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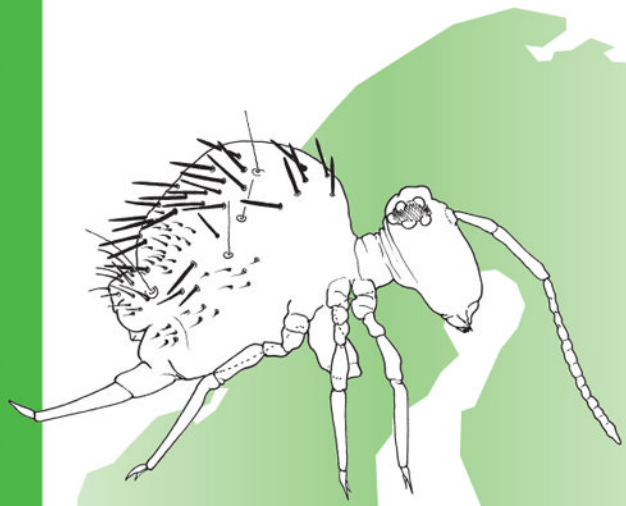
# The Collembola of Fennoscandia and Denmark

## Part II: Entomobryomorpha and Symphypleona

by: Arne Fjellberg



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## Part II: Entomobryomorpha and Symphypleona

*by*

*Arne Fjellberg*

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# Abstract

This volume dealing with the 239 Nordic species of Entomobryomorpha and Symphypleona completes the survey which was started with Part 1, Poduromorpha, which appeared ten years ago (Fjellberg, 1998a). The number of Collembola species being recorded in the Nordic countries have now reached 403 (a few more Poduromorpha are added since 1998). The detailed studies and use of mouthpart morphology in species diagnostics was introduced in Part 1 and is continued here. Structures of labium, labrum and maxilla are found to be particularly useful in diagnostics of higher taxa of Symphypleona. Colour photographs are used to illustrate some of the more characteristic species. Three new species are described (*Desoria potapovi* sp. nov., *Desoria tolya* sp. nov., *Isotomurus graminis* sp. nov.). The following new synonyms are established: *Folsomia janstachi* Potapov & Babenko, 2000 = *Isotoma* (now *Folsomia*) *coeruleogrisea* Hammer, 1938; *Folsomia norvegica* Altner, 1963 = *Folsomia thalassophila* Bagnall, 1940; *Proisotoma admaritima* Murphy, 1953 = *Isotoma* (now *Cryptopygus*) *clavata* Schött, 1893; *Isotoma ruseki* Fjellberg, 1979 = *Isotoma* (now *Desoria*) *fennica* Reuter, 1895; *Isotoma inupikella* Fjellberg, 1978 = *Isotoma* (now *Desoria*) *violacea* Tullberg, 1876; *Isotoma germanica* Hüther & Winter, 1961 = *Isotoma* (now *Desoria*) *intermedia* Schött, 1902; *Entomobrya subarctica* Stach, 1962 = *Podura* (now *Entomobrya*) *nivalis* Linnaeus, 1758.



# Acknowledgements

In addition to the help and support from colleagues and institutions which was acknowledged in Part 1, I am now much indebted to 'The Swedish Taxonomy Initiative' which offered a two year research grant to finish the present book. The grant was allocated to the Zoological Museum, Lund University. The hospitality and enthusiasm of their staff during my visit 2006–2007 is much appreciated.


# Subclass Arthropleona

## (continued from Part I)

A key to Nordic families of Collembola was given in Part I of this series (Fjellberg, 1998a). A new key is given here to those families which are treated in the present volume, including one new family (Oncopoduridae) which was discovered in our area after 1998. Keys to genera are found under the respective families.

# Key to families of Entomobryomorpha and Symphypleona

1 Body elongate, thorax and first abdominal segments clearly separated (Pl. 1, p. 227). Mucro hook-like, with one or more teeth (ENTOMOBRYOMORPHA) . . . . . 2

– Body more or less globular, segments of thorax and anterior abdomen not clearly separated (Pl. 13, p. 238). Mucro gutter-like, often with serrated edges (SYMPHYPLEONA) . . . . . 6

2 Body with scales or a dense cover of ciliated macrochaetae. PAO absent. If present (one species), then strongly lobed (Fig. 1F) . . . . . 3

– Body with an open cover of simple hairs, scales absent. PAO usually present, roundish (absent in two species) . . . . . ISOTOMIDAE (p. 4)

3 Mucro long, elongate (Fig. 1A–C) . . . . . 4

– Mucro short, hook-like (Fig. 1D, E) . . . . . ENTOMOBRYIDAE (p. 132)

4 Small (<1.5 mm) white species without eyes. Antennae normal. Mucro without setae . . . . . 5

– Large species (up to 4–5 mm) with pigment and dark eye-spots. Antennae strongly prolonged (Pl. 11: 1, p. 236). Mucro with setae (Fig. 1C) . . . . . TOMOCERIDAE (p. 162)

5 PAO absent. Mucro only with apical and subapical teeth. Dens dorsally with flattened, blade-like setae (Fig. 1B). Living with ants . . . . . CYPHODERIDAE (p. 161)

– PAO present, star-shaped (Fig. 1F). Mucro with more than two teeth, dorsal setae of dens not blade-like (Fig. 1A). Not living with ants . . . ONCOPODURIDAE (p. 166)

6 Small species (<0.5 mm), body pigment absent or poorly developed . . . . . 7

– Larger species, mostly with dark pigmentation . . . . . 8

7 Body strongly globular, eyes absent (Fig. 96A) . . . . . NEELIDAE (p. 168)

– Body more elongate, eyes present (Fig. 100A) . . . . . MACKENZIELLIDAE (p. 173)

8 Eye-spots dark, with 8 + 8 ocelli. Mostly well-pigmented species . . . . . 9

– Eye-spots absent, 1 + 1 ocelli. Pigmentation absent or very weak . . . . . ARRHOPALITIDAE (p. 187)

9 Males with simple antennae. Females with a pair of modified subanal setae (Fig. 1G, H) . . . . . 10

– Males antennae with clasping organ (Fig. 1I). Females without modified subanal setae . . . . . SMINTHURIDIDAE (p. 174)

10 Fourth antennal segment at least as long as third. Antennae elbowed between segments 3 and 4 . . . . . 11

– Ant.4 much shorter than ant.3. Antennae elbowed between segments 2 and 3 . . . . . DICYRTOMIDAE (p. 202)

11 Fourth antennal segment subdivided (Fig. 1J). Modified female subanal setae directed backwards/up (Fig. 1H) . . . . . 12

– Ant.4 simple. Female subanal setae directed forward/down (Fig. 1G) . . . . . KATIANNIDAE (p. 192)

12 Tibiotarsi with 2–3 strongly clavate apical setae which are adpressed to the claws (Fig. 1K). Pretarsus with one anterior seta only (Fig. 1M). Abd.5 with two pairs of trichobothria (Fig. 1O) . . . . . BOURLETIELLIDAE (p. 209)

– Tibiotarsi with pointed or weakly clavate apical setae which are not adpressed to the claws (Fig. 1L). Pretarsus with two setae (anterior/posterior) (Fig. 1N). Abd.5 with one pair of trichobothria . . . . . SMINTHURIDAE (p. 220)

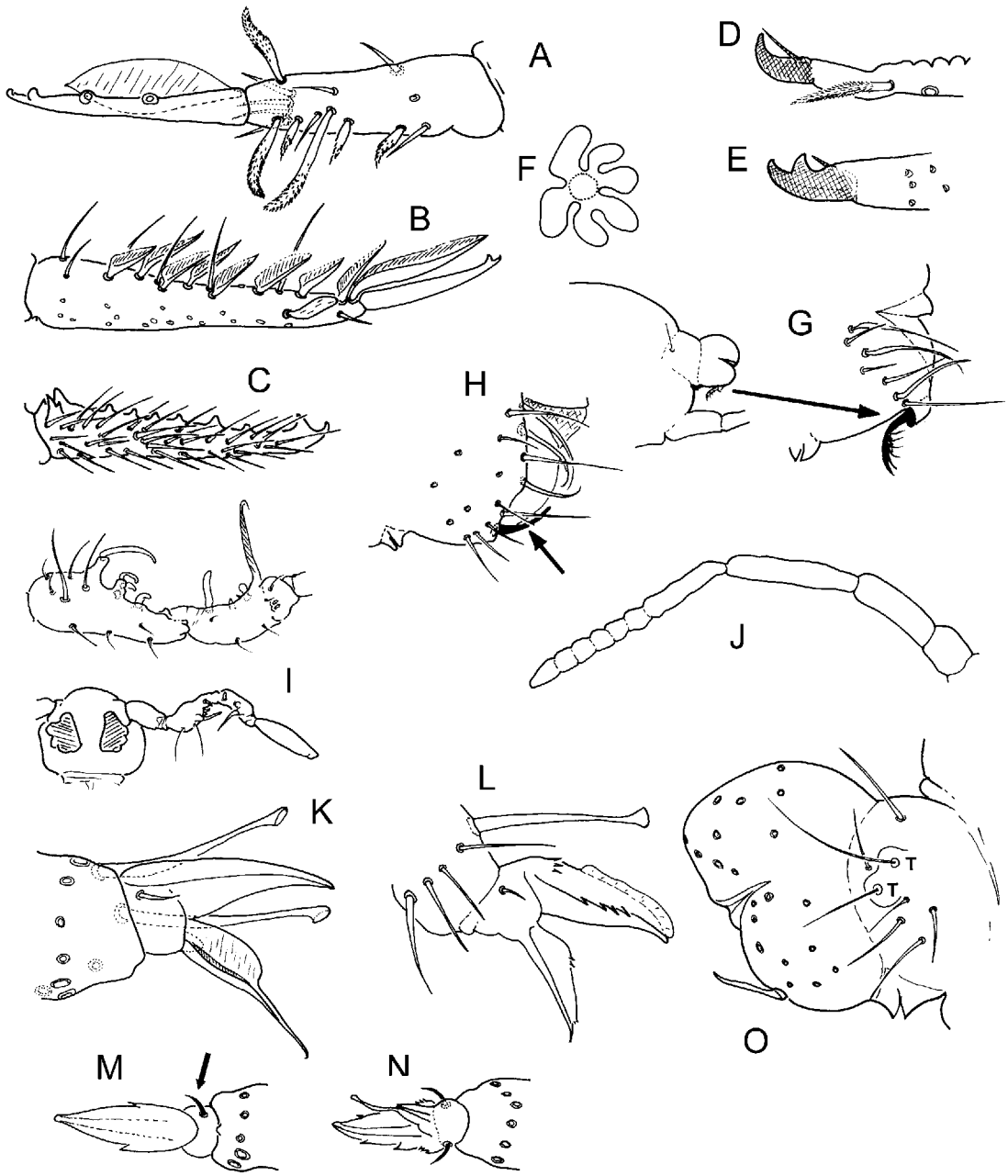


Fig. 1. Morphological details of Entomobryomorpha (A–F) and Symphypleona (G–O): (A) *Oncopodura crassicornis*, dens and mucro; (B) *Cyphoderus albinus*, ditto; (C) *Tomocerus minor*, mucro; (D) *Sinella tenebricosa*, ditto; (E) *Lepidocyrtus lignorum*, ditto; (F) *Oncopodura crassicornis*, PAO; (G) *Sminthurinus alpinus*, tip of abdomen with subanal seta enlarged (arrow); (H) *Bourletiella viridescens*, subanal setae (arrow); (I) *Sminthurides penicillifer*, male antennal clasping organ with details of ant.2–3 (above); (J) *Heterosminthurus insignis*, antenna; (K) *Heterosminthurus insignis*, apical tibiotarsus and claw on last leg; (L) *Spatulosminthurus flaviceps*, ditto; (M) *Bourletiella viridescens*, claw on left mid-leg with only the anterior pretarsal seta present (arrow); (N) *Lipothrix lubbocki*, ditto, with both pretarsal setae present; (O) *Heterosminthurus bilineatus*, abd.5–6 with two trichobothria (T) on each side.

# Section Entomobryomorpha

# Family ISOTOMIDAE

The Nordic members of this family are recognised by their slender body with an abundant cover of setae. Scales are never present. Abdominal segment 4 not or only slightly longer than segment 3. Prothorax without dorsal setae. An unlobed roundish or elongate postantennal organ is usually present (absent in two species). Most species have a long and well-developed furca, but the furca may also be completely or partly reduced.

The family has traditionally been split into three subfamilies: Anurophorinae, Proisotominae and Isotominae (Stach, 1947). Gisin's (1960) concept of Isotominae covers the three above subfamilies. The single genus *Actaletes*, not considered as belonging to Isotomidae by Stach, was included by Gisin as a second subfamily (Actaletinae). Potapov (2001), in the most recent survey of the family, abandoned the taxon Proisotominae, erected a new subfamily Pachyotominae, redefined Anurophorinae and kept the classical concept of Isotominae. Still the distinctions between the two latter subfamilies are not clear, with some genera or groups of species falling in between. In the present volume the subfamilies are left out, awaiting further phylogenetic analysis using new molecular methods in addition to traditional morphology.

For a modern review of the Palaearctic species of the family, Potapov (2001) may be consulted.

## Key to genera

1 PAO present. All dark and some white species go here . . . . . 3
– PAO absent. Only white species without eyes . . . . . 2
2 Mucro 3-toothed. Abd.5–6 fused, abd.4 free . . . . . *Isotomiella* Bagnall (p. 49)
– Mucro with a single apical hook. All segments of abd.4–6 fused . . . . . *Folsomina* Denis (p. 46)
3 All segments of abd.4–6 fused (Fig. 2A) . . . . . *Folsomia* Willem (p. 25)
– Abd.4 demarcated from abd.5 . . . . . 4
4 Manubrium with at least 8 setae in the mid-ventral group . . . . . 22
– Manubrium at most with 5 mid-ventral setae (Fig. 48E) . . . . . 5
5 Tip of abdomen without spines. Or, if spines or spine-like structures are present, then manubrium with some ventroapical setae . . . . . 6
– Tip of abdomen with 4 heavy spines (Fig. 2B). Manubrium without ventroapical setae . . . . . *Tetracanthella* Schött (p. 8)
6 Furca and retinaculum completely absent 7
– Furca and retinaculum present, but often more or less reduced . . . . . 10
7 Ocelli at most 3 + 3. White species, or pigment very diffuse . . . . . 8
– Ocelli 8 + 8, dark species . . . . . *Anurophorus* Nicolet (p. 20)
8 Abd.5 with uniform cover of setae . . . . . 9
– Abd.5 with reduced setal cover. Dorsomedian part with 4–5 very short setae on each side of the midline (Fig. 2C) . . . . . *Micranurophorus* Bernard (p. 24)
9 Abd.5–6 fused (Fig. 2D). Body very slim and tubular . . . . . *Jesenikia* Rusek (p. 17)
– Abd.5–6 clearly demarcated. Body less slender (Fig. 2E) . . . . . *Pseudanurophorus* Stach (p. 12)
10 Skin mostly smooth, never with coarse granulation all over body. Mostly slender species, often with long macrochaetae differentiated from the ground cover of short setae . . . . . 11
– Skin with strong granulation all over the body (Fig. 2G). Body plump (Fig. 2F), with uniform cover of short se-

