



Occasional Paper No. 368

A Review on Paronellinae (Collembola : Paronellidae) of India

A. K. Hazra



ZOOLOGICAL SURVEY OF INDIA



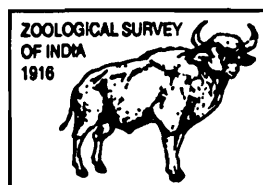
OCCASIONAL PAPER No. 368

**A REVIEW ON PARONELLINAE
(COLLEMBOLA : PARONELLIDAE)
OF INDIA**

A.K. HAZRA

*Zoological Survey of India
M-Block, New Alipore
Kolkata 70053*

*Edited by
The Director, Zoological Survey of India, Kolkata*



**Zoological Survey of India
Kolkata**

CITATION

Hazra, A.K. 2015. A review on Paronellinae (Collembola : Paronellidae) of India. *Rec. zool. Surv. India, Occ. Paper No., 368* : 1-63. (Published by the Director, *Zool. Surv. India*, Kolkata)

Published : May, 2015

ISBN 978-81-8171-413-8

© Govt. of India, 2015

ALL RIGHTS RESERVED

- No part of this publication may be reproduced, stored in a retrieval system or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording or otherwise without the prior permission of the publisher.
- This book is sold subject to the condition that it shall not, by way of trade, be lent, re-sold hired out or otherwise disposed of without the publisher's consent, in any form of binding or cover other than that in which it is published.
- The correct price of this publication is the price printed on this page. Any revised price indicated by a rubber stamp or by a sticker or by any other means is incorrect and should be unacceptable.

PRICE

India : ₹ 300/-

Foreign : \$ 20; £ 15

Published at the Publication Division by the Director, Zoological Survey of India, M-Block, New Alipore, Kolkata-700 053 and printed at East India Photo Composing Centre, Kolkata-700 006.

**RECORDS
OF THE
ZOOLOGICAL SURVEY OF INDIA
OCCASIONAL PAPER**

368

2015

Page 1-63

CONTENTS

| | |
|---------------------------------------|----|
| 1. INTRODUCTION | 1 |
| 2. MATERIALS AND METHODS | 2 |
| 3. GENERAL TAXONOMIC CHARACTERS | 2 |
| 4. SYSTEMATIC ACCOUNT | 3 |
| 5. DISCUSSION | 58 |
| 6. ACKNOWLEDGEMENTS | 60 |
| 7. REFERENCES | 60 |

INTRODUCTION

Collembola are abundant and ubiquitous, their tiny size and affinity to moisture, most of the species trying to avoid desiccation and prefer humid condition. These terrestrial arthropod with segmentation as head, thorax and abdomen (six segmented). The mouth parts are withdrawn into head capsule, primitively without wings, the leg segment distally is a tibiotarsus on an apical pretarsus from which a dorsal unguis a ventral unguiculus originates. The collophore-a ventral pair basally fused vesicles located in the first abdominal segment, on the third and fourth abdominal segment bear ventral bifurcate appendages former is known as tenaculum and later is furcula as springing appendages from which name springtail derives its name for this group. Majority of collembolans are detritus feeder. There is no record that the group is responsible for damage of any crop.

Paronellidae Börner, 1913 are medium to large sized family of collembola with two subfamilies Paronellinae and Cyphoderinae both are with the occurrence of stout dentes and plump mucrones. One of the important character by which Cyphoderinae is separated from Paronellinae with the presence of fringed, foliage scale of dentes which do not occur in the genera under Paronellinae.

Imms (1912) described Indian paronellids for the first time followed by Carpenter (1917, 1924), Bonet (1930), Brown (1932), Denis (1936), Salmon (1957), Yosii (1966a, b), Mitra (1966, 1967, 1973a, b, 1976, 1990, 1992), Prabhoo (1971 and Mitra *et al.*, (2004). Thereafter, Hazra (1995), Hazra *et al.*, (2000, '01a, '01b, '03, '04a, '04b, '04c), Hazra and Mandal (2012, '13), Mandal and Hazra (2002, '04, '09, '10, '13), Mandal (2011, '12, '13) have studied the Indian paronellids from different states of India based on the characters mentioned above.

Yosii (1956, '83, '89); Mitra, (1974, '75a, b, '77, '80, '93) while studying the Indian paronellids subdivided the genus using chaetotaxy but each author used a different set of criteria and as a result the group they proposed partially overlap (Soto-Adames, 2010). Mitra (1993) divides Paronellinae into five tribes according to pattern of cephalic and abdominal chaetotaxy. Following Mitra the Paronellidae of India comes under two tribes 1) Cremastocephalini 2) Calyntrurini.

The nomenclature used to designate setae on head and abdomen is after Yosii (1956) and Mitra (1993). The aim of the present work i) to take up consolidated studies of the Paronellids so far described by various authors from India, ii) to study the specimens named and unnamed

present in the National Zoological Collection has also been attempted and discussed. Some of the figures in this study are after Yosii (1956) and Mitra (1973).

MATERIAL AND METHODS

The specimens used for this study, preserved in alcohol (majority of the specimens were collected by the author) and also by several survey teams of this Institute.

The specimens after treatment with lactic acid were dissected out in head, abdomen, legs, furcula; gut content were removed by ventral incision. All the dissected parts were kept in 5% KOH with few drops of glycerol for over night. The dark pigmented specimens were warmed on heater on grooved slide. The material was then kept on lactic acid to examine the macrochaetal socket and other morphological characters. Each part of the specimens was mounted on the same slide by broken piece of cover-glass for study under Nikon microscope. The mounting medium used for this study is Hoyer's modified medium.

GENERAL TAXONOMIC CHARACTERS

The characters used for taxonomic study to discriminate each Indian Paronellids. The following general accounts have been considered for the present study.

Colouration : Body colour and pigmentation are regarded as primary important character for identification of taxa, but for some cases it varies.

Antennae : Usually four segmented with or without scales.

Head : Cephalic sub division of head capsule indicates the position of setae, but some time division overlaps.

Mouth parts : Clypeus, maxilla and labial papillae in most cases do not show any significant role, similarly mandible is of normal type.

Thorax : Prothorax reduced, length of thorax III is lesser than II. Macrochaetal arrangement has some important taxonomic character.

Trochanter : Hind trochanter has in all genera of Paronellidae a trochantral organ consisted of many spiny form setae. The number is variable less than 25 to more than 65 in some case it is significant for species identification.

Tibiotarsus : Some cases inner tibiotarsal lobe conspicuous. The tenant hair well developed clavate or acuminate. Some provides no clue to species identification.

Unguis & unguiculus : Unguis some time with two basolateral teeth, inner margin of unguis with paired inner basal, medial, in some cases minor distal teeth. The shape of unguiculus whether truncate or less lanceolate Mitra (1974) opined that transformation of truncated in

juvenile stage to lanceolate in adult form in case of *Callyntrura* species. However, further study on the biology may lead confirmation. The position and number of denticulation upon unguis play little role in species discrimination.

Ventral tube : Anterior face of ventral tube with macrochaetae, their nature and number are not important taxonomic character to identify up to species level at least in case of genus *Dicranocentroides*.

Dentes : Inner margin of each dentes with row of dental spine. The number of spine present on each dentes provides some clue to discriminate up to generic level.

Mucrones : The number of teeth varies from 2-6. The nature of some apical teeth shows some importance in identification up to species level at least in case of *Dicranocentroides*. Soto-Adams (2010) on basis of mucronal shape the species under the genus *Salina* from new world has divided in two groups viz. (i) having square or truncate with 3-4 teeth posteriorly (ii) other groups comprising of four species with rectangular mucrones.

Chaetotaxy : Yosii (1961) for the first time pointed out the importance chaetotaxy on each tergal segment. Mitra (1993) divided the cephalic region into five major sub-division like area dorsalis, verticalis, pariatialis, occipitalis, and cervicalis.

The described species from India were in most cases based on colour pattern, number of unguial teeth, number of spines on trochantral organ, number of mucronal teeth. Mitra (1975) while studying the *Dicranocentroides* stated, "The colour pattern of head and body can be accepted as an important character owing to its less variation," he also claims that there is sexual dimorphism in colour pattern, males are darker than females in *Dicranocentroides fasciculatus* of course this view requires further study.

SYSTEMATIC ACCOUNT

Order COLLEMBOLA

Suborder ARTHROPLEONA

Family PARONELLIDAE

Sub family PARONELLINAE

Members of this family can be distinguished from other family of Collembola by the straight unringed dentes, without spines but with a terminal bladder like projection. The mucro is short and blunt and quite different from that of other entomobryids.

Key to genera of Paronellinae from India

1. Scales absent 2
- Scales present 5

2. Mucro absent or vestigial *Yosiia*
 — Mucro well developed 3
3. Base of mucro with enlarged scale appendage 4
 — Base of mucro without scale appendage 6
4. Mucro with 3 teeth *Salina*
 — Mucro with 2 teeth *Pseudosalina*
5. Mesothorax not humped 8
 — Mesothorax sharply humped *Idiomerus*
6. Fourth antennal segment not divided in halves 7
 — Fourth antennal segment subdivided into two halves *Troglopedetes*
7. Vertex of head with macrochaetae 8
 — Vertex of head without macrochaetae *Lepidonella*
8. Genal & occipital areas of head with 1 or no macrochaetae *Callyntrura*
 — Genal & occipital areas of head with 3 macrochaetae *Dicranocentroides*

Genus *Salina* MacGillivray

1894. *Salina* MacGillivray, *Can. Entomol.* 26 : 105-110

Type species : *Salina banksi* MacGillivray, 1894

Salina bengalensis Mitra

(Fig. 1A-D)

1973. *Salina bengalensis* Mitra, *Oriental Insects*, 7(2) : 164-166

Diagnosis : Colouration : General ground colour of body pale yellow. Thoracic tergites II, III dark with orange suffusion at its margin, pigment continued to on abdominal tergites. I-VI in addition to orange to dark brown patches. Clothing : Body clothed with micro and macrochaetae, most of which ciliated, microchaetae slender and acuminate. Head : Pear-shaped with two dark ocellar fields bearing with 8 ocelli in each field; ocelli G and H smaller; 1+1, frontal spines 1+1 present. Ratio of antennal segments I-IV 27 : 41 : 31 : 46. Thorax : Prothorax reduced, relatively length of segments. II : III 17 : 13; unguis with paired basal and two unpaired inner teeth; tenent hair clavate. Abdomen : Relative ratio of length of abdominal segments I-VI 11 : 5 : 14 : 2 : 49 : 9 : 6. Ventral tube short. Manubrium : microdens 41 : 48; mucro long, superficially lobed into three teeth; dental scale appendage relatively short striated apically. Body length; 1.5 mm.

Material examined : West Bengal : 8 exs, Botanical Garden (Howrah), 16.1.2003, Coll. G.P. Mandal.

Distribution : India : West Bengal.

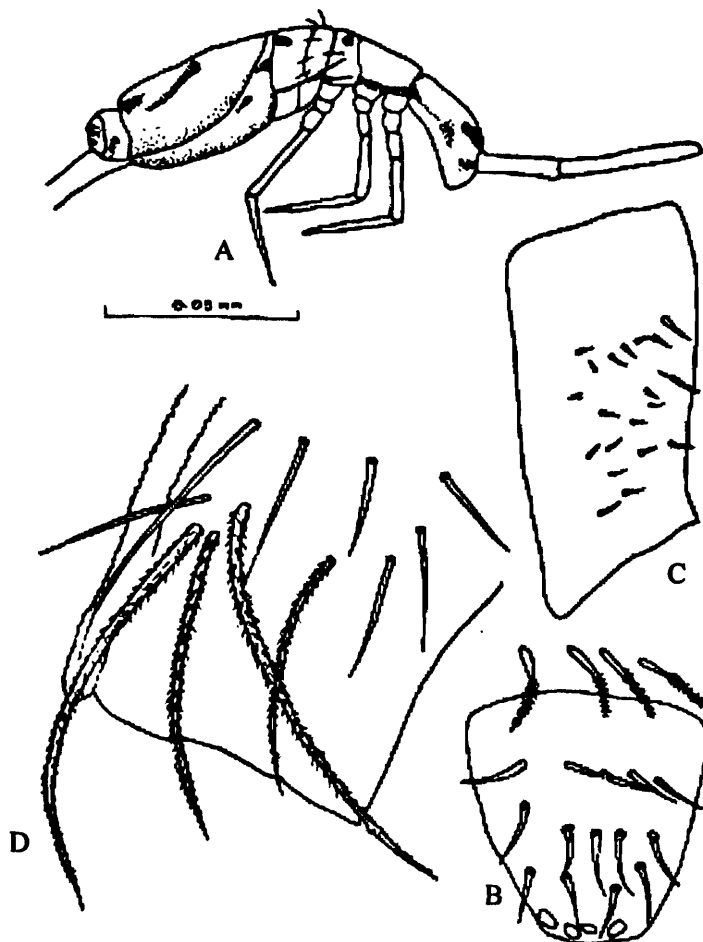


Fig. 1 : *Salina bengalensis*. A, habitus; B, labral chaetotaxy; C, trochanteral organ; D, chaetotaxy of anterior face of ventral tube.

***Salina bicinctoides* Yosii, 1966**

(Fig. 2A, B)

1960. *Salina bicinctoides* Yosii, *Res. Kyoto Univ. Sci*, 8 : 333-405.

Diagnosis : Ground colour white. Antennae lightly pigmented upon distal end in proximal three segments. Head pigmented between two eyes. Th. III distal part transversely pigmented, Abd. I, II proximally pigmented.

Th. III with transverse blue violet pigment based on distal part. Abd. I, II with proximal transverse band, Abd. IV posteriorly with pigment band. Measurement. Ant./head ratio 5 : 1, Ant. I : II : III : IV = 14 : 20 : 18 : 25. Abd. III : IV = 1 : 8, eye, 8+8. Trochanteral organ with 20 short setae. Developed mucro. Body length 1.5 mm.

Material : Maharastra : 1 ex. Mumbai, 02.x.1960, coll : R.Yosii.

Ditribution : India : Maharastra.

Remarks : descriptions are based on literature.

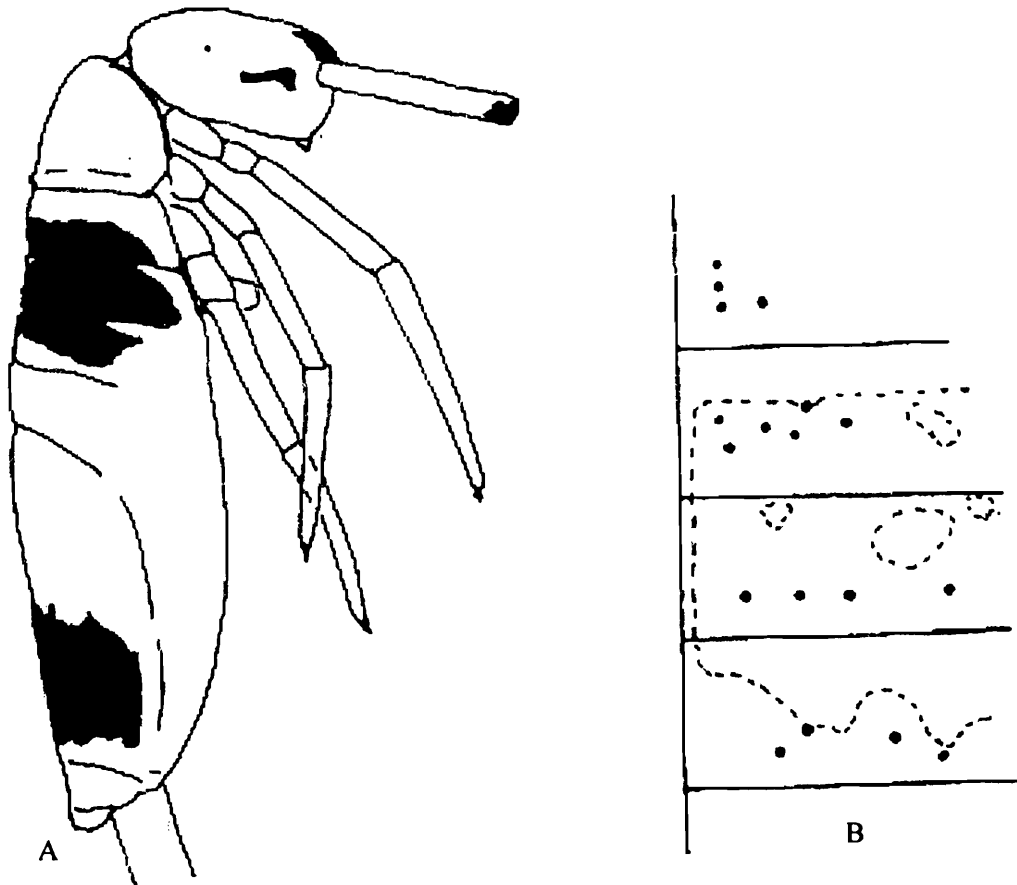


Fig. 2 : *Salina bicinctoides*. A, habitus; B, chaetotaxy of Ths III, Abds. I,II,III.

***Salina biformis* Mitra**

(Fig. 3A-E)

1966. *Salina biformis* Mitra, *Indian J. Ent, New Delhi*, 28(1) : 67-73

1973. *Salina biformis* Mitra, *Oriental Insects* 7(2) : 159-202

Diagnosis : Coloration : Two types of colour—dark and lighter. Head : Frontal spines 1+1 Ocelli 8+8, each group in two parallel rows, ocelli G and H smaller. Clothing : Macrochaetae more or less obliquely truncated and broadly acuminate on head, thoracic segments II, III and abdominal segments I-IV; macrochaetae of Thoracic II, III/Abdominal segments I, II=23, 26/17, 4. Thorax : Unguis short, curved with outer two paired basolateral, a paired inner basal and two distal unpaired teeth. Trochanteral organ poor. Abdomen : Ventral tube anteriorly with 4+4 macrochaetae and 7+7 microchaetae with 9+9 micro chaetae posteriorly and a short unpaired median proximal spiny seta. Body length 1.2 –1.4 mm.

Material examined : Uttar pradesh: 20 exs, Kansarao, Dehradun, 22.i.1965, Coll. S.K.Mitra.

Distribution : India : Uttarpradesh, Mizoram, Haryana and West Bengal.

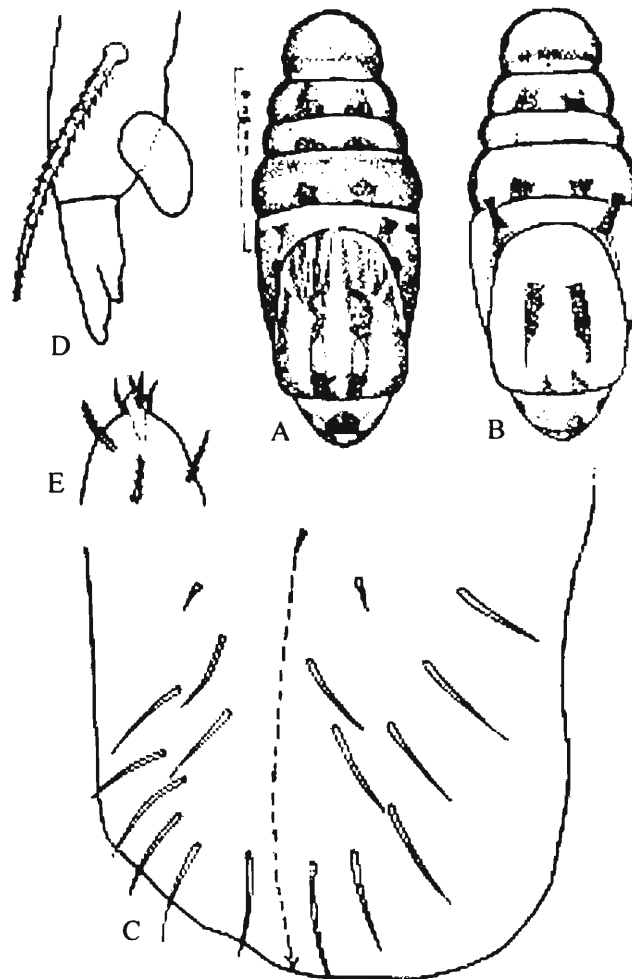


Fig. 3 : *Salina biformis*. A, B, habitus; C, chaetotaxy of posterior face of ventral tube; D, mucrodens complex; E, apex ant-IV.

***Salina bulbosa* (Salmon)**

(Fig. 4A-D)

1957. *Pseudoparonellids bulbosa* Salmon, *Acta. Zool. Cracov*, 11(14) : 314-362.

Diagnosis : Color : Yellow in colour with dark bluish shaded extending along the sides if the head, thorax and abdomen; antennae medium violet or blue; legs and furcula yellow; legs with pale blue shading around the segments. Clothing : Body and appendages with short ciliated setae and a pair of lasiotrichia on abdominal segment IV. posteriorly. Body : Antennae shorter than the body; ocelli, 8 to each side; abdominal segment. IV. 9 times longer than III; rami of tenaculum each with four barbs. Body length 1.7 mm. Legs : Claw with a pair of short, outer teeth about one fifth down; a pair of inner teeth at one third down and a single,

inner tooth at two thirds down; tenent single stout and clavate. Tenent hair, nearly twice as long as the claw, to each foot. Furcula : Manubrium : dens 42 : 47 : 2.5, dens swollen or

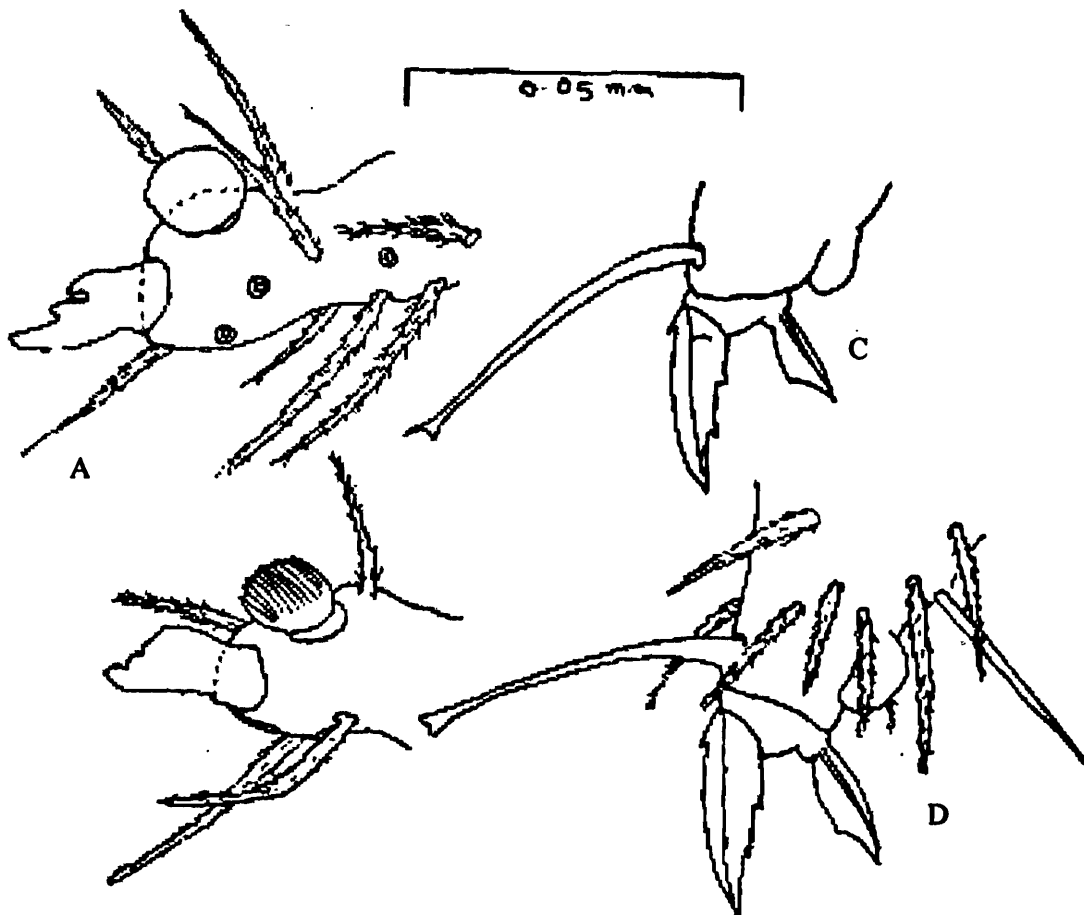


Fig. 4 : *Salina bulbosa*. A, B, microdens complex; C, D, foot complex.

distended apically; mucro small, parallel sided, plate like teeth across the apex and surrounded by strong ciliated setae arising from the apex of the dens.

Distribution : Manipur.

Remarks : Description is based on literature.

