

## New records of Collembola (Hexapoda) from West Bengal with notes on their Taxonomy

Pritha Mandal, Guru Pada Mandal\*, K. K. Suman, K. K. Bhattacharya and Dhriti Banerjee

*Apterygota Section, Zoological Survey of India, Prani Vigyan Bhawan,  
M Block, New Alipore, Kolkata- 700053, West Bengal, India*

### Abstract

This study deals with a total of 21 species of collembola under 14 genera of 6 families, which has been recorded for the first time from the state of West Bengal. A descriptive note on their taxonomy with proper illustrations is provided with an approach to improve the faunistic understanding of collembolans from the state. The new records were found from the collections of the survey undertaken during the year 2018 to 2022 as well as examining some of the previous state survey materials of the NZC depository at Apterygota section. Compiling previous literature on collembola from the state, the current study has updated the collembolan taxon list from 75 species to a total of 96 species.

**Keywords:** Entomobryomorpha, springtails, soil invertebrates, taxonomy, new record.

### Introduction

Collembolans are minute, wingless, and highly abundant soil organisms that contribute to soil structure formation and nutrient cycling through litter decomposition and fungal foraging (Hopkin, 1997). They exhibit a range of habitat preferences such as forest litter, desert, mountain snow caps, caves and littoral zone. Some members of the Tribe Cyphoderinae were also found to invade termite mounds and ant nests (Delamare-Deboutteville, 1948). Genera such as *Lepidocyrtus*, *Salina*, *Callyntrura*, *Dicranocentroides*, *Cyphoderus*, and *Homidia* are ubiquitous in distribution while, *Tomocerus* are limited to high altitudes, and *Spheredia*, *Sminthurus*, *Xenylla* are prevalent on agroecosystems of the plains.

Pioneering work on Indian Collembola was undertaken by Imms (1912), later researchers like Mitra (1966, 1967, 1974, 1995), Hazra & Chowdhari (1981), and Mandal (2011) contributed to this field. Mandal (2018) reported a total of 342 species of collembola from India, out of which only 75 collembolan species belonging to 13 families were studied from the state of West Bengal (Mandal *et al.*, 2018). The state exhibits a wide range of landforms, ecosystems, climatic

variations, and soil types, starting from the Himalayan terai in the north, dry deciduous forest in the east, and the mangroves at the coast of the Bay of Bengal. Such diverse eco-geographic regions favor the occurrence of a large number of discriminative collembolan species therefore, more exploration and extensive study is required from the state to enrich the knowledge of the collembolan taxonomy and diversity.

### Materials and methods

Several surveys and explorations of various habitats from the state were taken using different collection methods (aspirator, pan-trap, soil extraction, bush beating, etc.) during this study. The collected specimens were preserved in 70% alcohol and carried to the laboratory for later studies. Family-wise sorting of specimens was done under a Leica M205A stereo microscope attached to a Leica DMC6200 camera. Individual specimens were de-pigmented with Nesbitt's solution (Krantz, 1978) and later mounted on slides using Hoyer's media (Krantz, 1978) under a cover slip. Slides were dried on a hot plate for 48 - 72 hours until completely dried. Taxonomic identification and chaetotaxy

study of the fresh specimens were carried out under Leica 2500 D binocular microscope following the standard key of Bellinger *et. al.*, 1996 – 2023. The identified specimens were deposited at the NZC of the Zoological Survey of India.

**Abbreviations used in text:** Abd.—Abdominal segment; Ant.—antennal segment; mac—macrochaetae; PAO—postantennal organ; Th.—thoracic segment; Tita—tibiotarsus; VT—ventral tube; NZC—National Zoological Collection.

## Results

### Systematic Account

**Class Collembola** Lubbock, 1870 sensu Bellini & al, 2022

**Family Dicyrtomidae** Börner, 1906, sensu Deharveng, 2004

**Subfamily Dicyrtominae** Richards, 1968 sensu Bretfeld, 1999

**Genus *Calvatomina*** Yosii, 1966

**Type species:** *Dicyrtomina (Calvatomina) cruciata* Yosii, 1966

**Genus diagnosis:** Globular body, some abdominal segments fused, Ant IV much shorter than third. Neosminthuroid setae present.

1. ***Calvatomina trivandran*** Prabhoo, 1971 (Figure1, Plate – 1)

1971, *Dicyrtomina trivandran* Prabhoo, *Bull. Ent.* **12**: 44-31; figs. 24-31.

**Material examined:** 17 exs in alcohol, India: West Bengal: Kunti river embankment, collected from leaf litter, Singur, Hooghly dist., 09.vii.2022, 22.872°N, 88.277°E, coll. P. Mandal, (3303/ H14).

**Diagnosis:** Colour light brown with longitudinal bands of yellowish brown on the habitus, scattered deep blue patches present on the ventral area and legs. Ant.I-III yellowish with black ridges. Manubrium and dens joining has a black pigment patch. Body clothed with short plain setae. Unguis with pseudonychia and median teeth formulae- 1,2,2. Axial filament of the fore leg is longer, lacks clavate tenent hair. Nine dorsal smooth setae on manubrium, ratio of dens: mucro-2.93:1, inner lamella of mucro with 37-39 and outer lamella with 30-32 serrations.

**Distribution:** India: West Bengal (Hooghly\*); Jharkhand, Kerala.

**Remarks:** Endemic to India. First time recorded from West Bengal.

**Family Hypogastruridae** Börner, 1906

**Genus *Xenylla*** Tullberg, 1869

**Type species:** *Xenylla maritima* Tullberg, 1869

**Genus diagnosis:** Four or five ocelli present on each side, PAO absent. Apical organ of Ant IV formed with 2 papillae. Mandible without long apex, apical teeth large.