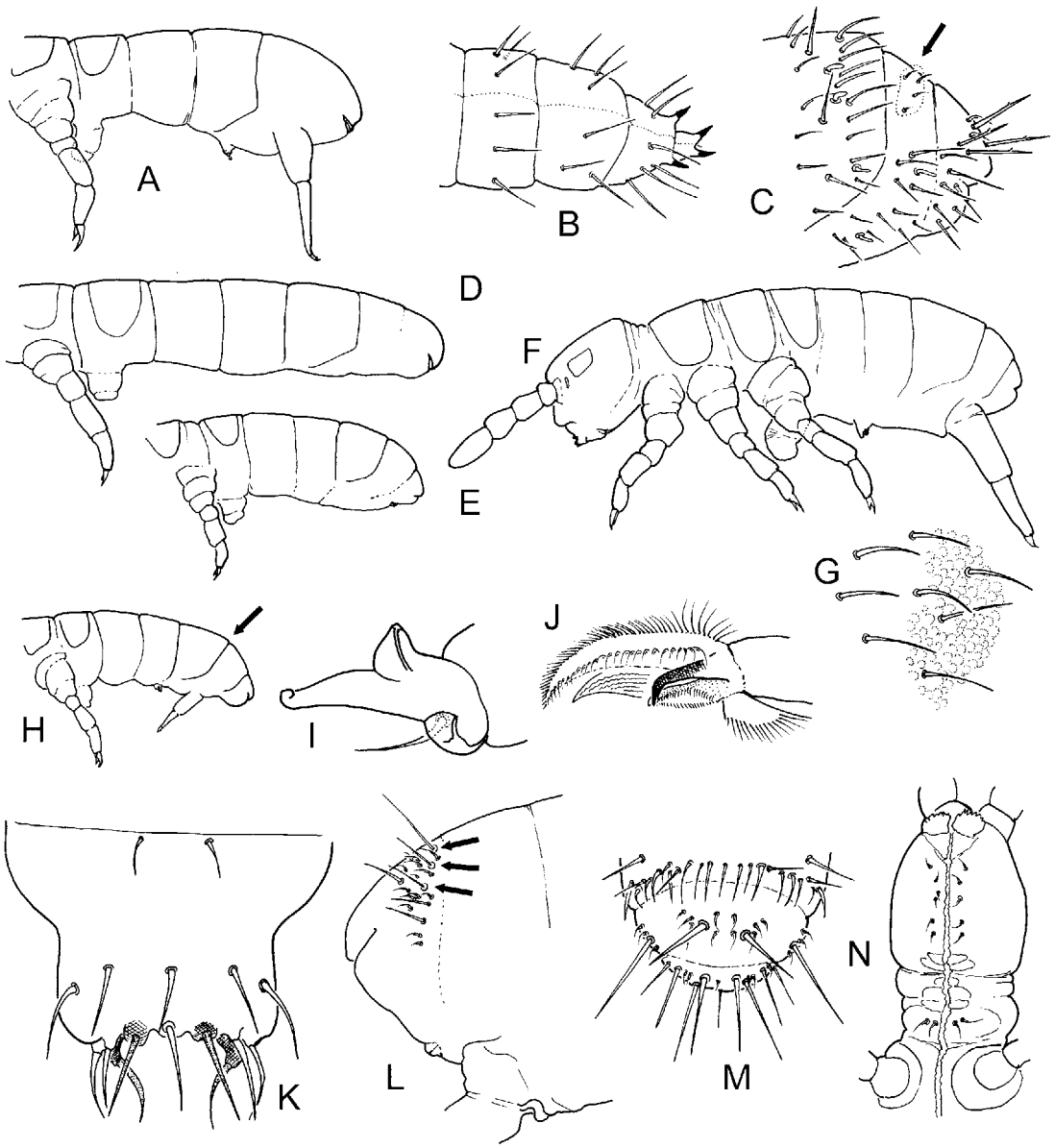


Fig. 2. (A) *Folsomia fimetarioides*, posterior part of body; (B) *Tetracanthella arctica*, abd.3–6; (C) *Micranurophorus musci*, abd.4–6 with groups of microsetae on abd.5 (arrow); (D) *Jesenikia filiformis*, posterior part of body; (E) *Pseudanurophorus binoculatus*, ditto; (F–G) *Pachyotoma crassicauda*, habitus (F) and details of skin structure on abd.5 (G); (H) *Folsomides angularis* with abdominal bend (arrow); (I) *Archisotoma megalops*, mucro; (J–L) *Archisotoma besselsi*, maxilla (J), labrum (K) and tip of abdomen (L) with trichobothria marked (arrows); (M) *Isotomodes productus*, tip of abdomen; (N) *Isotomodes bisetosus*, ventral side of head and th.1.

tae, macrochaetae absent
. . . . . *Pachyotoma* Bagnall (p. 77)

11 Manubrium with 1 + 1 or more ventral setae . . . . . 17

– Manubrium without ventral setae . . . . . 12

12 Abd.5 with uniform cover of setae. Th.1 without ventral setae. Both white and dark species . . . . . 13

– Setal cover of abd.5 reduced, with an isolated dorsomedian group of a few setae/spines (Fig. 2M). Th.1 with at least 1 + 1 ventral setae (Fig. 2N). White species without eyes . . . . . *Isotomodes* Axelson (p. 47)

13 Ocelli at least 2 + 2. Body pigment present. Dens not very short . . . . . 14

– Ocelli absent. White species with very short dens (Fig. 13A) . . . . . *Isotomodella* Martynova (p. 19)

14 Mucro with normal teeth. Labrum with 3 separate transverse rows of setae. Maxilla normal, with 3-toothed capitulum. Abd.6 without long, erect sensilla. Usually not marine littoral species . . . . . 15

– Mucro modified, with broad basal teeth (Fig. 2I). Labrum with the two distal rows of setae combined at the anterior edge (Fig. 2K). Maxilla specialised, capitular teeth reduced, lamellae strongly developed (Fig. 2J). Abd.6 with 2–3 pairs of long, erect sensilla (Fig. 2L). Strictly marine littoral species . . . . . *Archisotoma* Linnaniemi (p. 51)

15 Ventral tube with 4 + 4 or more lateral setae. Ocelli 8 + 8. Dorsal side of abdomen evenly curved . . . . . 16

– Ventral tube with 3 + 3 lateral setae. Ocelli at most 5 + 5. Dorsal profile of abdomen with a sharp bend between segments 4/5 (Fig. 2H) . . . . . *Folsomides* Stach (p. 59)

16 Ventral tube with at least 5 + 5 lateral setae. Dens with more than 5 ventral setae . . . . . *Ballistura* Börner (p. 75)

– Ventral tube with 4 + 4 lateral setae. No ventral setae on dens . . . . . *Subisotoma* Stach (p. 62)

17 Tibiotarsi with 7 setae in the apical whorl (T-setae absent). Abd.5–6 fused or demarcated. Mucro variable . . . . . 18

– Tibiotarsi with 11 setae (T-setae present, Fig. 3A). Abd.5–6 fused. Mucro with 3 teeth . . . . . *Appendisotoma* Stach (p. 73)

18 Ocelli and body pigment usually present. If absent, then mucro with two teeth only . . . . . 19

– Ocelli absent, white species. Mucro elongate with 5 teeth (Fig. 3B) . . . . . *Mucrosomia* Bagnall (p. 72)

19 Abd.5–6 demarcated . . . . . 20

– Abd.5–6 fused . . . . . *Cryptopygus* Willem (p. 62)

20 Either mucro has two teeth, or – in case the mucro has 3 teeth – body pigmentation is greyish brown and microsensilla are absent on abd.1–3 . . . . . 21

– Mucro with 3 teeth or more, body pigmentation bluish. Microsensilla present on abd.1–3 . . . . . *Scutisotoma* Bagnall (p. 84)

21 All sesilla absent on th.2–abd.1 (Fig. 57C). Maxilla specialized with narrow elongated lamellae (Fig. 57J). Marine littoral species with 2-toothed mucro (Fig. 57D) . . . . . *Strenzketoma* Potapov et al. (p. 87)

– At least macrosensilla are present on th.2–abd.1. Maxilla with broad lamellae (Fig. 53C). Not marine littoral species, mucro with 2 or 3 teeth . . . . . *Proisotoma* Börner (p. 78)

22 Trichobothria present on abd.4, usually also on abd.2–3. If all absent (*Isotomurus antennalis*), then ventral tube with 3 + 3 lateral setae and labial palp with more than 4 proximal setae (Fig. 3D) . . . . . *Isotomurus* Börner (p. 90)

– Trichobothria absent. If ventral tube has 3 + 3 lateral setae, then labial palp with 3 or 4 proximal setae . . . . . 23

23 Dens with a long subapical seta which bypass tip of mucro (Fig. 3C). Maxillary outer lobe without sublobal hairs (Fig. 3K) . . . . . *Agrenia* Börner (p. 88)

– Apical seta of dens shorter, not passing tip of mucro. Sublobal hairs 4 (Fig. 3L) . . . . 24

24 Tibiotarsi with clavate apical setae (Fig. 3E, F) . . . . . 25

– Tibiotarsi with pointed apical setae (Fig. 3G, H) . . . . . 26

25 Abd.5–6 fused. Mucro with 3 teeth. Tibiotarsi with 8–9 apical setae (Fig. 3F) . . . . . *Pseudisotoma* Handschin (p. 105)

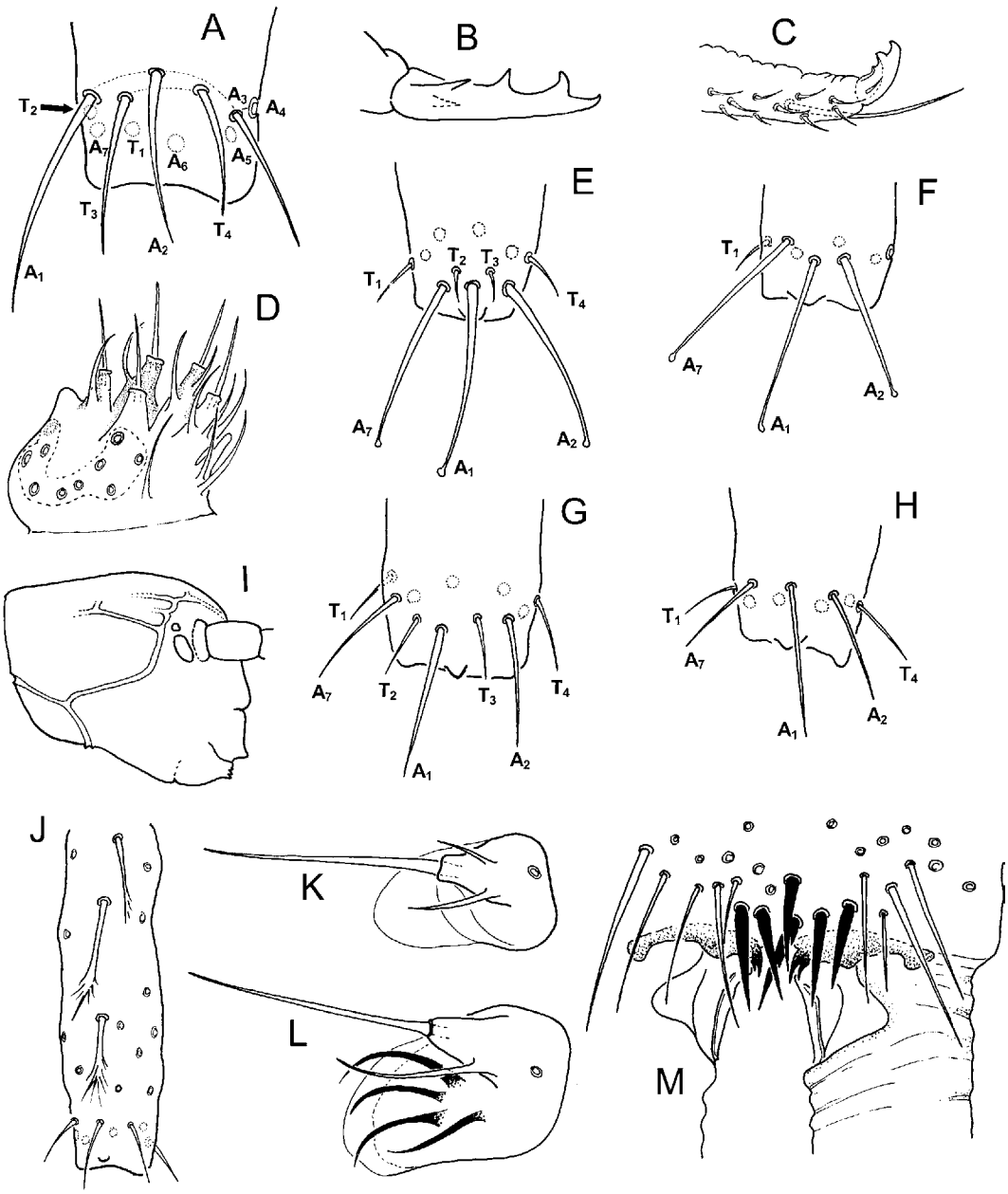


Fig. 3. (A) *Appendisotoma abiskoensis*, apical setae of right tib.2; (B) *Mucrosomia garretti*, mucro; (C) *Agrenia bidenticulata*, tip of dens showing long subapical seta; (D) *Isotomurus antennalis*, left labial palp (ventral) with bases of proximal setae encircled; (E–H) apical setae of right tib.2 in *Vertagopus arboreus* (E), *Pseudisotoma sensibilis* (F), *Desoria grisea* (G) and *Isotoma anglicana* (H); (I–J) *Marisotoma canaliculata*, right side of head with branching integumentary channels (I), outer side of right tib.2 with three feathered setae (J); (K–L) maxillary outer lobe in *Agrenia riparia* (K) and *Isotomurus fucicola* (L); (M) *Isotoma anglicana*, ventroapical part of manubrium with spine-like setae (black).

– Abd.5–6 demarcated. Mucro with 4 teeth. Tibiotarsi with 11 apical setae (Fig. 3E) ..... *Vertagopus* Börner (p. 100)

26 Tib.2 with 1–3 feathered setae on the outer side (Fig. 1J). Mucro with 3 teeth ..... 27

– Tib.2 without feathered setae. Mucro with 3 or 4 teeth ..... 28

27 Ventral tube with 3 + 3 lateral setae. Head with integumentary channels (Fig. 3I). Not marine littoral species ..... *Marisotoma* Fjellberg (p. 106)

– Ventral tube with 2 + 2 lateral setae. Head without integumentary channels. Strictly marine littoral species ..... *Halisotoma* (p. 111)

28 Ocelli 5–8 on each side. Eye-spots large, elongate ..... 29

– Ocelli at most 4–5 on each side. Eye-spots small, square or punctual ..... *Parisotoma* Bagnall (p. 108)

29 Tibiotarsi mostly with 11 apical setae (Fig. 3G) (two species with 8–9 apical setae). Manubrium with normal, slender ventroapical setae ... *Desoria* Nicolet (p. 117)

– Tibiotarsi with 8 apical setae (Fig. 3H). Manubrial ventroapical setae spine-like (Fig. 3M)..... *Isotoma* Bourlet (p. 114)

## Genus *Tetracanthella* Schött, 1891

*Tetracanthella* Schött, 1891, Ent. Tidskr. 12: 191. Type species: *Tetracanthella pilosa* Schött, 1891, by monotypy.

Our members of this genus are very homogenous by appearance and easily spotted in mixed samples. The body is cylindrical or flattened with a relatively short furca and 4 characteristic spines on abd.5–6 (Fig. 2B). Most species are dark bluish black with strongly differentiated macrochaetae. They often occur in dry habitats and move slowly.