***Salina celebensis* (Schaeffer)**

(Fig. 5A-C)

1898. *Cremastocephalus celebensis* Schaeffer, *Naturgesch.* 64 : 393-425

1957. *Salina celebensis* Salmon, *Acta. Zool. Cracov*, 11(14) : 313-362 (In part)

1973. *Salina celebensis* Mitra, *Oriental Insects*, 7(2) : 159-202

Diagnosis : Colouration : Pale yellow to ochereous, rarely with dark patches and dark tergal margins. Head : 1+1 Frontal spines 1+1. Head : Antenna I = 15 : 29. Thorax : Unguis little curved paired, inner basal teeth large, two unpaired inner teeth and usual external basolateral teeth. Unguiculus large, truncate abruptly from half of its length. Abdomen : Ventral tube with

4+4 macrochaetae anteriorly on its anterior face; microchaetae on the anterior face and posterior face not noted; mucro short, broad deeply lobed into three teeth. Dental scale appendages large subequal to mucro with distal striations. Clothing : Body clothed with flexed macrochaetae and blunt or broadly acuminate apices; number of macrochaetae on thoracic II, III/abdominal segments I, II = 7, 5/2, 3. Body length 2 mm.

Distribution : India : Assam; USA and SINGAPUR.

Remarks : Description based on literature.

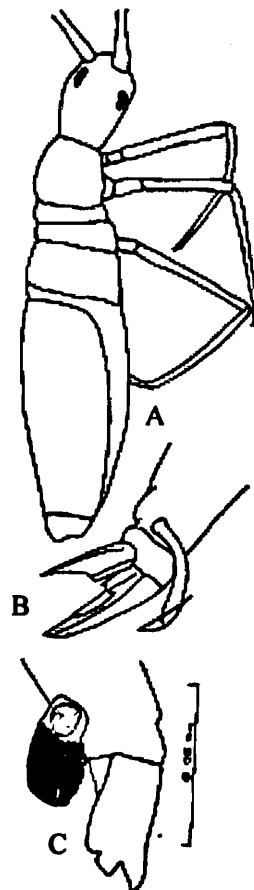


Fig. 5 : *Salina celebensis* A, habitus; B, foot complex; C, mucrodens complex.

***Salina choudhurii* Mitra**

(Fig. 6A-F)

1973. *Salina choudhurii* Mitra, *Orient. Ins.*, 7(2) : 159-202.

Diagnosis : Coloration : Pale yellow in colour with two symmetrical dark blue-black longitudinal bands, one on either side encircling the entire body through margins of head; thoracic and abdominal segments interconnected by the two transverse bands, margin of the band on abdominal segment II sometimes extending to segments I and III. Antennal segment I bluish basally and laterally, segments II, III, and IV darker distally with faint bluish pigment.

Legs with femora faintly bluish towards apex; rest of the appendages and furcula without pigment. Clothing : Antennae clothed with short acuminate ciliated setae, segments III, IV with smooth erect setae. Legs with femora clothed with setae, tibio-tarsi with longer acuminate, relative stiff ciliated setae. Manubrium clothed with short, acuminate, ciliated setae, dentes

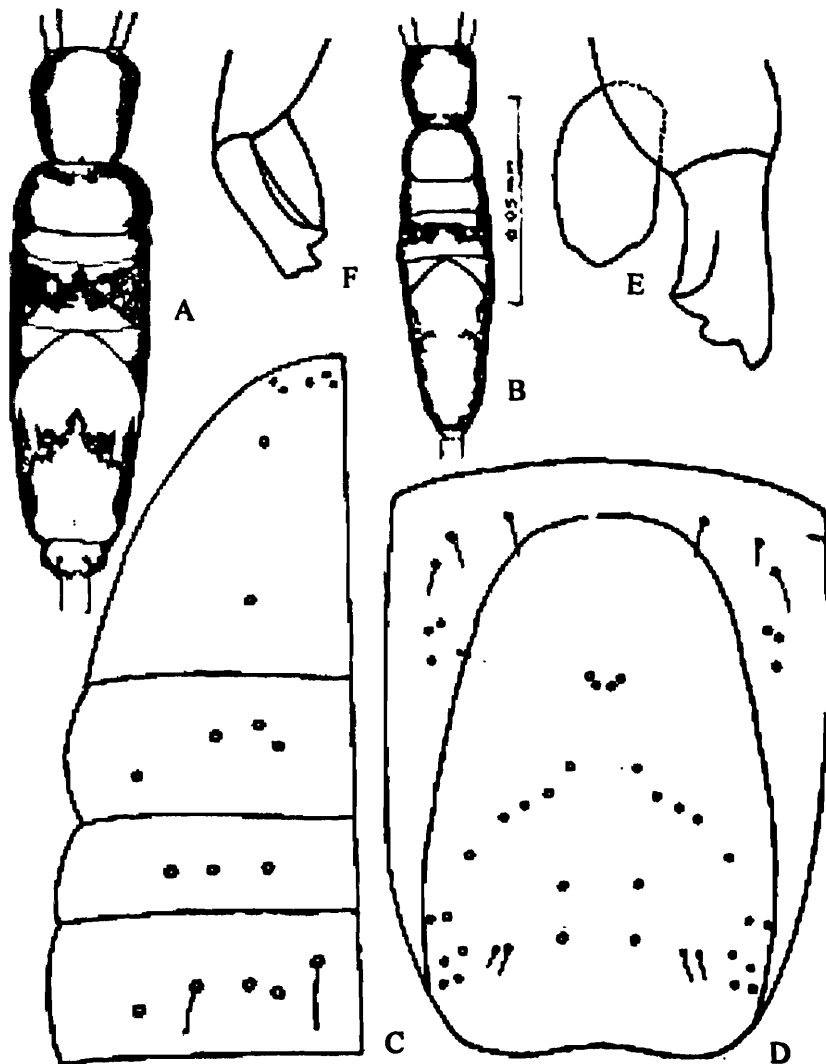


Fig. 6 : *Salina choudhurii*. A, B, habitus; C, chaetotaxy of Ths II, III/Abds. I, II; D, chaetotaxy of Abds. III, IV. E, mucrodens complex; F, a deformed mucrone.

with relatively long setae. Head : Ant I/ Head 23/15. Ocelli 8+8, ocelli G and H smaller than the rest. Antennae appreciably long, \bar{C} . twice the total length of head and body (excluding furca); ratio of length of antennal segments I-IV 23 : 29 : 25 : 32, antennal segment IV faintly annulated. Thorax : Relative length index of Ths. II : III = 36 : 9; Unguis short, slightly curved with inner paired basal and single unpaired distal teeth, outer basolateral teeth small, unguiculi large, truncate; tibio-tarsal lobe overhanging the base of unguiculus, well developed; tenent hair well developed, clavate, minutely ciliated; trochanteral organ composed of \bar{C} . 30 small spines. Abdomen : Abdominal segment IV more than 10 times the length of segment. III;

relative length index of segments I : II : III : IV : V : VI = 7 : 11 : 10 : 107 : 9 : 7. Manubrium : mucrodens 27 : 22, mucro tridentate bearing truncated apical teeth. Body length 1.7 mm.

Material examined : Meghalaya : 4 exs, Botanical garden, Shillong 28.iii.1991. Coll. A.K. Hazra; 7 exs, Forest near Mousumi cave, 27.iii.1991. Coll. A.K. Hazra; 5 exs, Nongstoin, 22.iii.1992. Coll. A.K. Hazra.

Distribution : India : Assam and Meghalaya (East Khasi and West Khasi Hills).

Remarks : The species is recorded for the first time Meghalaya.

Salina indica (Imms)

(Figs. 7.A-E)

1912. *Cremastocephalus indicus* Imms, *Proc. Zool. Soc. London* : 80-125.

1957. *Salina indica* (Imms) : Salmon, *Acta. Zool. Cracov.* 11(14) : 313-362 (in Part)

1973. *Salina indica* (Imms) : Mitra, *Oriental Insects* 7(2) : 159-202.

Diagnosis : Colouration : General ground colour of body pale yellow, usually devoid of any dark pigment, occasionally the tergal margins and lateral extension of abdominal segment III with faint blue pigment. Antennal segments pale yellow, segments I, II, III with a faint or diffused blue pigments or absent in some cases. Legs and furcula pale yellow without any trace of rings or bands.

Clothing : General surface of body densely clothed with acuminate, stiff microchaete; flexed macrochaetae subobliquely truncated and broadly acuminate, present on head. Thoracic segments II-III and abdominal segments I.-VI with ciliated, acuminate macrochaetae; lasiotrichia present as on abdominal segments II (2+2), III (3+3), IV (2+2).

Head : Frontal spines 1+1, conspicuous ; 2 dark pigmented ocellar fields one on each side of the head, each field containing 8 ocellii, arranged in two longitudinal parallel rows; ratio of antennal segments I-IV: 36 : 53 : 40 : 60.

Thorax : Relative length index of Thoracic segments : II : III = 25 : 17. Unguis elongate, slightly curved with paired basal, a median and a distal unpaired teeth on inner margin, paired external basolateral teeth normal. Unguculus of truncate type, nondentate; tenent hair well developed finely ciliated, clavate, tibiotarsal lobes well developed.

Abdomen : Relative length index of Abdominal segments I : II : III : IV : V : VI = 13 : 19 : 6 : 64 : 10 : 4; rami of retinaculum each with four teeth, corpus with a single median seta; ventral tube well developed. Manubrium : mucrodens = 45 : 54, mucro long, narrow, superficially lobed into three teeth; dental scale appendages relatively small faintly striated. Body length 1.4 mm.

Material examined : Arunachal: 40 exs, Mofutu (Phumpare), 20.11.1999, Coll. A.K. Hazra. Manipur: 40 exs, Kolasib (Charuchandrapur dist) 01.11.1996. Coll. S.K. Mitra; 2 exs, Santipur

(Churachandpur), 3.4.1992, Coll. A.K. Hazra; 37exs, Singut (Churachandpur), 18.6.1993, Coll. R.S. Burman. Sikkim : 19 exs, Mangan-chungthang road, Singhik, 3.11.92, Coll. A.K. Hazra; 100 exs, Namchi, 27.IV.1998, Coll. A.K. Hazra; 5 exs, Singhik, 34.11.1992. Coll. A.K. Hazra. Tripura : 6 exs, Nirmahal (West), 7.5.1995. Coll. A.K. Hazra; 10 exs, Paratia (South), 4.V.1995, Coll. A.K. Hazra.

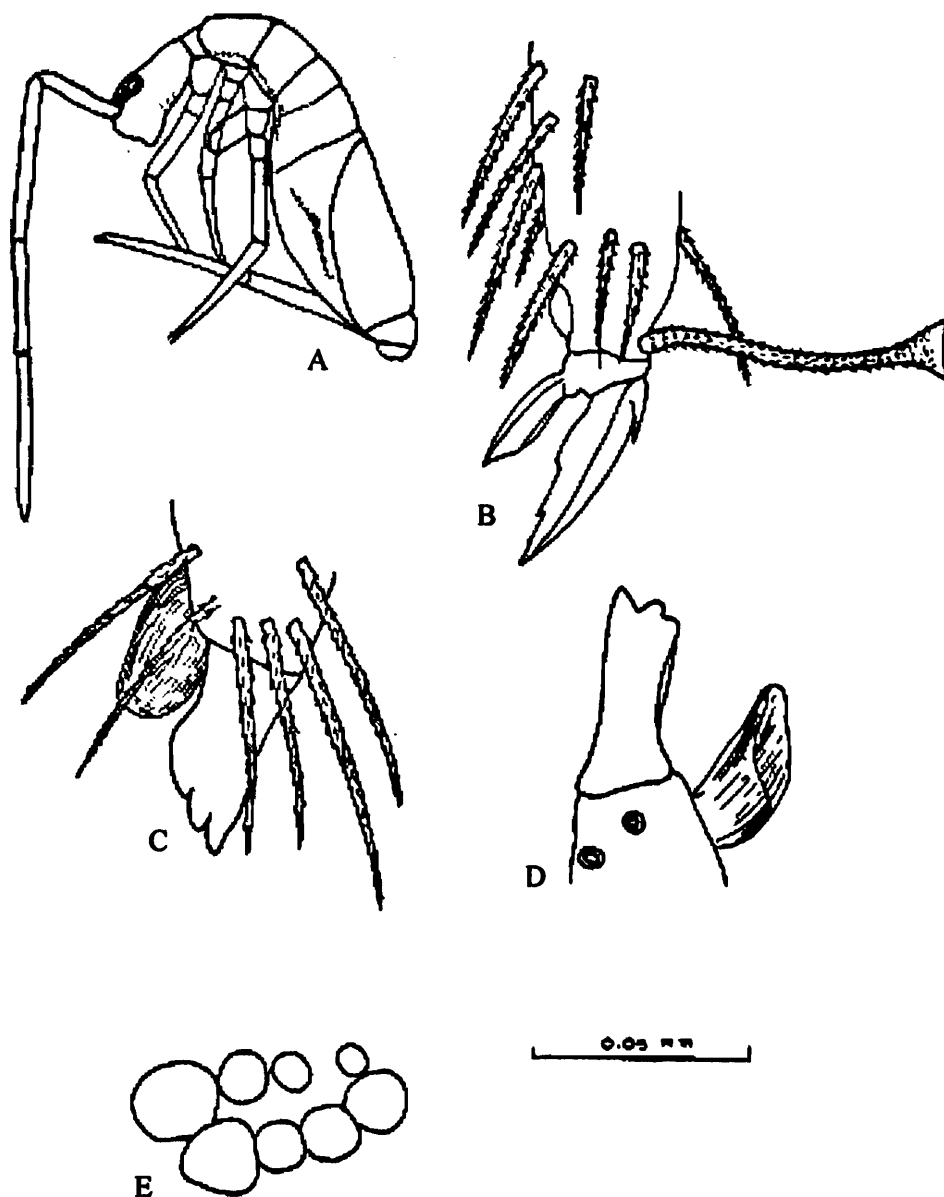


Fig. 7 : *Salina indica*. A, habitus; B, hind foot; C, micro and apex of dens; D, micro and apex of dens; E, ocelli.

Distribution : India : Sikkim, Arunachal, Manipur, Mizoram, Tripura, Uttarpradesh and West Bengal.

Remarks : The species is recorded for the first time from Arunachal Pradesh, Tripura and Sikkim.

***Salina javana* (Handschin)**

(Fig. 8A-E)

1928. *Cremastocephalus javanus* Handschin, *Treubia* 10 : 245.1973. *Salina javana* (Handschin) Mitra, *Orient. Ins.*, 7(2) : 179.

Diagnosis : Colouration : General ground colour varying from light green to pale yellow. Clothing : Body clothed with broadly acuminate macrochaetae, microchaetae sparsely cloth the general surface of body; lasiotrichia present as abdominal segments II(2+2), III(3+3), IV(2+2); chaetotaxy of head as characteristic of the *celebensis* group. Head : Ocelli 8+8; ratio of length of antennal segments I-IV 51 : 64 : 57 : 75; frontal spines 1+1. Thorax : Relative length index of Thoracic segments II: III=38 : 18. Legs similar; unguis short, broad little

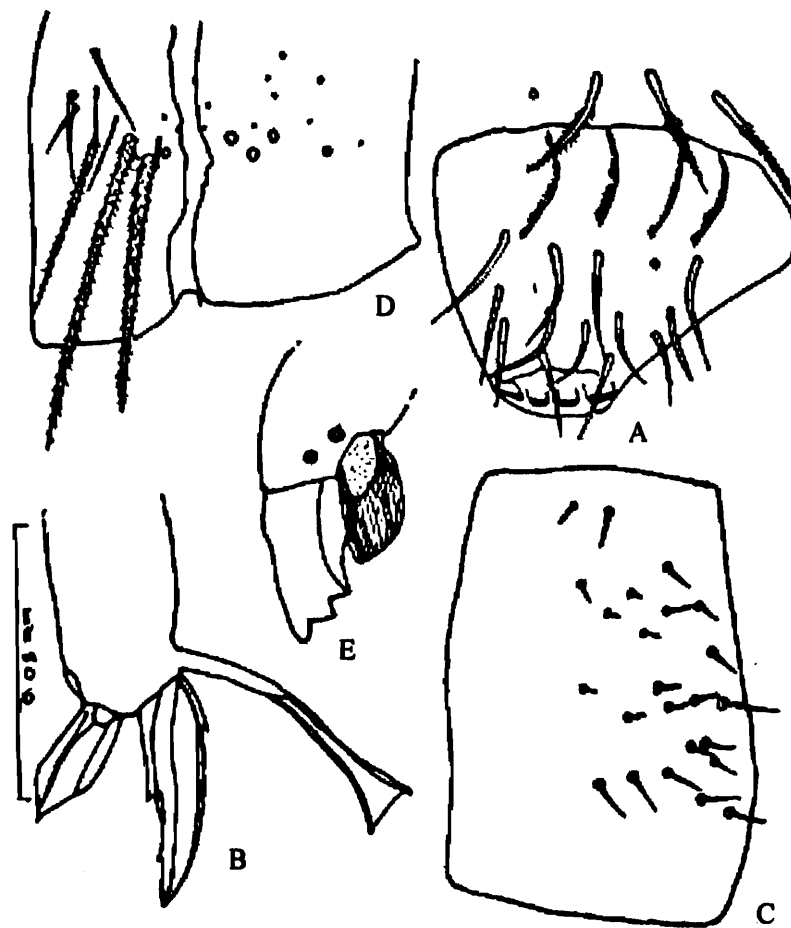


Fig. 8 : *Salina javana*. A, labral chaetotaxy; B, foot complex; C, trochanteral organ; D, chaetotaxy of anterior face of ventral tube; E, mucrodens complex.

curved; tenent hair well developed. Abdomen : Relative length index of abdominal segments I-VI = 11 : 20 : 3 : 80 : 9 : 5; segment IV elongate. Manubrium : mucrodens 65 : 67, mucrotridentate, distinctly lobed; dental scale appendage large, subequal to mucro with *striations*. Body length : 1.5-2 mm.

Material examined : West Bengal : 12 exs, Botanical garden (Howrah), 16.1.2003, Coll. G.P. Mandal.

Distribution : India : West Bengal; INDONESIA.

***Salina montana* (Imms)**

(Fig. 9A-C)

1912 *Cremastocephalus montanus* Imms, *Proc. Zool. Soc. London* : 80-125

1957. *Salina montana* Salmon, *Acta. Zool. Cracov.*, 11(14) : 313-362.

1973. *Salina montana* Mitra, *Orient. Ins.*, 7(2) : 159-202.

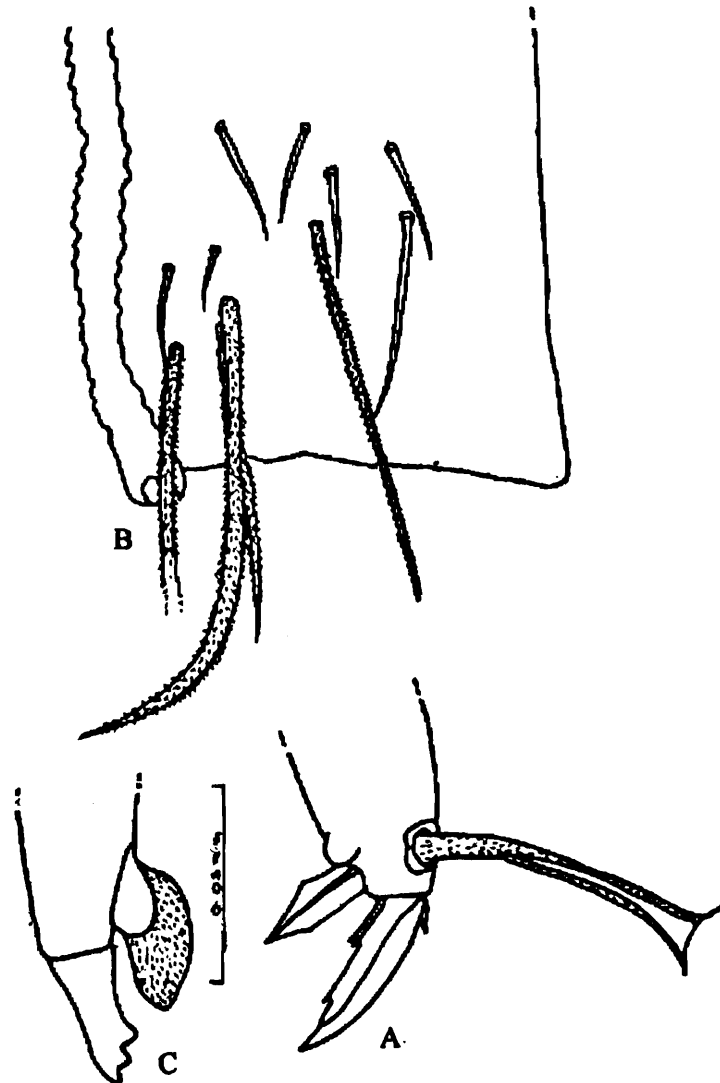


Fig. 9 : *Salina montana*. A, foot complex; B, chaetotaxy of anterior face of ventral tube; C, microdens.

Diagnosis : **Coloration** : Ground colour of head and body usually white, sometimes pale yellow; tergal margins of thoracic II, III and abdominal segments I, II edged with violet to blue black pigments. **Clothing** : Acuminate microchaetae as general clothing of body, macrochaetae anteromedially on either side of Abdominal segment. IV in a straight line. **Head** :

Pear shaped with 1+1 dark ocellar field, each field with 8+8 ocelli; ratio of length of antennal segments I-IV 47 : 67 : 57 : 93. Thorax : Relative length index of Ths II: III=29 : 17; unguis with paired basal *and* two distal unpaired teeth on inner margin. Abdomen : Relative length of abdominal segments I : II : III : IV : V : VI 13 : 23 : 4 : 79 : 14 : 8.5; ventral tube short with 4+4 ciliated macrochaetae and 7+7 microchaetae on its anterior face. Manubrium: mucrodens = 58 : 63; mucro short, broad prominently lobed into three teeth; Dental scale appendages large, striated apically, subequal to the length of mucro. Body length : 2 mm.

Material examined : Mizoram: 12 exs, Hill stream, KwanKwan, 4.IV.1994, Coll. A.K. Hazra. Manipur: 15 exs, Checkalpai Reserve Forest (Churachandpur), 3.4.1992, Coll. A.K. Hazra.

Distribution : India : Mizoram, Manipur, West Bengal, and Uttarpradesh.

Remarks : The species is recorded for the first time from Manipur and Mizoram.

Salina quattuorfasciata Handschin

(Fig. 10A-C)

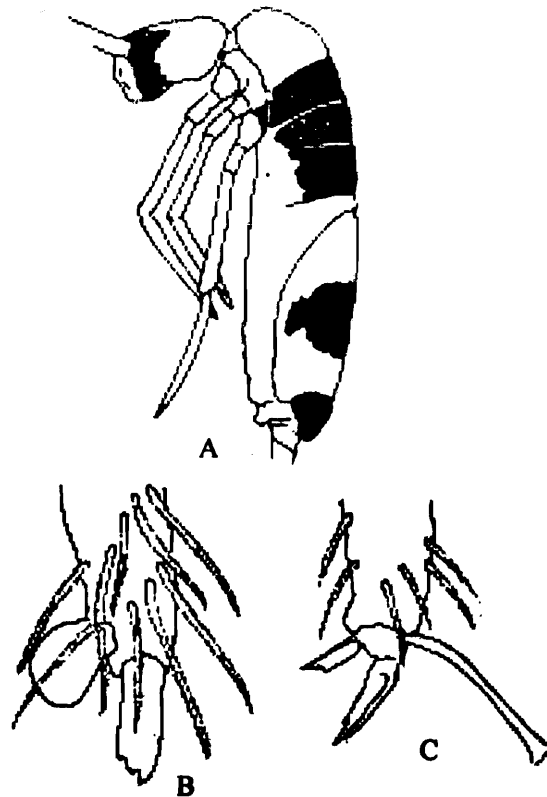


Fig. 10 : *Salina quattuorfasciata*. A, habitus; B, mucrodens complex; C, foot complex.

1928. *Cremastocephalus quattuorfasciata* Handschin, *Treubia*, 10 : 245 -270.

1929. *Salina quattuorfasciata* Handschin, *Rev. Suisse Zool.*, 36 : 229-262.

1971. *Salina quattuorfasciata* Prabhoo, *Oriental Ins.*, 5(1) : 36 : 244.

Diagnosis : Th.III, Abd.I, II covered with dark blue colour, Abd.IV posteriorly covered with blue colour, Abd.V and VI covered with blue colour. Unguis with 2 inner teeth, unguiculus truncated, tenant hair clavate. Antennae 1and1/2 times longer than body; eyes 8+8; mucro with 3 teeth, relative length index of Ant. I : II : III : IV = 25 : 37 : 29 : 41; Abd. II : IV = 4 : 40. Total body length : 2mm.

Material : Tamilnadu: 3exs. Attakati (Annamali Hills) 2.iii.1927, coll. E. Handschin.

Distribution : India : Tamilnadu.

Remarks : Description is based on literature.

