Two new species of collembola (Entomobryidae, Lepidocyrtinae) from Satkosia Tiger Reserve, Odisha, India

Guru Pada Mandal, Kusumendra Kumar Suman and Kaushik Kumar Bhattacharya

Abstract
Two new species of collembola under the genus Acanthurella and Lepidocyrtus subgenus Cinctocyrtus was described from Satkosia Tiger Reserve, Odisha, India. Acanthurella satkosiaensis n.sp. can be separated from other Acanthurella species by combinations of characters- claw structure, colour pattern and double rows of dental spine and Lepidocyrtus (Cinctocyrtus) satkosiaensis n. sp. has large no. of macrochaetae on anterior margin of head, trochanteral organ with 12 chaetae, unguis with 4 teeth and scale on furcula with both dorsal & ventral side.

Keywords: Collembola, Acanthurella, Lepidocyrtus (Cinctocyrtus), new species, Satkosia, India

Introduction
Satkosia Tiger Reserve, Odisha comprises of two sanctuaries Satkosia Gorge Sanctuary and Baisipalli Sanctuary is about 964 sq. Km having 525 sq. Km as core area. Satkosia Tiger Reserve is the meeting point of two biogeographic regions of India, the Deccan Peninsula and Eastern Ghats. The first Indian species of collembola was described by Ritter [1], followed by Imms [2], Carpenter [3, 4], Handschin [5], Bonet [6], Mukherjee [7], Brown [8], Denis [9, 11], Baijal [12-14], Salmo [15-17], Choudhuri and Roy [18], Yosii [19], Prabhoo [20], Mitra [21-26], Hazra [27] and very recently Mandal et al. [28-31] contributed to the knowledge of Indian Collembola. Mandal [32] has been published an updated checklist of Collembola from India consisting of 342 species under 113 genera grouped in 20 families.

Collembola fauna of Satkosia Tiger Reserve, Odisha was not known previously, Mandal & Arbee [33] has been first described a new species of Hypogastrurudae (Collembola) from Satkosia Tiger Reserve. The present paper describing herewith two new species of collembola under the genus Acanthurella and Lepidocyrtus subgenus Cinctocyrtus from Satkosia Tiger Reserve, Odisha, India.

Materials and Methods
As a part of Annual Programme of Research work of Zoological Survey of India, Kolkata, and the first author conducted survey during November, 2016, in Satkosia Tiger Reserve, Odisha and collected good numbers of collembola specimens through mouth operated aspirator and beating the forest litter. The collembolans were preserved in 70% ethyl alcohol.

In laboratory, collembola specimens were mounted under a cover slip in Hoyer’s solution, and all specimens and perman ent slides have been deposited in the Apterygota Section, Zoological Survey of India (ZSI), Kolkata. Abbreviations. Ant.-antennal segment; Th.-thoracic segment; Abd.-Abdominal segment; Mc-macrochaetae; me-microchaetae, bot-bothriotrichial complexes. ZSI = Zoological Survey of India (Kolkata).

Results
Two collembolan species belonging to two genera of the family Entomobryidae were identified as a result of the survey of which both the species of collembola, Acanthurella
Genus Acanthurella Borner, 1906

Acanthurella satkosiaensis n. sp.


Paratypes: 1 example on slide, same data as Holotype. Abd. IV 5.5-6 times as long as Abd. III along dorsal middle. Tenaculum with 4+4 teeth and one strong, striate, macrochaetae. Abd. IV postero-laterally with 1+1 ciliate macrochaetae (Fig.5F). Accessory macrochaetae of bothriotrichial complexes on Abd. II-IV ciliate, broadly modified or fan-shaped (Fig.4A). Ventral tube with anteriorly with 4+4 large ciliate setae (Fig. 4B). Manubrium ventrally covered with scales and ciliate setae. Manubrial distal end at the base of dens with ‘5’ strong, thick, long, striate, spine-like macrochaetae (Fig. 4C). Dens with two rows of spines and scales and ciliate setae (Fig.4D). Body scales. Scales rounded and finely striate (Fig. 4F). Scales present on head, body, Ant. I & II, whole leg and ventral side of furcula; scales on dens narrower than on body. Ecology. Collected from leaf litter of Silate Nullah, Banigocha East, district Nayagarh, Odisha.

Etymology. The new species is named after type locality, Satkosia Tiger Reserve, Odisha, India.

Genus Lepidocyrtus Bourlet, 1839

Lepidocyrtus (Cinctocyrtus) satkosiaensis n. sp.