2. ***Xenylla reducta*** Prabhoo, 1971 (Figure2, Plate – 1)

1971. *Xenylla reducta* Prabhoo, *Oriental Insects*, **5**: 7-9, Figure 28-32.

**Material examined:** 58 exs in alcohol, India: West Bengal: East Kolkata wetlands, collected from soil, Nalban, Kolkata dist., 25.iv.2019, 22.29°N, 88.22°E, coll. G.P. Mandal, (2660/ H14)

**Diagnosis:**

Body setae less in number. Unguis without tooth, 2 non-clavate or weakly clavate tenent hair. Anal spines short, curved and mounted on distinct papillae.

**Distribution:** India: West Bengal (Kolkata\*); Odisha, Kerala.

**Remarks:** Endemic to India. First time recorded from West Bengal.

**Family Hypogastruridae** Börner, 1906

**Genus *Xenylla*** Yosii, 1966

**Type species:** *Xenylla maritima* Tullberg, 1869

3. ***Xenylla welchi*** Folsom, 1916 (Figure3, Plate – 1)

1916, *Xenylla welchi* Folsom, *Pros. of the USNM*, **50**: 495,497

**Material examined:** 70 exs in alcohol, India: West Bengal: Rajarbathan village, collected from vegetable litter, Singur, Hooghly dist., 13.ii.2022, 22.872°N, 88.277°E, coll. P. Mandal; (3334/H14).

**Diagnosis:**

Adult body length average 0.8mm. 5+5 ommatidia on black eye patches. Body usually violate to blackish. Length of head: antennae-1.14: 1. Unguis unidentied, unguiculus absent. Knobbed tenent hair present, formula- 1, 2, 2. Ratio of dens: mucro – 2.03: 1. Mucro and dens are demarked by an articulation. Broad mucro is characteristic.

**Distribution:** India - West Bengal (Hooghly\*), Kerala.

Elsewhere: Europe, Australia, Caribbean mainland, Africa, America.

**Remarks:** Newly recorded from West Bengal.

**Family** *Brachystomellidae* Stach, 1949

**Genus** *Brachystomella* Ågren, 1903

**Type species:** *Brachystomella maritima* Ågren, 1903

**Genus diagnosis:** PAO present, 8+8 eyes present, Pseudocelli absent. No papillae on prothorax. Mandible not present quadrate maxilla with many anteriorly projecting teeth. Farcula present with lamellate mucro.

4. ***Brachystomella contorta*** Denis, 1931 (Figure4, Plate – 1)

1931, *Brachystomella contorta* Denis, *Boll. Lab. Zool. Portici*, **25**, 69, 111-120.

**Material examined:** 1 exs on slide, India: West Bengal: Jute Agricultural Research Institute, Barrackpore, North 24 Parganas dist., 15.x.1980, 22.75°N, 88.42°E, coll. S. K. Mitra, (903/H14).

**Diagnosis:**

Average body length 0.82 mm, colour deep purple, dark pigment scattered all over the body. Finely granulated integument with short and simple setae. Ant.IV with apical bulb with two guard setae, presence of six sensory setae. PAO rosette shaped with 6-7 peripheral elements, eyes with 8+8 subequal ocelli. Elongated buccal cone with four pre labral setae. Unguis with one small inner tooth and a rarely visible lateral tooth. Furcual short, dens with dorsal granulations and 5 setae. Spoon shaped mucro present with broad outer lamellae.

**Distribution:** India: West Bengal (North 24 Parganas\*), Kerala.

Elsewhere: Cosmopolitan.

**Remarks:** Newly recorded from West Bengal.

**Family** *Isotomidae* Schäffer, 1896

**Subfamily** *Proisotominae* Stach, 1947

**Genus** *Ballistura* Börner, 1906

**Type species:** *Isotoma schoetti* Dallon Torre, 1895

**Genus diagnosis:** Eyes present. Body cuticle not granulated. Antenna and legs lacks truncate or blunt setae. Straight projecting setae absent on Abd VI. Manubrium without ventral setae. Dens have smooth surface dorsally and more than 1+1 ventral setae. Mucro slightly longer.

5. ***Ballistura fitchi*** (Denis, 1933) Potapov, 2001 (Figure5, Plate – 1)

1933. *Proisotoma fitchi* Denis, *Boll. Lab. Zool. Portici*, **27**: 234-235, 315, 319; figs.14-20.

**Material examined:** 1 exs on slide, India: West Bengal: Jute Agricultural Research Institute, Barrackpore, North 24 Pargana dist., 18.viii.1980, 22.75°N, 88.426°E, coll. S. K. Mitra, (900/H14).

**Diagnosis:** Body deep blue pigmented, PAO ovulated. Unguis without any teeth, a small setae present at its base. Two clavate tenent hair present. Dens roughly lobulated on the dorsal side. Mucro bidentated and lamellate.

**Distribution:** India: West Bengal (North 24 Parganas), Tamil Nadu.

Elsewhere: Brazil, Caribbean mainland, Europe, Mediterranean, Malaysia.

**Remarks:** First time recorded from West Bengal.

**Family** *Isotomidae* Schäffer, 1896

**Subfamily** *Proisotominae* Stach, 1947

**Genus** *Cryptopygus* Willem, 1901

**Type species:** *Cryptopygus antarcticus* Willem, 1902

**Genus diagnosis:** Body surface smooth, covered with simple setae. Mandible with molar plate, PAO with simple rim. Abd V and Abd VI separated. Dens larger than manubrium and 2-6 ventral manubrial setae present. Mucro bidentated with lamellae.

6. ***Cryptopygus indicus*** Brown, 1932 (Figure6, Plate – 1)

1932. *Proisotoma (Isotomina) indica* Brown, *Proc. Haw. Ent. Soc.* **8**: 35-36; figs.1-5.