***Salina tricolor sikkimensis* Mitra**

(Fig. 11A-D)

1973. *Salina tricolor sikkimensis* Mitra, *Orient. Ins.*, 7(2) : 159-202

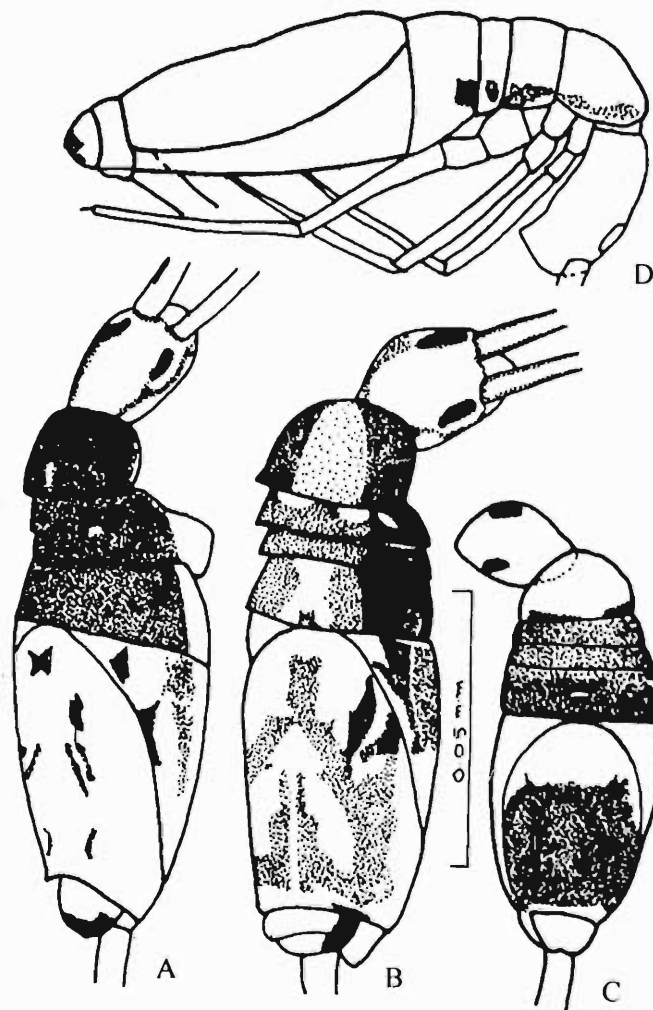


Fig. 11 : *Salina tricolor sikkimensis*. A,B,C,different colour forms; D, *Salina tricolor tricolor* lighter form.

Diagnosis : Colour pale yellow with dark blue black patches covering thoracic segment III and abdominal segments I and II; thoracic segment. II with or without pigment; half of

abdominal segment IV with posterior dark blue black pigment or irregular blotches or spots of the same pigment; lateral extension of abdominal segment III with or without extensive patch. Antennae pale yellow without dark pigment. Legs with femora dark apex, tibio-tarsi with basal and apical dark blue black patches. Body length 1-1.5 mm.

Material examined : Nagaland : 18 exs, Khezikinoma (Phek), 24.3.1997, Coll. A.K. Hazra.

Sikkim : 6 exs, Ranipool paddy field (East), 30.10.1992, Coll A.K. Hazra.

Distribution : India : Nagaland and Sikkim.

Salina striata (Handschin)

(Fig. 12A-D)

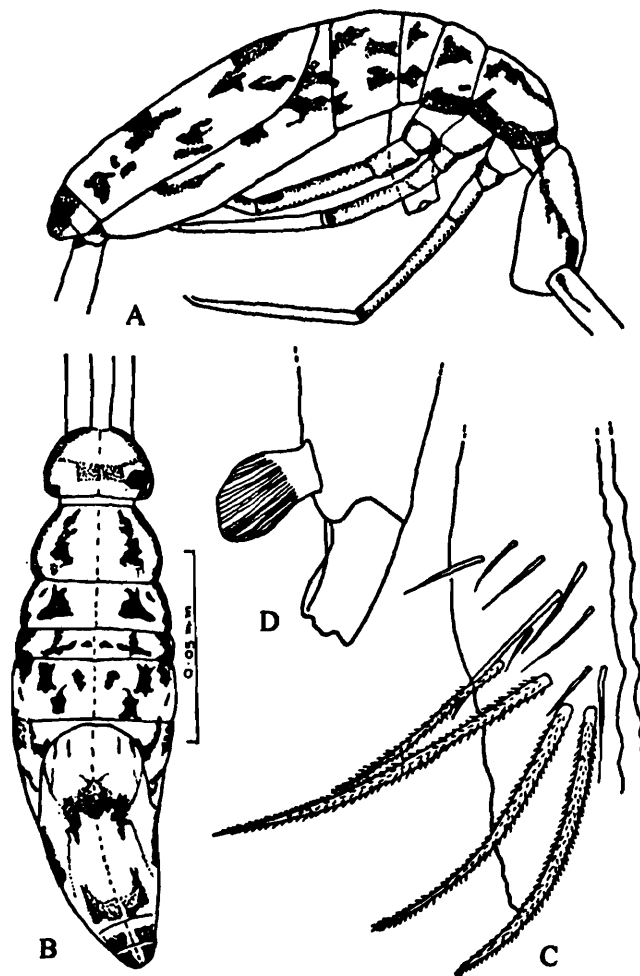


Fig. 12 : *Salina striata*. A, B, habitus; C, chaetotaxy of anterior face of ventral tube; D, mucrodens complex.

1928. *Cremastocephalus striatus* Handschin, *Treubia*, 10 : 245-270.

1929. *Salina striata* Handschin, *Rev. Suisse. Zool.*, 36 : 229-262.

1961 *Salina striatella* Yosii, *Nature and life in South East Asia*, 1 : 171-200.

1973. *Salina striata* Mitra, *Orient. Ins.*, 7(2) : 159-202.

Diagnosis : Coloration : Head and body white pale yellow to white in colour, head capsule with a medial dirty brown patch. Antennal segment I with a bluish longitudinal basal streak and another distal blue black pigmented patch. Clothing : Body sparsely clothed with short, ciliated acuminate microchaetae interspersed with flexed macrochaetae. Head : Pear shaped dorsally, frontal spine present 1+1; ocelli 8+8. Thorax : Relative length index of thoracic segments II : III = 15 : 9. Legs similar, unguis slightly curved with paired basal and single unpaired distal teeth on inner margin. Abdomen : Abdominal segments I : II : III : IV : V : VI = 8 : 14 : 3 : 41 : 7 : 3; Ventral tube well developed. Manubrium : mucrodens 28 : 33, mucro short, broad, prominently lobed into three teeth, median sometimes truncated tooth; dental scale appendages subequal to mucro with faint longitudinal striations. Body length : 3 mm

Material examined : Arunachal: 1ex, Rupa valley, 1.4.1999, Coll. A.K. Hazra; 20 exs, Tippi, Bhalukpong (West Kamang distt.). 30.3.1999, coll. A.K. Hazra. Meghalaya : 25 exs, Nongstoin, 21.3.1991, Coll. A.K. Hazra; 10 exs, Nongfa river bed (West Khasi Hill), 22.3.1991, Coll. A.K. Hazra; 42 exs, Botanical gardens, Shillong, 28.3.1991, Coll. A.K. Hazra, 500exs, Cherapunjee (East Khasi Hill) under growth of forest; 27.3.1992, Coll. A.K. Hazra.

Distribution : India : Arunachal, Assam, Meghalaya, Nagaland and Nilgiri Hills.

Remarks : The species is recorded for the first time from Arunachal Pradesh

***Salina tricolor tricolor* (Handschin)**

(Fig. 13A-H)

1928. *Cremastocephalus tricolor* Handschin, *Treubia*, 10 : 245-270.

1929. *Salina tricolor* Handschin, *Rev. Suisse, Zool.*, 36 : 229 -262.

1973. *Salina tricolor tricolor* Mitra, *Orient. Ins.* 7(2) : 159-202.

Diagnosis : Coloration : Head and body pale yellow with variable distribution of pigments. Clothing : Body sparsely and uniformly clothed with ciliated microchaetae interspersed with broadly acuminate, ciliated macrochaetae. Head : Pear shaped; Ocelli 8+8; frontal spines 1+1 present; ratio of length of antennal segments I-IV 26 : 33 : 29 : 46. Thorax : Relative length index of thoracic segments II : III = 9 : 4. Legs similar, unguis with paired basal and 2 distal unpaired inner teeth. Abdomen : Relative length index of abdominal segments I : II : III : IV : V : VI = 4 : 9 : 1.5 : 29 : 4 : 2.5; Ventral tube well developed. Manubrium: mucrodens 22 : 25; mucro deeply lobed in to three teeth, dental scale appendage nearly equal to mucro and with longitudinal striations. Body length 2mm.

Material examined : Mizoram : 6 exs, Kolasib, 31.9.1996, Coll. S.K. Mitra. Nagaland : 18 exs, Culvert No 36/3, phok (Phok distt.), 24.3.1997. Coll. A.K. Hazra.

Distribution : India : Manipur, Mizoram, Nagaland and Kerala (Type locality).

Remarks : The species was first described as *Cremastocephalus tricolor* by Handschin (1928). While revision of the genus Mitra (1973) described a subspecies *Salina tricolor tricolor*. The species is recorded for the first time from Mizoram and Nagaland.

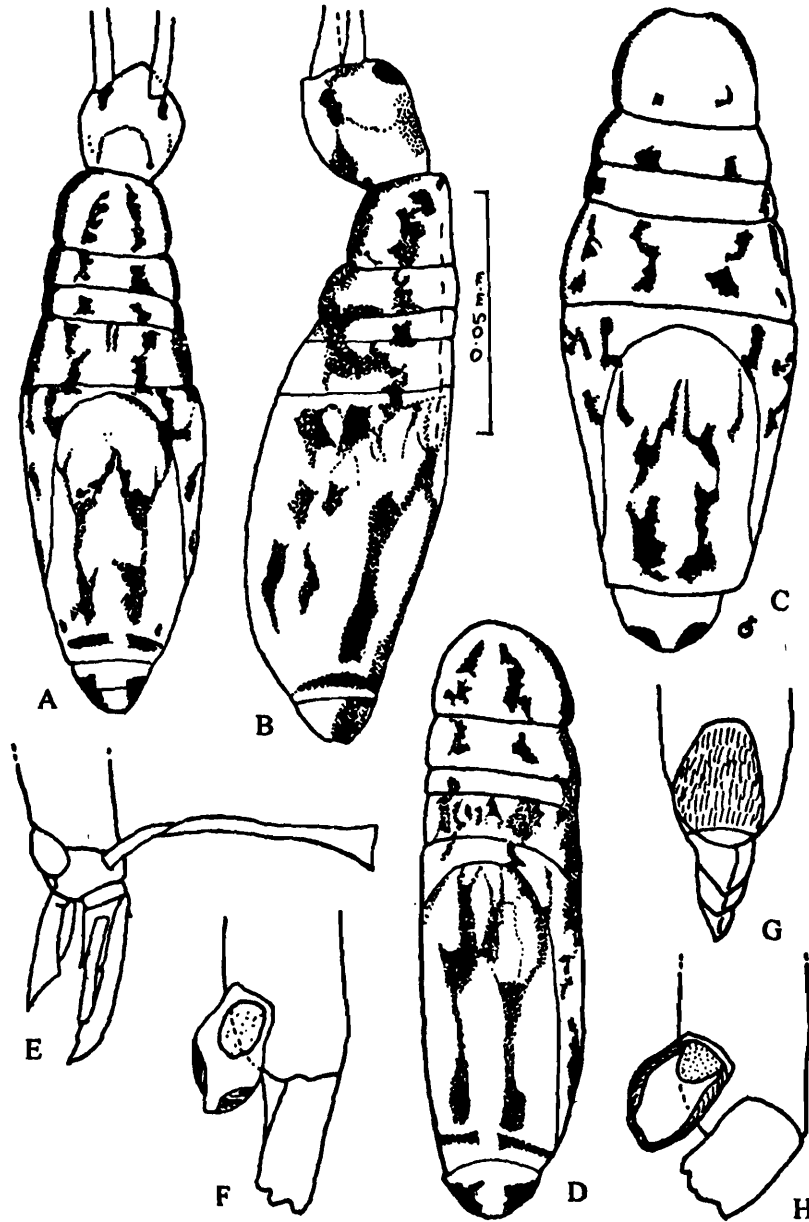


Fig. 13 : *Salina tricolor tricolor*. A, B, C, D, different colour forms; E,F,G,H, foot complex.

***Salina yosii* Salmon**

(Fig.14A-G)

1961. *Salina maculate yosii* Nature and Life in South-East Asia, 1 : 171-200; stach. 1964, Acta Zool Cracov. 9 : 1-26
1964. *Salina yosii* Salmon, Bull. Roy. Soc. N.Z., 2(7) : 145-644.
1973. *Salina yosii mitra*, Oriental Ins.7(2) : 159-202

Diagnosis : Coloration : General ground colour of body varying from white to pale yellow; symmetrical purple to violet markings present dorsally on thoracic II, III and abdominal segment III. Legs and furca pale yellow and without pigment. Clothing : Body clothed with slender acuminate, ciliated macrochaetae interspersed with longer macrochaetae. Thorax :

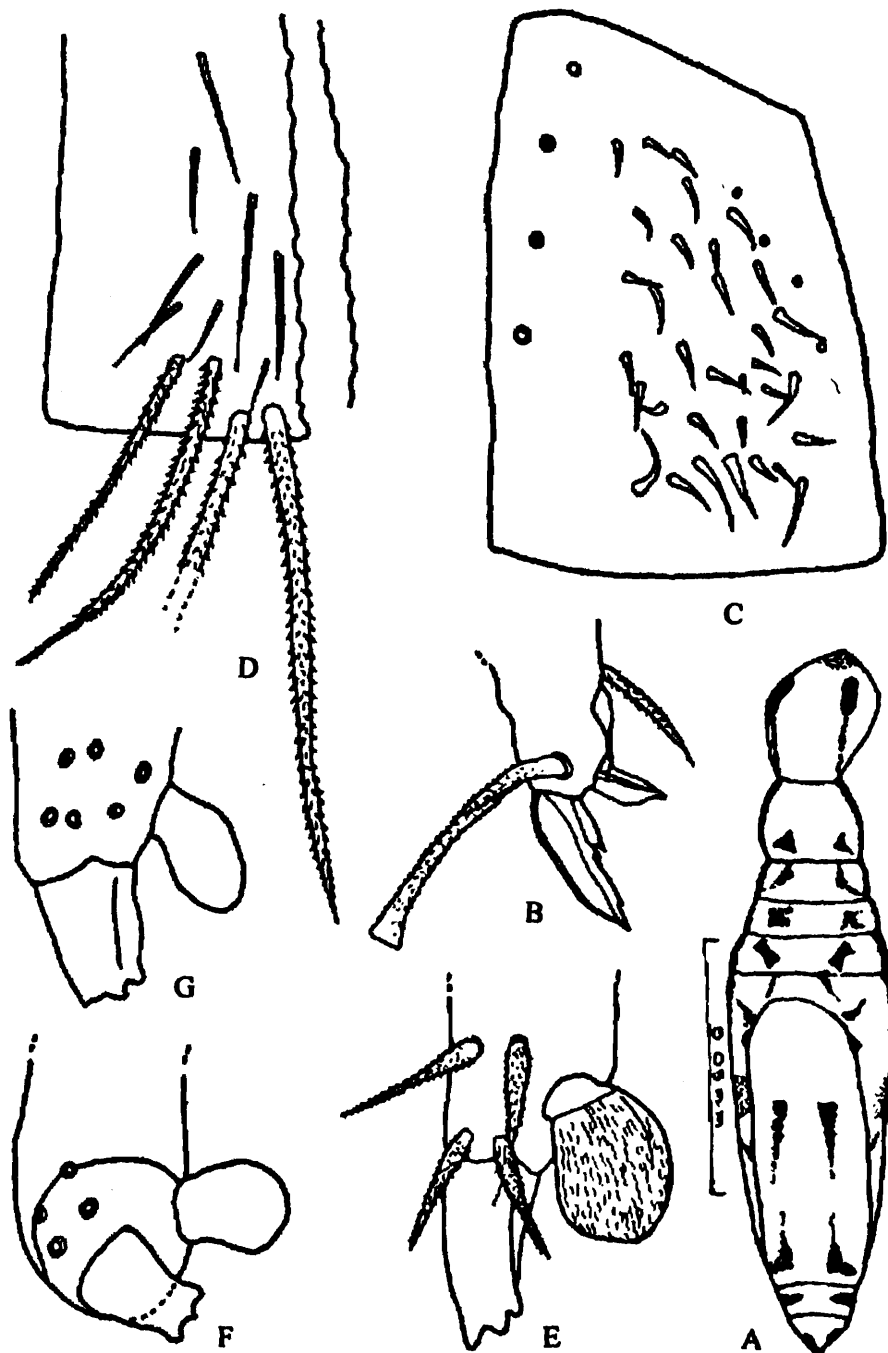


Fig. 14 : *Salina yosii*. A, habitus; B, foot complex; C, trochanteral organ; D, chaetotaxy of anterior face of ventral tube; E, F, mucrodens complex; G, a deformed mucrone.

Prothorax reduced, relative length index of thoracic segments II : III : 29 : 15. Hind tibio-tarsi much longer than the fore and mid ones; unguiculus truncate with a prominent midrib; tenent

hair long, clavate, finely ciliated. Abdomen : Relatively length index of abdominal segments I : II : III : IV : V : VI = 13 : 26 : 3 : 84 : 14.5 : 7.5. Manubrium : mucrodens 56 : 68, mucro short, broad and distinctly lobed into 3 teeth, dental scale appendages large, subequal to mucro. Body Length (excluding appendages) : 2 mm.

Material examined : Odisha : 14 exs, Dandabarr reserve Forest (Raigada), 30.1.1995, Coll. A.K. Hazra.

Disdtribution : India : Odisha, West Bengal; China and Thailand.

Remarks : The species is recorded for the first time from Odisha.

Key to the species and subspecies of *Salina*

1. Mucro long, narrow, superficially lobed into teeth, dental scale appendage relatively small, tergites with many macrochaetae The Indica Group 2
- Mucro short broad, deeply lobed into teeth, dental scale appendage relatively large, tergites with less number of macrochaetae The Celebensis Group 4
2. Body always with patches of blue-black or orange pigments 3
- Body without any pigment, thoracic tergites II, III and abdominal tergites I, II margins darker and II sometimes with faint violet pigment..... *indica* (Imms)
3. Thoracic tergite II with transverse orange bands or patches, abdominal tergites I-IV with median orange patches or pigments and V-VI with caudal patches.....
..... *biformis* Mitra
- Thoracic tergites II, III with dark blue-black pigment or orange suffusion extending abdominal tergites I., II; I-VI sometimes without patches *bengalensis* Mitra
4. Body devoid of dark pigment, tergal margins seldom with faint violet pigment; chaetotaxic formula of Ths. II, III/Abds. I, II = 7, 5/2, 3 *celebensis* (Schaffer)
- Body mostly with dark or variable or without pigment 5
5. Pigment usually in the form of violet streaks or small patches 6
- Pigment in the form distinct of longitudinal or transverse bands with various combination of pigments 7
6. Lateral margins of thoracic segments. II, III and abdominal tergites I, II, darker with darker pigment intruding into abdominal tergite II; thoracic segments II,III and abdominal I-IV with inconsistent violet patches *montana* (Imms)
- Lateral margins of thoracic segments. II, III and abdominal. I, II, III with purple pigment; abdominal segment IV with two characteristic median and caudal patches on each having violet lateral streaks *yosii* Salmon

7. Pigment usually tends to form longitudinal bands 8
 — Pigment usually tends to form transverse bands at least on thorax 9
8. Two longitudinal usually interrupted bands on each side of thoracic segments II, III and abdominal I, II and IV with an additional median and caudal band or patch
 *striata* (Handschin)
 — Two longitudinal bands forming more or less characteristic quadrangle ones on each side of body, lateral bands darkest; abdominal segments II-IV with an additional median streaks *tricolor* (Handschin)
- A. Pigment does not cover entire surface of any segment *tricolor tricolor* (Handschin)
 B. Dark blue-black pigment totally covers Th. III, Abds. I, II, Th. II entirely with pigment or non pigmented; half of Abd. IV posterodorsally with dark blue black pigment or with irregular blotches or spots; chaetotaxy as the principal form
 *tricolor sikkimensis* Mitra
9. Thoracic segments III with transverse blue-black bands; abdominal segments I, II, V and VI with a continuous lateral band from head to segment III and IV with paired medial patch *javana* (Handschin)
- A. Dark blue-black band surrounds the entire body through lateral margins of the head, thorax and abdomen with two dark blue-black narrow transverse bands which on abdominal segment II and IV connecting the lateral bands *choudhurii* Mitra
 B. Head proximally with pigment ring, thorax III, abd. V, VI with dark blue violet transverse band, abd. IV posterodorsally with dark blue pigment medially separated
 *quattuorfasciata* Handschin

Genus *Pseudosalina* Mitra

1973. *Pseudosalina* Mitra, Rev. Ecol. Biol. Sol., Paris, 10(3) : 359-377.

Pseudosalina christianseni Mitra

(Figs. 15A-E)

1973. *Pseudosalina christianseni* Mitra, Rev. Ecol. Biol. Sci., 10(3) : 361-377.

Diagnosis : Colouration : Body colour light yellow; blue black to violet patches present on Th. III, Abd. I and Abd. II. Pale orange present on dorsal side of Abds. III, IV; proximal end of head with deep blue band through the antennal. Ant. I, II, III, distally bluish, Ant. IV without pigment. Body surface uniformly covered with ciliated macrochaetae. Ths. II, III, Abds. I, II, III medially with acuminate macrochaetae and on abdomen, IV, V, VI, posteriorly, macrochaetal formula of Ths. II, III and Abds. II, III, IV = 43, 31 and 19, 13, 5, relative

long the width of Ants. I : II : III : IV = 40 : 43 : 41 : 55; Ant IV apically with prelabral setae 4, labral setae 5, 5, 4.

Thorax : Relative length index of Ths. II : III = 34 : 30; unguis on inner margin with paired teeth subapical teeth, external basolateral teeth present; unguiculus without teeth, lanceolate, tenant hair present and clavate; trochanter organ with 36-38 spines.

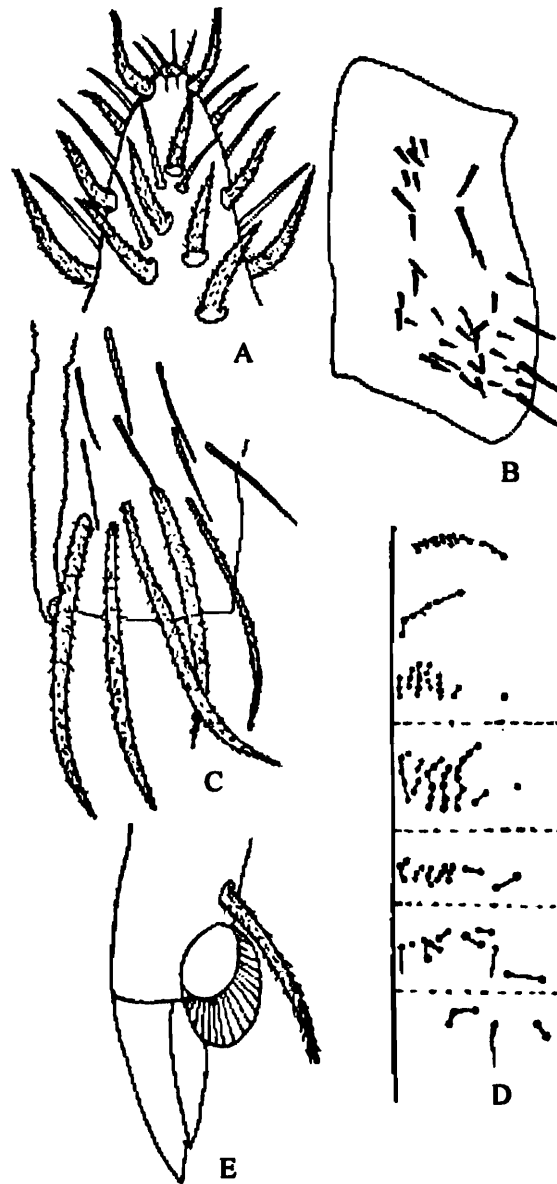


Fig. 15 : *Pseudosalina christianseni*. A, apex of IV Ant; B, trochanteral organ; C, chaetotaxy of anterior face of ventral tube; D, chaetotaxy of Ths. II, III Abd. I, II, III; E, apex of dentes.

Abdomen : Relative length index I : II : III : IV : V : VI = 12 : 17 : 10 : 57 : 11 : 7 : ventral tube anterior face with 5+5 macrochaetae teeth, single medium setae; relative length index of manubrium : macrodents = 49 : 62, mucro with 2 teeth. Body length : 0.6-1.1 mm.

Material examined : Uttarakhand : 2 exs. Dehradun dist., 25.ii.1967, coll : S.K. Mitra; Himachal Pradesh : 10 exs., Jabli, beside hill stream, Solan dist., 25.iii.2010. coll. G.P. Mandal.

Disdtribution : India : Uttarakhand and Himachal Pradesh.

Remarks : The species is recorded for the first time from Himachal Pradesh.

***Pseudosalina multiformis* Mitra**

(Figs. 16A-E)

1973. *Pseudosalina multiformis* Mitra, *Rev. Ecol. Biol. Sol., Paris*, 10(3) : 359-377.