### Key to species

1 Mucro present ..... 2

– Mucro absent ..... 4

2 Dens with 2 dorsal setae ..... 3

– Dens with 3 dorsal setae ..... 167. *pilosa* Schött

3 Abd.1–3 with 222 macrochaetae on each side (Fig. 4A) ..... 166. *strenzkei* Gisin

– Abd.1–3 with 223 macrochaetae on each side (as Fig. 4B) .. 165. *brachyura* Bagnall

4 Abd.1–3 with 223 macrochaetae on each side (Fig. 4B) ..... 5

– Abd.1–3 with 233 macrochaetae on each side (Fig. 4C)..164. *wahlgreni* Linnaniemi

5 Setae $a_1$ on abd.4 not longer than distance between their bases (Fig. 4D). Smooth fields on abd.4 normally absent ..... 162. *arctica* Cassagnau

– Setae $a_1$ on abd.4 longer than distance between their bases. Abd.4 with a broad smooth field (Fig. 4E) ..... 163. *fjellbergi* Deharveng

### 162. *Tetracanthella arctica* Cassagnau, 1959

Figs 4B, D, 5A–K

*Tetracanthella arctica* Cassagnau, 1959, Mém. Mus. Hist. nat. Paris (A)16: 234.

*Description.* – Size 1.6 mm, colour bluish black. Ocelli 8 + 8, two smaller than others. PAO narrow, in a deep groove, about twice as long as diameter of nearest ocellus. Antennae without apical vesicle. Ant.3 organ with two curved sensilla, partly covered by an integumentary fold, two long guard sensilla and a lateral spine-like sensillum associated with a long sensillum (Fig. 5J). Males with a variable number of erect, blunt sensilla on ventral side on ant.2–3. Labrum with 2/554 setae. Maxillary palp simple, with 3 sublobal hairs (Fig. 5K). Maxilla as Fig. 5F. Lamellae short, not reaching beyond tip of capitulum. Each of the six lamellae with many denticles and short marginal ciliation. Labium as Fig. 5G, palp without guards $b_4$, $d_4$, $e_5$ and $e_7$. Head with 3 + 3 setae along the ventral line. Body integument strongly reticulate, with increased polygon size on the last 3–4 abdominal tergites. Posterior part of abd.4 with integumentary polygons which are variable in size, some-

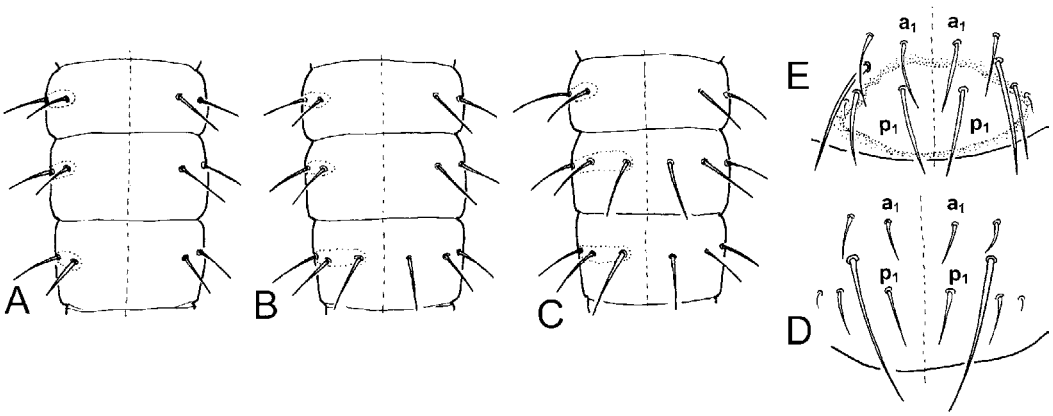


Fig. 4. *Tetracanthella* spp.: (A–C) Macrochaetal patterns on abd.1–3 in *strenzkei* & *pilosa* (A), *arctica*, *fjellbergi* and *brachyura* (B), *wahlgreni* (C); (D–E) axial chaetotaxy and smooth field on abd.4 in *arctica* (D) and *fjellbergi* (E).

times they are more or less dissolved or completely absent, giving an extensive smooth field behind the $p_1$ setae (Fig. 5H, I). Dorsal side with clearly differentiated macrochaetae which are pointed and distributed as Fig. 5A. Abd.1–3 with 223 macrochaetae on each side. Number of axial setae on each side of the midline of th.2–abd.4 as 64/2222 (Fig. 5B). Posterior edge of head with 3–5 pp setae on each side between the long $p_3$ setae (Fig. 5D). Setae $a_1$ on abd.4 not longer than distance between their bases, not reaching back to setae $p_1$ (Fig. 5H, I). Sensillary formula of th.2–abd.5 as 44/33324, of which 11/111 are microsensilla. Median sensilla situated behind the macrochaetae. Anal spines amber-coloured, moderately long and curved, set on large reticulate papillae. Th.3 with 1 + 1 ventral setae. Ventral tube with 3 + 3 lateral and 4 posterior setae. Retinaculum with 2 + 2 teeth and one seta. Furca as Fig. 5E, dens with one anterior and 2 posterior setae. Mucro absent. Apical whorl of tibiotarsi with 7 setae. Seta $A_1$ elongated and clavate on tib.1, on tib.2–3 also seta $A_2$ elongated/clavate. In non-reproductive males the inner side of tib.3 with a long, erect and pointed seta x (reproductive males not seen). Claws untoothed, unguiculus pointed, about half as long as inner edge of the claw.

*Discussion.* – The shorter body hairs will normally separate this species from the following *T. fjellbergi*, in which the $a_1$ setae on abd.4 are longer than the distance between their bases, reaching backwards beyond base of $p_1$ (Fig. 4D, E). Deharveng (1987) described *T. sibirica*, said to differ from *arctica* by more pp setae on head and by presence of a smooth field on abd.4. The present Nordic material of *arctica* indicates a strong variation in these characters. While specimens from Spitsbergen and Bjørnøya normally have 3 + 3 pp setae and moderately enlarged polygons on abd.4, specimens from SW Norway, the Faroe Islands and Ireland have 3–5 pp-setae on each side and abd.4 polygons ranging from moderate to very large and even dissolved or absent (smooth field present). Single specimens from these populations may be identified as *sibirica*. The species status of *sibirica* seems doubtful.

*Distribution and ecology.* – Originally described from Spitsbergen (Cassagnau, 1959). Subsequent records from Bjørnøya, the west coast of Norway, Iceland, Faroe Islands and Ireland (Kerry, J. Filser leg.). In arctic tundra, grass fields and moss on rocks. General distribution: Northern Holarctic.

## 163. *Tetracanthella fjellbergi* Deharveng, 1987

Figs 4B, E, 6C

*Tetracanthella fjellbergi* Deharveng, 1987, Trav. Lab. Ecobiol. Arthrop. Edaph. Toulouse 5 (3): 61.

*Description.* – Size 1.6 mm, colour dark bluish grey. PAO elongated, about 2.5 as long as diameter of nearest ocellus. Head with 3 + 3 pp-setae between the two $p_3$-setae (cf. Fig. 5D).

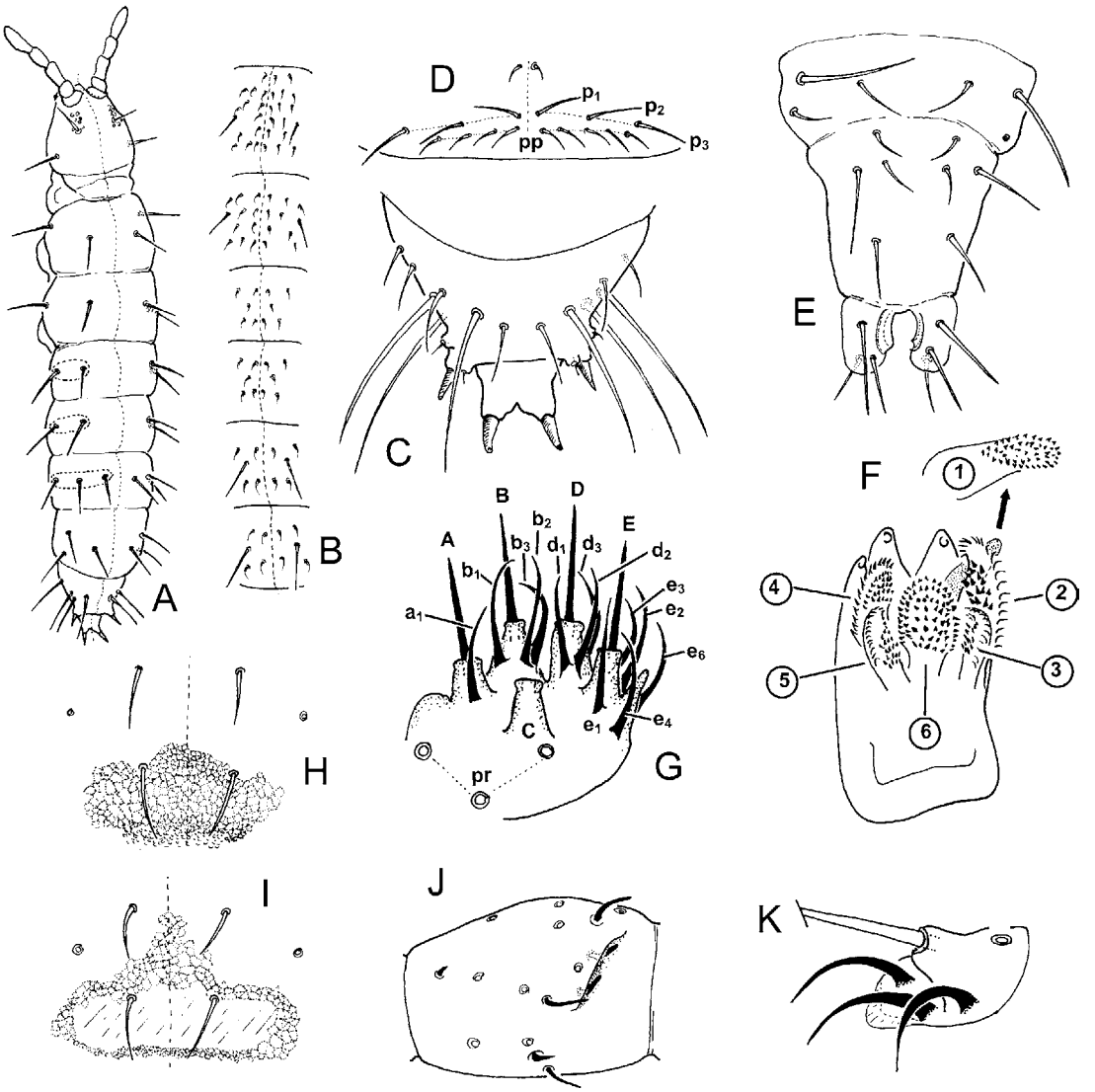


Fig. 5. *Tetracanthella arctica*: (A) Habitus and distribution of dorsal macrochaetae; (B) axial chaetotaxy of th.2–abd.4; (C) abd.5–6; (D) posterior edge of head; (E) furca; (F) maxilla; (G) left labial palp, ventral; (H–I) skin sculpture in axial part of abd.4, two different specimens from Faroe Islands; (J) right ant.3, lateral; (K) maxillary outer lobe with three sublobal hairs (black).

Abd.1–3 with 223 macrochaetae on each side. Abd.4 with relatively long setae, $a_1$-setae as long or longer than distance between their bases, reaching well beyond bases of $p_1$. A large smooth field is present on abd.4 (Fig. 4E), sometimes also on abd.3 and abd.2. Reproductive males with two blunt, erect and thick setae on inner side of tib.3 (Fig. 6C). In unreproductive males theses setae are normal, slender. Unguiculus long and filamentous, about 2/3 of inner unguis length.

*Discussion.* – Very similar to *arctica*, differing mainly by the longer body hairs and the presence of a large smooth field on abd.4.

*Distribution and ecology.* – Widely distributed in southern Norway, but not recorded from neighbouring countries (may have been con-

fused with *wahlgreni*). The species appears in forest soils and on tree trunks and seems to prefer acidic conditions. In Central Europe it was typical in soils on acid bedrock, but expanded its range to limestone ground during a period with marked acidification of the substrate due to airborne fallout (Rusek, 1993). General distribution: Palaearctic.

## 164. *Tetracanthella wahlgreni* Linnaniemi, 1907

Fig. 4C

*Tetracanthella wahlgreni* Linnaniemi, 1907, Acta Soc. Sci. fenn. 34: 129.

*Description.* – Size 1.5 mm, colour bluish black. PAO about 2.5 as long as diameter of nearest ocellus. Antennal sensilla, labrum, labium, maxilla and maxillary outer lobe as in *arctica*. Body integument with rather coarse reticulation, smooth fields present in posterior parts of abd.3–4 and between anterior pair of anal spines on abd.5. Anal spines and their basal papillae strongly amber-coloured. Abd.1–3 with 233 macrochaetae on each side (Fig. 4C). General hair cover very short, setae $a_1$ on abd.4 only about half as long as distance between their bases. Head with 4–5 pp-setae on each side between the long $p_3$-setae. Th.3 with $1 + 1$ ventral setae, retinaculum with $2 + 2$ teeth and one seta. Furca as in *arctica* (Fig. 5E), without mucro. Reproductive males with two blunt, erect setae on inner side of tib.3. Unguiculus reaching about $2/3$ of inner unguis.

*Discussion.* – Similar to *arctica* in most characters, but immediately recognised by presence of the $3 + 3$ macrochaetae on abd.2.

*Distribution and ecology.* – Widely distributed in Norway, scattered in other countries. Older records from Arctic Islands and Faroe Islands probably relate to *arctica*. Usually in dry inland forests and mountain heaths, ascending well into the alpine. General distribution: Palaearctic.

## 165. *Tetracanthella brachyura* Bagnall, 1949

Figs 4B, 6D, G

*Tetracanthella brachyura* Bagnall, 1949, Entomologist's mon. Mag. 85: 58.
*Tetracanthella britannica* Cassagnau, 1959.
*Tetracanthella hydrophila* Hüther, 1964.

*Description.* – Size 1.6 mm, colour bluish black. PAO elongated, about 2.5 as long as diameter of nearest ocellus. Maxillary outer lobe with 4 sublobal hairs. Head with 4–5 pp-setae on each side between the long $p_3$-setae. Abd.1–3 with 223 macrochaetae on each side. Body hairs in general short, setae $a_1$ on abd.4 shorter than distance between their bases. Integument on tergites with a fine polygonal meshwork, polygon size increased on the 3–4 last abdominal segments. Abd.4 sometimes with an open smooth area. Retinaculum with $3 + 3$ teeth and one seta. Dens with two dorsal and one ventral setae. Mucro 2-toothed (Fig. 6D). Reproductive males with two erect blunt setae on inner side of tib.3 (cf. Fig. 6C). Unguiculus short and pointed, only $1/3$ as long as inner edge of claw (Fig. 6G).

*Discussion.* – Differing from the two previous species by a set of plesiomorphic characters: Mucro present, maxillary outer lobe with 4 sublobal hairs, retinaculum with $3 + 3$ teeth. Otherwise similar in general characters.

*Distribution and ecology.* – Widely distributed in mountains and inland districts in southern Norway. Not recorded from neighbouring countries. Often abundant in wet meadows and bogs and along streams, lakes and snowfields. General distribution: Palaearctic.

## 166. *Tetracanthella strenzkei* Gisin, 1949

Figs 4A, 6A, F

*Tetracanthella strenzkei* Gisin, 1949, Mitt. faun. ArbGemein. Schleswig-Holstein, Hamburg u. Lübeck 2: 34.

*Description.* – Size 1.2 mm, colour greyish blue. PAO 2.0–2.5 as long as diameter of nearest ocellus. Three prelabral setae present. Maxillary outer lobe with one sublobal hair. Body integument with a fine meshwork of polygons, slightly enlarged on abd.4. Smooth fields absent. Macrochaetae rather short, abd.1–3 with 222 on each side (Fig. 4A). Abd.4 with a pair of $m_1$ setae between the median macrochaetae (Fig. 6A).

