, Jharkhand, India.

**Discussion:** The new species from Jharkhand, India can easily distinguished from other known *Cyphoderus* species by the claw pattern and number of scales present in dentes and body setae. It is close to *Cyphoderus albinus* in having shape of claw but clearly differs from *C. albinus* in the characteristics given in Table 3.



Family SMINTHURIDAE Lubbock, 1862  
 Subfamily SMINTHURINAE Lubbock, 1862  
 Genus *Temeritas* Delamare Deboutteville &  
 Massoud, 1963

*Type species: Sminthurus macroceros* Denis, 1933.

The genus *Temeritas* is characterized by large abdomen with long, thick setae; posteriorly without large cuticular glands. Eye-patches with 8+8 ommatidia. Potantennal setae missing. Antenna generally longer than body. Ant. III sometimes with several long, thick setae. Ant. IV with 20-40 subsegments. Trochanter III posteriorly with 1 spine. Dens anteriorly with 13 setae, inner setae sometimes spinelike. Posterior edges of mucro serrate; setae present or missing. Baijal & Kohli (1972) described a single species, *Temeritas bharatensis* from India and this is the another species of *Temeritas* is described here. There are 39 species of *Temeritas* known from the world.

4. *Temeritas dimna* sp. nov.  
 (Images 1-9; Figs. 1-2)

*Material examined:* HOLOTYPE: female on slide, India: Jharkhand: entry point Dimna Lake, Jamshedpur, East Singbhum district, 27.vi.2014, Lat & Long, 22.5N and 86.14E, collected by G.P.Mandal, Registration No. 1719/H 14/ZSI. PARATYPE: 2 exs in ethyl alcohol, India: Jharkhand: entry point Dimna Lake, Jamshedpur, East Singbhum district, 27.vi.2014, Lat & Long, 22.5N and 86.14E, collected by G.P.Mandal, Registration No. 1720/H 14/ZSI; 1 ex on slide, India: Jharkhand: entry point Dimna Lake,

Jamshedpur, East Singbhum district, 27.vi.2014, Lat & Long, 22.5N and 86.14E, collected by G.P.Mandal, Registration No. 1721/H 14/ZSI.

*Description:* Body length up to 2.1 mm (excluding appendages).

*Colour pattern:* Ground colour pale yellow in alcohol, violettish- black pigmented patches present dorsally and laterally on thorax and abdomen (Image 1). Head pale yellowish with black violet longitudinal band. Eyes patch darker blue-black. Antennae I and Ant. II light violet, Ant. III with light bluish apically and Ant. IV with bluish pigment. Legs are pale yellow. Furcula is pale yellow with light.

*Head:* Eyes eight + eight. Antennae 3.7 times as long as cephalic diagonal. Ratio of segments of antennae I: II: III: IV = 1:2.1:2.9:10.3. Antennal apical bulb absent. Ant. I with small setae (Image 2), Ant. II & Ant. III with several long thick ciliate and few multilaterate ciliate setae (Image 3 & 4). Antennae IV with 30 sub segments (Image 5). Ant. IV with long ciliated setae present in each sub segments with opposed rows (Fig. 1). Two strong, thick spine-like setae present in each ommatidium (Image 6). Head with large numbers of long ciliate setae. Post antennal setae absent.

*Thorax and legs:* Tibiotarsus with long differentiated setae ciliate, the distal one smooth. Unguis with two inner teeth present, one just base and other half past of lamella and no outer tooth. Unguiculus lanceolate with long terminal bristle (Fig. 2). Tenent hair absent. Ventral tube elongated and slender (Image 7).

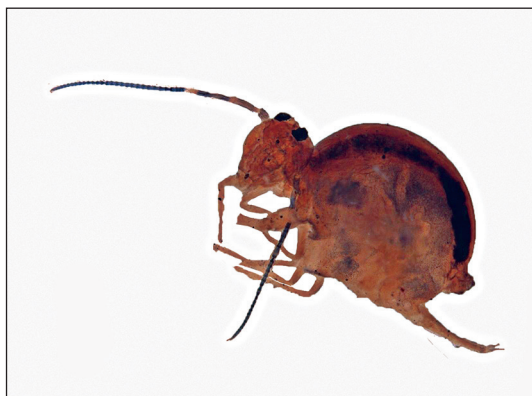


Image 1. *Temeritas dimna* sp. nov.