Diagnosis : Colouration : General ground colour of head and body varies from white to pale yellow, darker patches present on Ths. II, III and anteriorly on Abd. I; a longitudinal

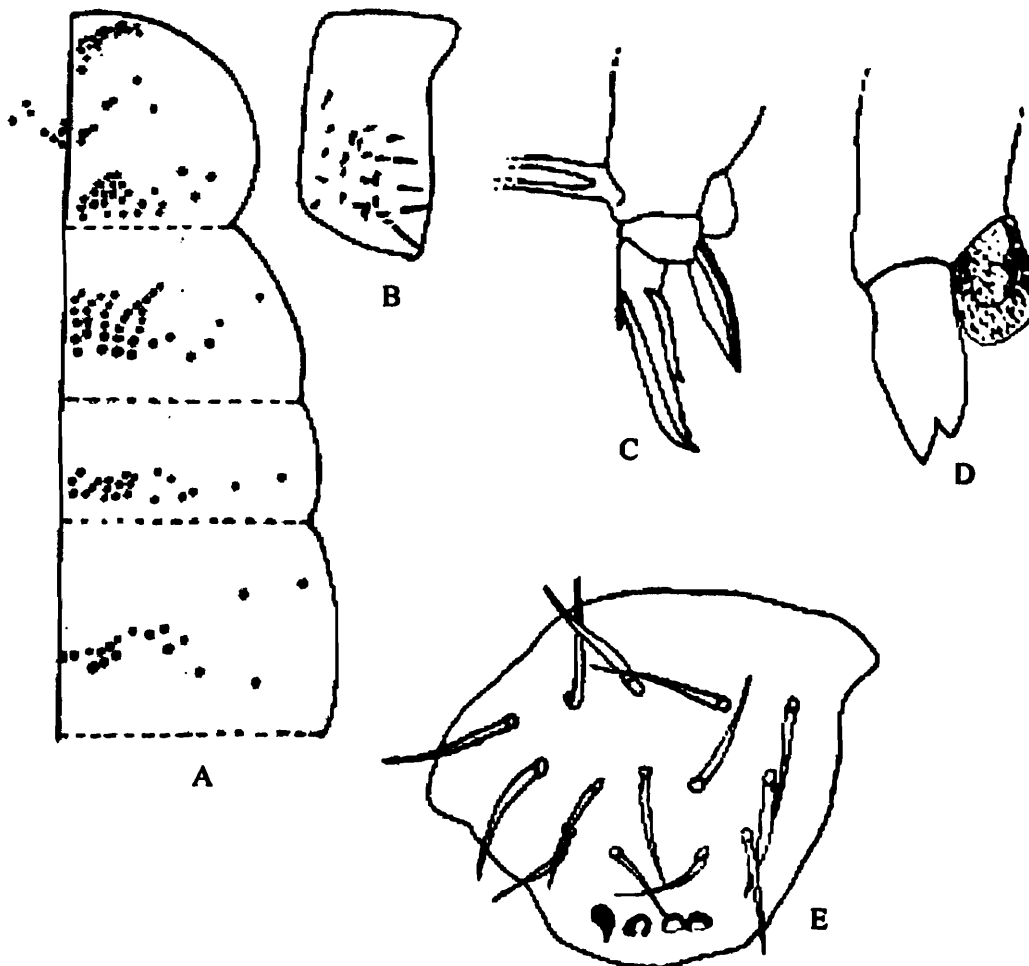


Fig. 16 : *Pseudosalina multiformis*. A, chaetotaxy of Ths. II, III Abd. I, II; B, trochanteral organ; C, foot complex; D, apex of dentes; E, chaetotaxy of labrum.

streak on each side of Abd. III continuing anteriorly to Abd. II and posteriorly on Abd. IV. Clothing : Body clothed with micro & macrochaetae. Head : Frontal spines 1+1 reduced; ocelli 8+8 in pigmented ocellar fields, ocelli G and H smaller than the rest; relative length index of Ants. I : II : III : IV = 13 : 8 : 7 : 18; Labrum setae 5, 5, 4. Thorax : Relative length

index of Ths. II : III = 26 : 17; legs all similar; unguis elongate, unguiculus lanceolate; tibio-tarsal lobe present; tenant hair finely ciliated, clavate; trochanteral organ with 26-32 spines. Abdomen : Relative length index of segments I : II : III : IV : V : VI = 14 : 21 : 8 : 75 : 7.5 : 7; ventral tube long, anterior face with 5+5 macrochaetae; relative length index of manubrium : mucrdens = 59 : 66; mucro bidentate; dental scale appendage faintly striated. Body length 1.29-2 mm (excluding appendages).

Material examined : Himachal Pradesh : 6 exs, Jabli hill stream under stone, Solan dist., 25.iii.2010, coll. G.P. Mandal; 4 exs., Gohura near Giri river, Solan dist., 21.iii.2010, coll. G.P. Mandal.

Distribution : Himachal Pradesh and Uttarakhand.

Remarks : The species is recorded for the first time from Himachal Pradesh.

Pseudosalina nigrocephala Mitra

(Figs. 17A-F)

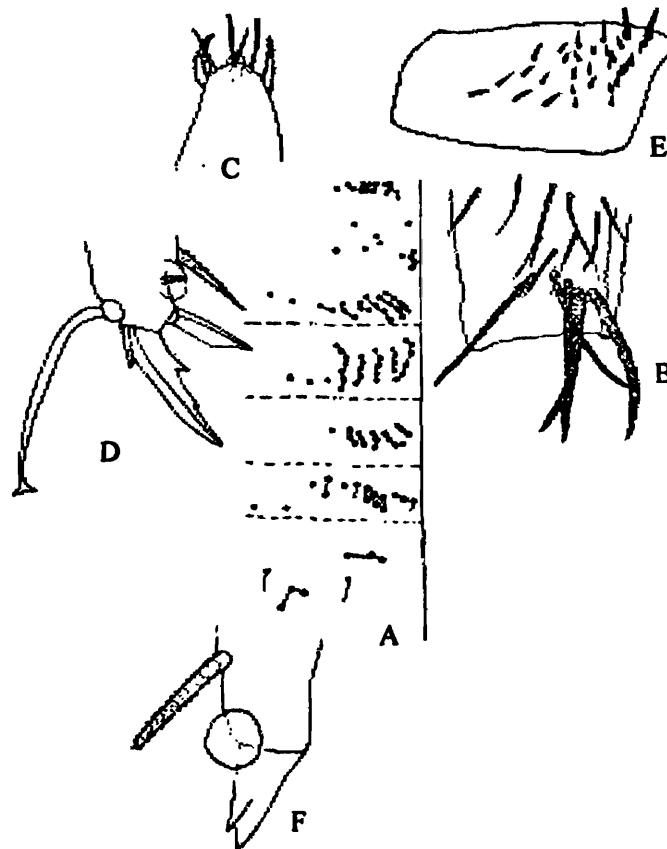


Fig. 17 : *Pseudosalina nigrocephala*. A, chaetotaxy of Ths. II, III Abd. I, II, III; B, anterior face of ventral tube; C, apex of Ant IV; D, foot complex; E, trochanteral organ; F, apex of dentes.

1966. *Salina nigrocephala* Mitra, *Indian J. Ent.*, 28 : 70-72.

1973. *Pseudosalina nigrocephala* Mitra, *Rev. Ecol. Biol. Sol.*, 10(3) : 363-365.

Diagnosis : Colouration : Body colour dull green, head blue-black, Th. III, Abd. I and the anterior half Abd. II with blue pigment; Abd. IV, V, VI with dorsomedial blue-black patch, Ant. IV without pigment. Body surface covered with slender setae. Head : Eye 8:8, length ratio of Ant. I: II: III: IV=17:19:14:28. Prelabral setae 4, labral setae 5, 5, 4, labrum anteriorly with 4 round tubercles. Thorax : Length index of Ths. II : III = 18 : 9; unguis with inner paired basal and 1 distal inner unpaired teeth, external basolateral teeth present; unguiculus truncate; trochanteral organ with 30-34 spins, tenant hair present and clavate. Abdomen : Ratio of Abds. I:II:III:IV:V:VI = 9:14:4:40:9:5; anterior face of ventral tube with 5+5 macrochaetae with 4 teeth, corpus with single median setae, furcula long, length ratio of manubrium: macrodens = 50 : 59; mucro with 2 teeth, dental scale present. Body length : 1.8-2.3 mm.

Material examined : Uttarakhand : 22 exs. Sahasradhara Hills, Dehradun dist., 12.viii.1985 coll. S.K. Mitra; Himachal Pradesh : 4 exs., Gohura near Giri river, Solan dist., 21.iii.2010, coll. G.P. Mandal.

Remarks : The species is recorded for the first time from Himachal Pradesh.

***Pseudosalina rapoportii* Mitra**

(Figs. 18A-D)

1973. *Pseudosalina rapoportii* Mitra, *Rev. Ecol. Biol. Sol.*, 10(3) : 372-374.

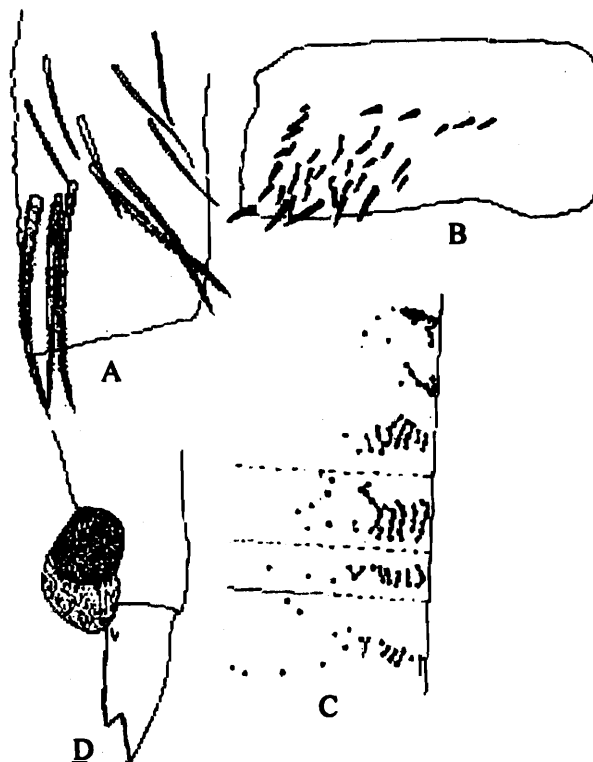


Fig. 18 : *Pseudosalina rapoportii*. A, chaetotaxy of anterior face of ventral tube; B, trochanteral organ; C, chaetotaxy of Ths. II, III Abd. I, II; D, apex of denticles.

Diagnosis : Body Colouration: colour dull yellow in colour; dark blue black pigment on head; Ths. II, III, and Abd. I covered with blue black pigment, Ant. IV without pigment. Ant. II distally with blue black pigment. Body covered with ciliated setae. Head : eyes 8+8; relative length index of Ant. I : II : III : IV = 36 : 37 : 28 : 31. Thorax : Ratio of Ths. II: III = 24:16; ratio of length of Abds. I : II : III : IV : V : VI = 11 : 15 : 11 : 55 : 8 : 6; inguis with paired inner basal and 1 unpaired distal teeth; unguiculus truncated without teeth, tenant hair present and clavate; trochantral organ with 36-40 spines. Abdomen : length ratio of Abds. I : II : III : IV : V : VI = 11 : 15 : 11 : 55 : 8 : 6; ventral tube anteriorly on anterior face with 5+5 macrochaetae; dentes longer than manubrium, length ratio manubrium:macrodens = 45 : 55; mucro with 2 teeth. Body length : 1.2 – 1.4 mm.

Material examined : Uttarakhand : 20 exs. Jeolykote, Nainital dist. Coll. S.K. Mitra, 10. ix. 1965.

Genus *Yosiia* Mitra

1967. *Yosiia* Mitra, *Proc. Zool. Soc., Calcutta*, 20 : 43-47.

Type species : *Yosiia dehradunia* Mitra, 1967

***Yosiia dehradunia* Mitra**

(Figs. 19A-E)

1967. *Yosiia dehradunia* Mitra, *Proc. Zool. Soc. Calcutta.*, 20 : 43-47.

Diagnosis : Coloration : Pale yellow with dust of blue pigment over the body and a pair of dark blue-black patches one on each side on abdominal segments III and IV. Clothing : Scales absent; head and body clothed with setae, mostly ciliated; longer setae broad, cylindrical and blunt or slender acuminate; setae arising in clusters from the cervix and decumbent on posterior margin of head, similar setae also present anteriorly on mesotergum, head capsule and body. Head : Pear-shaped; ocelli 8+8 in pigmented ocellar fields each group of 8 ocelli arranged in two longitudinal parallel rows. Thorax : Segment I reduced; the relative length index of segments II : III = 23 : 11. Legs similar; each tibio-tarsus with two large tibio-tarsal lobes; unguiculus of the "truncate" type; trochantral organ with 24 short spines. Abdomen : Relative length index of segments I : II : III : IV : V : VI = 6 : 15 : 4 : 67 : 9 : 6; Ventral tube short, anterior face with 4+4 long ciliated setae; rami of tenaculum each with 4+4 teeth; dens and manubrium subequal, dens crenulated; mucro vestigial; dental scale appendages greatly enlarged, dorsal in relation to dens and with longitudinal striations. Body length 1.14 mm.

Material examined : Sikkim : 2 exs, Benjong (South distt.), 9.11.1992; 2 exs, Jorethang, 9.11.1992; 20 exs, Mamring, Rongpo, 13.11.1992, Coll. A.K. Hazra. Tripura: 6 exs, Zoo garden, 27.5.1995, Coll. A.K. Hazra.

Distribution : India : Sikkim, Tripura and Uttaranchal

Remarks : The extension of distribution of this monotypic genus to the North Eastern part of India is interesting.

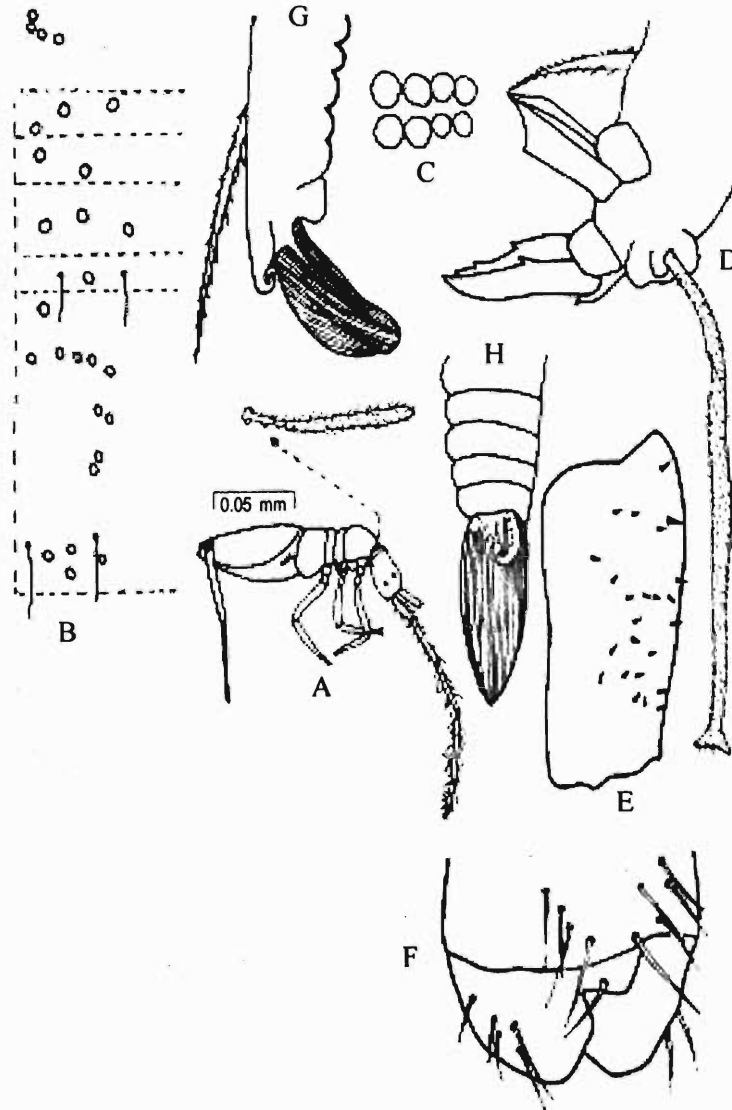


Fig. 19 : *Yosiia dehradunia*. A, chaetotaxy of Ths. II, III Abd. I, II, III, IV; B, chaetotaxy of anterior face of ventral tube; C, apical part of denticles; D, trochanteral organ; E, apical part of foot complex.

Genus *Callyntrura* Börner

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

Callyntrura (Handschinphysa) escheri (Handschin, 1929) (Figs. 20A, B.)

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

Diagnosis : Ground colour of the body yellowish blue. Th. II, Abd. II and ventral tube, subcostal, trochanter, distal part of Abd. IV and Abd. V with blue pigment patches. Antennae

bluish violet. Ant. I dark blue, distal part of femur, tibia and dentes blue pigment. Unguis with three inner teeth, mucro 4 teeth. Body length : 3 mm.

Loc : 1 ex., Attakatti (Anamalai Hills), under litter, 2.iii.1927.

Remarks : Description based on literature.

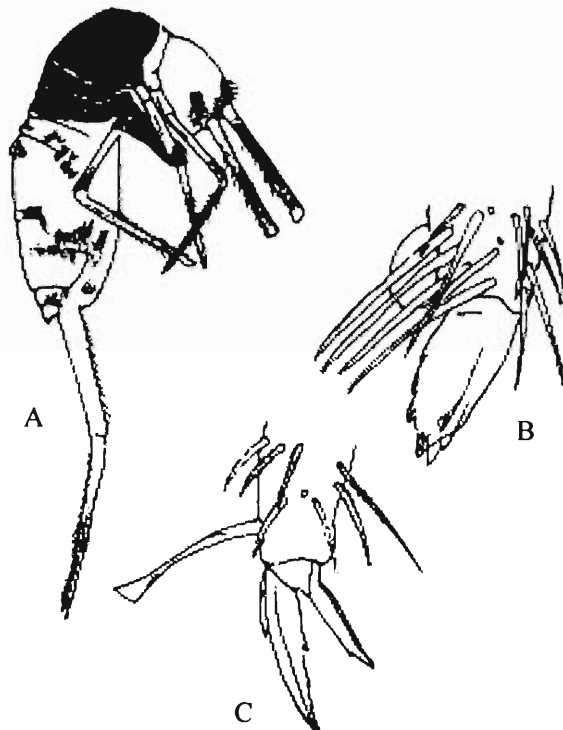


Fig. 20 : *Callyntrura (Callyntrura) escheri*. A, habitus; B, foot complex.

Callyntrura (Callyntrura) semiviolacea (Handschin)

(Figs. 21A-H)

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

Diagnos : Coloration : Pale yellow in colour with variable pigmented patches; thoracic II, III and abdominal segments I, II, III with violet to blue pigments at its margin extending laterally to abdominal segments III, IV; IV and V, mostly non-pigmented; thoracic II and abdominal segments II, III and posterior of abdominal segments IV and VI with seldom dorsal pigmented patches. Antennal bases with violet pigment. Femora sometime with darker distal patches. Clothing : Head, body and appendages clothed with setae and lanceolate scales; macrochaetae on head, abdominal segments IV, V, VI acuminate, thoracic II, III and abdominal segments I, II, III with obliquely truncated macrochaetae. Head : Pear shaped with 4+4 dark frontal spines; ocelli 8+8 in pigmented ocellar fields; Antennae very long, about twice and a half the

length of head and body. Ant.I/Head diagonal = 31/19; ratio of length of antennal segments I-IV : 38 : 37 : 23 : 84. Abdomen : Relative length index of abdominal segments I : II : III : IV : V : VI 3.2 : 6 : 2 : 27 : 3 : 2; ventral tube long; anterior face anteriorly with macrochaetae transiting posteriorly; rami of retinaculum each with 4 teeth; dental scale appendages absent; mucro deeply lobed into 6 teeth; dentes dorsally near base of mucrones with two short with minute striations. Body length 2 mm.

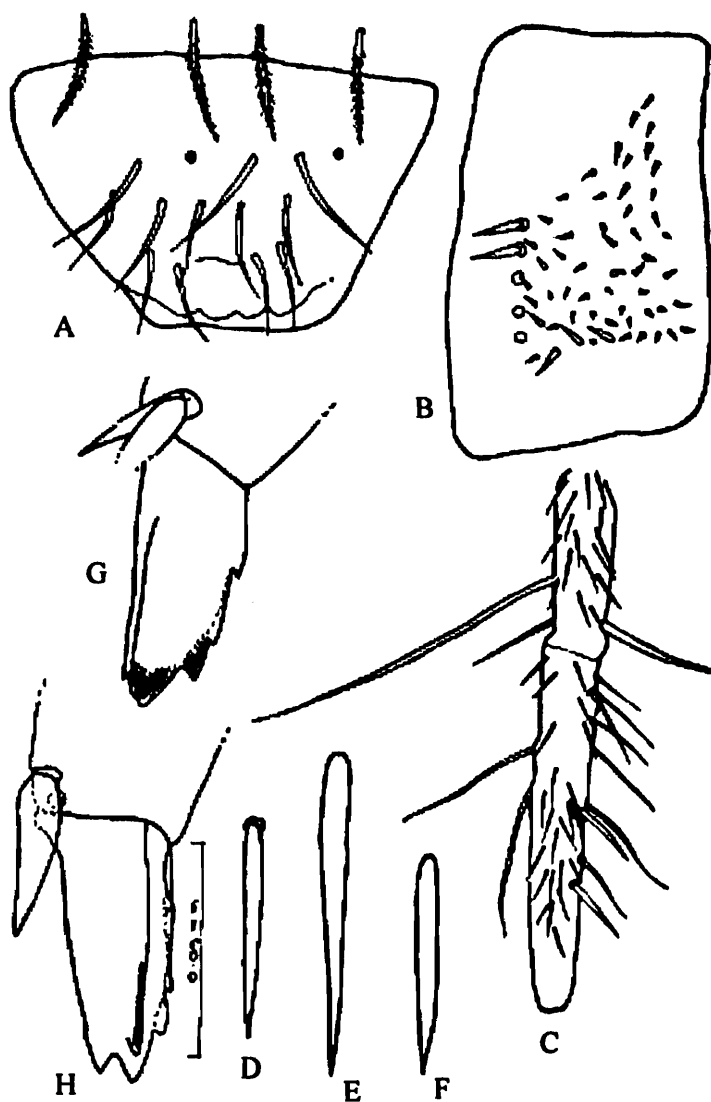


Fig. 21 : *Callyntrura (Callyntrura) semiviola*. A, labrum; B, trochanteral organ; C, hind tibiotarsus; D,E,F, spiniform setae from inner margin of tibiotarsus; G,H, mucrodens complex.

Material examined : Odisha : 8 exs, Sijumali (Rayagada) 12.11.1994, Coll. A.K. Hazra.

Distribution : India : Odisha, Tamilnadu, and Kerala.

Remarks : Handschin (1929) described the species as *Microphysa semiviola*. Handschin (1964) changed its generic status to *Aphysa*. Mitra (1974) synonymised *Aphysa* with *Callyntrura*. The species is recorded for the first time from Odisha.

***Callyntrura (Handschinphysa) ceylonica* (Ritter, 1911), Yosii, 1966**
(Figs. 22A-C)

1911. *Campylothorax ceylonicas*, Ritter, *Wien. Ann. Nat. Hist. Hofmus.*, 24 : 379-398.

1966. *Callyntrura ceylonica* Yosii, *Res. Kyoto Univ. Sci. Exped. Karakoram and Hindukush.* 8 : 333-405.

1971. *Aphysa ceylonica* Prabhoo, *Oriental Ins.*,

1974. *Callyntrura (Handschinphysa) ceylonica* Mitra, *Rev. Zool. Biol. Sol.*, 11(3) : 397-439.

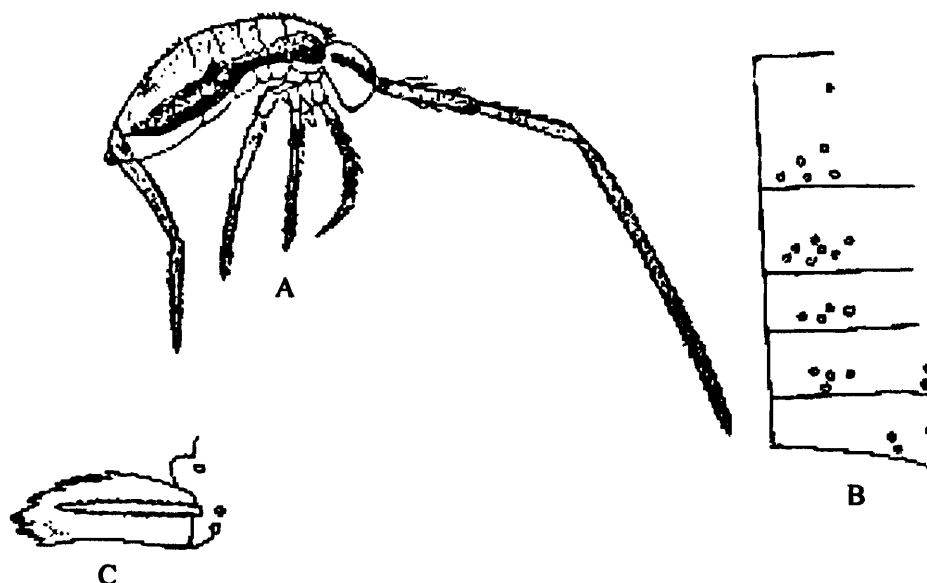


Fig. 22 : *Callyntrura (Handschinphysa) ceylonica*. A, habitus; B, macrochaetae on Ths. II, Abds. III; C, mucro.