Setae $a_1$ on abd.4 longer than distance between their bases. Head with 5 + 5 pp-setae between the long $p_3$ setae (cf. Fig. 5D). Anal spines short, only weakly curved, basal papillae almost absent in anterior pair (Fig. 6A). Thorax without ventral setae. Retinaculum with 2 + 2 teeth and no seta. Dens with 3 setae and a small hook-like mucro (Fig. 6F). Tibiotarsi with 1-2-2 clavated apical tenent hairs. Also two of the inner tibiotarsal setae are strongly elongated. Unguiculus small, less than 1/4 of inner unguis (as Fig. 6G). Modified setae on tib.3 in reproductive males not observed.

*Discussion.* – The small anal spines, reduced number of macrochaetae on abd.3, presence of $m_1$ setae on abd.4 and the small mucro readily identify this species from the four previous ones. From *pilosa* it differs by having only two dorsal setae on dens.

*Distribution and ecology.* – Scattered records in southern Norway, Denmark and Sweden. Usually in moss/lichens on old hardwood trees, but also in moss on rocks in open coastal habitats. General distribution: Palaearctic.

### 167. *Tetracanthella pilosa* Schött, 1891

Figs 4A, 6E

*Tetracanthella pilosa* Schött, 1891, Ent. Tidskr. 12: 192.

*Description.* – Size 1.2 mm, colour dark blue. PAO 1.5–2.0 as long as diameter of nearest ocellus. Four prelabral setae present. Maxillary outer lobe with one sublobal hair. Body integument with a meshwork of distinct polygons, becoming enlarged in median parts of the abdominal tergites, in particular on abd.4. Smooth fields absent. Abd.1–3 with 222 macrochaetae on each side (Fig. 4A). Abd.4 with 3 + 3 axial setae, $m_1$ present (as Fig. 6A). Setae $a_1$ on abd.4 longer than distance between their bases. Head with 4–5 pp-setae on each side between the long $p_3$ setae. Anal spines moderately long, on small basal papillae. The longest macrochaetae on the body, in particular on tip of abdomen, blunt-tipped or clavate. No ventral setae on th.3. Retinaculum with 3+3 teeth and one seta. Dens long and slender, with 3 dorsal and one ventral seta. Mucro strong (Fig. 6E). Tibiotarsi with 1-2-2 clavated tenent hairs. Unguiculus short, about 1/3 of inner unguis. Modified setae on inner side of tib.3 in males not observed.

*Discussion.* – Easily identified by the blunt-tipped abdominal macrochaetae, the large mucro and 4 setae on dens.

*Distribution and ecology.* – Apparently a rare species which has only been recorded a few times in Norway, Sweden and Finland. In Norway collected twice in plant communities on dry calcareous rocks. General distribution: Palaearctic.

## Genus *Pseudanurophorus* Stach, 1922

*Pseudanurophorus* Stach, 1922, Annls hist.-nat. Mus. natn. hung. 19: 15. Type species: *Pseudanurophorus boerneri* Stach, 1922, by subsequent designation by Stach, 1947, Apteryg. faun. Poland 1, Fam. Isotomidae: 10.

Small species (less than 1.0 mm) without or with weak pigmentation and reduced number of ocelli. PAO present. Mandibles fully developed, with molar plate. Maxillae with 3-tooted capitulum and ciliate lamellae of which the longest reaches beyond tip of capitulum. Body hairs short and smooth, macrochaetae undifferentiated in most species. Head with 3–5 postlabial setae along each side of the ventral line. Furca and retinaculum completely reduced. Anal spines absent. Last antennal segment without apical bulb. Two last abdominal segments not fused. Tibiotarsi with 7 apical setae ($A_{1-7}$). All T-setae absent. Males have not been observed in our species, and they are probably parthenogenetic.

### Key to species

1 Ocelli present . . . . . 2
– Ocelli absent . . . . . 3
2 Ocelli 3 + 3 . . . . . 168. *isotoma* (Börner)
– Ocelli 1 + 1 . . 169. *binoculatus* Kseneman
3 Sensillary formula on th.2–abd.5 as 31/01124
171. *psammophilus* (Potapov & Stebaeva)
– Sensillary formula on th.2–abd.5 as 43/22223 . . . . . 170. *alticola* Bagnall

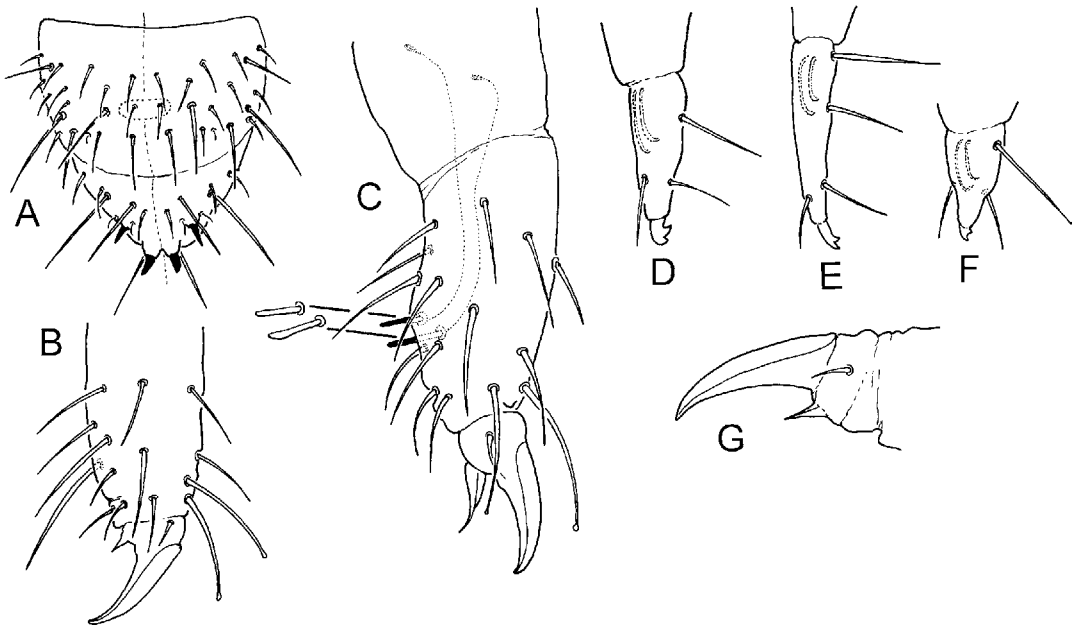


Fig. 6. *Tetracanthella* spp.: (A–B) *strenzkei*, abd.4–6 (A), left tib.3 (B); (C) *fjellbergi*, left tib.3, reproductive male; (D–F) furca in *brachyura* (D), *pilosa* (E), *strenzkei* (F); (G) *brachyura*, claw.

*Note.* – Two of the above species, *alticola* and *psammophilus*, were placed in the genus *Isotomodella* by Potapov & Stebaeva (2002). Their reason for doing so is mainly the position of the sensilla on abd.1–3: Well in front of the p-row (mid-tergite) in *Isotomodella*, within the p-row in *Pseudanurophorus*. This distinction may be relevant on generic level, but the relationships between the involved taxa are still obscure and a conservative view is therefore followed here, keeping all Nordic species without furca as *Pseudanurophorus*.

## 168. ***Pseudanurophorus isotoma*** (Börner, 1903)

Fig. 7A–H

*Pseudanurophorus isotoma* Börner, 1903, Sber. Ges. naturf. Freunde Berl. 1903: 138.
*Pseudanurophorus isotoma* Börner f. *capitata* Denis, 1932. Bödvarsson (1963).

*Description.* – Size 1.1 mm. Colour white, with scattered black pigmentation on dorsal side. The 3 + 3 ocelli each underlain by a dark spot. Body slender, tip of abd.6 with a short terminal prolongation (Fig. 7B). PAO roundish oval (Fig. 7G). Ant.1 with two slender ventroapical sensilla. Ant.2 with a lateroapical slender sensillum. Ant.3 with a spine-like lateroapical sensillum and an antennal organ like Fig. 7E, basal microsensillum present. Ant.4 with many curved, setaceous sensilla. Labrum with 3/554 setae, anterior rows not papillate. Apical edge smooth. Frontoclypeal field with 4 central setae. Maxillary palp simple, with 4 sublobal hairs. Labial palps complete, terminal sensilla on papillae A and B thicker and less pointed than on papillae C, D and E. Basal fields with 4 median and 5 lateral setae. Maxilla as Fig. 7D. Lam.1 with two fringes of cilia. Body hairs smooth, acuminate, with well-differentiated macrochaetae (Fig. 7A, B). Abd.6 with an unpaired axial macrochaeta near tip ($P_0$, Fig. 7B). Axial chaetotaxy of th.2–abd.3 mostly as 98/444, but variations are frequent. Macrosensilla slender, hair-like, distributed as 33/22224. Spine-like microsensillum only present on mesothorax. Macrosensilla on abd.1–4 placed in the p-row, on thorax the upper sensillum is frequently set in front of the p-row. Ventral side of head with 4–5 setae on each side

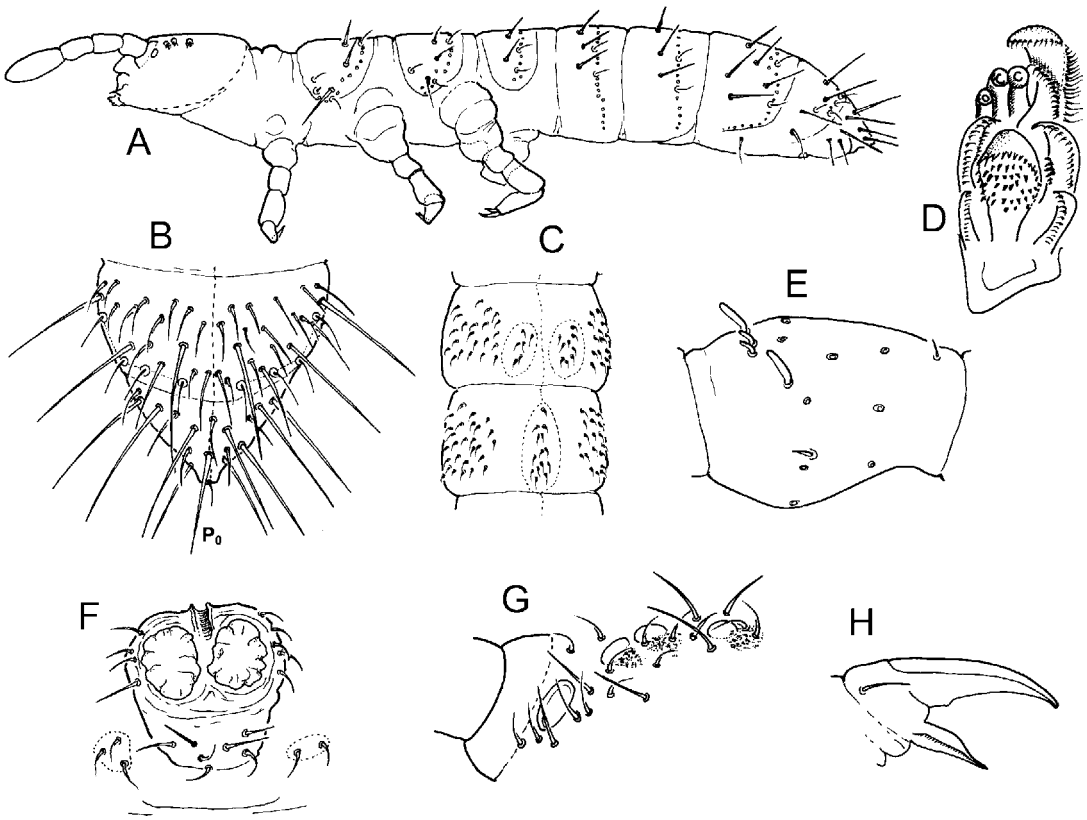


Fig. 7. *Pseudanurophorus isotoma*: (A) General habitus and distribution of dorsal macrochaetae and sensilla; (B) abd.5–6, dorsal; (C) abd.2–3, ventral; (D) maxilla; (E) left ant.3; (F) ventral tube; (G) PAO and eyes; (H) claw.

of the midline. Th.3 with 2–3 ventral setae on each side of the midline. Ventral tube with 4–5 distal and 6–7 caudal setae. In addition there are 2–3 setae on each side just outside the base of the ventral tube (Fig. 7F). Abd.2 with an isolated group of setae on each side of the mid-ventral line, while abd.3 has en elongated setaceous field in the midline (Fig. 7C). Tibiotarsi with complete A, B and C whorls with 7 setae each, in addition a few D-setae are present on all legs. Apical T-setae absent. Apical tenent hairs not developed. Claws simple, without teeth (Fig. 7H).

*Discussion.* – The 3 + 3 ocelli readily identify this species.

*Distribution and ecology.* – The only Nordic record is that of Bödvarsson (1963) from grass fields in a city park in Lund, Sweden. The above description is based on these specimens which are kept in the Zoological Museum, Lund. General distribution: Palaearctic, N. Africa.

## 169. ***Pseudanurophorus binoculatus*** Kseneman, 1934

Figs 8A, 9A–I

*Pseudanurophorus binoculatus* Kseneman, 1934, Acta Soc. Scient. nat. moravo-siles. 9 (8): 1.

*Description.* – Size 0.5 mm. General body shape as Fig. 8A, rather short and stout. Colour white with scattered black pigment granules. Eyespots darker. Ocelli 1 + 1. PAO oval (Fig. 9I). Ant.1 with 14–15 setae, ventral side with one or two blunt apical sensilla (Fig. 9E). Ant.2 without lateroapical sensillum. Ant.3 without basal microsensilla, antennal organ normal. Ant.4 with two of the dorsal sensilla distinctly thicker than

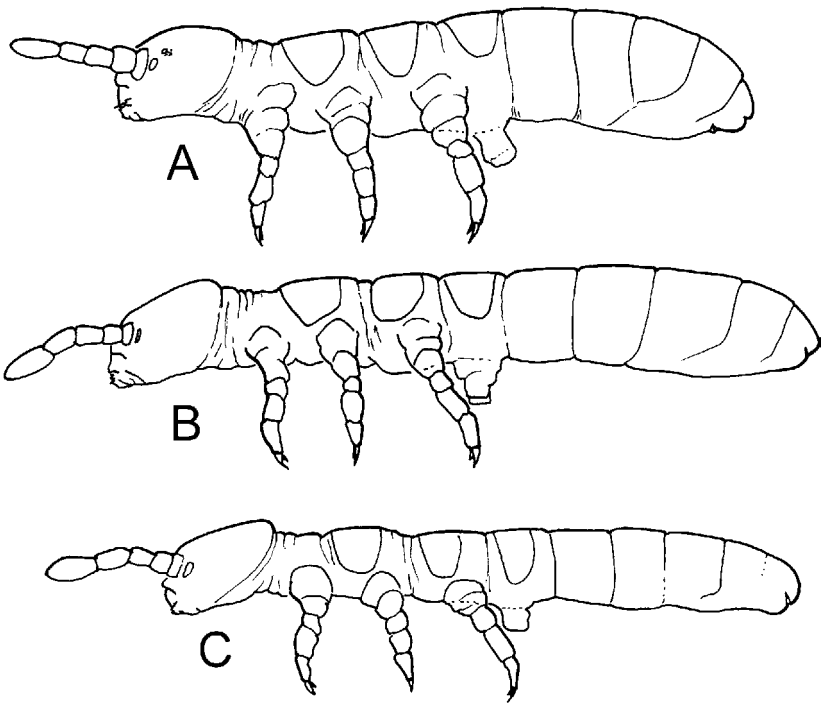


Fig. 8. General habitus of *Pseudanurophorus binoculatus* (A), *P. alticola* (B) and *Jesenikia filiformis* (C).

