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

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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], Bajjal^[12-14], Salmon^[15-17], Choudhuri and Roy^[18], Yosii^[19] Prabho^[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 & Arba^[33] has been first described a new species of Hypogastruridae (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 were studied under a Leica Digital Module (DM 2500) microscope and identified using keys and illustrations after Christiansen and Bellinger^[34]. Photographs were taken under a Leica Digital Module R (DMR) microscope using amounted Leica DFC 295 digital camera, and were enhanced with Photoshop CS4 (Adobe Inc.).

All specimens and permanent 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; mc-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*

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satkosiaensis n. sp. and *Lepidocyrtus* (*Cinctocyrtus*) *satkosiaensis* n. sp. was described, illustrated, and diagnosed from Satkosia Tiger Reserve, Odisha, India. The current systematic position, diagnosis of the genus, detailed descriptions of each species and differences between closely related species and ecology are also discussed.

Taxonomic position

Family entomobryidae schäffer, 1896

Subfamily lepidocyrtinae wahlgren, 1906 Sensu Szeptycki (1979)

Genus *Acanthurella* Borner, 1906

1906. *Acanthurella* Borner, *Mitt. Naturalist. Mus. Hamburg*, 23:147-188.

Type species: *Acanthurella braueri* Borner, 1906

***Acanthurella satkosiaensis* n.sp.**

(Figs.1–4)

Material examined. Holotype: female on slide, INDIA, Odisha, Satkosia Wild Life Sanctuary, Silate Nullah, Banigocha East, district Nayagarh, Altitude 265 ft, Latitude 20°31'065" North and 84°47'406" East, date 18.xi.2016, coll. G. P. Mandal (Registration No. 2401/H14) deposited in the National Zoological Collection, Zoological Survey of India, (Kolkata). Paratypes: 1 example on slide, same data as Holotype (Registration No. 2211 / H14) and 1 example in ethyl alcohol, same data as Holotype (Registration No. 2505/H14) deposited in the National Zoological Collection, Zoological Survey of India, (Kolkata).

Description: Body length up to 2.0 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: III: 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 labial papilla. Sub apical setae of maxillary outer lobe large, subequal in length; three smooth hairs on sublobal plate (Fig. 2C). Thorax & legs. Dorsal macro chaetae shown in Fig. 2D. Relative length ratio of Th. II and Th. III as 2.6: 1. Th. II & Th. III without macrochaetae. Legs with macrochaetae & mesochaetae. Precoxae with a straight row of 9-10 ciliate macrochaetae (Fig. 2E). Coxae with series of mid-line laterally consists of 14-16 ciliate macrochaetae (Fig.2F). Trochanter with mesochaetae & macrochaetae anteriorly three rows consists 8-10 setae and posteriorly with one row, 14-15 setae (Fig.3A). Femur with strong, large, ciliate macrochaetae (Fig.3B). Tibiotarsus with one inner outstanding-ciliate macrochaetae acuminate but tapered only at tip. Differential setae, strong, ciliate. Dorsally with 4-5 long, ciliate macrochaetae (Fig. 3C). Unguis with one outer and & two inner paired at 0.33x distance from base, inner median one at 70x and distal one 90x distance from base (Fig. 3D). Unguiculus slender and acuminate with outer edge serrate. Tenant hair strong clavate and shorter than unguis. Trochanteral organ with about 45–46 smooth spiny setae (Fig. 3E). Abdomen. Ratio of segments of Abd. I : II : III : IV : V : VI as 1 : 1.6 : 2.1 : 11.6 : 1 : 0.4.

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.3F). Accessory microchaetae 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). Mucro bidentate, apical tooth smaller than subapical one, mucronal basal spine short 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.

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

Genus *Lepidocyrtus* Bourlet, 1839

1839. *Lepidocyrtus* Bourlet, Mémoire sur les Podures. *Mémoires de la Société Royale des Sciences, de L'Agriculture et des Arts de Lille*, 1, 377–417.

Subgenus *Cinctocyrtus* Yoshii & Suhardjono, 1989

1989. *Cinctocyrtus* Yoshii & Suhardjono, *Acta Zoologica Asiae Orientalis*, 1, 23–90.