Material examined. Holotype: male on slide, INDIA, Odisha, Satkosia Wild Life Sanctuary, Buguda, Banigocha West, Baisapally, district Nayagarh, Latitude 20°24'841" North and 84°47'406" East, date 19.xi.2016, coll. G. P. Mandal (Registration No. 2507/H14) and 1 example in ethyl alcohol, same data as Holotype (Registration No. 2396/ H14) deposited in the National Zoological Collection, Zoological Survey of India, (Kolkata).

Description. Body length up to 1.2 mm (excluding appendages). Colour pattern. Ground colour pale yellow. Eyes blue-black. Blue pigment patch on lateral margin of head and Thorax II. Ant. III & IV. blue pigment distally, Ant. I & II devoid of pigment. Abd. V & VI, with blue pigment patch anteriorly (Fig. 1). Head. Antennae 1.5 times as long as cephalic diagonal. Ratio of segments of antennae I: II: II: IV = 1: 1.7: 1.5: 2.5. Ant. IV without antennal apical bulb (Fig. 2A). Eyes 8+8, G and H smaller. Cephalic scales & setae shown in Fig. 2B. Prelabral & labral setae 4/5, 5, 5, 4 all smooth. Lateral process of labial palp slightly curved, as thick as normal setae, with tip reaching apex of subapical tooth (Fig.4E). Body scales. Scales rounded and finely striate (Fig. 4F). Scales present on head, body, Ant. I & II, whole leg and ventral side of furcula; scales on dens narrower than on body. Ecology. Collected from leaf litter of Silate Nullah, Banigocha East, district Nayagarh, Odisha.


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Genus Lepidocyrtus Bourlet, 1839

Lepidocyrtus (Cinctocyrtus) satkosiaensis n. sp.
distal unpaired tooth minute, lateral teeth well developed (33% from unguis base); unguiculus truncate, with an inner tooth, tenant hair clavate, sub equal to unguis. (Fig.2F). Smooth setae on L III short (0.6 times the total unguis). Tibiotarsus with largest Mc 1.4 times maximum width of tibiotarsus, finely serrated Mc (Fig.3A). Ventral tube not scaled, with 8+8 ciliate setae anteriorly. Posterior face with large no. of smooth ciliated setae (Fig.3B). Tenaculum with 4 teeth and one large, thick seta. Abd. V & VI with large no. of Mc (Fig.3C). Ratio manubrium/dens such as 1/1.06. Manubrium has thick setae laterally (Fig.3D). Manubrial plate with 3 inner chaetae, 2 outer chaetae and 2 pseudopores (Fig.3E). Dental plate with rounded tubercle (Fig. 3F); length of not annulated terminal dens/micro ratio = 2. Mucro with subapical tooth equal to terminal one. Mucronal spine smooth surpassing the subapical tooth (Fig.4A). Chaetotaxy. Large number of ciliated Mc on anterior margin of head (Fig.4B). Abd. III & Abd. IV with anterior side trichobothria close to each other (Fig.4C). Smooth microchaetae present on the body. Body scales rounded, oval & truncate (Fig.4D).

Ecology. Found in the leaf litter of nullah near Buguda, Banigocha West, Baisapally. Etymology. The new species is named after type locality Banigocha West, Baisapally.

Discussion
Bornor, 1906 erected Acanthurella, based on the presence of dental scales, dental spines, body scales all rounded and finely striate; few macrochaetae on dorsal body except collar, antennae without apical bulb. Presently, nine species in the genus are known from the world [35] and only one species, Acanthurella betlaensis Mandal et al. 2016 was known from India. The second one is described in this paper. The new species, Acanthurella satkosiaensis n.sp. from Satkosia Wild Life Sanctuary, Odisha can be separated from other Acanthurella species by its claw structure, colour pattern and double rows of dental spine. It is most close to Acanthurella betlaensis in colour pattern of Antennae, Th. II & Abd. V & VI, unguiculus structure, mucronal shape, ‘5’ strong, long, thick, striate, spine-like setae at distal end of manubrium; it differs from Acanthurella betlaensis in absence of transverse pigment on anterior side of Abd. IV (present in A. betlaensis), unguis with ‘4’ inner teeth (2 in A. betlaensis), trochanteral organ with about 45–46 smooth spiny setae (‘40’ in A. betlaensis), two rows of dental spines (multiple rows in A. betlaensis), less no. of macrochaetae on collar, presence of 1+1 macrochaetae of Abd. IV (postero-lateral), chaetotaxy of legs and body size. Remarkably, both the species A. betlaensis & A. satkosiaensis n. sp. having ‘5’ strong, thick, long, striate, spine like setae at the distal end of manubrium. Cinctocyrtus was established by Yoshii & Suhardjono, 1989 as a subgenus of Lepidocyrctus Bourlet, 1839 based on the rounded tubercle at inner side of basal dentes. This subgenera is characterized by 8+8 ommatidia, 4 segmented antennae, apical bulb present on Ant. IV, dens without spines, bidentate mucro without accessory spinlet. Most members of Cinctocyrtus are distributed in Southern Asia, particularly in Indonesia, Thailand, Malaysia. So far 11 species were described around the world [35]. Baquero et al. [36] described Lepidocyrctus (Cinctocyrtus) kuhlensis from Himachal Pradesh, India but later it was transferred to Lepidocyrctus (Setogaster) kuhlensis due to mucronal spine with spinelet. Presently, only single species Lepidocyrctus (Cinctocyrtus) medius Schaffer, 1898 was recorded from India, the second one is described in this paper. The new species, Lepidocyrctus (Cinctocyrtus) satkosiaensis n. sp. has large no. of macrochaetae on anterior margin of head, trochanteral organ with 12 chaetae, unguis with 4 teeth and scale on furcula with both dorsal & ventral side. The new species is similar with Lepidocyrctus (Cinctocyrtus) medius Schaffer, 1898 having clavate tenant hair, truncate unguiculus and mucronal spine smooth but differences between Lepidocyrctus (Cinctocyrtus) medius Schaffer, 1898 and this new species recorded in the Table 1.