Diagnosis : Colouration : Ground body colour pale yellow; blue-black pigment band on the lateral side of the ocellar field to Abd. V. Ant. IV totally blue pigmented. Clothing : Body covered with setae and scales. Head : eyes 8+8 ocelli; ratio of Ant. I : II : III : IV = 36 : 35 : 25; Thorax : unguis with a pair of inner teeth, medium unpaired tooth, unguiculus without teeth, tenant hair present and clavate, anterior face of ventral tube with 3+3 macrochaetae ratio of manubrium : dentes = 10 : 13, mucro with 7 teeth. Body length: 1.85-2.5mm

Material examined : Kerala : 5 exs., Under rock, Wynad dist., 20.vii.1959 coll. N.R. Prabhoo; 8 exs., tea field, Nallikai Estate, verudiperiyay dist., 27.vii.1964 coll. N.R. Prabhoo; 6 exs., forest tea field, Poonmudi dist., 10.vi.1965 coll. coll. N.R. Prabhoo.

***Callyntrura (Handschinphysa) cingulata* Bonet**

1930. *Microphysa cingulata* Bonet, *Rev. Esp. Ent.*, 6(3) : 249-273.

Diagnosis : Colouration : Ground colour pale yellow, ocellar field black, violet to blue pigment antennal bases continuing posteriorly to dorso lateral surface of head; Ths. I, II, Abds. I, II, III laterally pigmented with violet to blue blue-black pigment; Abd. IV lateral longitudinal pigment, dorsomedial transverse band, Abd. V posterior margin with violet to

blue black pigment. Ant. I, II, III, entirely with blue-violet pigment, pigmentation legs variable, femora and tibiotarsi banded patches with diffused violet pigment distally. Head; eyes 8+8; G and H smallest. Thorax : relative length index of Ths. II : III = 21 : 10, unguis elongate with paired inner and 2 distal unpaired teeth, basolateral teeth present unguiculus lanceolate inner margin with single tooth; tenant hair clavate. Abdomen : relative length index of Abds. I : II : III : IV : V : VI = 6 : 11 : 7 : 51 : 6 : 4; mucro with 6 teeth. Body length: 2 mm.

Material : Maharashtra : 6 exs., Bandra, Bombay dist., coll : Francis Xavier College, 1930.

Remarks : The species is based on literature; type: deposited to Madrid Museum, Spain.

Callyntrura (Handschinphysa) delamarei Mitra

(Figs. 23A-E.)

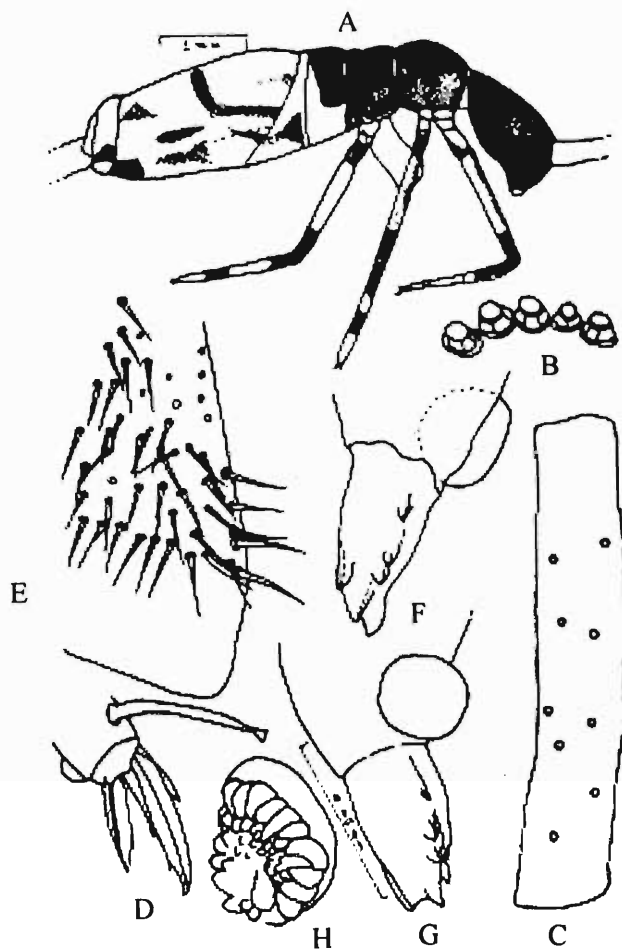


Fig. 23 : *Callyntrura (Handschinphysa) delamarei*. A. habitus; B. Sockets; C. Chaetotaxy of Ant. I; D. Foot complex of leg. III; E. trochanteral organ; F., G. mucrodens; H. male genital field.

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

Diagnosis : Colouration : Pale yellow in spirit, dark violet to blue black patches covering head. Thoracic II, III and abdominal segments I, II and IV with a narrow middle transverse

stripe extending anteriorly; abdominal segment III with dark patches extending posteriorly general surface of segment IV and V with two dark patches one on each side. Clothing : Body clothed with scales, usually lanceolate in shape; antenna clothed with scales and setae. Head : Pear shaped in outline; frontal spines 4+4 dark, finely ciliated; ocelli 8+8. Thorax : Relative length index of thoracic I : II : III = 11.5 : 6. Legs similar; unguis little curved with inner paired basal and distal unpaired teeth; unguiculus lanceolate, tenent hair well developed. Abdomen : Relative length index of abdominal segments I : II : III : IV : V : VI = 3.5 : 7 : 2.5 : 33 : 4 : 2; rami of retinaculum with 4 teeth. Manubrium: mucodens = 26 : 36; mucro deeply lobed into six teeth, dental scale appendages large with 2 spiniform dorsal setae near base of each mucrone. Body length 2-2.5 mm.

Material examined : Odisha : 14 exs, Baphlimali Hill top (Rayagada), 22.2.96, Coll. A.K. Hazra.

Distribution : India : Odisha.

Remarks : The occurrence of the species from the above locality reveals that the further extension of distribution of *Callyntrura (Handschinphysa) delamarei* to the Southern part Odisha.

***Callyntrura (Handschinphysa) lineata* (Parona)**

(Figs. 24 A-D.)

1892. *Entomobrya lineata* Parona, *Atti. Soc. Ital., Milano*, 34 : 132-135.

1912. *Paronella borneri* Imms, *Proc. Zool. Soc. London*, pp. 80-125.

1912. *Paronella phanolepis* Imms, *ibid*, pp. 80-125,

1957. *Handschinphysa lineata* Salmon, *Acta. Zool. Cracov.*, 11(14) : 313-362.

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

Diagnosis : Coloration : Body pale yellow with variable purple to blue black pigment; head with or without pigment thoracic I, II and abdominal segments I, II, III. Pigmented with purple to blue black pigment laterally or entirely. Clothing : Head, body and appendages clothed with setae and pseudoscales; macrochaetae flexed, obliquely truncated and ciliated (brush setae) setae on thoracic II, III and abdominal segments I, II, III. Antennae and legs clothed with darker, acuminate, ciliated setae. Head : Pear shaped, frontal spines 4+4 present; ocelli, 8+8. Head /Ant I = 28/27; ratio of length of antennal segments I-IV = 28 : 28 : 18 : 48; apex segment IV with a conspicuous sense knob encircled with setae. Thorax : Relative length index of thoracic segments II : III 52 : 22; unguis elongate, little curved, unguis with paired inner and 2 distal unpaired teeth; unguiculus lanceolate; tenent hair clavate. Abdomen : Relative length index of the segments 13 : 24 : 8 : 130 : 12 : 5; rami of retinaculum each with 4 teeth. Manubrium: mucrodens 110 : 148; dentes stout; mucro plump with 6-9 teeth. Body length : 2.5-4 mm.

Material examined : Tripura : 5 exs, Sepahijola, 1.5.1995, Coll. A.K. Hazra; 6 exs, Rest House at rubber plantation, 29.4.1995, Coll. A.K. Hazra.

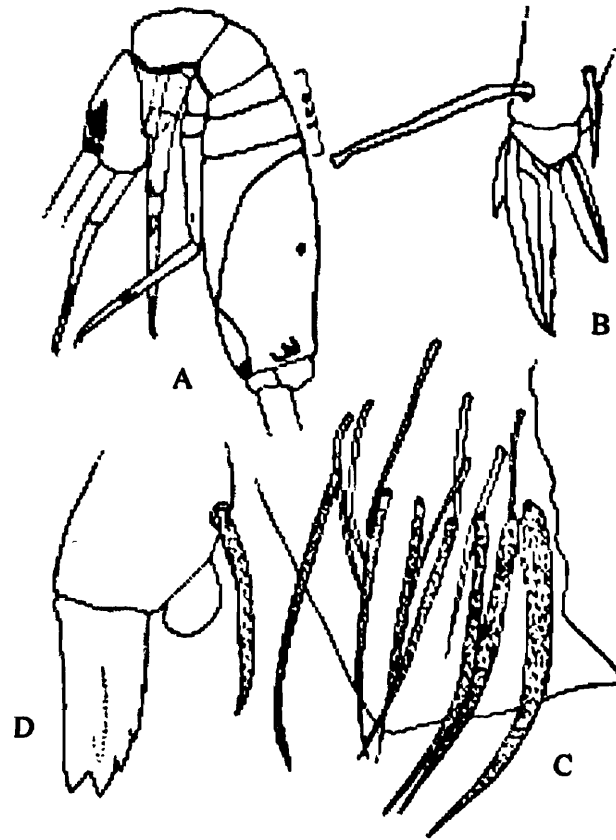


Fig. 24 : *Callyntrura (Handschinphysa) lineata*. A, habitus; B, foot complex; C, chaetotaxy of anterior face of ventral tube; D, mucrodens complex.

Distribution : India : Manipur, Tripura and Uttaranchal.

Remarks : The species is recorded for the first time from Tripura.

***Callyntrura (Handschinphysa) longicornis* (Oudemans)**

(Figs. 25A-G)

1890. *Entomobrya longicornis* Oudemans, *Zool. Ergeb*, 1 : 73-91

1911. *Campylothorax ceylonicus* Ritter, *Neue Thysanuren und Collembolen aus Ceylon und Bombay, gesammelt von Dr. Uzel. Ann. K.K. Naturhist. Hofmus. Wien* 24 : 379-398.

1957. *Handschinphysa longicornis* Salmon, *Acta. Zool. Cracov.*, 2(14) : 313-363.

Diagnosis : *Coloration* : Yellowish to brown with blue black ocellar fields with a narrow edging to the thoracic and abdominal terga. Abdominal segments III and IV with lateral blue-black shading and V and VI each with ventro-lateral blue black pigment blotches. *Clothing* : Body with pointed scales except across the dorsal surface of the thorax and anterior part of the abdomen. *Body* : Antennae longer than the body; ratio of length of antennal segments I-IV 66 : 75 : 52 : 110, segment IV annulated. *Body length*, to 3.5 mm. *Legs* : Claw with two

long outer pseudonychia reaching the level of the inner teeth. Legs with one distal tooth and a pair of basal teeth. Furcula : Manubrium : dens to mucro as 110 : 135 : 718; dens with many spines like ciliated setae. Mucro with 7-9 teeth, one of them always with a lateral ridge and two subapical and two or three plate like teeth on the posterior face.



Fig. 25 : *Callyntrura (Handschinphysa) longicornis*. A, B, D, moudens complex C, serrated spine like setae from dens; E, F, foot complex; G, ocelli.

Material examined : Assam : 30 exs, Tezpur, 2.xi.1998, Coll. G.P. Mandal. Sikkim : 28exs, Pelling, 6.x.1998; 14 exs, Legship, 9.v.1998, Coll. A.K. Hazra.

Distribution : India : Assam and Sikkim.

Remarks : The species is recorded for the first time from.

***Callyntrura (Callyntrura) carli* (Handschin)**

(Figs. 26A, B)

1929. *Aphysa carli* Handschin, *Rev. Suisse Zool.*, 36 : 229-262

Diagnosis : Body length 3 mm. ground colour of the body yellowish. Th. I – Abd, III covered with blue pigment. Coxa, subcoxa, trochanter and femur with blue colour. Ant. II, proximally light blue, III and IV segment dark blue pigment. Dentes with blue pigment.



Fig. 26 : *Callyntrura (Callyntrura) carli*. A, foot complex; B, mucro.

Measurement : Ant. I : II : III : IV = 75 : 55 : 130. Th. II : III = 25 : 17, Abd. I : II : III : IV : V : VI = 12 : 14 : 8 : 67 : 10 : 5 unguis with 3 inner teeth, unguiculus truncated, mucro with 6 teeth.

Distribution : India : Tamil Nadu (Nilgiri Hills)

Remarks : Descriptions are based on literature.

***Callyntrura (Handschinphysa) nigerrima* (Prabhoo) Mitra**1971. *Aphysa nigerrima* Prabhoo, *Oriental Ins.*, 5(1) : 39-41.1974. *Callyntrura (Handschinphysa) nigerrima* Mitra, *Rev. Zool. Biol. Sol.*, 11(3) : 397-439.

Diagnosis : Colouration: Head, Head Ths. II, III, Abd. I, II, III, with blue-black pigment; Abd. IV postolaterally pigmented dorsomedially longitudinal pigment strand; base of manubrium and femora with pigment patches, ventral tube pigmented. Head; Eyes 8+8. Thorax : Unguis paired basal and a distal unpaired teeth, unguiculi lanceolate, tenant hair clavate. Abdomen : Mucrone with 6 teeth, dental scale appendages present.

Material examined : India : Kerala, 2 exs., Sentinal rock field, Wynad dist., 20.vii.1952, coll. N.R. Prabho.

Callyntrura (Handschinphysa) prabhooi Mitra

(Figs. 27A-C.)

1971. *Aphysa vestita* Prabho, *Oriental Ins.*, 5(1) : 42-43.

1929. *Microphysa vestita* Handschin, *Treubia*; 6 : 25-258.

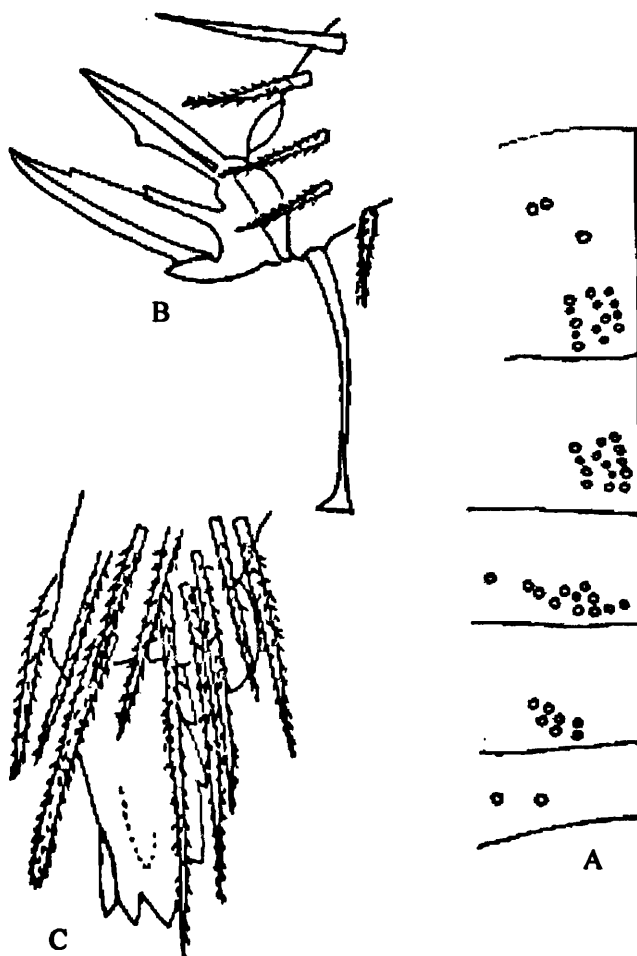


Fig. 27 : *Callyntrura (Handschinphysa) prabhooi*. A, chaetotaxy of Ths. II, III, Abd. I, II, III; B, foot complex; C, mucrodens complex.

Diagnosis : colouration : head, ths. ii, iii, abd. i and ii anteriorly with deep blue pigment; abd iv medially with a deep wide transverse band of deep blue pigment, abd. v with deep blue transverse band. thorax : unguis with paired basal and a distant unpaired teeth on inner margin, unguiculus lanceolate, tenent hair. Abdomen: Mucrone with teeth. Chaetotaxy: Ths. II, III/Abds. I : II = 17, 14/17, 7; Abd. III dorsomedially with 2+2 macrochaetae. Body length : 35 mm.

Material examined : India, Kerala : 10 exs., Wynad dist. Coll. N.R. Prabho, 20. vii.1959.

Callyntrura (Callyntrura) serrata (Salmon) Mitra
(Figs. 28A-F.)

1957. *Handschinphysaserrata* Salmon, *Acta. Zool. Cracov.*, 11(14) : 313-362.

1957. *Aphysa serrata* Salmon, *Bull. Roy. Soc., N.Z.* 7(2) : 145-644.

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

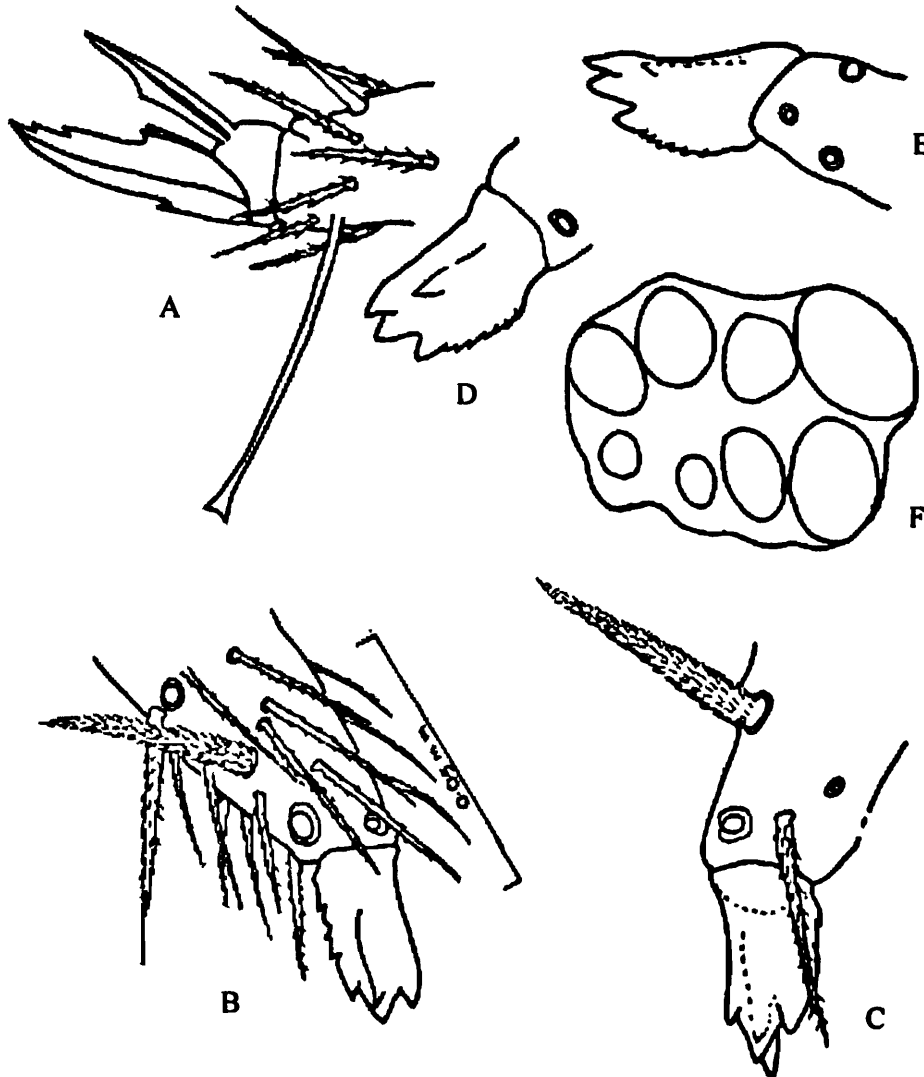


Fig. 28 : *Callyntrura (Handschinphysa) serrata*. A, foot complex; B, mucrodens complex; C, mucrodens complex with another specimen; D, muro from inner side; E, muro from outer side; F, ocelli.

Diagnostic characters : Coloration : Body with deep blue-black shading extending as a broad lateral band along the sides of the head, thorax and abdominal segments I-III. Antennae and legs shaded with deep blue. Furcula yellow. Clothing : Body clothed with scales and ciliated spine like setae and a pair of lasiotrichia on each of the abdominal segments III and IV; dens with a row of very stout and long, finely plumose setae along the posterior and anterior face. Head : Ocelli 8+8 on each side. Antennae longer than head. Thorax : Claw with a pair of small outer lateral teeth; unguiculus on the hind feet almost reaching the subequal

inner tooth; clavate tenent hair strong, slender and slightly longer than the claw to each foot. Abdomen : Manubrium to mucrodens = 54 : 85 : 4; mucro with two prominent apical teeth, one prominent subepical tooth on the posterior face, a large lateral tooth and a row of tooth like serration along the posterior edge which is most salient feature of the sopecies. Body length 1.4mm.

Material examined : Tripura : 5 exs, Sepahijola (West), 29.4.1995, Coll. A.K. Hazra .

Distribution : India : Nagaland and Tripura.

Callyntrura (Callyntrura) sudindica (Prabhoo) Mitra

(Figs. 29A-C.)

1971. *Aphysa sunindica* Prabhoo, *Oriental Ins.*, 5(1) : 42-43.

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

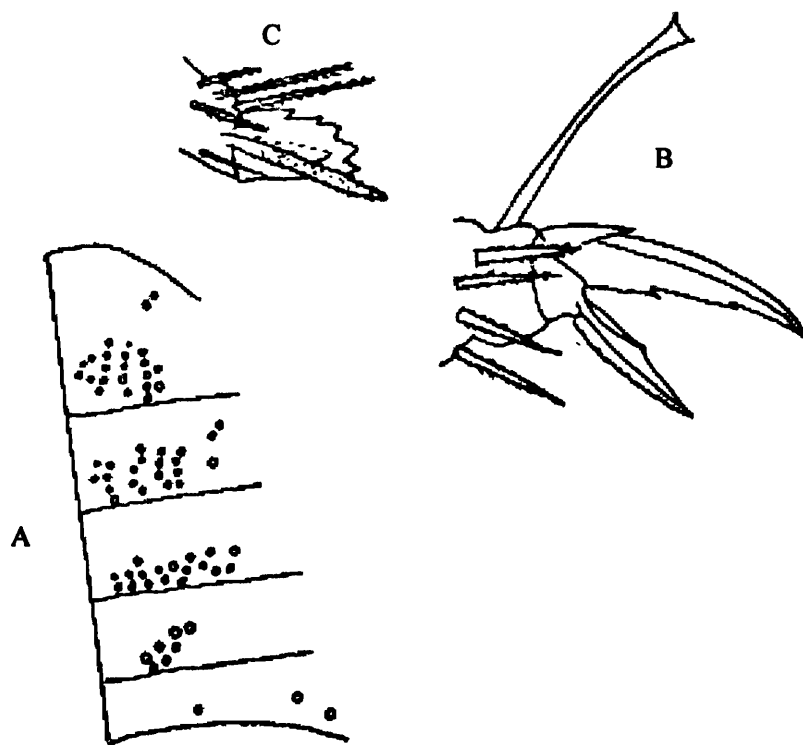


Fig. 29 : *Callyntrura (Callyntrura) sudindica*. A, chaetotaxy of Ths. II, III, Abds. I, II, III; B, foot complex; C, mucro.

Diagnosis : Colouration : Ground body colour pale yellow, light blue pigment on lateral mesonotum, Abd. IV, Abd. V posteriorly blue pigment. Ratio of Ant. I : II : III : IV = 30 : 30 : 17 : 49. Eyes : 8+8; Unguis with inner length; a unpair median tooth, unguiculus truncated, tenant hair clavate, Mucro with 7 teeth. Body length: 3 mm.

Material examined : India : Kerala : 7 exs, Wynad dist. Tea field, 20.vii.1959. coll. N.R. Prabhoo.

Callyntrura (Callyntrura) fissisetosa Handschin
(Figs. 30A, B.)

1929. *Aphysa fissisetosa* Handschin, *Rev. Suisse Zool.*, 36 : 229-262

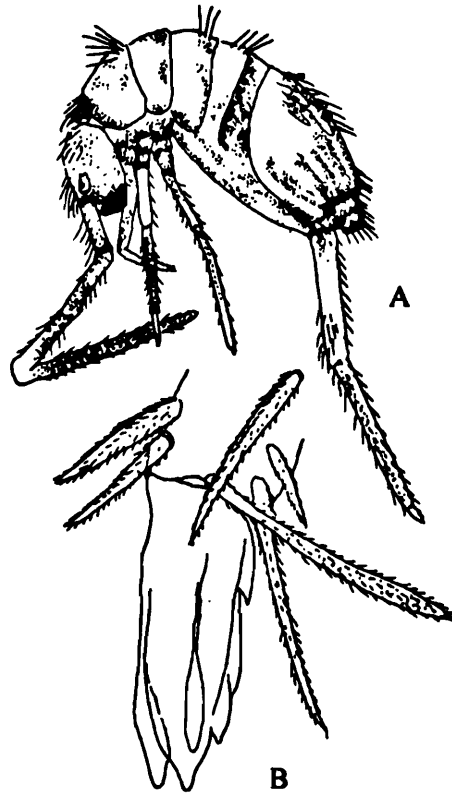


Fig. 30 : *Callyntrura (Callyntrura) fissisetosa*. A, habitus; B, mucro.