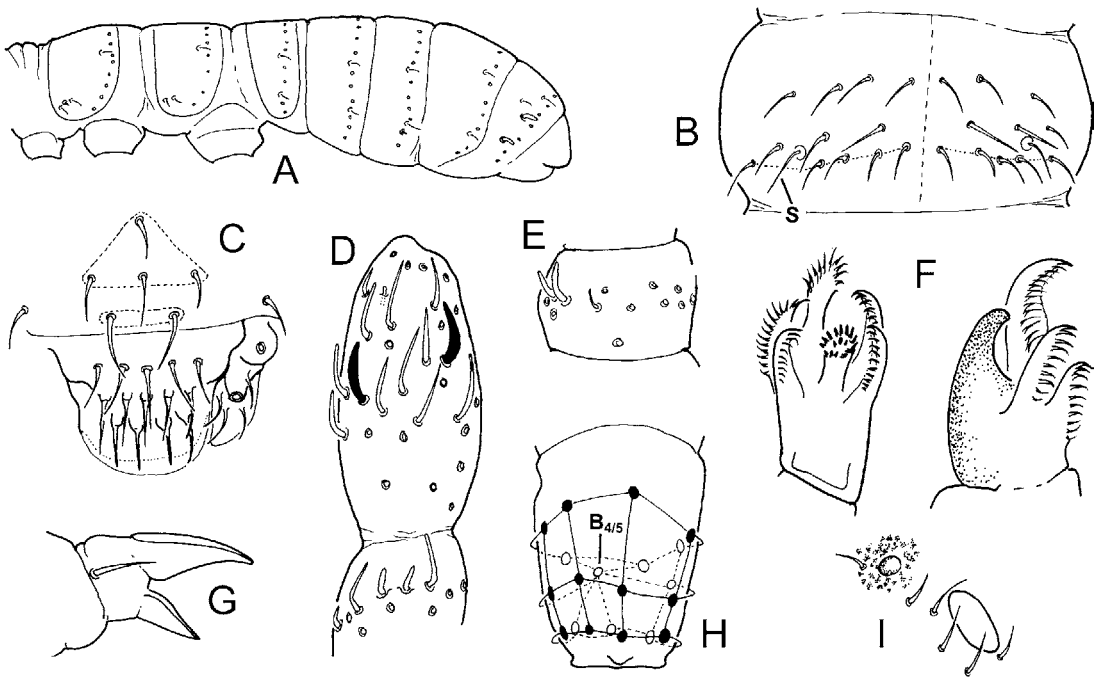


Fig. 9. *Pseudanurophorus binoculatus*: (A) Distribution of dorsal sensilla on th.2–abd.5; (B) dorsal chaetotaxy of abd.1; (C) labrum with prelabral and frontoclypeal setae encircled; (D) left ant.3–4; (E) right ant.1, ventral; (F) maxilla; (G) claw; (H) chaetotaxy of left tib.2; (I) PAO and eye-spot.

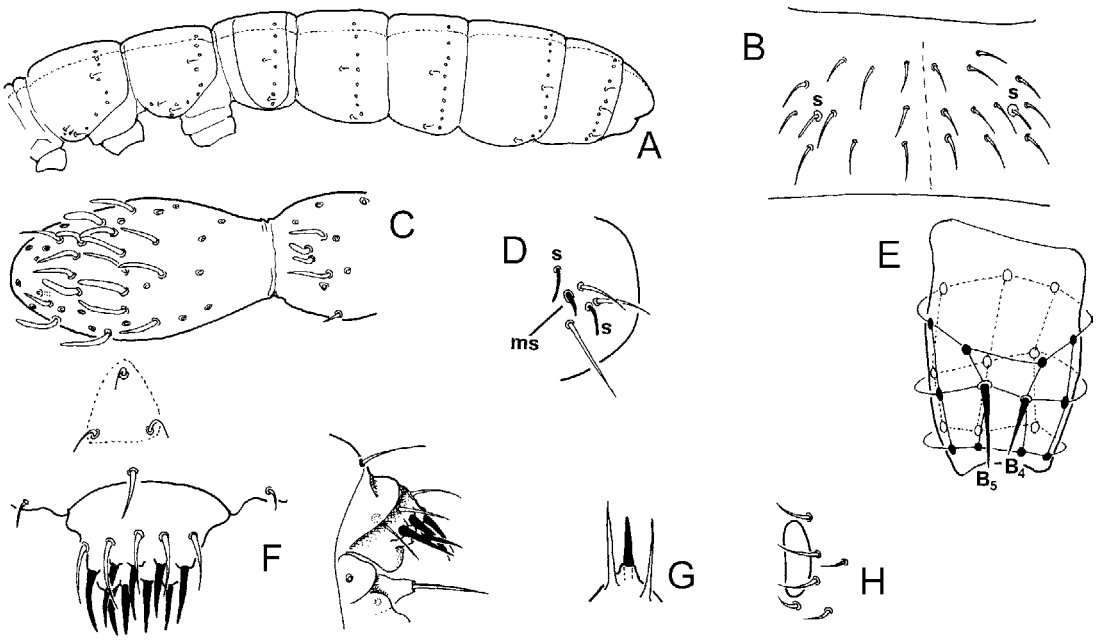


Fig. 10. *Pseudanurophorus alticola*: (A) Distribution of dorsal sensilla on th.2–abd.5; (B) dorsal chaetotaxy of abd.1; (C) ant.3–4 sensilla; (D) right corner of th.2; (E) chaetotaxy of left tib.2; (F) labrum, frontal (left) and profile (right); (G) hypostomal setae; (H) PAO.

others (Fig. 9D). Labrum with 4/554 setae, anterior row on distinct basal papillae. Apical edge smooth. Central part of frontoclypeal field with 4 setae (Fig. 9C). Maxillary outer lobe with bifurcate palp and 3 sublobal hairs. Labial palp with 5 papillae, 15 guard setae ($e_7$ absent) and 3 proximal setae. Basal fields with 4 median and 5 lateral setae. Maxilla as Fig. 9F, with 6 lamellae. Longest lamella reaches well beyond tip of capitulum. Lam.1–5 with marginal ciliations only. Lam.6 with a few coarse serrations. Number of setae along each side of the dorsal midline of th.2–abd.3 as 54/222, but often irregular. Sensillary formula as 43/22324, of which 10/001 are microsensilla (Fig. 9A). Upper sensilla of abd.1–3 slightly in front of the p-row (Fig. 9B). The two lower sensilla on abd.5 enlarged. Ventral setae absent on thorax. Ventral tube with $4 + 4$ distal and two caudal setae. Furcal field with a few (5–7) setae. Inner side of tib.1–2 with an unpaired $B_{4/5}$ seta (Fig. 9H). Claws short, unarmed (Fig. 9G).

*Discussion.* – Easily identified by the $1 + 1$ ocelli and the enlarged sensilla on abd.5.

*Distribution and ecology.* – Common and widely distributed. In various habitats, usually in forest litter and meadows, ascending to alpine regions. General distribution: Palaearctic.

## 170. ***Pseudanurophorus alticola*** Bagnall, 1949

Fig. 10A–H

*Pseudanurophorus alticola* Bagnall, 1949, Entomologist's mon. Mag. 85: 59.
*Pseudanurophorus binoculatus* var. *inoculatus* Bödvarsson, 1957, Zool. Iceland 3 (37): 19.

*Description.* – Size 0.5 mm. Colour white. Body long and slender (Fig. 10A). Ocelli absent. PAO oval (Fig. 10H). Ant.1 with 15 setae, ventral side with two apical sensilla, the one slightly thicker than the other. Ant.2 with a lateroapical sensillum. Ant.3 organ normal, ant.4 with many thickened sensilla (Fig. 10C). Labrum with 1/554 setae (Fig. 10F). The two anterior rows of labral setae spine-like, projecting roof-like above the reduced apical edge. Central part of the frontoclypeal field with 3 setae. Maxillary outer lobe

with simple palp and 4 sublobal hairs. Labial palp complete, with 5 papillae, 16 guards and 3 proximal setae. Basal fields with 4 median and 5 lateral setae. Main hypostomal seta short and thick (Fig. 10G). Maxilla similar to that of *binoculatus* (cf. Fig. 9F), but lam.1 with a few coarse serrations on inner side in addition to the marginal ciliation. Number of setae along each side of the dorsal midline of th.2–abd.3 as 54/333, but often irregular. Sensillary formula as 43/22223, of which 10/000 are microsensilla (Fig. 10A). The spine-like sensilla on th.2 as large as the macrosensilla (Fig. 10D). Sensilla on abd.5 not enlarged. Upper sensilla on abd.1–3 in mid-tergal position (Fig. 10B). Th.3 with 1–2 setae on each side of the ventral line. Ventral tube with 4 + 4 distal and 5–6 caudal setae. Furcal field with 5–6 setae. Both $B_4$ and $B_5$ present on inner side of tibiotarsi, $B_5$ much longer than $B_4$ (Fig. 10E). Claws as in *binoculatus* (cf. Fig. 9G).

*Discussion.* – Bagnall's types of *alticola* were detected in 1975 when Peter N. Lawrence found three slides in the British Museum's unidentified Bagnall collection, labelled '*Pseudanurophorus*. Co. Down, Slieve Donard, c. 2.200 ft. u.f.43, RSB'. In 1976 I examined the slides and judged the three specimens to be conspecific with Bödvarsson's *inoculatus*, originally described from Iceland as a variety of *binoculatus*.

*Distribution and ecology.* – Scattered records only, but apparently widespread in northern and mountainous districts. Also in the Arctic (Svalbard, Bjørnøya). Usually in damp habitats, repeatedly collected in plant cushions growing on wet gravel along the shores of inland lakes. General distribution: Palaearctic.

## 171. ***Pseudanurophorus psammophilus*** (Potapov & Stebaeva, 2002)

Fig. 11A–D

*Isotomodella psammophila* Potapov & Stebaeva, 2002, Zool. Zh. 81: 440.

*Description.* – Size 0.5 mm. Colour white. Body long and slender. Ocelli absent. PAO broad oval (Fig. 11D). Ant.1 with 13–14 setae, with two ventroapical sensilla, one slightly longer than the other. Ant.2 with a lateroapical sensillum. Ant.3 organ normal, with a spine-like sensillum in lateroapical position. Basal microsensilla absent on ant.3. Ant.4 with many moderately thickened sensilla (similar to *alticola*, Fig. 10C). Labrum with 2/454 setae, those of the anterior row thick, spine-like. Frontoclypeal field with two central setae (Fig. 11B). Maxillary outer lobe with simple palp and 4 sublobal hairs. Labial palp with 5 papillae, 3 proximal setae and 14 guard setae ($e_7$ and one other guard from the E-group absent). Basal fields with 4 median and 5 lateral setae. Maxillae not checked. Number of setae along each side of the dorsal midline of th.2–abd.4 as 44/3333 (Fig. 11A). Sensillary formula of th.2–abd.5 as 31/01124, including one microsensillum which is only present on mesothorax. Sensilla of abd.2–3 in mid-tergal position. The two lower sensilla on abd.5 shorter than the two upper. Ventral chaetotaxy not checked. Tibiotarsi with reduced numbers of setae in the B and C whorls, totally tib.1–3 have 16-16-17 setae.

*Discussion.* – Very similar to *alticola*, but clearly different by the sensillary formula. The loss of the median seta in the upper row on labrum is unusual, and so is the loss of two guards of the E-complex on the labial palp and the reduced number of tibiotarsal setae.

*Distribution and ecology.* – Only one specimen from Norway is known, collected together with *Jesenikia filiformis* in a sandy seashore meadow with *Dryas* vegetation at Lille Follesøya in TRY: Skjærvøy (17.V.1986, A. Fjellberg leg.). General distribution: Palaearctic.

# Genus *Jesenikia* Rusek, 1997

*Jesenikia* Rusek, 1997, Eur. J. Ent. 94: 115. Type species: *Jesenikia filiformis* Rusek, 1997, by original designation.

One Nordic species differing from *Pseudanurophorus* by having the two last abdominal segments fused.

## 172. ***Jesenikia filiformis*** Rusek, 1997

Figs 2D, 12A–E

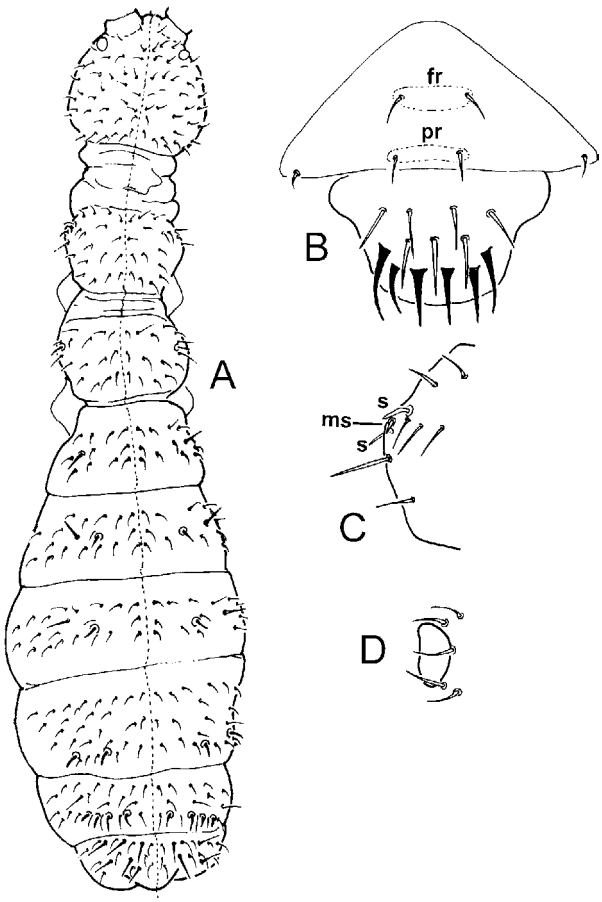


Fig. 11. *Pseudanurophorus psammophilus*: (A) Dorsal chaetotaxy, partly deformed specimen; (B) labrum with prelabral (pr) and frontoclypeal (fr) setae encircled; (C) th.2, left corner; (D) PAO.

*Jesenikia filiformis* Rusek, 1997, Eur. J. Ent. 94: 115.