**Material examined:** 4 exs in alcohol, 1 on slide, India: West Bengal: Village Karicha, collected from leaf litter, Singur, Hooghly dist., 09.vii.22, 22.872°N, 88.277°E, coll. P. Mandal, (3337/ H14).

**Diagnosis:**

Body length 0.75 mm, general colour dull, black pigment on the head. Ocelli 5+5, partly pigmented. Uniformly scattered short setae all over the body, posterior segments with slightly larger ones. PAO ovoid with a slight constriction in middle. Unguis monodentated, tenent hair absent. Two strong ventral bristles present at the apex of manubrium. Dens dorsally crenulated, mucro with two equal size teeth.

**Distribution:** India: West Bengal (Hooghly\*), Assam, Odisha, Tamil Nadu.

**Remarks:** Endemic to India. Newly recorded from West Bengal.

**Family** Isotomidae Schäffer, 1896

**Subfamily** Proisotominae Stach, 1947

**Genus** *Cryptopygus* Willem, 1901

**Type species:** *Cryptopygus antarcticus* Willem, 1902

7. *Cryptopygus tridentatus* (Handschin, 1929) (Figure7, Plate – 2)

1929, *Proisotoma tridentate* Handschin, *Revue Suisse de Zoologie*, **36** (16): 229-262.

**Material examined:** 50 exs in alcohol, 1 on slide, India: West Bengal: Susunia forest, collected from leaf litter, Bankura dist., 01.xii.2022, 23.399°N, 86.973°E, coll. G. P. Mandal, (3279/H14).

**Diagnosis:**

Body dark blue with paler extremities and abdominal areas, pigmentation more pronounced towards the back. Segmentation areas are lightly coloured. 8+8 ommatidia present; PAO elongated, oval and with lateral thickening. Abd V and Abd VI fused. Unguis with a internal tooth, empodial appendages with basal lamella and a strong club tenent hair. Dents are heavily ringed. Mucro tridented with short and straight apical tooth.

**Distribution:** India: West Bengal (Bankura\*), Tamil Nadu.

**Remarks:** Endemic to India. First time recorded from West Bengal.

**Family** Isotomidae Schäffer, 1896

**Subfamily** Isotominae Schäffer, 1896

**Genus** *Isotoma* Bourlet, 1839

**Type species:** *Cryptopygus antarcticus* Willem, 1902

**Genus diagnosis:** Eyes 6+6 or 8+8. Body setae normal, ventral manubrial setae spine like. Distinct PAO present. Three or more teeth present on mucro. Pseudonychia absent, small lateral teeth on unguis. Tita without clavate setae. Abd II-IV lack bothriotricha. Spines absent from crenulated dens.

8. *Isotoma plumosa* (Salmon, 1969) Lawrence, 1978 (Figure8, Plate – 2)

1969. *Rhodanella plumosa* Salmon, *Zool. Publ. Victoria Univ. Wellington*, **51**:47: figs.29-34.

1978. *Isotoma plumosa* Lawrence, *Rev. Ecol. Biol. Sol*, **15**:369.

**Material examined:** 20 exs in alcohol, 1 on slide, India: West Bengal: Neora Adventures Base Camp, Lava Park, Darjeeling dist., 26.xi.2019, 27.085°N, 88.65°E, coll. G.P.Mandal, (2931/H14).

**Diagnosis:**

Length about 0.82mm. Ground colour pale brown with irregular dark brown patches. Head: Antenna ratio – 1: 1.12. Antennae uniformly brown, darker at the apex. Coxa and lateral tooth with gray patches. PAO ovoid, presence of pin setae on Ant IV unguis with a lateral tooth, unguiculus with a conspicuous corner tooth. Mucro with 4 teeth, without basal spine.

**Distribution:** India: West Bengal (Darjeeling\*), Assam, Sikkim.

Elsewhere: Himalayan Region.

**Remarks:** Newly recorded from West Bengal.

**Family** Paronellidae Börner, 1913

**Subfamily** Paronellinae Börner, 1906 sensu Zhang et al, 2019

**Genus** *Cyphoderus* Nicolet, 1842

**Type species:** *Delamarerus immsi* Mitra, 1976

**Genus diagnosis:** Body without pigmentation and eyes. Mandibles reduced. Lanceolated unguiculus with a broad outer tooth. Dens crenulated with large strong leaf-like scales.

9. *Cyphoderus assimilis* Börner, 1906 (Figure9, Plate – 2) 1906, *Cyphoderus assimilis* Börner, *Mitt. Naturhist. Mus. Hamburg* **23**:181

**Material examined:** 1 exs in alcohol, 1 on slide, India: West Bengal: Village Rajarbathan, collected from rotten banana bark, Singur, Hooghly dist., 25.xii.2023, 22.869°N, 88.279°E., coll. P. Mandal, (3339/H14); 21 exs in alcohol, 1 ex. on slide, India: West Bengal: Near Pond, Pathar Beria, collected from wood log, South 24 Parganas dist., 18.xi.2022, 22.464°N, 88.124°E, coll. K.K.Bhattacharya, (3301/H14).

**Diagnosis:**

Absence of body pigmentation, Head lacks eyes and PAO, with four segmented antennae. Unguis of the foreleg is relatively larger and with a basal and two small distal teeth, single curved tenent hair present. Dens with two rows of sphere shaped scales, six in number. Mucro relatively large, straight and bidented.

**Distribution:** India: West Bengal (Hooghly\*, South 24

Parganas\*), Andhra Pradesh, Maharashtra, Odisha.  
Elsewhere: South Africa, South East Asia, Mediterranean.