Diagnosis : Body length 3 mm.-4mm. ground colour bluish white. Ant I-III diffuses blue pigment. Ant IV dark blue pigment. Th. II, Abd. II diffuse pigment Abd. III dark pigment Abd. IV distally, Abd. V, VI with dark pigment. Unguis with three inner teeth, mucro 4 teeth. Loc : Tamilnadu : Palni Hills, 6.iv.1927, 3 exs.

Remarks : Description based on literature.

Callyntrura (Callyntrura) variabilis Mitra
(Figs. 31A-F)

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

Diagnosis : Colouration : general ground colour of body yellowish. Ants. I, II, III distally narrow blue ring, Ant. IV distally bluish, pigment distribution on thorax and abdomen variable. Abds. V and VI with blue-black pigment. Head : Eyes 8+8, length index of Ants. I : II : III : IV = 18 : 17 : 11 : 27; prelabral setae 4; labral setae 5, 5, 4. Thorax : Ths. II : III = 42 : 25; unguis with paired basal, 2 unpaired distal teeth on inner margin unguiculus lanceolate, tenant hair clavate, trochanteral organ with 55-57 long setae. Abdomen : Ratio of Abd. I : II : III :

IV: V: VI = 17 : 24 : 8 : 94 : 10 : 4; Manubrium : mucrodens : 23 : 29. Mucro with 6 teeth.
Body length: 2 mm.

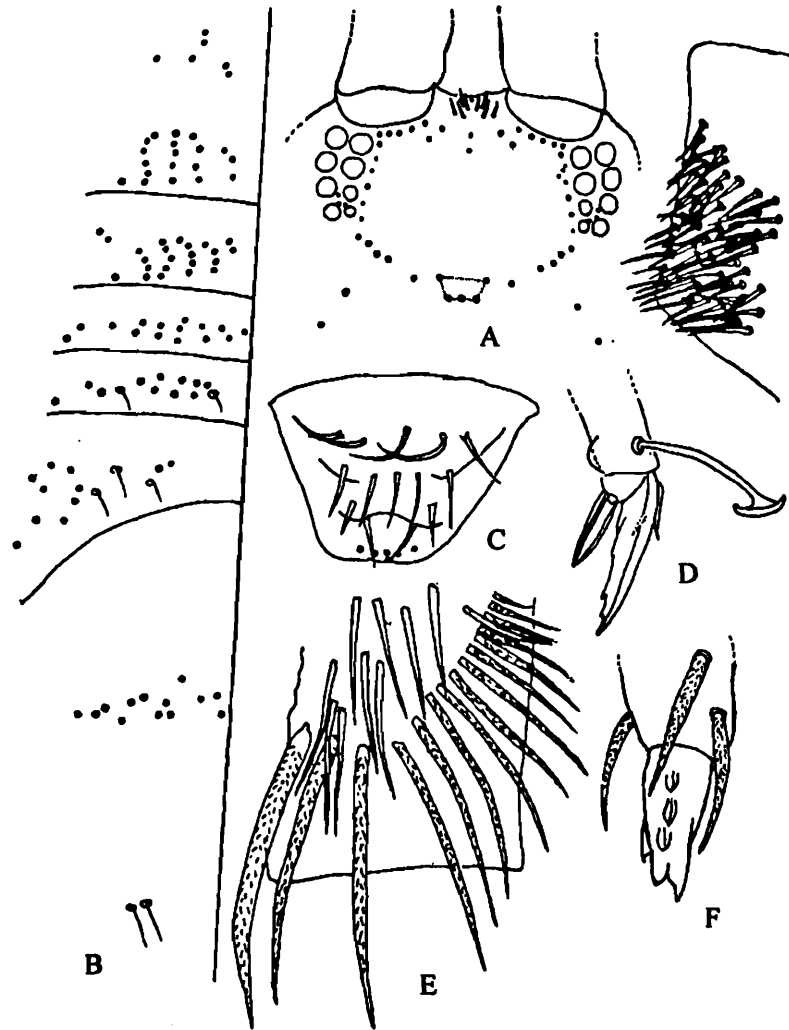


Fig. 31 : *Callyntrura (Callyntrura) variabilis*. A, head chaetotaxy; B, chaetotaxy of Ths. II, III, Abd. I, II, III, IV; C, labrum; D, foot complex; E, ventral tube-anterior face chaetotaxy; F, mucrodens.

Material examined : India : Uttarakhand : 10 exs. Hrisikesh Dist.23.ii.1965, Coll. S.K. Mitra.

***Callyntrura (Handschinphysa) vestita* (Handschin)**

(Figs. 32A-H)

1925. *Microphysa vestita* Handschin, *Treubia*, 6 : 225-270; 1928, *Treubia*, 10 : 225-270

1957. *Handschinphysa vestita* Salmon, *Acta.Zool. Cracov.*, 11(14) : 313-362

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

Diagnosis : Coloration : Unique in colour pattern and usually without any variation; body green in fresh, pale yellow in spirit dark purple to blue black patches covering head, thoracic II, III and abdominal segments I, II, III. Clothing : Body clothed with flexed macrochaetae,

acuminate, nonflexed setae and scales. Head : Pear shaped with 4+4 dark frontal spines; ocelli 8+8. Antennae subequal or little longer than body, ratio of length of antennal segments I-IV 43 : 40 : 27 : 60. Thorax : Relative length index of thoracic segments II : III 63 : 31; unguis straight, little curved apically with inner, paired basal teeth reduced, single unpaired tooth small; external basolateral teeth large; unguiculi lanceolate. Abdomen : Relative length index of abdominal segments I : II : III : IV : V : VI 18 : 31 : 14 : 172 : 22 : 9; rami of retinaculum each with 4 teeth. Manubrium: mucrodens = 45 : 53; mucro usually with 6 teeth, dental scale appendages small. Body length 2-2.5 mm.

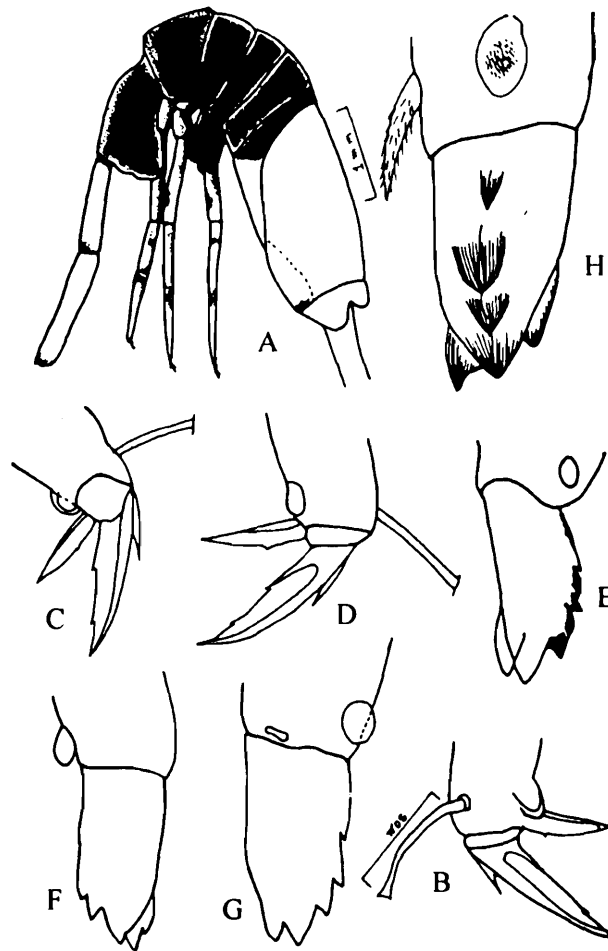


Fig. 32 : *Callyntrura (Handschinphysa) vestita*. A, habitus; B, C, D, foot complex; E, F, G, H, mucrodens complex.

Material examined : Manipur : 24 exs, Checkalpai Reserve Forest (Churachandpur) 3.4.1992, Coll. A.K. Hazra. Meghalaya : 6exs, Nongstoin (West Khasi Hill), 20.3.1991; 4exs; Botanical garden, Shillong, 28.3.1991, Coll. A.K. Hazra; 4 exs, Umedinpur (Shillong), 4.3.1965, Coll. B.K. Tikadar.

Distribution : India (Assam, Manipur, Meghalaya and Nagaland) and INDONESIA.

Remarks : The species is recorded for the first time from Manipur and Meghalaya.

***Callyntrura (Callyntrura) zaheri* Mitra**
(Figs. 33A-E)

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

Diagnosis : Coloration : Pale yellow in colour with variable violet to blue black patches on head and body. Clothing : Body clothed with ciliated setae and scales bearing faint striations, scalesostly lanceolate. Head : Pear shaped. Frontal spines 4+4; ocelli 8+8. Head /Ant.I variable. Thorax : Relative length index of thoracic segments II : III 16 : 6.5. Legs similar, tibiotarsi divided anteriorly; unguis little curved with a paired basal, a medial unpaired and a subapical rudimentary teeth; unguiculus lanceolate; tenent hair well developed, finely ciliated, clavate. Manubrium: mucrodens =37 : 44; mucro deeply lobed into 7 teeth, dental scale appendages absent. Body length 2.5 –3mm.

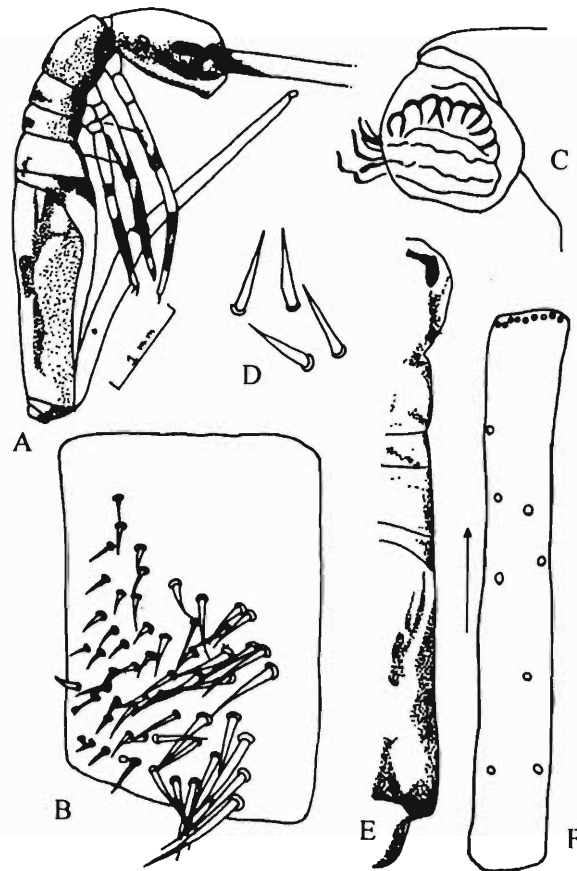


Fig. 33 : *Callyntrura (Callyntrura) zaheri*. A, habitus; B, trochanteral organ; C, male genital field; D, frontal spines; E, habitus (dorsal); F, chaetotaxy of ant I.

Material examined : Odisha : 24 exs, Baphlimali hill top (Raigada), 31.1.95, Coll. A.K. Hazra.

Remarks : The species is recorded for the first time from Odisha.

Distribution : India : Odisha and West Bengal.

Key to the species of *Callyntrura*

1. Dental scale appendage present (*Handschinphysa*) 2
- Dental scale appendage absent (*Callyntrura*) 5
2. Head, thoracic II, III and abdominal segments I-II with deep blue-black pigment, IV with or without median dark blue-black patches 3
- Pigmentation variable or without pigment, thoracic II, III and abdominal segments I-III pigmented, IV-VI at least with a pair of pigmented spots or patches ... *lineata* (Parona).
3. Abdominal segments IV-VI with or without transverse pigmented bands or spots *vestita* (Handschin)
- Abdominal segments IV-VI with either median transverse pigmented bands or patches; legs without bands 4
4. Abdominal segment III with lateral purple patches extending to the body; legs with bands *borneri* (Imms)
- Abdominal segment III with a lateral conspicuous pigmented spot, IV with with a narrow transverse patch, others with darker pigmented streaks *delamarei* Mitra
5. Ventral side of mucro with many serrations; thoracic II, III and abdominal tergites III, IV with dark blue-black pigment *serrata* (Salmon)
- Ventral side of mucro with distinct teeth; thoracic and abdominal tergites without pigments 6
6. Lateral margins of heads, thoracic. II, III, abdominal segments. I, II, III with purple Pigment *semiviola* (Handschin)
- Abdominal segment. IV with dorsal pigmented patches 7
7. Body with faint purple to blue pigment with a narrow lateral stripe extending to abdominal segment IV *zaheri* Mitra
- Body with variable pattered rings 8
8. Thorax dusky; abdominal segment IV with transverse patch *japonica* (Kinoshita)
- Thorax with blue-black pigment; abdominal segments. III and IV with lateral blue black pigment blotches *longicornis* (Oudemans)

Genus *Dicranocentroides* Imms

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

Type species : *Dicranocentroides fasciculatus* Imms, 1912

Dicranocentroides fasciculatus Imms

(Figs. 34 A-I)

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

1917. *Paronella crassicornis* Carpenter, *Rec. Ind. Mus. Calcutta*, 8 : 561-568. New synonymy.

1925. *Dicranocentroides fasciculatus* Schott, *Sarawak Mus. Jour.*, 3 : 107-127 (Lapus for *fasciculatus*)

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

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

Diagnosis : Coloration : Males larger and darker, female lighter and smaller; thoracic segment II with reddish to brown pigment and abdominal segments III, IV and V, dark brown, IV, V sometime paler. Clothing : Clothed with pseudoscales of various shapes and sizes from lanceolate to secondarily truncated or round apices. Head : Pear shaped, when viewed from above; 1+1 dark ocellar field, each field containing 8 ocelli, arranged in 2 longitudinal parallel rows.

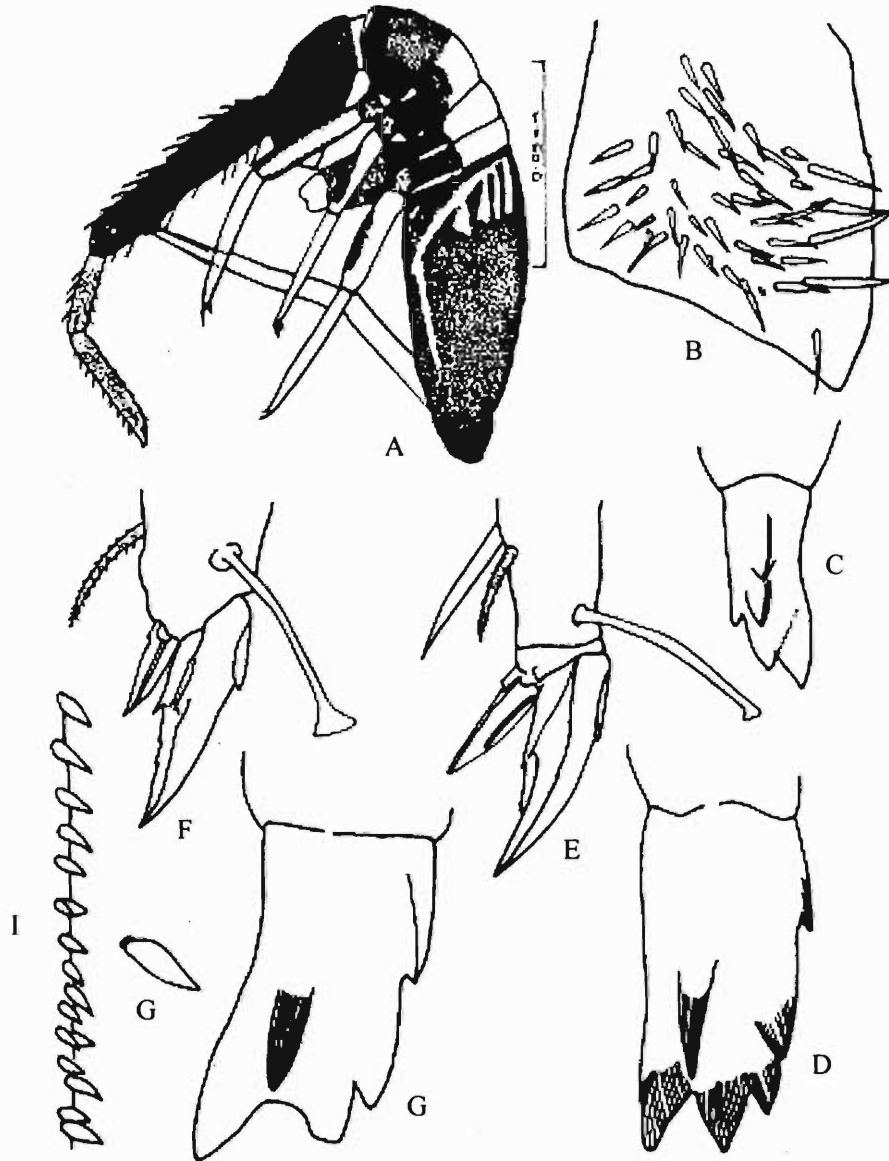


Fig. 34 : *Dicranocentroides fasciculatus*. A, habitus; B, trochanteral organ; C, microdens; D, E, F, foot complex; G, microdens complex; H, dental spine; I, part of denticles showing spines.

Thorax : Relative length index of thoracic segments II : III = 46 : 32. Legs similar; unguis moderately curved with external basolateral teeth; trochanteral organ well developed, each tibio-tarsus with 6-7 very stout, stiff, spiniform setae on inner and lateral margins. **Abdomen :** Relative length index of abdominal segments I : II : III : IV : V : VI = 21 : 21 : 13 : 108 : 9 : 4; ventral tube long with 3 protrusible vesicles and 2 anterior small rudimentary vesicles. **Manubrium:** microdens = 85 : 122; microdens large with 5-6 teeth. Body length 2-3 mm.

Material examined : Arunachal: 150 exs, Hill stream side, Tippi, 30.3.12999, Coll. A.K. Hazra. Mizoram : 20 exs, Sairep, 17.4.1995, Coll. T.P. Bhattacharyay, 8 exs, Pythor village, 4.4.1994, Coll. A.K. Hazra. Nagaland: 30 exs, Khezikenoma, 24.3.1997; 12 exs, Keolie village, 24.3. 1997, Coll. A.K. Hazra. Sikkim : 5 exs, Singhik, 5.9.92; 500 exs, Namchi, 30.4.1998; 330 exs, Namuta Basti, Namchi, 30.4.1998; 60 exs, Ravangla, 2.5.1998, Coll. A.K. Hazra. Tripura: 4 exs, Raukhola (West), 2.5.1995, Coll. A.K. Hazra.

Distribution : India : Sikkim, Arunachal Pradesh, Manipur, Mizoram, Nagaland and Tripura; NEPAL.

Remarks : The species is recorded for the first time from Arunachal Pradesh and Nagaland.

***Dicranocentroides flavescens* Yosii**

(Figs. 35A-E)

1966. *Dicranocentroides fasciculatus* f. n. *flavescens* Yosii, Res. Kyoto Univ. Sci. Exped. Karakoram and Hindukush, 1955, 8 : 333-405.

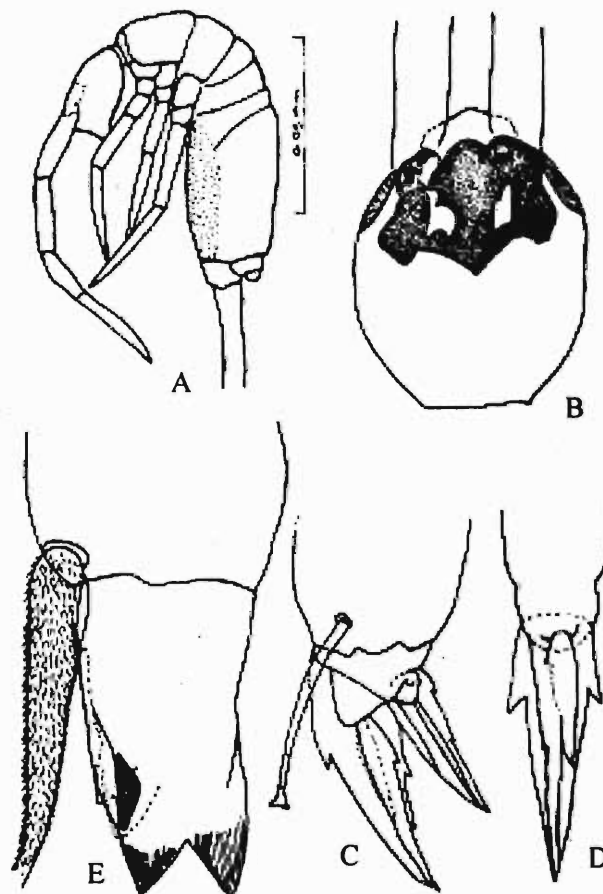


Fig. 35 : *Dicranocentroides flavescens*. A, habitus; B, head showing pigmentation; C, foot complex of leg III; D, foot complex of leg II; E, mucrodens complex.

Diagnosis : Coloration : Body pale yellow to brownish generally without dark patches; tergal margins margins of abdomen III and IV with faint bluish pigment having a dark

characteristic patch on vertex in between two ocellar fields; antenna without pigment. Head : Pear shaped. When viewed from above; 1+1 dark ocellar field, each with 8 ocelli in two longitudinal parallel rows. Antennae subequal to body; relative length index of antennal segments is I-IV : 15 : 17 : 12 : 19. Thorax : Relative length index of thoracic segments II : III 14 : 8.5. Legs similar; unguis little curved with paired external basolateral teeth; unguiculus lanceolate, acuminate usually with 2 outer teeth. Abdomen : Relative length index of abdominal segments I : II : III : IV : V : VI 5 : 6 : 4 : 39 : 5.5 : 2; ventral tube long with protrusible vesicles retracted. Manubrium: mucrodens 28 : 38; dentes armed with two closely apposed rows of spines on inner margin; mucro large, parallel sided with 6 teeth. Body length 2-3.5 mm.

Material examined : Arunachal : 52 exs, Sessa, 31.3.1999., 150 exs, Hill stream side, Tippi, 30.3.1999, Coll. A.K. Hazra. Mizoram : 20 exs, Sairep, 17.4.1995, Coll. T.P. Bhattacharyay, 10 exs, Pythor village, 4.4.1994, Coll. A.K. Hazra. Nagaland : 20 exs, Khezikenoma, 24.3.1997; 12 exs, Keolie village, 24.3. 1997, Coll. A.K. Hazra. Sikkim : 6 exs, Singhik, 5.9.92; 500 exs, Namchi, 30.4.1998; 330 exs, Namuta Basti, Namchi, 30.4.1998; 60 exs, Dethong Basti, Ravangla, 2.5..1998, Coll. A.K. Hazra. Tripura: 4 exs, Ranikhola (West), 2.5.1995, Coll. A.K. Hazra.

Distribution : India : Manipur, Maharashtra, Mizoram, Nagaland, Sikkim, Tripura, Arunachal Pradesh, Uttar Pradesh and West Bengal; NEPAL.

Remarks : The species is recorded for the first time from Tripura and Nagaland.

Dicranocentroides indica (Handschin)

(Figs. 36A-D)

1929. *Aphysa indica* Handschin, *Rev. Suisse, Zool.* 36 : 221-262.

1975. *Dicranocentroides indica* (Handschin) : Mitra, *Rec.Zool. Surv. India.* 71 : 57-95.

Diagnosis : Coloration : Head and body brown colour with faint purple blue pigment. Antennal segments I, II, and III with a distinct distal bluish ring, IV mostly with blue pigment. Legs with dark brown pigment; furca with diffused blue pigment. Clothing : Body clothed with scales, cervix and anterior margin of thoracic segment II with a 'Collar' of acuminate setae; macrachaetae obliquely truncated thoracic II, III and abdominal segments I., II and III; segments IV, V and VI with acuminate setae at the posteriomedial part. Head : with two dark ocellar fields, each having 8 ocelli in two longitudinal parallel rows. Antennal segments I and II stouter; ratio of length of antennal segments. I -IV 17 : 19 : 13 : 25; segment IV superficially annulated, apical sense knobs not distinct. Thorax : Relative length index of thoracic segments II : III = 12 : 9. Legs similar; unguis with paired basal and medial unpaired teeth, unguiculus lanceolate; tenent hair long, narrow and clavate. Abdomen : Relative length index of abdominal segments. I; II; II : IV : V : VI = 6 : 6 : 3 : 29 : 3 : 1; Ventral tube long with protrusible vesicle retracted. Manubrium: mucrodens 22 : 35, mucro short, quadrangular with six striated teeth.