Table 1. Differential characters between Lepidocyrctus (Cinctocyrtus) medius Schaffer, 1898 and Lepidocyrctus (Cinctocyrtus) satkosiaensis n. sp.

<table>
<thead>
<tr>
<th>Character</th>
<th>L. (Cinctocyrtus) medius Schaffer, 1898</th>
<th>L. (Cinctocyrtus) satkosiaensis n. sp.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ant III. Organ with</td>
<td>two rounded, short rods/sensilla</td>
<td>live medium size slender sensilla</td>
</tr>
<tr>
<td>Eye, number of ommatidia</td>
<td>8+8</td>
<td>8+8</td>
</tr>
<tr>
<td>scales on leg</td>
<td>absent</td>
<td>absent</td>
</tr>
<tr>
<td>Th. II projected over head</td>
<td>considerably</td>
<td>considerably</td>
</tr>
<tr>
<td>setae on ventral tube, anterior side</td>
<td>5+5</td>
<td>8+8</td>
</tr>
<tr>
<td>scales on furcula</td>
<td>ventral side</td>
<td>both ventral &amp; dorsal</td>
</tr>
<tr>
<td>Trochanteral organ, chaetae number</td>
<td>10</td>
<td>12</td>
</tr>
<tr>
<td>unguis inner teeth</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>unguis pair teeth% from basis</td>
<td>50</td>
<td>35</td>
</tr>
<tr>
<td>Tenant hair</td>
<td>clavate</td>
<td>clavate</td>
</tr>
<tr>
<td>unguiculus shape</td>
<td>truncate</td>
<td>truncate</td>
</tr>
<tr>
<td>manubrial thick setae, laterally</td>
<td>absent</td>
<td>present</td>
</tr>
<tr>
<td>mucronal spine</td>
<td>smooth</td>
<td>smooth</td>
</tr>
<tr>
<td>Filiform chaeta on lateral Abd. II</td>
<td>absent</td>
<td>absent</td>
</tr>
<tr>
<td>Body length</td>
<td>1.6 mm</td>
<td>1.2 mm</td>
</tr>
</tbody>
</table>

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Fig 1: *Acanthurella satkosiaensis* n.sp.: Habitus, dorso-lateral view;

Fig 2: *Acanthurella satkosiaensis* n.sp.: 2A: Ant. IV without apical bulb; 2B: Cephalic scales & setae; 2C: Mouthparts; 2D: Mc on collar; 2E: Mc on precoxae; 2F: Mc on coxae;

Fig 3: *Acanthurella satkosiaensis* n.sp.: 3A: Trochanter setae; 3B: Femur Mc; 3C: Tibia tarsus setae; 3D: Unguis; 3E: Trochanteral organ; 3F: Mc on Abd. IV;

Fig 4: *Acanthurella satkosiaensis* n.sp.: 4A: bot. complex on Abd.II; 4B: Ventral tube; 4C: Manubrial distal thick setae; 4D: Dental spine; 4E: Macro; 4F: Abd. Scales.

Fig 1: *Lepidocyrtus* (*Cinctocyrtus*) *satkosiaensis* n. sp.: Habitus, dorso-lateral view;

Fig 2: *Lepidocyrtus* (*Cinctocyrtus*) *satkosiaensis* n. sp.: 2A: Ant. IV with apical bulb; 2B: Ant. III sensilla; 2C: Mouthparts; 2D: Cephalic end setae; 2E: Trochanteral organ; 2F: Unguis inner teeth;
References