**Remarks:** First time recorded from West Bengal.

**Family** Paronellidae Börner, 1913

**Subfamily** Paronellinae Börner, 1906 sensu Zhang et al, 2019

**Genus** *Pseudocyphoderus* Imms, 1912

**Type species:** *Pseudocyphoderus annandalei* Imms, 1912

**Genus diagnosis:** Mouth cone directing downwards, mandibles present. Unguis with three teeth and without inner projection. Dens with feather like scales and setae. Small mucro, teeth may present or absent.

**10. *Pseudocyphoderus annandalei*** Imms, 1912 (Figure11, Plate – 2)

1912. *Pseudocyphoderus annandalei* Imms, *Proc. Zool. Soc. Lond.*: **81**, 116-117; figs. 87-89.

1992. *Cyphoderus (Pseudocyphoderus) annandalei* Yosii, *Contr. boil. Lab. Kyoto Univ.* **28**: 113.

**Material examined:** 50 exs in alcohol, 1 exs on slide, India: West Bengal: Jute Agricultural Research Institute, Barrackpore, North 24 Pargana dist., 03.vii.1984, 22.872°N, 88.277°E, coll. S. K. Mitra, (1955/H14).

**Diagnosis:**

Body colour creamy white. Cockroach-like body, compressed laterally, with small rounded scales. Ant. IV without terminal bulb, other Ant. segments with strong setae. Hypognathous mouthparts greatly reduced, with thick ciliated prelabral setae. Unguis small, without inner distal tooth and tunica, with a weakly developed tenent hair and wing-like outer basal teeth. Large unguiculas with a broad outer tooth. 10 spinous setae in 'L' arrangement on trochantral organ. Dens with winged scales, 5 outer and 2 inner, with 3 basal and 2 inner small setae. Terminally blunt short mucro present.

**Distribution:** India: West Bengal (North 24 Parganas\*), Andhra Pradesh, Maharashtra, Odisha.

**Remarks:** Endemic to India. First time recorded from West Bengal.

**Family** Paronellidae Börner, 1913

**Subfamily** Paronellinae Börner, 1906 sensu Zhang et al, 2019

**Genus** *Delamarerus* Mitra, 1977

**Type species:** *Delamarerus immsi* Mitra, 1977

**Genus diagnosis:** Body lacks pigmentation, eyes usually absent. Mandibles with well developed molar plate. Mostly five apical teeth and single fringed inner tooth present on unguis, clear tunica present. Dens with large flattened scales and setae. Bidented mucro subequal with dens.

**11. *Delamarerus immsi*** Mitra 1977 (Figure10, Plate – 2)

1977. *Delamarerus immsi* Mitra, *Rev. Ecol. Biol. Sol.* **13** (4): 645-652; figs.1-3.

**Material examined:** 57 exs in alcohol, 1 exs on slide, India: West Bengal, Kenduah, Siuri, Birbhum dist., 07.xi.1974, 23.88 °N, 87.72 °E, coll. S. K. Mitra, (472/H14).

**Diagnosis:**

Triangular head with 2 sense-bulbs on Ant-III. Unguis with large tunica or fringe membranous structure and a distal teeth, one of the paired inner teeth is modified in a slender process. Unguiculas lanceolate. Weakly developed trochanteral organ with 15 tiny spines. Dens distinctly shorter than manubrium. Elongated, slender mucro bidented. Dens with five outer and two inner hyaline scales.

**Distribution:** India - West Bengal (Birbhum\*), Andhra Pradesh, Maharashtra, Odisha.

**Remarks:** Endemic to India. Newly recorded from West Bengal.

**Family** Paronellidae Börner, 1913

**Subfamily** Troglopedetinae Börner, 1913

**Genus** *Cyphoderopsis* Carpenter, 1917

**Type species:** *Cyphoderopsis kempfi* Carpenter, 1917

**Genus diagnosis:** Body without pigment, scales present, head with 6+6 or fewer eyes. Ant IV not subdivided. Metathorax and mesothorax are not humped. Mucro sharply demarcated and four times or more long than width.

**12. *Cyphoderopsis kempfi*** Carpenter, 1917 (Figure12, Plate – 2)

1917. *Cyphoderopsis kempfi* Carpenter, *Rec. Ind. Mus. Calcutta*, **8** (9): 561-568.

**Material examined:** 15 exs in alcohol, India: West Bengal: Suntalyekhola bridge, Samsing Range, Neora Valley National Park, Kalimpong dist., 07.vi.2018, 26.59°N, 88.47°E, coll. G.P. Mandal, (2855/H14); 1 exs in alcohol, 1 on slide, India: West Bengal: Chiple khola

pool, Samsing Range, Neora Valley National Park, Kalimpong dist., 08.vi.2018, 27.012°N, 88.47°E, coll. G.P. Mandal, (2860/H14).

**Diagnosis:** Body usually white in colour, approx length 1.5mm. Ant I & II with scales, Ant IV with many sensory setae and devoid of apical bulb. Eyes absent. Unequal paired inner proximal teeth and one small distal tooth present on unguis. Unguiculus lanceolate and spatulate tenent hair present. Trochantral organ with 20 small spine like setae arranged in 'L' shape. VT with 3+3 anterior and 25 posterior setae. Manubrium and dens are ventrally scaled, dens with 2 rows of short spines. Mucro bidentated with a third basal serrated tooth.

**Distribution:** India: West Bengal (Kalimpong\*), Andhra Pradesh, Maharashtra, Odisha.

**Remarks:** Endemic to India. Newly recorded from West Bengal.

**Family** Paronellidae Borner, 1913

**Subfamily:** Paronellinae Borner, 1913 sensu SotoAdams *et. al.*, 2008

**Genus** *Callyntrura* Borner, 1906

**Type species:** *Paronella anopla* Borner, 1906

**Diagnosis:** Scales present on body, head with 8+8 eyes, 4 well segmented antenna and vertex with 2+2 macrochaetae. Occipital and genal areas with 1+1 or without mac. Spines absent on manubrium and dens. Three or more teeth present on mucro.