***Lepidocyrtus* (*Cinctocyrtus*) *satkosiaensis* n. sp.**

(Figs. 1–4 & Table 1)

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°43'428" East, date 19.xi.2016, coll. G. P. Mandal (Registration No. 2506/H14) deposited in the National Zoological Collection, Zoological Survey of India, (Kolkata). Paratypes: 1 example on slide, and 4exs. in ethyl alcohol, same data as Holotype (Registration No. 2507 / H14) and 8 examples 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 (without head and furca) upto 1.2 mm. Body colour pale white/greyish, Antennae darker grey, with distal half of Ant. III & whole Ant. IV pale violet. Pale violet patches on legs, especially on coxa & trochanter (Fig.1). Head. Scales only head and body. All antennal segments without scales. Ratio antennal: cephalic diagonal = 1.54, ratio Ant. I /II /III/ IV such as 1: 1.5: 1.6: 2.1. Ant. IV with apical bulb and differentiated sensilla (Fig.2A). Ant. III organ composed by five medium size smooth sensilla (Fig.2B). Eyes 8+8. Prelabral and labral chaetae 4/554, all smooth, outer maxillary palp with 2 smooth macrochaetae. Lateral process of outer labial papilla weak, short & pointed. Mandible with 4 teeth. Labium chaetae smooth (Fig.2C). Two long, broad, macrochaetae present on head end/posterior, other setae are short, smooth and slender (Fig. 2D). Cephalic scales are rounded, oval & truncate. Anterior margin of head with large nos. of long, ciliated macro chaetae. Body. Th. II considerably projected over head. Th. II with macrochaetae. Scales on dorsal and ventral head, body and ventral, dorsal manubrium and dens. Trochanteral organ composed of 12-14 chaetae (Fig. 2E). Unguis with basal paired teeth at 35% the basis of inner edge; 2 unpaired teeth at 60% of inner edge,

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/mucro 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.

Etyymology. The new species is named after type locality.

Discussion

Borner, 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,

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 *Lepidocyrtus* 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 *Lepidocyrtus (Cinctocyrtus) kulluensis* from Himachal Pradesh, India but later it was transferred to *Lepidocyrtus (Setogaster) kulluensis* due to mucronal spine with spinelet. Presently, only single species *Lepidocyrtus (Cinctocyrtus) medius* Schaffer, 1898 was recorded from India, the second one is described in this paper. The new species, *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. The new species is similar with *Lepidocyrtus (Cinctocyrtus) medius* Schaffer, 1898 having clavate tenant hair, truncate unguiculus and mucronal spine smooth but differences between *Lepidocyrtus (Cinctocyrtus) medius* Schaffer, 1898 and this new species recorded in the Table 1.

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

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



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

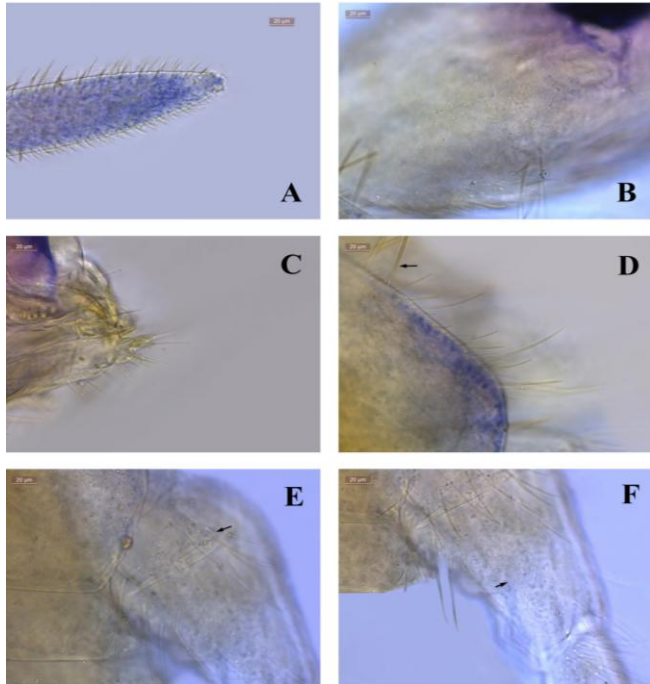


Fig 2: *Acanthurella satkosiaensis* n.sp.: 2A: Ant. IV without apical bulb; 2B: Cephalic scales & setae; 2C: Mouthparts; 2D: Mc on collar; 2E: Mc on precoxae; 2F: Mc on coxae;