Material examined : Arunachal : 25 exs, Sessa, West Kamang distt. 31.3.1999, Coll. A.K. Hazra. Manipur. : 10 ex, Santipur, 3.4.1992, Coll. A.K. Hazra; 2exs; Keibul Natinal park, churachandpur, 2.4.1992 ;22 exs, Chakalpai resrve forset (Churachandpur), 3.4.1992, Coll. A.K. Hazra. Mizoram : 25 exs, Sairep (Lunglei), 17.4.1995, Coll. T.P. Bhattacharjee. Nagaland : 18exs, Karbi Awlong Road (Dimapur), 19.3.1997. Coll. A.K. Hazra.

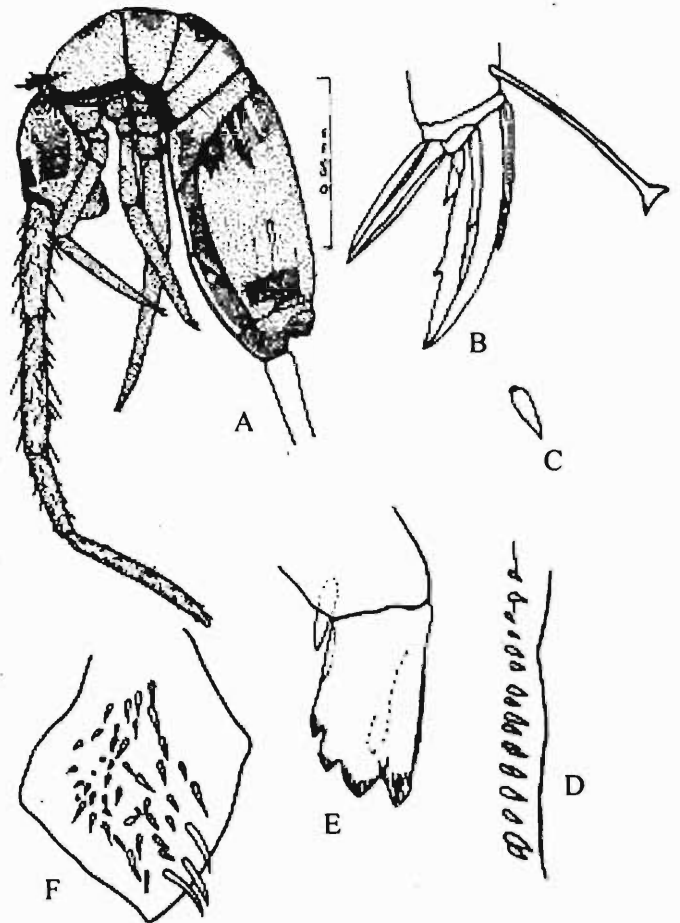


Fig. 36 : *Dicranocentroides indica*. A, habitus; B, foot complex; C, dental spine; D, portion of dentes showing spines; E, mucrodens complex; D, trochanteral organ.

Distribution : India : Assam, Nagaland, Manipur, Meghalaya, Mizoram, West Bengal and Kerala.

Remarks : The species is recorded for the first time from Manipur, Mizoram and Nagaland.

***Dicranocentroides gisini* Mitra**

(Figs. 37A-G)

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

Diagnosis : Coloration : Body pale yellow; Ths II, III, Abds I, II, II, usually devoid of any dark pigmented patches. Clothing : Body clothed with scales and dark, macrochaetae on head flexed (brush setae); thoracic II, III, abdominal segments I, II and IV-VI with median and

posterior acuminate setae. Head : Pear shaped. Ocellar field dark 1+1 each with 8 ocelli in two longitudinal. Antenna subequal to the length of head and body with variable segments; ratio of length of antennal segments I-IV 11 : 15 : 16 : 20. Thorax : Relative length index of thoracic segments II : III = 14 : 9.8. Legs all similar; unguis little curved with 2 external

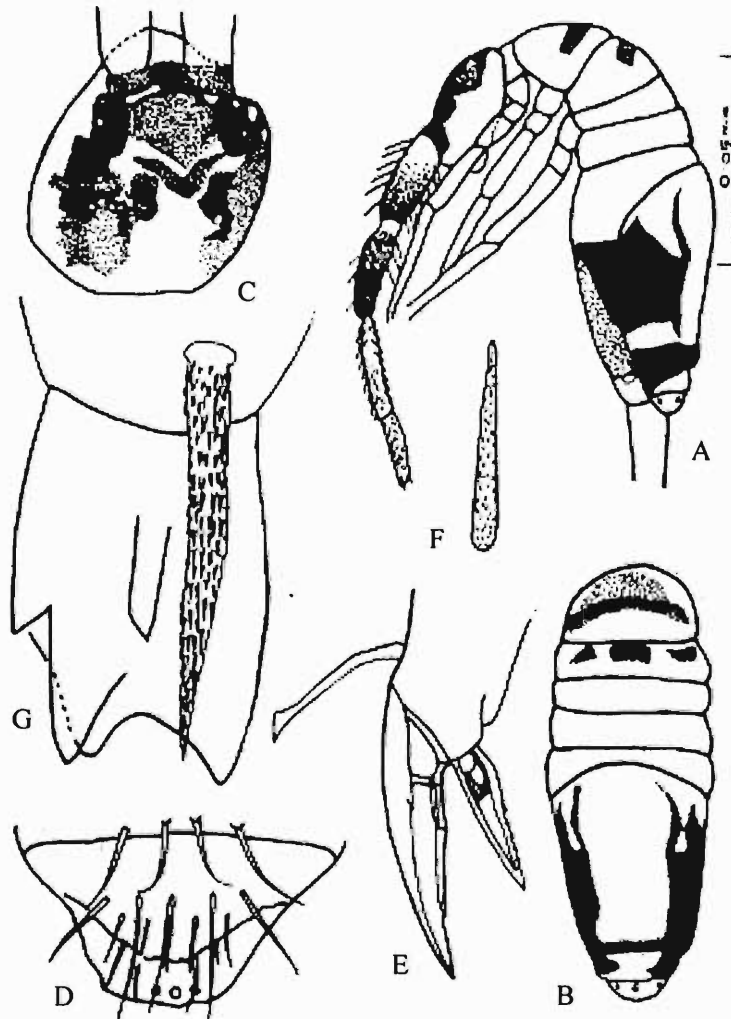


Fig. 37 : *Dicranocentroides gisini*. A, B, habitus; C, head showing pigmentation; D, labral chaetotaxy; E, foot complex; F, tibiotarsal spine; G, mucrodens complex.

basolateral teeth; unguiculus lanceolate, acuminate with 5 lamellate and serrated 5 teeth. Abdomen : Relative length index of abdominal segments I : II : III : IV : V : VI 7 : 7 : 3.5 : 3.4 : 5 : 3.5; Ventral tube long with protrusible vesicle retracted. Manubrium : mucrodens = 27 : 40; dentes armed with two closely apposed rows of spines on inner margin; mucro large with 6 teeth, lateral tooth large, surpassing beyond the apical tooth. Body length 2.3 mm.

Material examined : Nagaland : 1 ex, Minkong protected forest (Mokokchung), 22.3.1994, Coll. P. Mukhopadhyay; 1ex, Lungsong (Wokha), 14.10.1998, Coll. T.K. Pal.

Distribution : India : Orissa, Nagaland, and Uttaranchal.

Dicranocentroides salmoni Mitra

(Figs. 38A-F)

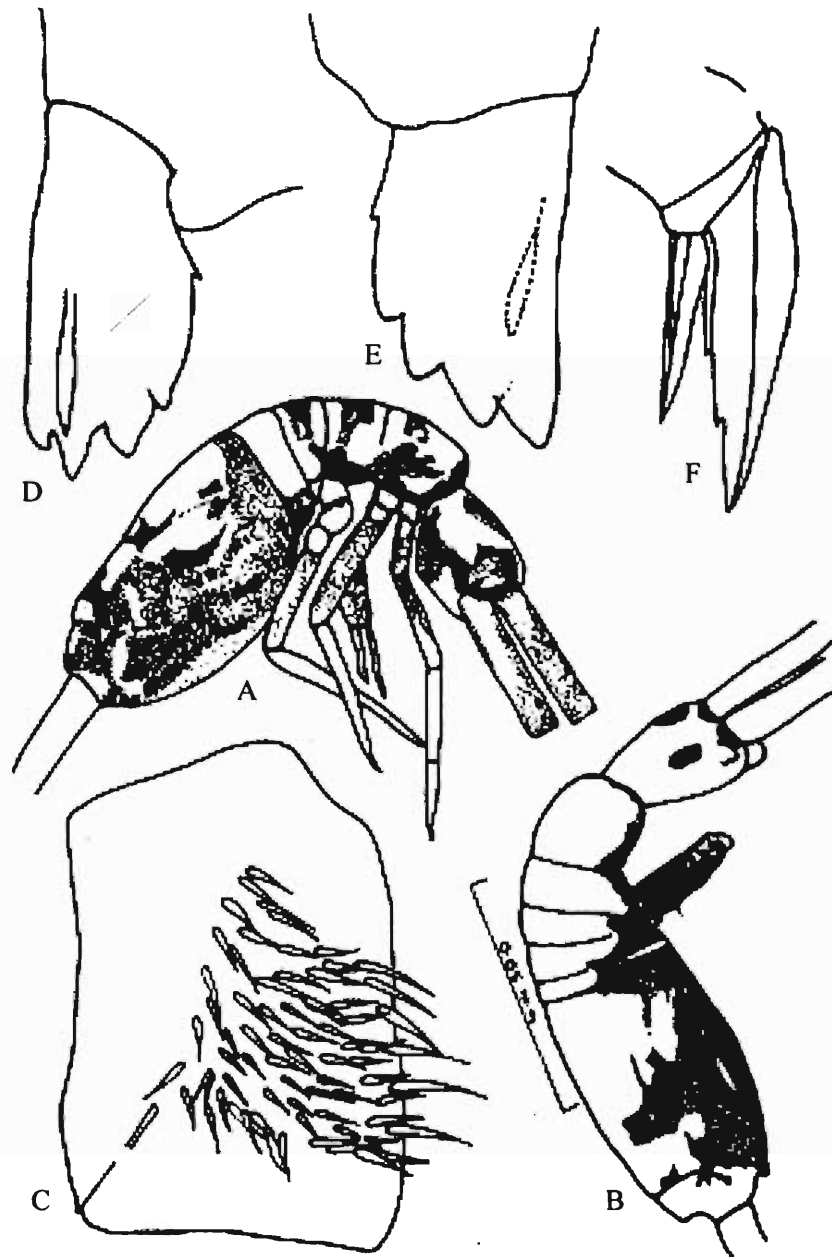
1957. *Handschinphysa crassicornis* Sensu Salmon, *Acta. Zool. Cracov.* 11(14) : 313-362.1975. *Dicraanocentroides salmoni* Mitra, *Rec. Zool. Surv. India.* 71 : 57-95.

Fig. 38 : *Dicranocentroides salmoni*. A, B, habitus; C, trochanteral organ; D, E, microdens complex; F, foot complex.

Diagnosis : Coloration : Extremely variable colour pattern. Pigmented; thoracic II and abdominal segment III with median pigmentation extending laterad, abdominal segment IV with two transverse bands. Clothing : Body clothed with scales and ciliated obliquely truncated macrochaetae (brush setae) present on head, thoracic II III and abdominal segments I, II;

segment IV with posterior-median and of V, VI acuminate, ciliated setae, III with 2 median macrochatae on each side and IV with 16 macrochaetae at the middle. Head : Pear shaped when viewed from above; ocellar field dark 1+1 each with 8 ocelli in two longitudinal rows. Antennae subequal to the length of head and body; ratio of length of antennal segments I-IV 20 : 19.5 : 14 : 25. Thorax : Relative length index of thoracic segments II : III = 14 : 10. Legs similar; tibio-tarsi anteriorly segmented with 6-7 lateral spine like setae; unguis elongate, unguiculus lanceolate; tenent hair long and clavate. Abdomen : Relative length index of segments I : II : III : IV : V : VI 7 : 7 : 4 : 37 : 4 : 2; ventral tube long, rami of reticulum each with 4 teeth. Manubrium: mucrodens 28 : 40; each dentes armed with a row of stout spines of more than three fourth of its length and transiting into stiff ciliated setae; mucro large with 6 teeth. Body length 2.3 mm.

Material examined : Arunachal : 10 exs, Neharlagoon 21.3.1999, Coll. A.K. Hazra. Manipur : 32 exs, Checkalpai Reserve Forest 3.4.1992, Coll. A.K. Hazra; 3 exs, Kharasam (Churachandpur), 14.6.1993, Coll. R.S. Burman. Mizoram : 20 exs, Saiha, 7.4.1994 Coll. A.K. Hazra, 20 exs; Chawnhu Forest, Lawngtlai, 2.4.1994, Coll. A.K. Hazra; 36exs, Sairep, Lunglei, 17.4.1995, Coll. T.P. Bhattejee. Nagaland : 12exs, Pulebadge wild Sanctuary, 25.3.1997, Coll. A.K. Hazra; 10 exs, Jufa Hills (Kohima); 23.3.1997, Coll. A.K. Hazra; 8 exs, Karbi-Awlong Road (Dimapur), 19.3.1997, Coll. A.K. Hazra; 2 exs, Ysemyong (Mokokchung), 21.3.1994, Coll. P. Mukhopadhyay. Sikkim : 9 exs, Singhik, 5.11.92, Coll. A.K. Hazra; 23 exs, Mangan - chungthun Road, 3.11.1992, Coll. A.K. Hazra, 23 exs, Benjong South district, 9.11.91992, Coll. A.K. Hazra, 15 exs, Tong, 3.11.1992, Coll. A.K. Hazra; 47 exs, South east of Tashi Hills, 01.11.1992, Coll. A.K. Hazra; 5exs, Kabi, 7.11.1992, Coll. A.K. Hazra; 1ex, Rongo, P.W.D Rest house Campus, 12.11.1992, Coll. A.K. Hazra; 3 exs, Kopche, 28.4.1998, Coll. A.K. Hazra.

Distribution : India : Arunachal, Assam, Manipur, Mizoram, Meghalaya, Nagaland and Sikkim.

Dicranocentroides duduensis Hazra and Mandal

(Figs. 39A-F)

2013. *Dicranocentroides duduensis* Hazra and Mandal

Diagnosis : Colour pattern : Ground colour of the body deep yellow in alcohol. Ant. I distally with dark pigment rings, rest devoid of pigment. Ant. II entirely with dark pigment, region of subdivision of each segment of antennae non-pigmented; Ant. I and Ant. II polychaetotic brush like setae, Ant. II covered with more dense setae in comparison to Ant. I; dorsal margin of Ant. III and Ant. IV light blue pigment, tip of Ant. IV with dark pigment apically. Tibiotarsi with bluish violet pigment, inner margin of each femur with longitudinal

dark pigment. Th. II centrally devoid of colour pigment, medially and distally with two blue black patches, both the patches fused laterally and forms arrow head like-band one on each sides; Th. III with two discontinuous patches on each side; medial patches wider and darker, lateral patches with light pigment. Abd. I small dot like sub-medial blue black pigment on both

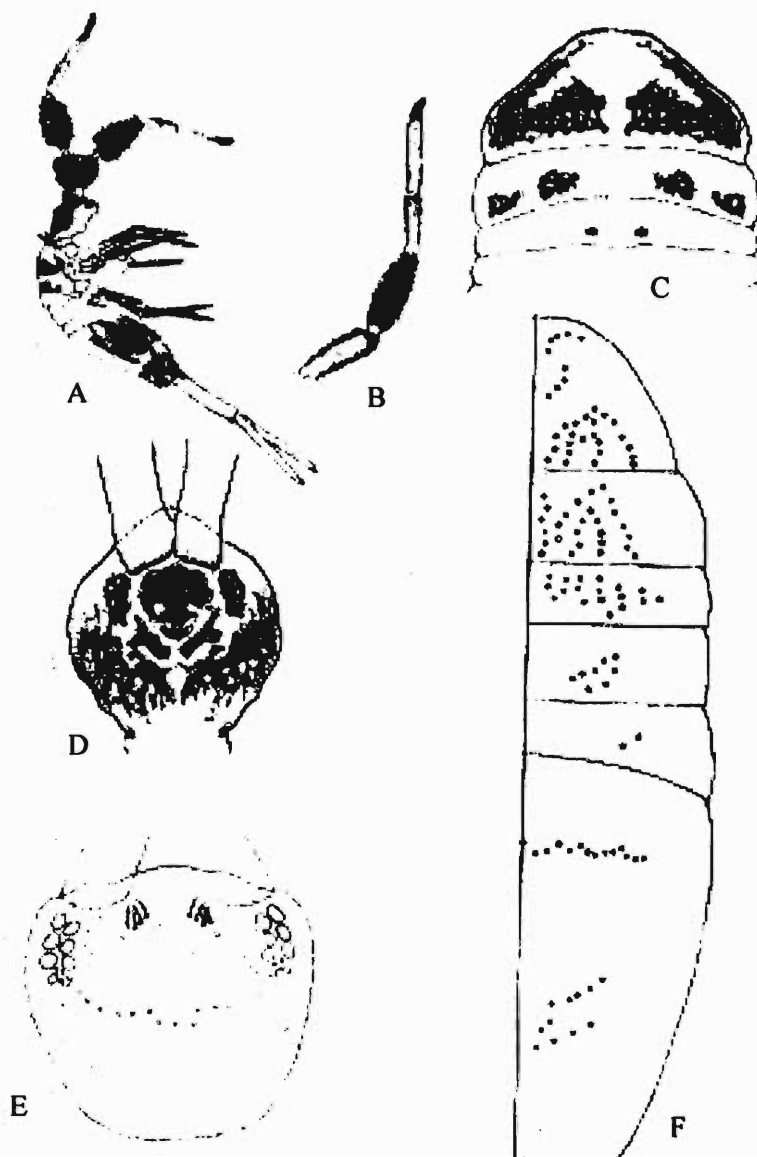


Fig. 39 : *Dicranocentroides duduensis*. A, habitus (lateral); B, antennae; C, dorsal pigmentation Ths. II,III, Abd. I; D, head pigmentation; E, cephalic chaetotaxy; F, semi-diagrammatic dorsal chaetotaxy of Th. II - Abd. IV.

side. Abd. II devoid of any colour patch; Abd. IV laterally and extended to the ventro-laterally with the Abd. III, Abd. IV dorso-medially vertical dark bluish pigment patches one on each side medially diffused with the large lateral patches and extended posteriorly, bluish terminal end of the Abd. IV with dark bluish patches which extend laterally of Abd.V and base of the manubrium. Abd. VI devoid of any pigment. Clothing : Body clothed with dark brown scales

and setae; cervix of Th. II with several smooth setae. Chaetotaxy-Head: vertex with V_0+V_{1-7} , frontal region of head with 4+4 setae sub-dorsal region with 11 setae, ocular region with 3 macrochaetae; post-ocular region with one macrochaetae; occipital with single macrochaetae; Th. II, III with 32-33/27, Abd.I, 18/8; Abd.III 2 constant, Abd. IV medially with transverse row with 14-13 setae and posteriorly with 11+11 setae. Body scales pointed, rounded or truncate and densely covered with striation.

Head : Pear shaped, two longitudinal parallel rows of ocelli (8+8) covered with dark pigment, G & H ocelli smaller in size than the rest. Antennae as long as trunk of the body; relative length index of Ant. I : II : III : IV = 11.5 : 21.6 : 8.3 : 24; Ant. IV with apical sense knob and one pin seta with some smooth setae ; pre labral setae 4, labral setae 5/ 5/4, anterior margin of labrum with 4 tubercles round in shape.

Thorax : Relative length index of Th. II : III = 27.5 : 25.5; unguis slightly curved with 2 external baso-lateral teeth 1+1 on each side of unguis, inner margin of unguis with paired inner basal and pair medial teeth, distal teeth unpaired; unguiculus lanceolate, acuminate, without any teeth on outer lamella; inner tibio-tarsal lobe present, tenant hair developed, slightly clavate; trochanteral organ with about 66 strong, short spine, tibio-tarsus with variable stout, striated spinous setae on inner lateral margin.

Abdomen : Relative length index of Abd. I : II : III : IV : V : VI = 19 : 21.5 : 21.2 : 58.5 : 11.7 : 6.7; manubrium : dens : mucro = 41 : 54 : 1.02; ventral tube long with protrusible vesicle retracted, anterior face anteriorly with several long macrochaetae; general surface of posterior faces with short spine like setae; rami of retinaculum 4+4 teeth; corpus with a median setae; relative length index of manubrium: mucrodens = 41 : 69; dentes in their inner margin with two rows of closely opposed spines, besides stiff, ciliated setae distally; mucrolarge with 6 teeth, lateral tooth long outer view of mucronal teeth with light striation, arrangement of mucronal teeth in other view; Body length without appendages 2.4 mm.

Material examined : Uttar Pradesh : 20 exs., Kila Forest Rest House campus, Dudhwa, Tiger Reserve, Lakhimpur Kheri, 15.i.2009, Coll. G. P. Mandal.

Key to the species of *Dicranocentroides* from India

1. Body without pigment patches 2
- Body with pigment patches 3
2. Unguiculus with 1-2 external teeth in outer lamella *flavescens* Yosii
- Unguiculus without external tooth in outer lamella *indica* (Handschin) Mitra
3. Ant. I-IV; Th. II with pigment patches *fasciculatus* Imms
- Ant. I-IV; Th. II with or without pigment patches 4

4. Abd. III, IV with transverse band*salmoni* Mitra
 — Abd. III, IV without transverse band 5
 5. Unguis with paired medial teeth; Ant. I, II with brush like setae
 *duduensis* Hazra & Mandal
 — Unguis with single medial tooth; Ant. I, II without brush like setae *gisini* Mitra

Genus *Idiomerus* Imms, 1912

Type species *Idiomerus pallidus* Imms, 1912 .

***Idiomerus pallidus* Imms**

(Figs. 40A-D)

1912. *Idiomerus pallidus* Imms, Proc. Zool. Soc. London, pp. 80-125

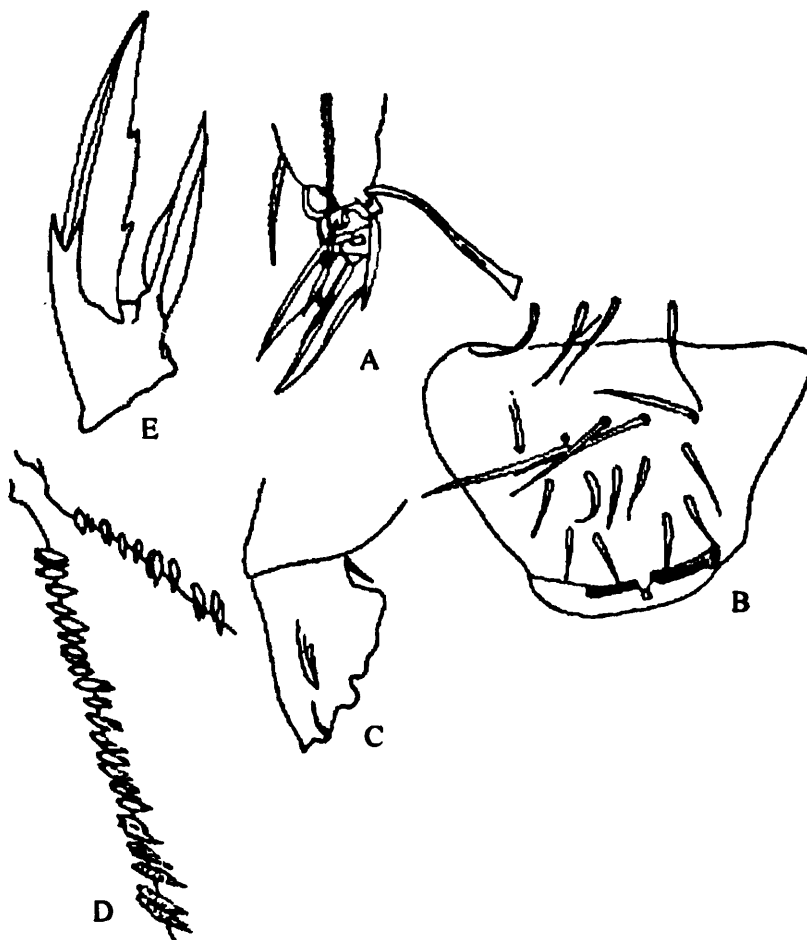


Fig. 40 : *Idiomerus pallidus*. A, foot complex with tenant hair; B, labrum; C, mucro; D, dental spine.

Diagnosis : Colouration : Ground colour of body yellow with light blue black pigment. Th. II proximally and Abd. IV distally pigmented, live specimens show shining golden pigment on head, Ths. II, III, Abds. I, II, III, and on proximal part of Abd. IV. Relative length ratio of Antennae I : II : III : IV = 25 : 27 : 24 : 38; eyes : 8+8.

Thorax : Th. II with prominent hump distally, relative length index of Ths. II : III = 18 : 5; unguis with paired inner basal and one unpaired teeth, unguiculi lanceolate, tenant clavate and long, trochanteral organ with 51 spines.

Abdomen : Relative length ratio of Abds. I : II : III : IV : V : VI : 4 : 8 : 4 : 40 : 9 : 3; ventral tube anterior face with 4+4 macrochaetae. With 4 teeth carpus with median setae, dentes with two rows of spines, no dental scale appendages, mucrone broad with 6 teeth. Body length 3-4 mm.