13. *Callyntrura (Callyntrura) semiviolacea* (Handschin, 1929) (Figure13, Plate – 3)

1929. *Microphysa semiviolacea* Handschin, *Rev. Suisse Zool.*, **36**: 229-262.

1964. *Aphysa semiviolacea* Salmon, *Bull. Roy. Soc., N. Z.*, (7) **2**: 145-644.

1974, *Callyntrura (Callyntrura) semiviolacea* Mitra, *Rev. Ecol.Biol.Sol.*, **11** (3): 397-439.

**Material examined:** 16 exs in alcohol, 1 on slide, India: West Bengal: Hill stream, Suntalyekhola, Samsing Range, Neora Valley National Park, Kalimpong dist., 06.vi.2018, 27.022°N, 88.47°E, coll. G.P. Mandal (2849/H14); 5 exs in alcohol, 1 on slide, India: West Bengal: Singalila National Park, Darjeeling dist., 27.ii.2021, 27.151°N, 87.233°E, coll. K.K.Suman, (3042/H14); 35 exs in alcohol, India: West Bengal: Gorumara Beat, Gorumara National Park, Jalpaiguri dist., 26.vi.2019, 26.471°N, 88.499°E, coll. G.P. Mandal, (2794/H14).

**Diagnosis:**

General body colour pale yellow with variable violate to blue pigment patches along the margins Th.II-II and Abd.I-III. Bases of antennae and legs with diffused violate patches. Femora with a darker patch placed distally. Body covered with various types of setae and lanceolate scales, legs with long acuminate setae. Head with 4+4 frontal spines, ocelli 8+8. Smooth labral setae, formula – 5, 5, 4. Unguis with paired basal, two unpaired distal teeth and a external basolateral teeth. Unguiculus almost lanceolate, clavate tenent hair finely ciliated. Mucro with 6 striated teeth, two short spines on dens near the base of mucro.

**Distribution:** India: West Bengal (Darjeeling\*, Jalpaiguri\*, Kalimpong\*), Kerala, Odisha, Puducherry, Tamil Nadu.

**Remarks:** Endemic to India. First time recorded from West Bengal.

**Family** Paronellidae Borner, 1913

**Subfamily:** Paronellinae Borner, 1913 sensu Soto Adams *et. al.*, 2008

**Genus** *Callyntrura* Borner, 1906

**Type species:** *Paronella anopla* Borner, 1906

14. *Callyntrura (Callyntrura) variabilis* Mitra, 1974 (Figure14, Plate – 3)

1974. *Callyntrura (Callyntrura) variabilis* Mitra, *Rev. Ecol.Biol.Sol.* **11**: 426-429; figs 22-24.

**Material examined:** 4 exs in alcohol, 1 on slide, India: West Bengal: Madarihat, Jalpaiguri dist., 08.xi.1974, 26.68°N, 89.26°E, coll. T. Sengupta, (2522/H14).

**Diagnosis:**

Ground colour of body yellow to brown patched with dark blue-black pigment. Dirty brown antenna, Ant I-III each distally with a narrow blue ring, Ant IV pigmented blue. Th III, Abd I & II pigmented laterally. Most of the specimens with three median triangular patches on Abd. IV. A median longitudinal marking present on Th II to apex of Abd IV. Incomplete violate rings are present on legs, blue black coxae, tita are no pigmented distally. Body with lanceolate scales and flexed setae. 13- 14 mac present horizontally on either side of Abd IV. labral setae – 5,5,4 smooth, with 4 anterior tubercle. Unguis with paired basal, two unpaired, one small apical and one external basolateral teeth. Unguiculus toothless and lanceolate. Dental scale appendage absent. Six teeth

present on mucro.

**Distribution:** India: West Bengal (Jalpaiguri\*), Bihar, Uttarakhand, Uttar Pradesh.

**Remarks:** Endemic to India. Newly recorded from West Bengal.

**Family** Paronellidae Börner, 1913

**Subfamily:** Paronellinae Börner, 1913 sensu Soto Adams *et. al.*, 2008

**Genus** *Dicranocentroides* Imms, 1912

**Type species:** *Dicranocentroides fasciculatus* Imms, 1912

**Genus diagnosis:** Body scale present, 8+8 eyes present, mesothorax and metathorax are not strongly bent. Vertex of head with mac. Three mac present on genal and occipital areas. Dens with two rows of spines. Mucro with 3 or more teeth, markedly separated from dens.

**15. *Dicranocentroides fasciculatus*** Imms, 1912 (Figure15, Plate –3)

1912. *Dicranocentroides fasciculatus* Imms, *Proc. Zool. Soc. London*: 80-125.

1957. *Dicranocentroides fasciculatus* Salmon, *Acta Zool. Cracov.* **11** (14): 313 –362.

1975. *Dicranocentroides fasciculatus* Mitra, *Rec. Zool. Surv. Ind.*, **71**:57-95.

**Material examined:** 1 exs in alcohol, 1 on slide, India: West Bengal: Hill stream, Suntalyekhola, Samsing Range, Neora Valley National Park, Kalimpong dist., 06.vi.2018, 27.012°N, 88.47°E, coll. G.P. Mandal (2857/H14); 4 exs in alcohol, 1 on slide, India: West Bengal: Red Panda Project Site, Singalila National Park, Darjeeling dist., 28.ii.2021, 27.151°N, 87.233°E, coll. K.K.Suman, (3041/H14).