*Description.* – Size 0.4 mm. Colour white. Body shape unusually long and slender (Figs 2D, 12A). Ocelli absent. PAO oval. Ant.1 with 14 setae, one ventroapical sensillum. Ant.2 with one lateroapical sensillum. Ant.3 without the spine-like lateroapical sensillum, ant.4 with many thickened sensilla (Fig. 12B). No apical papilla. Labrum with 2/554 setae, anterior two rows set close together, with spine-like setae. Apical edge reduced. Frontoclypeal field with 3 setae in the central part. Maxillary outer lobe with simple palp and probably only 3 sublobal hairs of which two are set close together. Labial palp complete (5 papillae, 16 guards, 3 proximals), basal fields with 4 median and 5 lateral setae. Hypostomal setae as in *alticola* (cf. Fig. 10G). Mandibles well developed, normal. Maxilla apparently as in *alticola*, but hard to study due to the small size. Body hairs short, smooth and pointed. Macrochaetae well developed, 3 + 3 on each of the tergites of abd.1–5 (Fig. 12E). Number of setae on each side of the dorsal midline of th.2–abd.4 as 54/3323 ($m_1$ absent on abd.3, Fig. 12E). Sensilla on tergites of th.2–abd.5 distributed as 32/12223, of which 10/000 are spine-like microsensilla (Fig. 12A). The spine-like sensilla on th.2 as large as the macrosensilla. Median sensilla absent on th.2–abd.1. The sensilla on abd.1–3 are set in the p-row (Fig. 12E). The lower sensilla on abd.3 almost in ventral position (Fig. 12C). The upper abd.5 sensilla slightly longer than others (Fig. 12D). Head

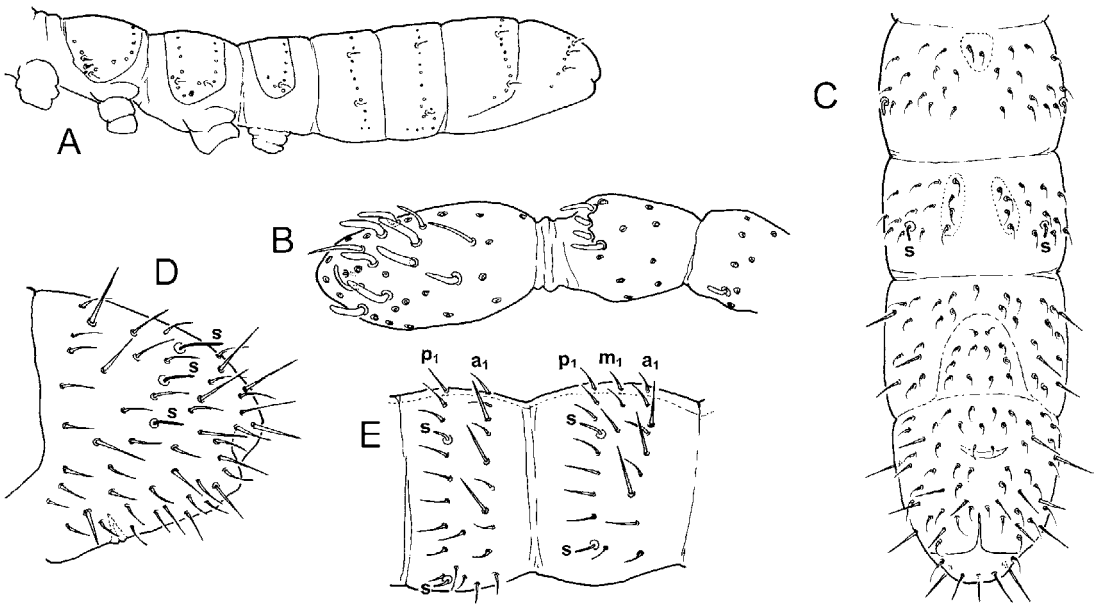


Fig. 12. *Jesenikia filiformis*: (A) Distribution of sensilla on th.2–abd.5, left side; (B) ant.2–4, sensilla; (C) abd.2–6, ventral side; (D) the fused abd.5–6, left side; (E) abd.2–3, right side.

with 3 + 3 postlabial setae along the ventral line. Th.3 with 1 + 1 ventral setae. Ventral tube with 4 + 4 distal and 4 posterior setae. Ventral chaetotaxy of abd.2–6 as Fig. 12C. Characteristic is the oblique row of 3–4 setae on each side of the abd.3 midline and the 2–3 setae in the medioanterior field on abd.2. Tibiotarsi with 7 apical setae (T-setae absent). Inner side of tib.1–2 with both $B_4$ and $B_5$ present. Claws short (as *binoculatus*, cf. Fig. 9G).

*Discussion.* – The species resembles *Pseudanurophorus alticola*, but is even smaller and more slender. The ant.4 sensilla are thicker and the sensillary formula is different. Also on abd.1–3 the sensilla are set in the p-row, while they are mid-tergal in *alticola*. The fusion of the two last abdominal segments also separates *filiformis* from the *Pseudanurophorus* species.

In the original description Rusek (1997) gives the sensillary formula as 33/13323.

*Distribution and ecology.* – In dry, sandy seashore habitats (meadows, dunes). Southern distribution. Not seen from Finland. General distribution: Palaearctic.

## Genus *Isotomodella* Martynova, 1967

*Isotomodella* Martynova, 1967, Izv. Akad. Nauk. tadzhik. SSR (Biol. Nauk) 28 (3): 37. Type species: *Isotomodella pusilla* Martynova, 1967, by original designation.

As pointed out by Potapov (1997a) the genus is probably closely related to *Pseudanurophorus*, differing by presence of a short furca.

### 173. *Isotomodella pusilla* Martynova, 1967

Fig. 13A–G

*Isotomodella pusilla* Martynova, 1967, Izv. Akad. Nauk. tadzhik. SSR (Biol. Nauk) 28 (3): 38.

*Description.* – Size 0.5 mm. Colour white. Body shape slender, cylindrical (Fig. 13A). Abd.5–6 separated. Ocelli absent. PAO oval. Ant.1 with 11 ordinary setae, 2 ventral thickened sensilla and one dorsobasal microsensillum. Ant.2 with a lateroapical sensillum. Ant.3 organ normal, with

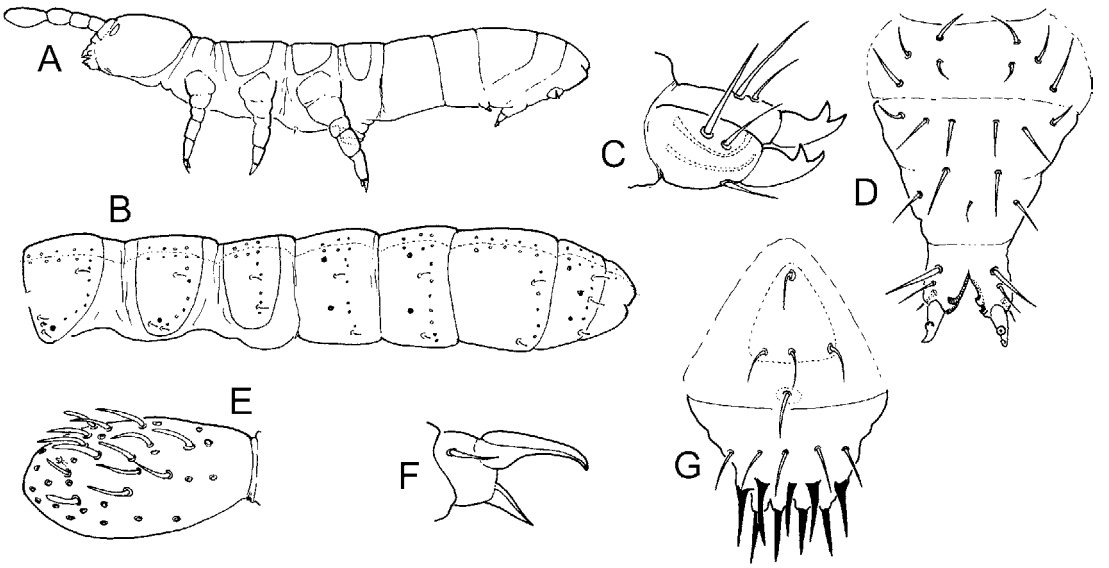


Fig. 13. *Isotomodella pusilla*: (A) habitus; (B) distribution of sensilla; (C) dens and mucro, lateral; (D) furca, dorsal: (E) ant.4; (F) claw; (G) labrum with one prelabral and three frontoclypeal setae encircled.

a lateroapical spine-like sensillum. Ant.4 without apical bulb, with several moderately thickened sensilla (Fig. 13E). Labrum with 1/554 setae, anterior two rows spine-like. Anterior labral edge reduced. Frontoclypeal field with 4 setae (Fig. 13G). Maxillary outer lobe with simple palp and 4 sublobal hairs. Labium complete, with 5 papillae, 16 guards and 3 proximal setae. Basal fields with 4 basal and 5 lateral setae. Mandibles normal. Maxilla with 3-toothed capitulum and marginally ciliate lamellae, of which lam.1 passes well beyond tip of capitulum. Body hairs short and smooth, pointed. Macrochaetae weakly developed. Number of setae on each side of the dorsal midline of th.2–abd.5 as 54/33353 (somewhat variable on abd.4–5). Sensillary formula as 43/22223, of which there is only one spine-like microsensillum on th.2 (Fig. 13B). Macrosensilla slender, hair-like. The upper ones on abd.1–3 well in front of the p-row. Head with $3 + 3$ postlabial setae along the ventral line. Th.3 with $1 + 1$ ventral setae. Ventral tube with $4 + 4$ distal and 4 posterior setae which are set in a single transverse row. Retinaculum with $2 + 2$ teeth and one (rarely two) seta. Furca as Fig. 13C, D. Dens short, with 2 dorsal and 1 ventral seta. Manubrium with 11 posterior setae, basal field with 8 setae. Mucro with two sharp teeth. The inner retinacular ridges of dens reaches the base of mucro. Tibiotarsi with 7 apical setae (T-setae absent), $A_1$ longer than other setae, pointed. Inner side with $B_5$ much longer than $B_4$. Claws simple, short (Fig. 13F). Males probably absent (samples are small).

*Discussion.* – This very small species is easily recognised with the characteristics of the small furca in combination with the separate abd.5–6.

*Distribution and ecology.* – In our area only from N. Norway and mountains in S. Norway. In shell sand meadows and *Dryas* heaths. General distribution: Palaearctic.

## Genus *Anurophorus* Nicolet, 1842

*Anurophorus* Nicolet, 1842, Neue Denkschr. Allg. schweiz. Ges. ges. Naturw. 6 (3): 52. Type species: *Anurophorus laricis* Nicolet, 1842 by subsequent designation under the Plenary Powers, Opinion 439.

Body slender, cylindrical. Pigmentation bluish black or grey. Two last abdominal segments fused. Anal spines absent. Furca absent. Ocelli $8 + 8$, G and H reduced in size. Last antennal segment with 1–2 small apical bulbs. Ant.3

organ normal, with two short sensilla partly covered by an integumentary fold. Labrum with 5-5-4 setae, 3 prelabrals. Maxillary palp simple, number of sublobal hairs variable. Head normally with 4 + 4 postlabial setae along ventral line. Ventral tube with 3 + 3 distal and 4 posterior setae. Tibiotarsi with 2-3-3 clavate tenent hairs. Unguiculus in our species less than 1/3 of inner edge of unguis.

Members of this genus are easily recognised by their medium size, usually dark colour and the absence of furca and anal spines. They often occur in abundance in field and move slowly.

## Key to species

1 PAO small and narrow (Fig. 14A, left), macrochaetae clavate or blunt-tipped . . . . 2
– PAO larger, elongate (Fig. 14A, right). Macrochaetae acuminate . . . . . 4
2 Ant.3 without additional sensilla on dorsal side (Fig. 14F) . . . . . 3
– Ant.3 with additional sensilla on dorsal side (Fig. 14G) . . . . . 174. *laricis* (Nicolet)
3 Inner side of tib.1–2 with $C_4$ and $C_5$ subequal, long (Fig. 14C). Maxillary palp with two sublobal hairs. Retinacular field with 1–2 setae (Fig. 14D) . . . . . 176. *fulvus* Fjellberg
– Inner side of tib.1–2 with $C_4$ almost twice as long as $C_5$ (as Fig. 14B). Maxillary palp with 1 sublobal hair. Retinacular field with at least 5 setae (Fig. 14E) . . . . . 175. *palaearcticus* Potapov
4 Th.2 with 1 + 1 ventral setae. Maxillary palp with 3 sublobal hairs. Abd.1–3 normally with 5 + 5 axial setae along middorsal line. Smaller species, up to 1.0 mm . . . . . 178. *atlanticus* Fjellberg
– Th.2 without ventral setae. Maxillary palp with two sublobal hairs. Abd.1–3 normally with 4 + 4 axial setae. Larger species, up to 1.5 mm . . . . . 177. *septentrionalis* Palissa

## 174. *Anurophorus laricis* Nicolet, 1842

Figs 14A, B, E, G, 15A–D

*Anurophorus laricis* Nicolet, 1842, Neue Denkschr. Allg. schweiz. Ges. ges. Naturw. 6 (3): 53.

*Description.* – Size up to 1.4 mm. Colour bluish black. Body shape slender, cylindrical, integument with an easily visible reticulation of square or polygonal cells. PAO small and narrow (Fig. 14A). Ant.1 with 1–2 (variable) ventrolateral sensilla, ant.2 with one and ant.3 with two ventrolateral sensilla. Ant.3 organ normal, the two central sensilla partly hidden by an integumentary fold. A variable number of additional sensilla are present on the dorsal side of ant.3 (Fig. 14G). Ant.4 with many curved sensilla. Apex with 1–2 deeply embedded apical bulbs, the second is often indistinct. Labral edge smooth, without ciliation or papillae/folds. Central part of frontoclypeal field with 4 setae. Mandibles normal, with strong molar plate. Maxillae with a 3-toothed capitulum and 6 lamellae which do not pass beyond the teeth (Fig. 15B). Lam.1 weak and hyaline, with fine denticles only. Lam.2–5 with strong marginal ciliation and a few denticles on the inner faces. Lam.6 pad-shaped, covered with denticles. Maxillary outer lobe with one sublobal hair. Labium with 4 median and 5 lateral setae. Labial palp with 5 papillae, 11 guards ($b_4$, $d_4$, $e_4$, $e_5$ and $e_7$ absent) and 3 proximal setae. Papilla E with 4 guards. Hypostomal group with H shorter and thicker than $h_1$ and $h_2$. Head with 4–5 postlabial setae on each side along the ventral line. Body hairs short and smooth. The short, curved setae on tip of abdomen finely serrated. Number of setae along each side of the midline of th.2–abd.3 as 6–7, 4–5/3–5, 3–5, 4–5, very variable. Sensillary formula: 22/21114 (Fig. 15C). The anterior microsensillum on abd.1 is not much smaller than the macrosensillum. Microsensilla absent from thorax. Macrochaetae blunt-tipped or weakly knobbed, well developed on th.2–3 (one on each side), lower subcoxae and abd.4–6. Upper subcoxa on last pair of legs with one seta (Fig. 15A). Th.1–2 without ventral setae, th.3 with 4–6 setae on each side of the midline. Ventral tube 3 + 3 distal and 4 posterior setae. Mid-ventral part of abd.2 with 4–6 setae. Retinacular field on abd.3 and furcal field on abd.4 with many setae. On tib.1–2 whorls A, B and C are regular with 7 setae in each. On tib.3 whorls B and C are more irregular and some additional proximal setae (D-whorl) are usually present. T-setae

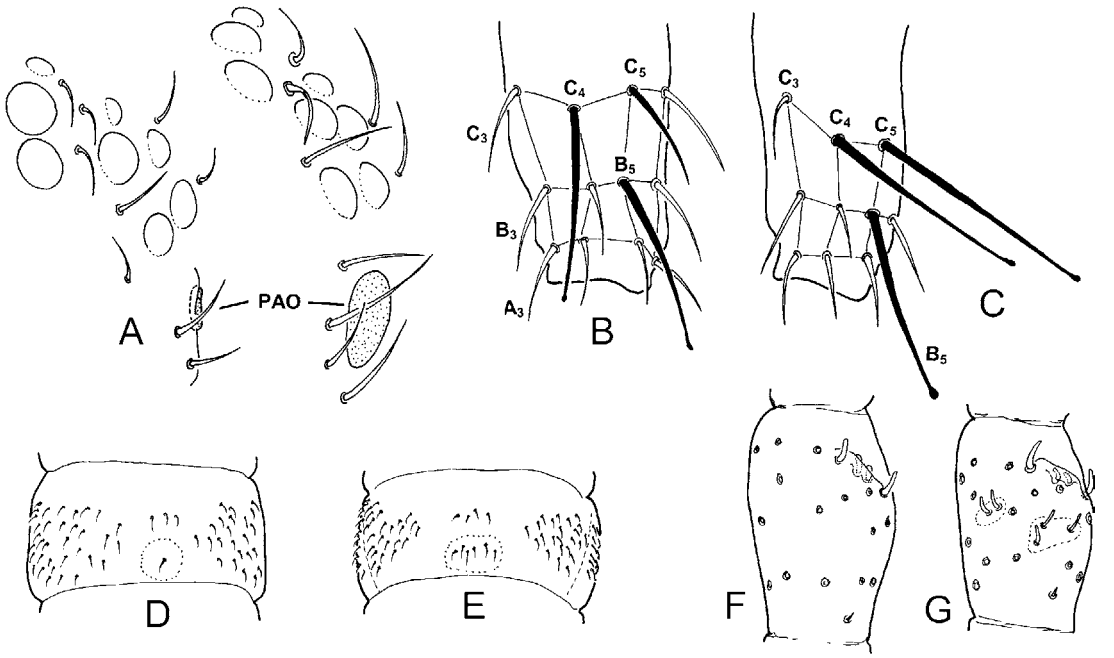


Fig. 14. *Anurophorus* spp.: (A) Right eye field and PAO in *laricis* (left) and *septentrionalis* (right); (B–C) inner side of right tib.2 in *laricis* (B) and *fulvus* (C); (D–E) retinacular field (encircled) on ventral side of abd.3 in *fulvus* (D) and *laricis* (E); (F–G) sensilla on dorsal side of right ant.3 in *palaearcticus* (F) and *laricis* (G).