Material examined : India, Kerala : 250 exs., Maddathorai, beside hill stream, Quilon dist. 14.xii.1976, Coll. S.K. Mitra,, 65 exs. Valliaparathodu, beside hill stream, Silent valley, 18. iv.1980, Coll. A.K. Hazra.

Genus *Lepidonella* Yosii, 1960

Lepidonella ceylonica (Yosii) Dehanverg & Bedos

1966. *Microparonella ceylonica* Yosii, 1966. *Res. Kyoto Univ. Sci. Exp. Karakoram and Hindukush*, 8 : 333-405.

Diagnosis : Colouration : Ground colour white, purple black pigment on Abds. II, III, and distal half of Abd. IV. Ants. Blue pigment, Ant. Short, ratio of Ants. I : II : III : IV = 3 : 5 : 5 : 8. Eyes : 8+8.

Thorax : Unguis with paired inner basal teeth with 2 unpaired distal teeth, tenant hair clavate, trochanteral organ with 12 setae, anterior face of ventral tube with 7+7 setae, posterior face with many ciliated setae. Dentes distally with 3 rows of dorsal setae inner row with 30 spines, ventrally scaled, mucro with 4 teeth. Body length : 1 mm.

Material : India, Maharashtra, 3 exs Nasik dist., 30.ix.1960 coll. R.Yosii.

Remarks : Description based on literature.

Lepidonella duodecimaculata (Prabhoo) Dehanverg & Bedos

(Figs. 41A-C)

1971. *Microparonella duodecimaculata* Prabhoo, *Oriental Ins.*, 5(1) : 43-44.

Diagnosis : Colouration : Body ground colour yellow, Ths. I, II, Abd. I transversely covered with blue-black pigment, Abd. II, III dorsomedially transverse blue-black pigment patches extended laterally, Abd. IV dorsomedially broad blue-black pigment patch, ventral tube basally pigmented; Ant. IV with blue-black pigment, Ant. I, II, III each joint with light pigment. Antennal ratio : I : II : III : IV = 18 : 36 : 31 : 55; Eyes 6+6. Thorax : Unguis with a pair of external teeth, median unpaired tooth proximally with paired inner teeth, unguiculus inner lamella truncated, tenant hair clavate. Abdomen : with 4+4 setae, corpus with a single

setae; dental spines in two rows with 28-32 spines in each; mucro with 3 teeth. Body length : 0.96 mm.

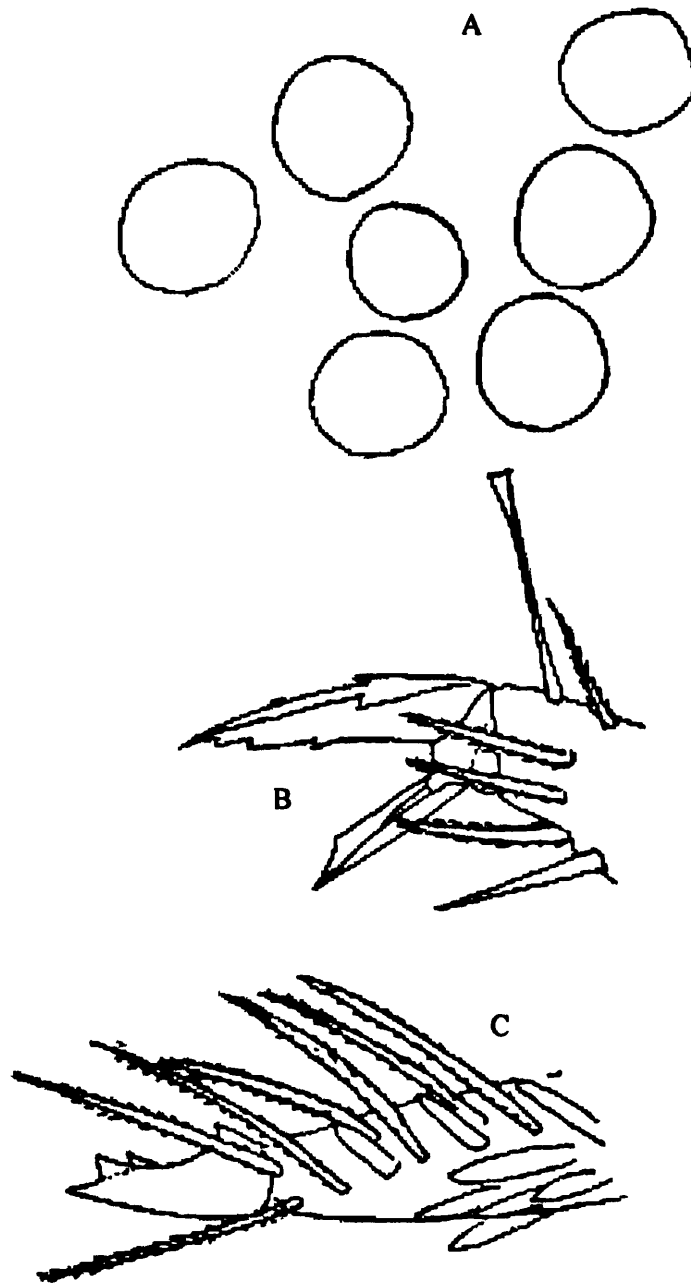


Fig. 41 : *Lepidonella duodecimoculata*. A, eye; B, foot complex; C, mucrodens.

Material : India, Kerala : 12 exs. Wynad dist., Chellote tea field, 27.x.1963, coll. N.R. Prabhoo.

Genus *Troglopedetes* Absolon, 1907, nec Joseph, 1872

Troglopedetes gracilils (Carpenter)

(Figs. 42A,B)

1924. *Cyphoderopsis gracilis* Carpenter, *Rec. Ind. Mus., Calcutta*. 26 : 288.

Diagnosis : Body uniformly pale yellow colour; mesonotum 2.25 times as long as metanotum; ratio of antennal segments I-IV I : II : III : IV = 3 : 6 : 6 : 10; fourth abdominal segment six times as long as the third; furcula about 3 quarters as long as body, dens three quarter as manubrium; mucro relatively short with blunt terminal and two acute dorsal teeth. Body length 1.25 mm.

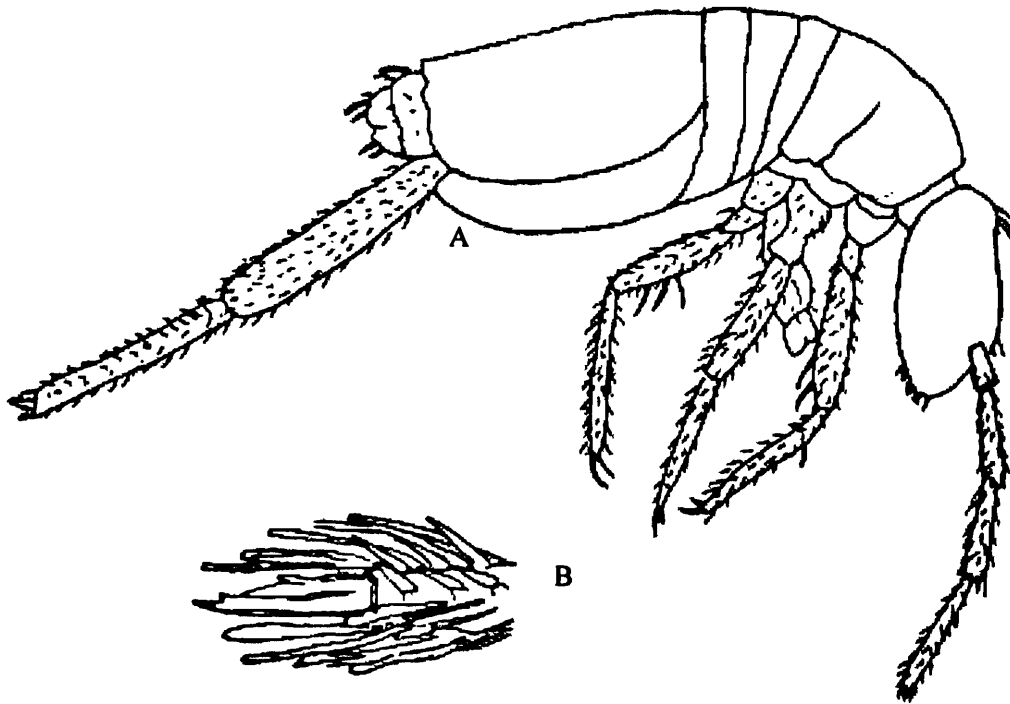


Fig. 42 : *Troglapedetes gracilis*. A, habitus; B, mucro.

Distribution : India : Meghalaya.

Remarks : Carpenter (1924) recorded the species from Sijucave at an altitude of 500 ft. of Meghalaya state. Description based on literature.

***Troglapedetes kempi* (Carpenter)**

(Figs. 43A-C)

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

Diagnosis : Coloration : White colour, antenna 1.25 as long as head; ratio of antennal segments I-IV as 5 : 8 : 6 : 14; Claws with a strong basal teeth and two distal teeth; Furcula two-thirds as long as body; manubrium longer than dens and mucro together; dens 3.5 times as long as mucro; mucro with blunt terminal and a strong proximal tooth little basal serrations and a feeble distal dorsal tooth. Body length 1.5 mm.

Distribution : India : Assam.

Remarks : Carpenter (1917) described the species from the collection of S.W. Kemp (26.11.1911) from Assam. Description based on literature.

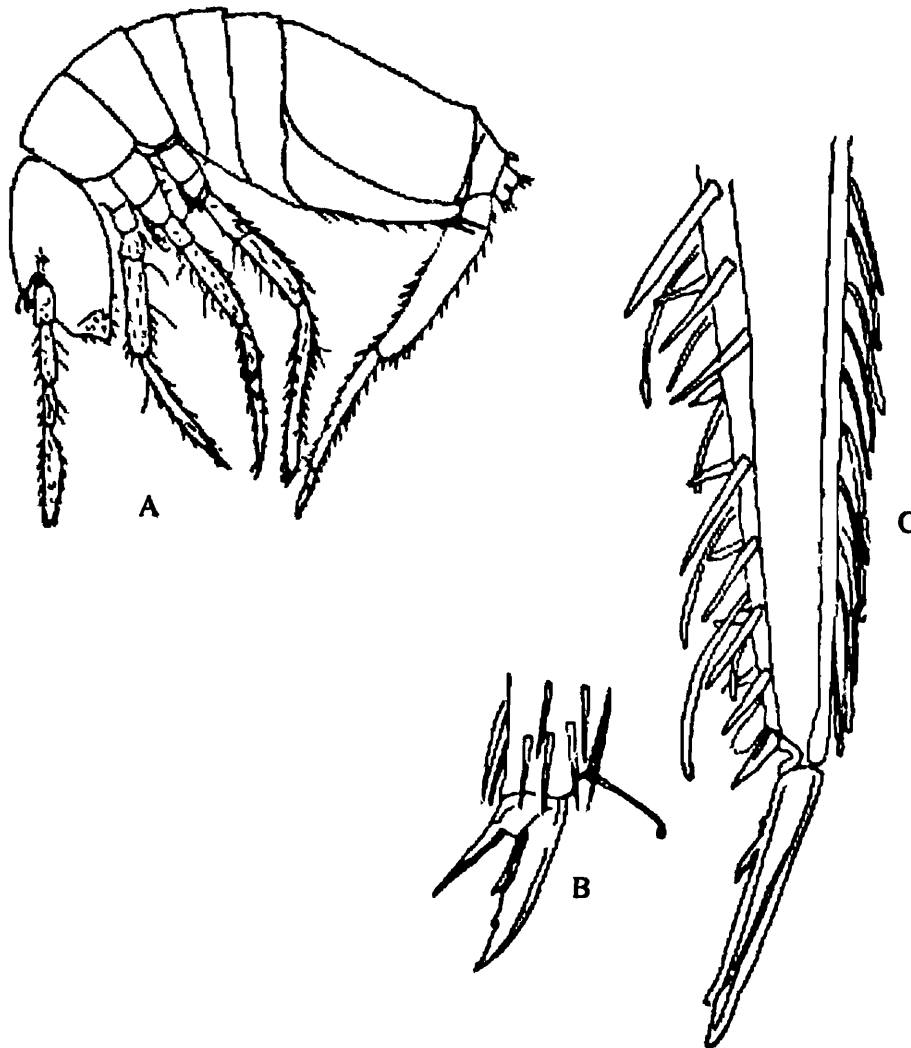


Fig. 43 : *Troglopedetes kempii*. A, habitus; B, foot complex; C, mucrodens.

DISCUSSION

The subfamily Paronellinae represented by 49 species in India. The present study based on the collections present in the national collections of Zoological Survey of India. The present author had the occasion to collect large number of Paronellids in different localities in India. The standard taxonomical characters for discrimination of genera and species of the family Paronellidae are number of mucronal teeth, trochantral organ spine, unguis and unguiculus teeth. Mitra (1975) while studying the *Dicranocentroides* observed "the colour pattern of head and body can be accepted as an important character owing to its less variation". Yosii (1965) based on two new species of Paronellidae like *Callyntrura (Handschinphysa) taiwanica* and *Callyntrura (Handschinphysa) microphysamum* from Taiwan stated that both of these species

have similar chaetal arrangement, although different in colour pattern on the basis of present or absence body setae, flexed macrosetae the chaetotaxic classification of the genera under the family Paronellidae have been subdivided as achaetotic-genera having typical scale without flexed macrochaetae and chaetotic – the genera with pseudo scales or without scales but with macrochaetae. The genus *Lepidonella* comes under the former category in India with two species viz. *ceylonica* (Yosii, 1966) and *dudecimoculata* (Prabhoo, 1971). The chaetotic forms further divided into oligochaetose (less number of macrochaetae) and polychaetose (many macrochaetae). The species under genera *Salina (celebensis) yosiia* are oligochaetose. The polychaetose genera are *Salina* (Indica gr.), *Pseudosalina*, *Dicranocentroides*, *Callyntrura* and *Idiomerus*.

The range of the number of macrochaetae on each side of thorax and abdomen in some genera under the family Paronellidae of India are given below which confirms the observations made by Mitra (1993). Th.II (1; 15-25; 28-50; 43-58; 68-69; 20; 8-26; 35-55) respectively in *Yosiia*, *Salina (celebensis) group*, *Salina (indica) group*, *Pseudosalina*, *Lepidonella*, *Idiomerus*, *Callyntrura*, *Dicranocentroides*. Similarly the number macrochaetae in other segments of the body of the genera mentioned above were as follows :

Th. III (3; 6-12; 17-26; 30-40; 46-47; 42; 30; 23; 13; 12-20; 15-21; 11-23; 33-49).

Abd. I (3; 4-5; 9-17; 17-23; 23-26; 3; 5-15; 18-31)

Abd. II (3; 2-4; 4-6; 13-18; 10-11; 4; 5-12; 12-20)

Abd. III (4; >1; 1; 5-6; 9-10; 1; 4-11; 2)

Abd. IV (1; 2; 2; 2; 7; 13; 9-16; 10-14)

The following variations in number of macrochaetae with changes of localities also have been noted from the species dealt with in this study under following genera.

Th.II with 2 macrochaetae of the genus *Yosiia* which were collected from Jharkhand.

Th. III of the genus *Salina (indica) group* showed 30 macrochaetae of the specimens which were collected from Arunachal Pradesh.

Abd. II of the genus *Dicranocentroides* from Uttarakhand bears only 25 macrochaetae.

The genus *Dicranocentroides* with maximum number of macrochaetae (201) in all the segments of the body followed by *Pseudosalina* (147) and minimum number of macrochaetae (15) were found in the genus *Yosiia*. However these characters were found reasonably constant for separating the species under this family.

It may be concluded that the colour pattern in some species of the genus *Dicranocentroides* relatively constant together with the macrochaetae number and arrangement in case other species are to be considered as species specific.

SUMMARY

The present study deals with 49 species under 8 genera of subfamily Paronellinae under the family Paronellidae is reviewed and redescribed from India. Brief discussion on the chaetotaxic arrangement for the identification of the species also provided. Eighteen species under the subfamily have been recorded for the first time from nine different states. A new species has already been accepted for publication during the course of the study.

ACKNOWLEDGEMENTS

The author is deeply indebted to Dr. K. Venkataraman Director, Zoological Survey of India for providing the opportunity to study collections dealt with in this investigation and also for rendering the laboratory facilities. My heart felt thank is due to Dr. G.P. Mandal, Scientist-C and Officer-in-charge of Apterygota section of the same Institute for placing the collections & rendering all-round help during course of this investigation. Grateful thank is due to MoEF, Govt. India for granting fund as Emeritus scientist to the author for conducting this investigation. The last but not the least to Shri K.K. Suman & all other staff members of the Apterygota section for their time to time assistance during this work.

REFERENCES

- Bonet, F. 1930. Sur quelques Collemboles de L' Inde. *Eos.*, **6** : 249-273.
- Borner, C. 1913. Die Familien der Collembolan. *Zool. Anz.* **41** : 315-322.
- Carpenter, G.H. 1917. Collembola: Zoological results of the abor expedition 1911-1912. *Rec. Ind. Mus.*, **8** : 561-568.
- Carpenter, G.H. 1924. Collembola of the siju cave, Garo Hills, Assam. *Ibid.*, **25** : 285-289.
- Denis, J.R. 1936. Yale North India-Expedition : Report on Collembola. *Mem. Conn. Acad. Arts and Sci.*, **10** : 261-282.
- Handschin, E. 1929. Beitrage zur Collembolen fauna von Sud Indien. *Rev. Suisse, Zool.*, Geneva, **36** : 229-262.
- Hazra, A.K. 1995. Fauna of Meghalaya (Insecta : Collembola) : *State Fauna Series : Zool. Surv. Ind.*, **4(3)** : 13-32.
- Hazra, A.K., Mitra, S.K., S. Sengupta and Bhattacharyya, B. 2000. Fauna of Tripura (Insecta: Apterygota : Collembola). *State Fauna Series*, **7(2)** : 141-154.
- Hazra, A.K., G.P., Mandal and S.K. Mitra. 2001. a. Diversity and Distribution of Collembola (Insecta : Apterygota) from Sikkim Himalaya. *Orion press Int.*, **1** : 144-148.
- Hazra, A.K., G. P., Mandal and S.K. Mitra. 2001b. Diversity and Distribution of Collembola (Insecta : Apterygota) from Manipur. *Env. & Ecol.*, **19(3)** : 519-522.

- Hazra, A.K., G.P. Mandal, S.K. Mitra and B. Bhattacharyya, 2003. Fauna of Sikkim (Insecta : Apterygota : Collembola). *State Fauna Series*, 9(2) : 109-123.
- Hazra, A.K., G.P. Mandal and K. K. Suman. 2004a. Diversity and Distribution of Collembola (Insecta : Apterygota) from Western Ghat (part-1)) *Orion Press International*, 3 : 499-504.
- Hazra, A.K., G.P. Mandal and K.K. Suman. 2004b. On a collection of Collembola insects from Jammu and Kashmir. *Bionotes*, 6(1) : 30.
- Hazra, A.K., G.P. Mandal and K.K. Suman, 2004c. On a collection of Collembola (Insecta : Apterygota) from Ghatsila, Jharkhand. *Bionotes*, 6(2) : 48.
- Hazra, A.K. and G.P. Mandal. 2012. Insecta : Collembola (Apterygota). Fauna of Andaman & Nicobar Islands. *Zool. Surv. Ind. State Fauna Series*, 19(1) : pp: 7-14.
- Hazra, A.K. and G.P. Mandal. 2013. A New Species of Collembola (*Dicranocentroides* : Paronellidae) from India. *Journal of Threatened Taxa*. (In Press).
- Imms, A.D., 1912. On some Collembola from India, Burma and Ceylon with a catalogue of the Oriental species of the order *Proc. Zool. Soc., London*, 80-125.
- Mandal, G.P. and A.K. Hazra, 2002. Collembola Insects from Sri Sai Venkateswara National Park, Tirupati, Andhra Pradesh. *Bionotes*, 4(4) : 89.
- Mandal, G.P. and A.K. Hazra. 2004. On a collection of Collembola insects from Himachal Pradesh with Zoogeographical note. *Bionotes*, 6(4) : 116-117.
- Mandal, G.P. and A. K. Hazra. 2009. The Diversity of Collembola (Hexapoda) from East and North East India with some notes on their Ecology. *Records of the zool. Surv. Ind. Occasional Paper No. 298*. pp. 1-206.
- Mandal, G.P. and A.K. Hazra. 2010. Insecta : Collembola. Fauna of Uttarakhand. *Zool. Surv. Ind. State Fauna Series*, 18(2) : 1-12.
- Mandal, G.P. 2011. Collembola (Hexapoda) fauna from Bibhuti Bhushan Wild life Sanctuary, Parmadan, West Bengal, India. *Rec. zool. Surv. Ind.*, 111(2) : 61-66.
- Mandal, G.P. 2012. Collembola (Hexapoda) from Thar Desert Rajasthan, India. *Nova Science Publishers, Inc. USA. Book chapter*, 11 : 177-183.
- Mandal, G.P. and A.K. Hazra. 2013. New Records of Collembola from Arunachal Pradesh, India. *Bionotes.*, Vol. 15 (2) : 50-51.
- Mandal, G.P. and A.K. Hazra. 2013. A New Record of *Yosia dehradunia* (Paronellidae : Collembola) from Jharkhand, India. *Bionotes*, Vol. 15 (2) : 55.
- Mandal, G.P. 2013. Two additional New Records of Collembola from Arunachal Pradesh, India. *Bionotes.*, Vol.15 (3) : 85.

- Mitra, S.K. 1966a. On some Indian Collembola with the description of a new species of *Xenylla* (Collembola : Hypogastruridae). *Sci. & Cult, Calcutta*, **32** : 210-211.
- Mitra, S.K. 1966b. Two new species of *Salina* MacGillivray (Collembola : Entomobryidae : Paronellinae) *J. Ent. New Delhi*, **28**(1) : 67-73.
- Mitra, S.K. 1967. A new genus and species of Indian springtail (Insecta : Paronellinae) *Proc. Zool. Soc., Calcutta*, **20** : 43-47.
- Mitra, S.K. 1973a. A new Paronellinae genus of Indian spring tail (Collembola : Entomobryidae : Paronellinae) with the descriptions of three new species. *Rev. Ecol. Biol. Sol., Paris*, **10**(3) : 359-377.
- Mitra, S.K. 1973b. A revision of *Salina* MacGillivray, 1894 (Collembola : Entomobryidae) from India. *Orient. Ins., Delhi*, **7**(2) : 159-202.
- Mitra, S.K. 1974. A critical study on some species of *Callyntrura* Börner, 1906 (Collembola : Entomobryidae : Paronellinae) from India. *Rev. Ecol. Biol. Sol., Paris*, **11**(3) : 397-439.
- Mitra, S.K., 1975. Studies on the genus *Dicranocentriodes* Imms (1912) (Collembola : Entomobryidae : Paronellinae) from India. *Rec. zool. Surv. India*, **71** : 57-95.
- Mitra, S.K. 1990. On *Idiomerus* Imms (1912) from India (Collembola : Entomobryidae : Paronellinae) *Rec. zool. Surv. Ind.*, **86** : 69-82.
- Mitra, S.K. 1992. Concept of *Pseudoparonella* Handschin, 1925. (Collembola : Entomobryidae : Paronellinae) *Rec. zool. Surv. India*, **92** (1-4) : 265-284.
- Mitra, S.K. 1993. Chaetotaxy, Phylogeny and Biogeography of Paronellinae (Collembola : Entomobryidae) *Rec. zool. Surv. India, Occ. paper No. 154* : 1-100.
- Mitra, S.K. G.P. Mandal and Hazra, A.K. 2004. On some collection of Collembola (Apterygota : Insecta) from Uttaranchal, India, *Rec. zool. Surv. Ind.*, **102**(3-4) : 1-9.
- Prabhoo, N.R. 1971. Soil & litter Collembola of South India. I. Arthropleona. *Oriental Insects*, **5** : 1-46.
- Salmon, J.T. 1957. Some Paronellinae (Collembola) from India. *Acta. Zool. Cracov.*, **11**(14) : 313-362.
- Soto-Adames. 2010. Review of the New World species of *Salina* (Collembola: Paronellidae) with bidentate mucro, including a key to all New World members of *Salina*. *Zootaxa*. **2333** : 26-40
- Yosii, R., 1961. On some Collembola from Thailand. *Nature and life in southeast Asia*, **1** : 171-200.

- Yosii, R., 1966a. On some Collembola of Afghanistan, India and Ceylon, collected by the Kuphe Expedition. *Res. Kyoto Univ. Sci. Exp. Karakoram and Hindukush*, **8** : 333-405.
- Yosii, R., 1966b. Collembola of Himalaya. *Jour. Coll. Arts. & Sci. Chiba. Univ., (Nat. Sci. Ser.)*, **4(4)** : 461-531.
- Yosii, R., 1956. Monographic holencollemblen Japans. *Contr.biol.lab.Kyoto Univ.* **3** : 1-109.
- Yosii, R., 1983. Entomological Report from the sabh 9 Forest Resarch Centre) No. 7 : Studes on paronellid Collembola of East Asia, pp. 28. *Published by the Japan International Coperation agency.*
- Yosii, R., 1989. Notes on the collembolan fauna of Indonesia and its vicinities I. Miscellaneous notes with special reference to seirini and lepidocyrtini. *AZAO*, **I** : 23-90.