**Diagnosis:** Average body length 2-3 mm. Males are darker and larger than females. Body clothed with various shaped pseudoscales. Th II with reddish brown pigment and Abd III-IV with dark brown pigment, Abd IV-V are somewhat lightly pigmented. Pear shaped head with 8+8 ocelli. Six- Seven strong, spiniform setae present on the inner and lateral margin of each tita. Unguis slightly curved with external basolateral teeth. Well developed trochantral organ present. Three elongated vesicle along with two anterior small vesicles present on ventral tube. Mucro with 5-6 teeth.

**Distribution:** India: West Bengal (Darjeeling\*, Kalimpong\*), Andaman and Nicobar Islands, Arunachal

Pradesh, Bihar, Maharashtra, Manipur, Mizoram, Nagaland, Sikkim, Tripura, Uttarakhand, Uttar Pradesh. Elsewhere: Sino- Japanese and continental South East Asia.

**Remarks:** Newly recorded from West Bengal.

**Family** Paronellidae Börner, 1913

**Subfamily:** Paronellinae Börner, 1913 sensu Soto Adams *et. al.*, 2008

**Genus** *Dicranocentroides* Imms, 1912

**Type species:** *Dicranocentroides fasciculatus* Imms, 1912

**16. *Dicranocentroides salmoni*** Mitra, 1975 (Figure16, Plate – 3)

1975. *Dicraanocerntroides salmoni* Mitra, *Rec.Zool. Surv. India*. **71**:57-95.

**Material examined:** 18 exs in alcohol, 1 on slide, India: West Bengal: Hill stream, Suntalyekhola, Samsing Range, Neora Valley National Park, Kalimpong dist., 06.vi.2018, 27.012°N, 88.47°E, coll. G.P. Mandal, (2852/H14); 6 exs in alcohol, 1 on slide, India: West Bengal: Upper Gairibus, collected from leaf litter, Jhalong, Kalimpong dist., 09.ii.2023, 27.012°N, 88.47°E, coll. P. Mandal, (3340/H14); 17 exs in alcohol, 1 on slide, India: West Bengal: Chapramari Beat, Gorumara National Park, Jalpaiguri dist., 06.vi.2018, 26.548°N, 88.514°E, coll. G.P. Mandal, (2795/H14).

**Diagnosis:**

Body with variable colour pattern; Th. III and Abd I- II with deep pigmentation. Lateral and transverse bands of pigment present on Abd IV. Body covered with scales and brush setae. Abd III with 2+2 and Abd IV with 16+16 mac placed medially on each side. Elongated unguis with a pair of external basolateral and inner teeth; a distal unpaired subapical tooth present. Acuminate unguiculas with one tooth on outer lamella. 6-7 spine like setae present on each tita. Corpus of retinaculum with a median setae. Two rows of stout spines present on each dens.

**Distribution:** India: West Bengal (Jalpaiguri\*, Kalimpong\*), Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, Uttar Pradesh, Uttarakhand.

**Remarks:** Endemic to India. Newly recorded from West Bengal.

**Family** Entomobryidae Schäffer, 1896 sensu Zhang *et al*, 2019

**Subfamily** Lepidocyrtinae Wahlgren, 1906 sensu Zang et al, 2019

**Genus** *Lepidocyrtus* Bourlet, 1839

**Type species:** *Lepidocyrtus curvicollis* Bourlet, 1839

17. *Lepidocyrtus (Allocyrtus) lepidornatus* (Handschin, 1930) Yoshii, 1982

(Figure17, Plate – 3)

1930, *Acanthurella lepidornata* Handschin, *Phililp. J. Sci.* 42:411, 416-417; p1.2 Figure20-23.

1982, *Lepidocyrtus (Allocyrtus) lepidornatus* Yosii, *Ent. Rep. Sabah. For. Res. Eenter*, 5: 7, 22-23, 39, 47; Figure12, 25.

**Material examined:** 45 exs in alcohol, 2 on slide, India: West Bengal: Mathurkur, collected from leaf litter, Polba-Dadpur, Hooghly dist., 01.i.2023, 22.889°N, 88.219°E., coll. P. Mandal, (3342/H14).

**Diagnosis:**

Body colour pale yellow, oval hyaline body scales showing a characteristic pattern, frontal scales of the head are dark violate. Ant II – IV are distally dark blue. 8+8 ommatidia on each side. Dark scales are scattered all over the body, characteristic square pattern observed on Abd IV. Unguis with three unpaired inner teeth and with a club shaped tenent hair. Bidentated mucro with a basal spine. Dents have four strong pointed spines at its base.

**Distribution:** India: West Bengal (Hooghly\*), Himachal Pradesh, Ladakh.

Elsewhere: Japan, Malaysia.

**Remarks:** First time recorded from the state.

**Family** Entomobryidae Schäffer, 1896 sensu Zhang et al, 2019

**Subfamily** Lepidocyrtinae Wahlgren, 1906 sensu Zang et al, 2019

**Genus** *Lepidocyrtus* Bourlet, 1839

**Type species:** *Lepidocyrtus curvicollis* Bourlet, 1839

**Genus diagnosis:** Body covered with finely striated rounded scales. Head with 8+8 eyes, Abd VI without projection. Dens with scales and basal appendix, without spines. Mucro have two teeth.

18. *Lepidocyrtus (Acrocyrtus) cryptocephalus* Handschin, 1929 (Figure20, Plate – 4)

1929. *Lepidocyrtus cryptocephalus* Handschin, *Rev.suisse*

*Zool.* 36: 230, 240-241, 261; Figure 14-16.

**Material examined:** 44 exs in alcohol, 1 on slide, India: West Bengal: Ashalay Coachbai (8 Mile), Samsing Range, Neora Valley National Park, Kalimpong dist., 09.vi.2018, 27.02°N, 88.47°E, coll. G.P. Mandal, (2925/H14); 50 exs in alcohol, India: West Bengal: Neora Forest near Neora Bridge, towards Gorubathan, Neora Valley National Park, Kalimpong dist., 08.vi.2018, 26.581°N, 88.455°E, coll. G.P. Mandal, (2960/H14).