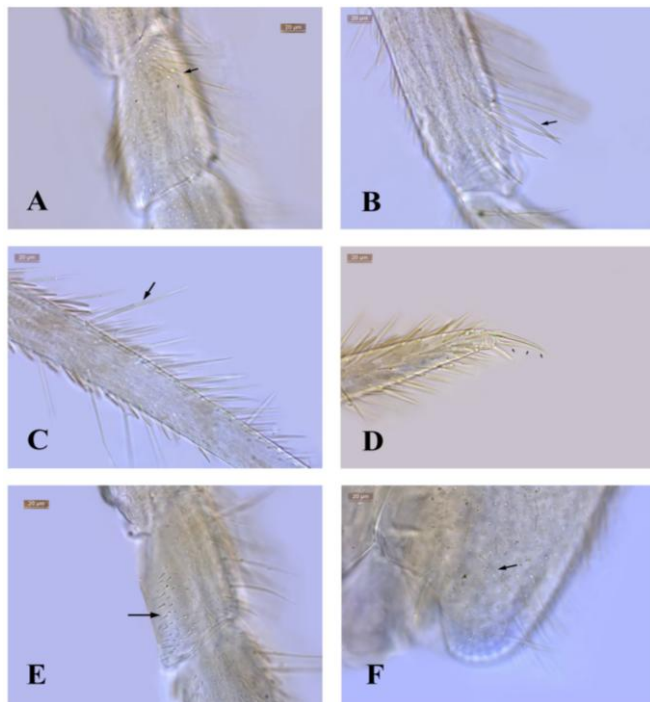


Fig 3: *Acanthurella satkosiaensis* n.sp.: 3A: Trochanter setae; 3B: Femur Mc, 3C: Tibia tarsus setae; 3D: Unguis, 3E: Trochanteral organ; 3F: Mc on Abd. IV;

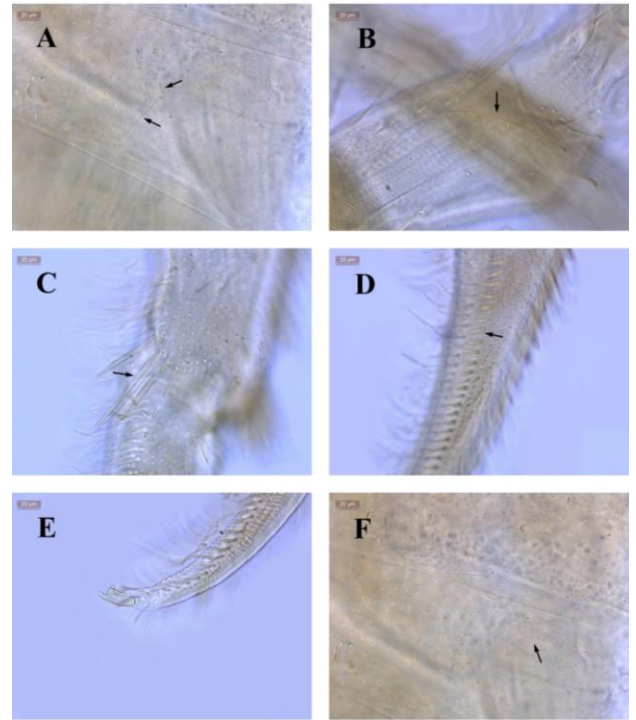


Fig 4: *Acanthurella satkosiaensis* n.sp.: 4A: bot. complex on Abd.II; 4B: Ventral tube; 4C: Manubrial distal thick setae; 4D: Dental spine; 4E: Mucro; 4F: Abd. Scales.