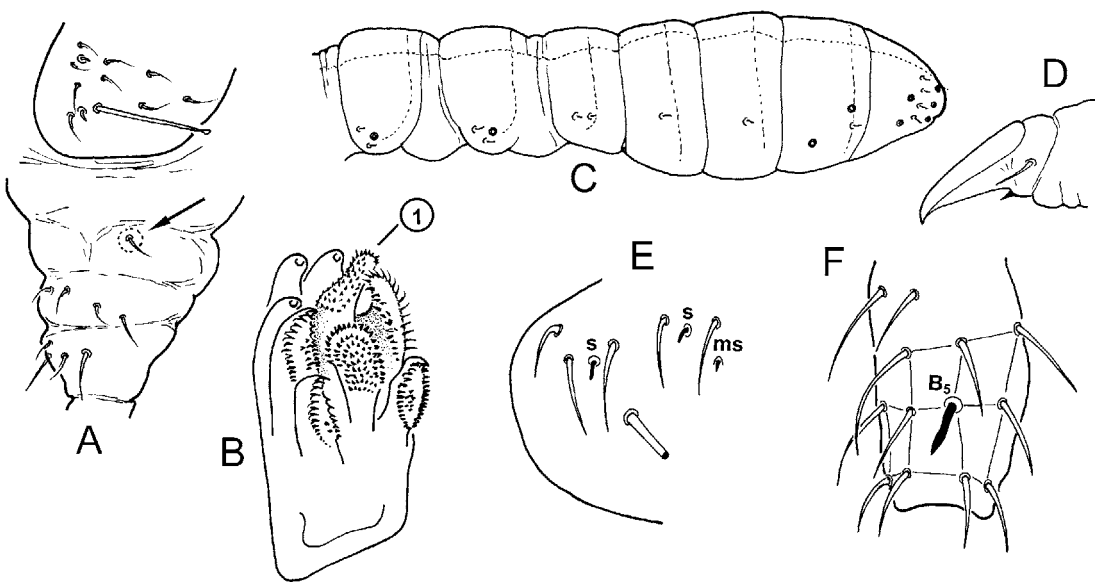


Fig. 15. *Anurophorus* spp.: (A–D) *laricis*, (A) left corner of th.3 and basis of third leg with seta of upper subcoxa marked (arrow), (B) maxilla, (C) distribution of dorsal sensilla, (D) claw; (E) *fulvus*, sensillary complex of th.2, left side; (F) *septentrionalis*, inner side of right tib.3, reproductive male with thickened $B_5$.

absent. Outer side of tibiotarsi with 2-3-3 long, clavate tenent hairs ($A_1$, $A_2$, $A_7$). $A_2$ short and acuminate on tib.1. On the inner side of tib.1–2 setae $B_5$ and $C_4$ are long and blunt-tipped, $C_5$ short and pointed (Fig. 14B). On tib.3 $C_5$ is long and blunt-tipped. Inner side of all coxae have one long blunt-tipped macrochaeta. Claws unarmed, with very short unguiculus (Fig. 15D).

*Discussion.* – The most common species of the genus which is readily identified by the very small PAO (hard to detect unless specimens are well cleared), blunt-tipped macrochaetae and presence of some additional ant.3 sensilla.

*Distribution and ecology.* – Widely distributed, but older records from Sweden and Finland may refer to *palaearcticus* or *septentrionalis*. A characteristic animal under bark scales on live trees, in particular on conifers. Also in moss and lichens on rocks, often in very dry sites. Sometimes in the forest floor. General distribution: Western Palaearctic (Potapov, 1997b).

## 175. *Anurophorus palaearcticus* Potapov, 1997

Fig. 14F

*Anurophorus palaearcticus* Potapov, 1997, Acta zool. cracov. 40: 32.

*Description.* – Very similar to previous species, but often the colour is paler, bluish grey. The absence of additional sensilla on ant.3 (Fig. 14F) is the only sharp character which separates this species from *laricis*.

*Distribution and ecology.* – Probably a boreal species with eastern distribution which does not reach Denmark and western parts of Norway. Under bark on spruce and pine growing in bogs. General distribution: Palaearctic.

## 176. *Anurophorus fulvus* Fjellberg, 1988

Figs 14C, D, 15E

*Anurophorus fulvus* Fjellberg, 1988, Fauna norv. Ser. B 35: 39.

*Description.* – Similar to the two previous species, differing in the following characters: Ant.3 without additional dorsal sensilla (present in *laricis*), maxillary palp with two sublobal hairs (one in others), labial palp with $e_4$ present (absent in others), inner side of tib.1–2 with $C_4$ and $C_5$ both prolonged and subequal (Fig. 14C), upper subcoxa on last leg with 2–4 setae (one in others, cf. Fig. 15A), retinacular field on abd.3 with 1–2 setae (at least 5 in others, Fig. 14D, E), and the short, curved setae on tip of abdomen which are strongly serrated (faintly serrated in others). Th.2 sometimes with a small microsensillum inside the two anterolateral macrosensilla (Fig. 15E). Colour of the species is variable from pale yellowish brown to dark blue. Reproductive males without modified setae on inner side of tib.3.

*Distribution and ecology.* – On mainland Scandinavia only in N. Norway. Also seen from Faroe Islands and Greenland. In moss and lichens on rocks, mainly above tree line. In the surroundings of Tromsø the proportions of dark and pale forms often vary significantly among discrete populations living on erratic boulders separated by less than 10 m, indicating that these populations are quite isolated with little genetic exchange. General distribution: Palaearctic.

## 177. *Anurophorus septentrionalis* Palissa, 1966

Figs 14A, 15F

*Anurophorus septentrionalis* Palissa, 1966, Notul. ent. 46: 50.

*Description.* – Similar to the previous three species, but differing from all of them by larger PAO (Fig. 14B) and relatively shorter macrochaetae which are pointed, not blunt or knobbed. Apart from the macrochaetae, the body hairs are in general longer than in previous species. Abd.4 has two sensilla on each side, not only one (22/21124). Macrochaetae on inner side of tibiotarsi as in *laricis*, but shorter. Maxillary palp with two sublobal hairs. Labial palp with 5 guards on the E-papilla. Ant.3 without additional dorsal sensilla. Retinacular area of abd.3 with 3–4 setae. Tip of abdomen with enlarged polygons and thick, brownish cuticle. The short, curved setae on abd.6 distinctly serrated. Upper subcoxa of hind leg with 3–4 setae. Inner side of tib.1–2 with prolonged and slightly knobbed $C_4$ and $B_5$. Reproductive males with a

modified slightly club-shaped seta on inner side of tib.3 ($B_5$, Fig. 15F).

*Distribution and ecology.* – Probably a boreal species with eastern distribution. Absent from Denmark and western parts of Norway. Usually in litter of coniferous forest. General distribution: Palaearctic.

## 178. *Anurophorus atlanticus* Fjellberg, 1974

*Anurophorus atlanticus* Fjellberg, 1974, Norsk ent. Tidsskr. 21: 127.

*Description.* – Size up to 1.0 mm. Colour greyish, with rather scattered pigmentation. PAO as in *septentrionalis*, oval (Fig. 14A). Ant.1 with one ventral macrosensillum. Ant.4 with two apical bulbs. Maxillary palp with 3 sublobal hairs. Labial palp with 5 guards on the E-papilla. Number of setae along mid-dorsal line of th.2–abd.3 as 76/555, with frequent variation. Sensillary formula 22/21114, of which the anterior one on abd.1 is a spine-like microsensillum. Macrochaetae moderately strong, acuminate. Last abdominal segments with a rather dense and long pilosity, with enlarged granulation of the brownish integument. Anterior part of the body with almost invisible granulation. Th.2 with 1 + 1 ventral setae, th.3 with 3–5 setae on each side of the median line. Retinacular field on abd.3 with 3–4 setae. Upper subcoxa on hind leg with 3–4 setae. On inner side of tib.1–2 only $B_5$ differentiated as a macrochaeta. Inner side of tib.3 without differentiated macrochaeta, reproductive males with $B_5$ erect and pointed, not club-shaped. Claws with a fine tooth on the inner edge.

*Discussion.* – This smallest of our *Anurophorus* species is easily identified by the presence of ventral setae on th.2 and the 3 sublobal hairs of the maxillary palp. Also the increased number of dorsal setae is characteristic. Normally the other species have 4 + 4 setae along the mid-dorsal line of abd.1–3, while *atlanticus* has 5 + 5.

*Distribution and ecology.* – Probably an overlooked species. Many records from Norway, but few others. The species shows a preference for decaying wood and is often collected under bark on rotten logs of conifers and hardwood, both standing and fallen. General distribution: Palaearctic.

# Genus *Micranurophorus* Bernard, 1977

*Micranurophorus* Bernard, 1977, Gt Lakes Ent. 10 (2): 75. Type species: *Micranurophorus musci* Bernard, 1977 by original designation.

The single Nordic species has no furca and eyes, and may be confused with a *Pseudanurophorus*. It is recognised by the peculiar abd.5 which has a reduced chaetotaxy, bearing only 4 + 4 microchaetae in the dorsomedian part (Fig. 16B).

## 179. *Micranurophorus musci* Bernard, 1977

Figs 2C, 16A–E

*Micranurophorus musci* Bernard, 1977, Gt Lakes Ent. 10 (2): 75.
*Micranurophorus schalleri* Christian, 1986, Verh. zool.-bot. Ges. Österr. 124: 121.

*Description.* – Size 0.4 mm. Colour white, no ocelli. Body shape characteristic, with a sharp bend between abdominal segments 4 and 5 (Figs 2C, 16A, B). Furca absent. PAO small, roundish (Fig. 16D). Ant.1 with two ventral thickened sensilla. Lateroapical sensilla not present on ant.2–3. Ant.3 organ normal, with exposed sensilla. Ant.4 with several thickened sensilla (Fig. 16C). Labrum with 5-5-4 setae, anterior row spine-like, covering the reduced apical edge of labrum. Two prelabral setae. Frontoclypeal field with two setae. Labial palp complete, apart from E-papilla which has only 4 guards and a small lateral process ($e_4$, $e_5$, $e_7$ absent). Basal fields with 4 + 5 setae. Hypostomal setae normal, H thick and spine-like, as long as $h_1$ and $h_2$. Head with 3 + 3 postlabial setae. Maxillary palp simple, with 4 sublobal hairs. Mandibles normal. Maxilla as in *Pseudanurophorus* (cf. Fig. 9F), with long marginal ciliations on lam.1 which reaches well beyond tip of the 3-toothed capitulum. Body hairs smooth and pointed. Macrochaetae erect, but short (Fig. 16B). Tip of abdomen with 7 long macrochaetae which have a short furcation in the middle. Posterior edge of abd.4 with

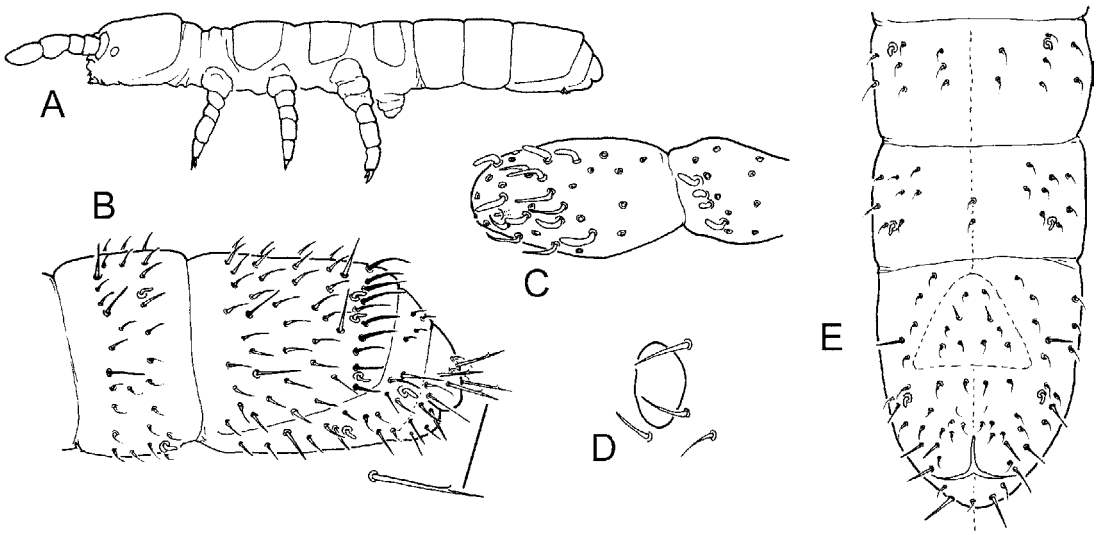


Fig. 16. *Micranurophorus musci*: (A) Habitus; (B) abd.3–6 with detail of forked marochaeta; (C) sensilla of left ant.3–4; (D) PAO; (E) abd.2–6, ventral.

strong setae. Number of setae along each side of the midline of th.2–abd.4 as 54/3335. Dorsal part of abd.5 with $4+4$ microchaetae only. Sensilla of the tergites short and thick, distributed as 43/22232, including one spine-like macrosensillum on th.2. Characteristic is the shift in the position of the lateral sensilla on abd.2–3 and abd.5 almost to the ventral side (Fig. 16E). Th.2–3 with $2+2$ ventral setae. Ventral tube with $4+4$ distal and 4 posterior setae. Ventral chaetotaxy of abd.2–6 as Fig. 16E. Furcal field with about 10 setae. Tibiotarsi with complete A and B whorls (7 setae in each, $B_4$ and $B_5$ both present), whorl C reduced on ventral side. Apical tenet hairs not developed. On tib.3 setae $B_5$ and $C_5$ are stronger than the others. Claws and unguiculi short, without teeth. Only females are seen.

*Discussion.* – A small and certainly neglected species, easy to identify by the unusual morphology of the last three abdominal segments and the sensillary distribution.

*Distribution and ecology.* – A characteristic animal in dry sandy soils, in particular along the Nordic coasts where it is often associated with *Jesenikia filiformis*. Also some inland records. Widely distributed in Norway, probably overlooked in other countries. General distribution: Holarctic.

## Genus *Folsomia* Willem, 1902

*Folsomia* Willem, 1902, Annls Soc. ent. Belg. 46: 280. Type species: *Folsomia candida* Willem, 1902, by original designation.