**Diagnosis:**

Adult body length near 2mm. General body colour pale yellow, Ant III & Ant IV entirely violate. Apex of the forehead pigmented deep- black. Abd I and II often with black bandage, proximal part of Abd IV and Abd V- VI are completely covered with blue pigment.

Large, dense setae present at the extremities of body and And VI. Acuminate, large bothriotricas are present on middle portion of Abd IV. Hyaline body scales present at the border of the segments and over the furca. Mesothorax overhangs on head in a hood-like manner.

**Distribution:** India: West Bengal (Kalimpong\*), Assam, Daman, Diu, Dadra and Nagar Haveli, Odisha, Puducherry, Tamil Nadu.

**Remarks:** Endemic to India. First time recorded from West Bengal.

**Family** Entomobryidae Schaffer, 1896 sensu Zhang F et al, 2019

**Subfamily** Lepidocyrtinae Wahlgren, 1906 sensu Zang et al, 2019

**Genus** *Seira* Lubbock, 1870

**Type species:** *Degeeria domestica* Nicolet, 1842

**Genus diagnosis:** Eyes with 8+8 or 6+6 ommatidia. Body covered with scales, four segmented antennae present. Dens possess scales. Mucro vestigial or falcate.

19. *Seira (S.) cinerea* Yosii, 1966 (Figure18, Plate – 4)

1966. *Seira cinerea* Yosii, *Res. Kyoto U. Exped. Karakoram* 8: 364-365; Figure21A-F.

**Material examined:** 1 exs on slide, India: West Bengal, North 24 Parganas dist., 19.x.1979, 23.88 °N, 87.72 °E, coll. S. K. Mitra, (1802/H14).

**Diagnosis:**

Average body length 1.32 mm. 6+6 ocelli present. Body bluish gray with brown scales. Ant III- IV darker anteriorly. Ventral portion of the head, Th II- III and



Abd II with bluish tint. Bluish gray pigment spreads over Th III continued to Abd V. Furca basally pigmented. Straight unguis with one basal and two distal unpaired teeth.

**Distribution:** India: West Bengal (North 24 Parganas\*), Lakshadweep, Maharashtra, Punjab.

**Remarks:** Endemic to India. First time recorded from West Bengal.

**Family** Entomobryidae Schaffer, 1896 sensu Zhang F *et al*, 2019

**Subfamily** Lepidocyrtinae Wahlgren, 1906 sensu Zang *et al*, 2019

**Genus** *Seira* Lubbock, 1870

**Type species:** *Degeeria domestica* Nicolet, 1842

20. *Seira (S.) punctata* (Ritter, 1911) (Figure19, Plate – 1)  
1911. *Drepanura punctata* Ritter, *Ann.K.K.naturh. Hofmus/ Wein* 24:383-384; figs.13-15

**Material examined:** 11 exs in alcohol, 1 exs on slide, India: West Bengal: East Kolkata wetlands, Tardaha, Naskarait pond, collected from litter, Kolkata dist., 26.iv.2019, 22.29°N, 88.22°E, coll. G.P. Mandal, (2651/H14).

**Diagnosis:**

General body colour dirty yellow, segment extremities and Abd VI are pigmented with deep blue colour. Ant IV is the longest and entirely blue. Abd I–III are completely purplish-blue pigmented. Culb hairs not present, feathered hair or setae are densely present on antennae, legs and furca. Antenna half in length as of the body. Unguis with three unpaired teeth placed distally, unguiculas 2/3 of unguis and toothless. Clubbed tenent hair is longer than the unguis. Apical part of the dens strongly curved, falcate mucro placed distally.

**Distribution:** India: West Bengal (Kolkata\*), Daman, Diu, Dadra and Nagar Haveli, Maharashtra.

**Remarks:** Endemic to India. Newly recorded from West Bengal.

**Family** Entomobryidae Schaffer, 1896 sensu Zhang F *et al*, 2019

**Subfamily** Lepidocyrtinae Wahlgren, 1906 sensu Zang *et al*, 2019

**Genus** *Seira* Lubbock, 1870

**Type species:** *Degeeria domestica* Nicolet, 1842

21. *Seira (Seira) arunachala* Mitra, 1976 (Figure21, Plate – 4)