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

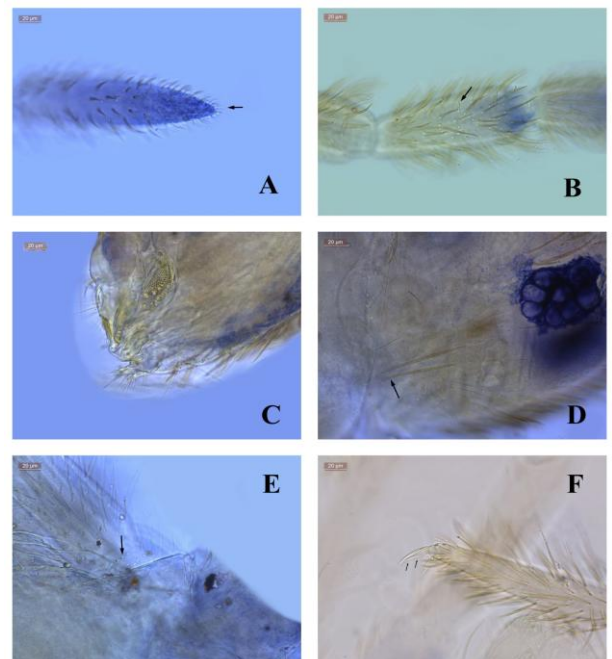


Fig 2: *Lepidocyrtus (Cinctocyrtus) satkosiaensis* n. sp.: 2A: Ant. IV with apical bulb; 2B: Ant. III sensilla; 2C: Mouthparts; 2D: Cephalic end setae; 2E: Trochanteral organ; 2F: Unguis inner teeth;

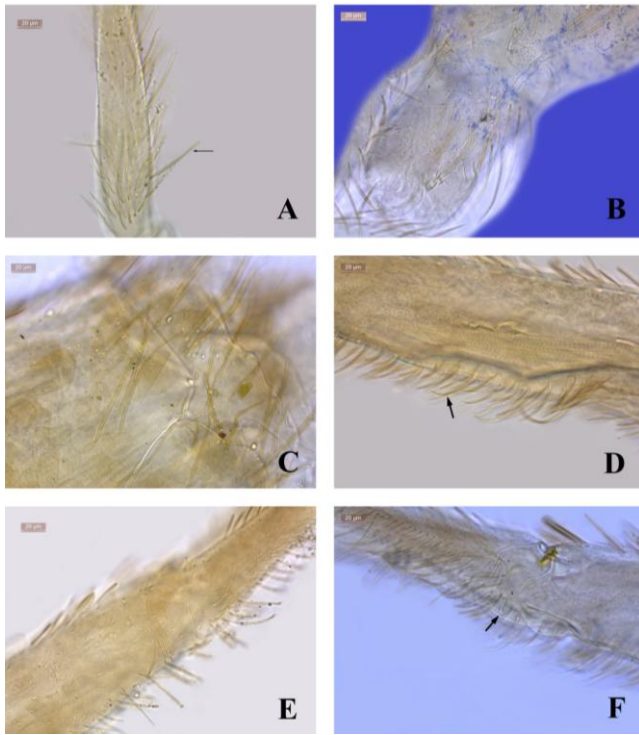


Fig 3: *Lepidocyrtus (Cinctocyrtus) satkosiaensis* n. sp.: 3A: Mc. on tibia-tarsus; 3B: Ventral tube setae anterior; 3C: Abd.V-VI setae; 3D: Manubrial thick setae; 3E: Manubrial plate; 3F: Dental tubercle;

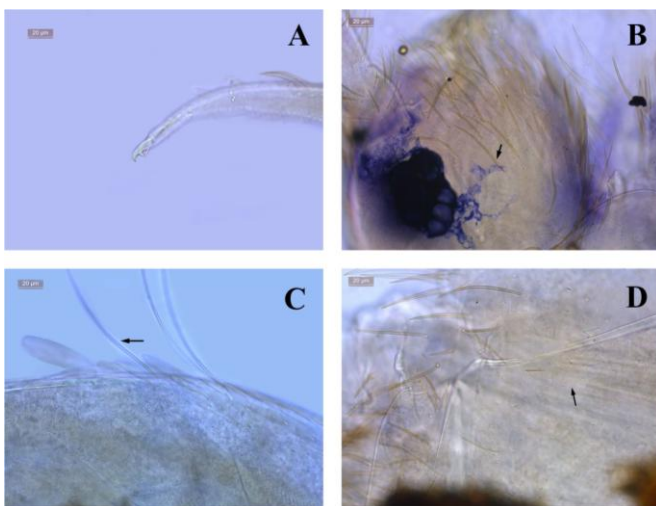


Fig 4: *Lepidocyrtus (Cinctocyrtus) satkosiaensis* n. sp.: 4A: Mucro; 4B: Cephalic setae; 4C: bot on Abd. III & IV; 4D: Abdominal scale.

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