Image 2. Antennae I

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Image 3. Antennae II



Image 4. Antennae III

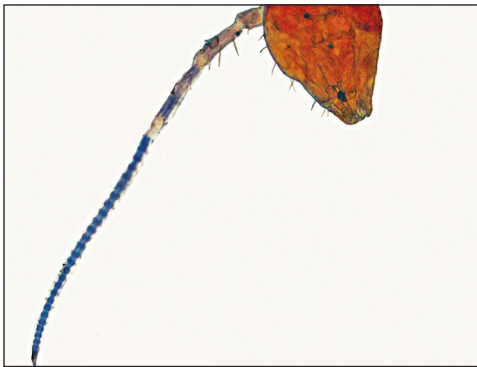


Image 5. Antennae IV



Image 6. Spine-like setae on ocelli



Image 7. Ventral tube



Image 8. Dentes



Image 9. Mucro

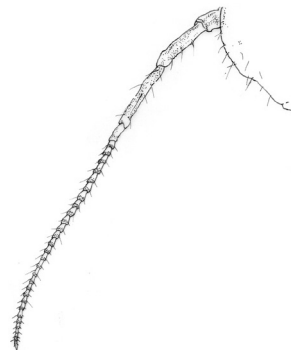


Fig. 1. Ant. IV

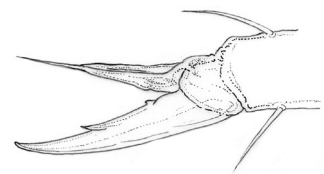


Fig. 2. Unguis and unguiculus

**Table 4.** The differences between *Temeritas bharatensis* and *Temeritas dimna* sp. nov.

Characters	<i>Temeritas bharatensis</i>	<i>Temeritas dimna</i> sp. nov.
Antennal segments IV with subdivision	Antennae IV with 36 sub segments	Antennae IV with 30 sub segments
Inner tooth of unguis	One	two
Mucronal inner lamella with teeth	Mucronal inner lamella without strong teeth	Mucronal inner lamella with 19-20 strong teeth present
Mucronal setae	A strong basal mucronal setae present	mucronal setae absent
Body length	1.8 mm	2.1 mm

**Abdomen:** Abd. V and Abd.VI with large ciliated macrochaetae. Ratio of mucro: dens: manubrium=1:2.5:1.6. Manubrium with few long setae. Dens with few long setae, 10 setae on inner margin and 7 setae in outer margin (Image 8). Mucronal apical tooth smaller than subapical one. Mucronal setae absent. Mucro with inner lamella crenulated and outer lamella plain. Mucronal inner lamella with 19-20 strong teeth present (Image 9).

**Body clothing:** Body clothed with short, long ciliate setae on head, dorsal side of thorax and abdomen. Abd.V and VI clothed with large numbers of long, thick, ciliated setae. Legs, manubrium and dens are clothed with long ciliate setae.

**Ecology:** Found under moist leaf-litter and grasses of Dimna lake surrounding, Jamshedpur, West Singhbhum district.

**Etymology:** The new species is named after the type locality.

**Discussion:** The new species from Dimna Lake, Jamshedpur, Jharkhand, India can easily distinguished from other known species of *Temeritas* by the colour pattern, claw structure and furcula. It is close to *Temeritas bharatensis* in

having similar type of unguiculus but clearly differs from *Temeritas bharatensis* in the characteristics given in Table 4.

### SUMMARY

A total of 4 species of Collembola belonging to 3 genera under 3 sub families of 2 families have been described as new to science from the state of Jharkhand, India. The detailed descriptions of each species of Collembola with discussion for difference between nearer species, total numbers of species the world as well as from India are also provided.

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