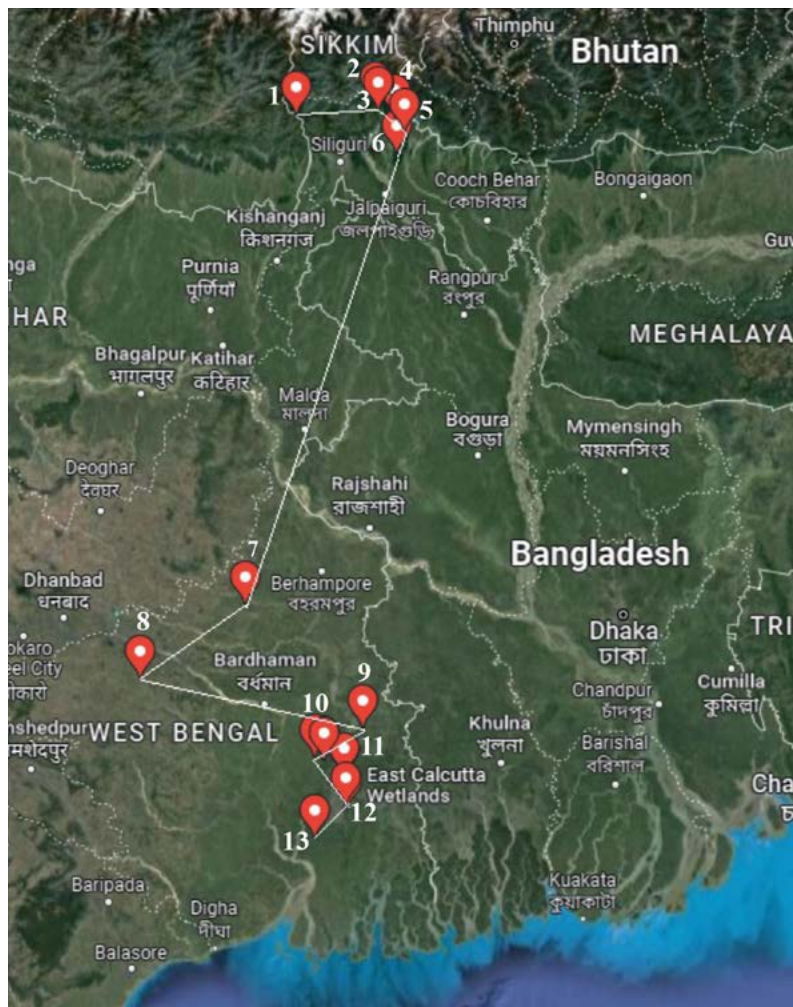
*Siera arunachala* Mitra, 1976. *Oriental Insects*, **10** (2): 143:149.

**Material examined:** 1 exs in alcohol, 1 on slide, India: West Bengal: Village Rajarbathan, collected from Leaf litter and rotten banana bark, Singur, Hooghly dist., 25.xi.2022, 22.869°N, 88.279°E., coll. P. Mandal, (3341/H14).

**Diagnosis:** Pale yellow body with two blue colour patch on the targal margins of Th III, Abd I–III and on the posterior side of Abd IV; Th II, Abd V–VI are devoid of pigment. Body clothed with flexed mac and scales. Paired inner teeth and a subapical unpaired tooth present on the unguis, nondented and lanceolate unguiculas present. 17 spines arranged in a quadrate on the trochanteral organ. VT with 4+4 mac and 4+4 nonciliated setae. Dens crenulated with a falcate mucro without basal spine.

**Distribution:** India: West Bengal (Hooghly\*), Arunachal Pradesh, Bihar.

**Remarks:** Endemic to India. First time recorded from West Bengal.



1. Singallila National Park, Darjeeling.
2. Neora forest, near bridge, Kalimong.
3. Samsing range, Neora Valley NP, Kalimpong.
4. Suntalyekhola bridge, Kalimong.
5. Chapramari National Park, Jalpaiguri.
6. Gorumara beat, Gorumara National Park, Jalpaiguri.
7. Kendua, Siuri, Birbhum.
8. Susunia forest, Bankura.
9. North 24 Pargana.
10. Mathurkur, Polba-dadpur, Hooghly.
11. Jute Agricultural Research Institute, North 24 Pargana.
12. Nalban, Kolkata.
13. Patharberia, South 24 pargana.

**Figure1:** Collection site of the first time recorded species from the state of West Bengal.

## Discussion

The present study represents a total 21 species of collembola belonging to 14 genera of 6 families for first time reported from the state of West Bengal. Earlier, Mandal *et. al.*, (2018) recorded a total of 75 collembolan species belonging to 43 genera under 13 families from the state. Different landforms, soil types and distribution of plant species enable the state to encompass a rich diversity of collembolan fauna. Seven species of the new records which were found from the districts of North Bengal (Figure1), mainly from the

fam. Paronellidae and out of the 21 first time records, 11 species belonging to the order Entomobryomorpha are predominantly found in the plain areas (Figure1), that are quite relevant to the previous study conducted in the state by Mandal, 2020, showing a concentrated distribution of collembolan fauna towards plains. Therefore, more expeditions and investigations are required from the plains as well as higher altitudes to improve the morpho-taxonomic knowledge of collembola and to have a comparative understanding of their distributional ranges from the state.



**Fig. 1:** *Calvatomina trivandrana* Prabhoo, 1971



**Fig.2:** *Xenylla reducta* Prabhoo, 1971



**Fig.3:** *Xenylla welchi* Folsom, 1916



**Fig.4:** *Brachystomella contorta* Denis, 1931



**Fig.5:** *Ballistura fitchi* (Denis, 1933) Potapov, 2001



**Fig.6:** *Cryptopygus indicus* Brown, 1932



**Fig. 7:** *Cryptopygus tridentatus* (Handschin, 1929)



**Fig. 8:** *Isotoma plumosa* (Salmon, 1969)  
Lawrence, 1978



**Fig. 9:** *Cyphoderus assimilis* Borner, 1906



**Fig. 10:** *Delamarerus immsi* Mitra 1977



**Fig. 11:** *Pseudocyphoderus annandalei* Imms, 1912



**Fig. 12:** *Cyphoderopsis kempii* Carpenter, 1917



**Fig.13:** *Callyntrura (Callyntrura) semiviolacea* (Handschin, 1929)



**Fig.14:** *Callyntrura (Callyntrura) variabilis* Mitra, 1974



**Fig.15:** *Dicranocentroides fasciculatus* Imms, 1912



**Fig.16:** *Dicranocentroides salmoni* Mitra, 1975



**Fig.17:** *Lepidocyrtus (Allocyrtus) lepidornatus* (Handschin, 1930)



**Fig.18:** *Seira (S.) cinerea* Yosii, 1966



**Fig.19:** *Seira (S.) punctata* (Ritter, 1911)



**Fig.20:** *Lepidocyrtus (Acrocyrtus) cryptocephalus*  
Handschin, 1929



**Fig.21:** *Seira (Seira) arunachala* Mitra, 1976

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