Members of this genus are the only Nordic isotomids having all three last abdominal segments fused to a single segment (apart from *Folsomina* which differs by having a hook-like mucro with one tooth only). The body shape is mostly straight and cylindrical, with some species having a more pear-shaped curved body (*Isotoma*-like). All species have a labrum with 554 setae. Prelabral setae 2–4. Maxillary palp is bifurcate with 4 sublobal hairs. Labium with all papillae A–E present. Retinaculum with $4+4$ teeth and one seta (except in one species). Tibiotarsi with 7 apical setae (T-setae absent) which are undifferentiated, acuminate. Manubrium with ventroapical setae always present. Dorsal setae of manubrium offers good diagnostic characters. The following chaetotaxy is here introduced (Fig. 17J):

ap: apical
L: lateral macrochaeta
l: lateral microchaeta
M: median macrochaetea
m: median microchaeta
ml: mediolateral microchaeta

pr: proximal
v: ventral
vl: ventrolateral

## Key to species

1 Mucro with two teeth . . . . . 2
– Mucro with 3 teeth . . . . . 202. *fimetarioides* (Axelson)
2 Manubrium with 1 + 1 ventroapical setae (Fig. 17A) . . . . . 3
– Manubrium with more than 1+1 ventroapical setae . . . . . 8
3 Ocelli absent . . . . . 4
– Ocelli present . . . . . 5
4 Dens without dorsal seta in the mid-section (Fig. 17B). Microsensilla 10/000. Sensilla of abd.1–3 within the p-row (Fig. 17K). Small (0.5 mm) non-arctic species . . . . . 183. *dovrensis* Fjellberg
– Dens with one dorsal seta in the mid-section. Microsensilla 11/111. Sensilla on abd.1–3 in front of the p-row. Large (1.5 mm) arctic species . . . . . 194. *taimyrica* Martynova et al.
5 Ocelli 2 + 2 . . . . . 6
– Ocelli 1 + 1 . . . . . 192. *palearctica* Potapov & Babenko
6 Retinaculum with 1 seta. Dens with 6–8 ventral setae. Integument normal, smooth 7
– Retinaculm with 4–5 setae. Dens with 3 ventral setae. Integument "dotted" (Fig. 17F) . . . . . 193. *brevicauda* Agrell
7 Th.2 with hind corner sensillum (s) in front of p-row (Fig. 17D) . . . . . 190. *quadrioculata* (Tullberg)
– Th.2 with hind corner sensillum set within the p-row (Fig. 17E) . . . . . 191. *manolachei* Bagnall
8 Abd.4–6 with 2 + 2 leaf-like broad sensilla (Fig. 17L) . . . . . 9
– Abd.4–6 only with slender sensilla . . . . . 10
9 Prelabral setae 3. Manubrium with 2 + 2 ventroapical setae, seta $ml_1$ absent. Non-arctic species . . . 189. *sensibilis* Kseneman
– Prelabral setae 4. Manubrium with more than 2 + 2 ventroapical setae, seta $ml_1$ present (Fig. 17J). Arctic species . . . . . 188. *coeruleogrisea* (Hammer)
10 Ocelli present . . . . . 11
– Ocelli absent . . . . . 16
11 Median sensilla of abd.1–3 between macrochaetae $M_1$–$M_2$ (Fig. 17I) . . . . . 12
– Median sensilla of abd.1–3 between macrochaetae $M_2$–$M_3$ (Fig. 17H) . . . . . 14
12 Ocelli 1 + 1 . . . . . 13
– Ocelli 2 + 2 . . . . . 198. *penicula* Bagnall
13 Manubrium usually with 2 + 2 ventroapical setae. Th.3 with median macrochaeta present (Fig. 17G). Mainland alpine species . . . . . 196. *agrelli* Gisin
– Manubrium usually with more than 2 + 2 ventroapical setae. Th.3 without median macrochaeta. Arctic islands species . . . . . 195. *binoculata* (Wahlgren)
14 Ocelli 3 + 3. Dens with 6 dorsal setae. Coastal species . . . . . 15
– Ocelli 2 + 2. Dens with 5 dorsal setae. Alpine species . . . 201. *microchaeta* Agrell
15 Colour whitish. Abdominal macrochaetae longer, $M_1$ on abd.4–6 at least 2.5 as long as inner length of the last claw . . . . . 200. *thalassophila* Bagnall
– Colour dark. Macrocahaetae shorter, $M_1$ on abd.4–6 at most 1.5 as long as inner length of the last claw 199. *sexoculata* (Tulllberg)
16 Body completely white. Abd.1–3 with sensilla set in the p-row (Figs 18A, 20E, F). Microsensilla 10/100 or 10/000 . . . . . 17
– Body with scattered dark pigmentation. Sensilla of abd.1–3 in front of p-row (as Fig. 24A). Microsensilla 11/111 . . . . . 198. *spinosa* Kseneman
17 Th.3 without ventral setae . . . . . 18
– Th.3 with ventral setae present . . . . . 20
18 Manubrium with 2 + 2 ventroapical setae. Macrochaeta $M_1$ on abd.4–6 about twice as long as inner length of the last claw . . . . 19
– Manubrium with more than 2+2 ventroapical setae. $M_1$ about three times as long as

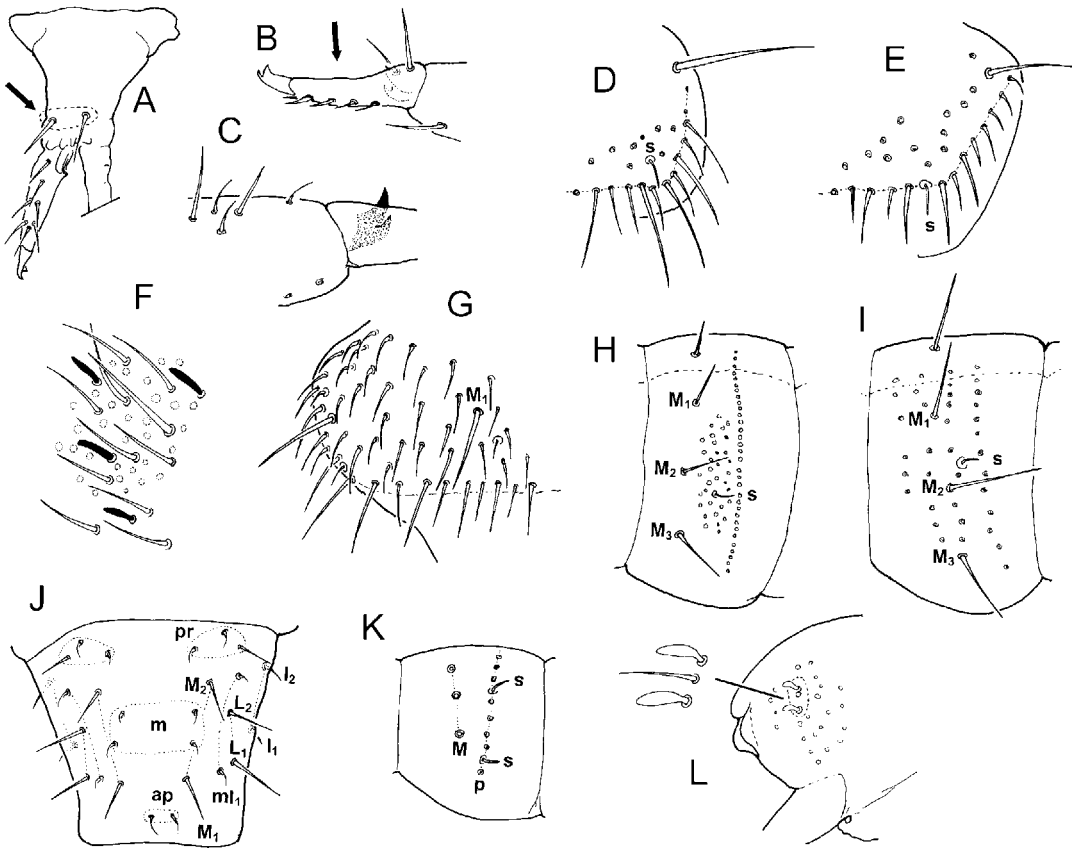


Fig. 17. *Folsomia* spp.: (A) *manolachei*, furca with 1 + 1 ventroapical manubrial setae marked (arrow); (B) *dovrensis*, furca with no mid-dorsal seta on dens (arrow); (C) *inoculata*, manubrium/dens transition with enlarged dental hooks (black); (D–E) right corner of th.2 in *quadrioculata* (D) and *manolachei* (E); (F) *brevicauda*, detail of skin sculpture, setae and sensilla (black) on abd.5; (G) *agrelli*, left side of th.3; (H–I) position of sensilla in relation to macrochaetae on abd.2 in *thalassophila* (H) and *agrelli* (I); (J) *coeruleogrisea*, chaetotaxy of manubrium, dorsal side; (K) *dovrensis*, position of sensilla and macrochaetae on abd.1, left side; (L) *sensibilis*, enlarged sensilla on abd.5.

inner length of the last claw
. . . . . 180. *fimetaria* (Linnaeus)

19 Prelabral setae 4. Microsensilla 10/100. Manubrium without seta $ml_1$
. . . . . 184. *bisetosa* Gisin

– Prelabral setae 3. Microsensilla 10/000. Manubrial seta $ml_1$ present
. . . . . 185. *bisetosella* Fjellberg

20 Dens with 2 or more dorsal setae in middle section. Basal hooks of dens small . . . . . 21
Mid-section of dens with one dorsal seta. Basal hooks conspicuous (Fig. 17C)
. . . . . 187. *inoculata* Stach

21 Prelabral setae 4. Manubrium with more than 3 + 3 ventroapical setae, seta $ml_1$ present. Ventral tube with more than 4 + 4 laterodistal setae . . . . . 22

– Prelabral setae 2. Manubrium with 3 + 3 ventroapical setae, seta $ml_1$ absent. Ventral tube with 4 + 4 laterodistal setae
. . . . . 186. *litsteri* Bagnall

22 Manubrium in large specimens with more than 20 dorsal setae
. . . . . 181. *candida* (Willem)

– Manubrium at most with 10–12 dorsal setae
. . . . . 182. *stella* Grow & Christiansen

## Key to species groups

1 Abd.4–6 only with slender sensilla . . . . . 2
– Abd.4–6 with leaf-like, broad sensilla (Fig. 17L) . . . . . *sensibilis* group (p. 35)
2 Median sensilla on abd.1–3 in front of the p-row (Fig. 17H-I) . . . . . 3
– Median sensilla on abd.1–3 on level with p-row (Fig. 17K) . . . . . 5
3 Median sensilla on abd.1–3 between $M_1$ and $M_2$ (Fig. 17I) . . . . . 4
– Median sensilla on abd.1–3 between $M_2$ and $M_3$ (Fig. 17H) . . . . . *sexoculata* group (p. 43)
4 Ventroapical manubrial setae 1 + 1 . . . . . *quadrioculata* group (p. 37)
– Ventroapical manubrial setae 2 + 2 or more . . . . . *binoculata* group (p. 40)
5 Mucro with two teeth . . . . . *fimetaria* group (p. 28)
– Mucro with three teeth . . . . . *fimetarioides* group (p. 45)

## *fimetaria* group

Blind species with median sensilla of abd.1–3 on level with the p-row. Mucro with two teeth, abd.4–6 with slender sensilla only. Eight species.

### 180. *Folsomia fimetaria* (Linnaeus, 1758)

Fig. 18A–G

*Podura fimetaria* Linnaeus, 1758, Systema naturae, 10th ed.: 609.

*Description.* – Size up to 1.4 mm. Colour white, no ocelli. Body shape slightly pear-shaped, with abdomen curved and thicker towards tip (Fig. 18A). PAO narrow elongate (Fig. 18E). Ant.1 with two ventral sensilla. Ant.2 with a lateroapical sensillum. Ant.3 with a lateroapical spine-like sensillum. Males with a few short, erect sensilla ventrally on ant.2–3. Subterminal sensillum on ant.4 very small, peg-like. Anterior labral setae spine-like, on sockets. Prelabral setae 4. Frontoclypeal field with 6 setae. Terminal sensilla on labial papillae A and B thick and blunt. Lateral papilla long, finger-like. Maxilla as Fig. 18F. Lam.1 with apical and subapical fringes of long cilia. Head with 3–5 postlabial setae on each side of the ventral line. Body integument smooth. Macrochaetae moderately long on anterior part of the body, longer and slightly serrated on abd.4–6 (Fig. 18C). $M_1$ on abd.4–6 about 3 times (2.7–3.1) as long as inner unguis. Ground cover of hairs unusually sparse on dorsal side of abd.4–6. Macrosensilla long and slender, distributed as 43/222. Abd.4–6 with 7–8 sensilla, all long. Posterior sensilla on th.2–abd.3 set in p-row. Microsensilla as 10/100. Subterminal row of setae on posterior part of head with alternating long and short setae. Thorax without ventral setae. Ventral tube with 5–6 distal setae on each side and 5–6 posterior setae. Furca strong, with dens longer than manubrium (Fig. 18B). Manubrium with oblique ventroapical rows of 3 + 3 setae, and usually on pair proximal to these (Fig. 18D). Claws with a strong inner tooth (Fig. 18G). Reproductive individuals not epitokous.

*Discussion.* – Easily distinguished from other members of the group by absence of ventral setae on thorax and presence of at least 3 + 3 ventroapical setae on manubrium. The pear-shaped abdomen, long serrated macrochaetae and sparse ground cover of setae on abd.4–6 are also characteristic.

*Distribution and ecology.* – Common in rich organic substrate along the coast in wrack beds and meadows, but also in inland habitats (compost, debris along shores of lakes and rivers, rich hardwood litter). Not in meager coniferous forest and alpine habitats. Absent in arctic islands. In the old publications of Wahlgren (1906) and Axelson (1907) *fimetaria* is reported from most districts of Sweden and Finland, but these records are unreliable because of confusion with other white, blind species. Only verified records are therefore listed in the present catalogue. General distribution: Holarctic.

### 181. *Folsomia candida* (Willem, 1902)

Fig. 19A–I

*Isotoma candida* Willem, 1902, Annls Soc. ent. Belg. 46: 280.

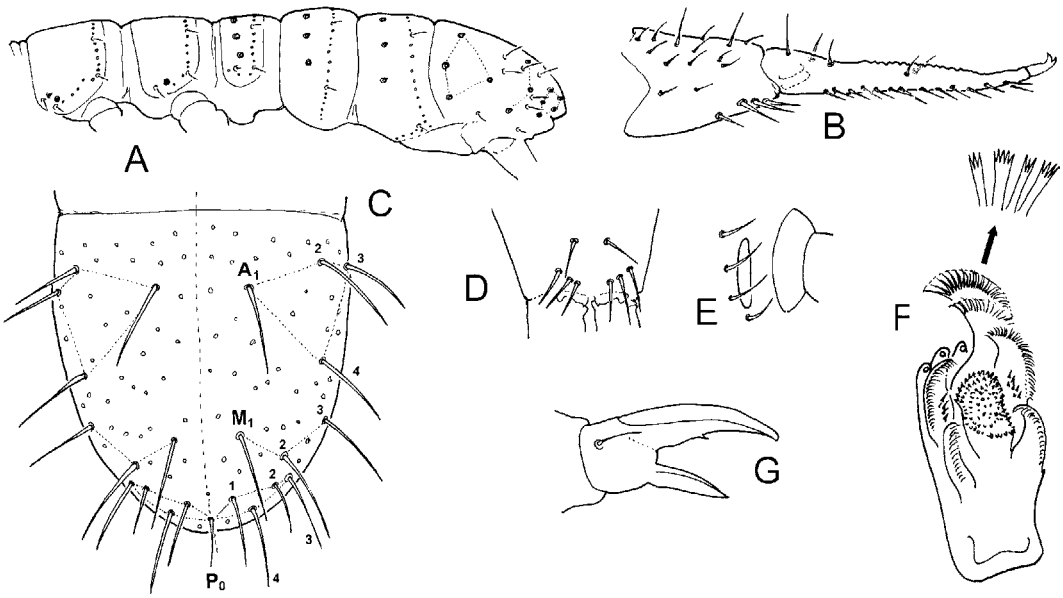


Fig. 18. *Folsomia fimetaria*: (A) Distribution of sensilla and macrochaetae on th.2–abd.6; (B) furca; (C) macrochaetae on abd.4–6; (D) ventroapical part of manubrium; (E) PAO and antennal base; (F) maxilla with detail of apical fringe; (G) claw.

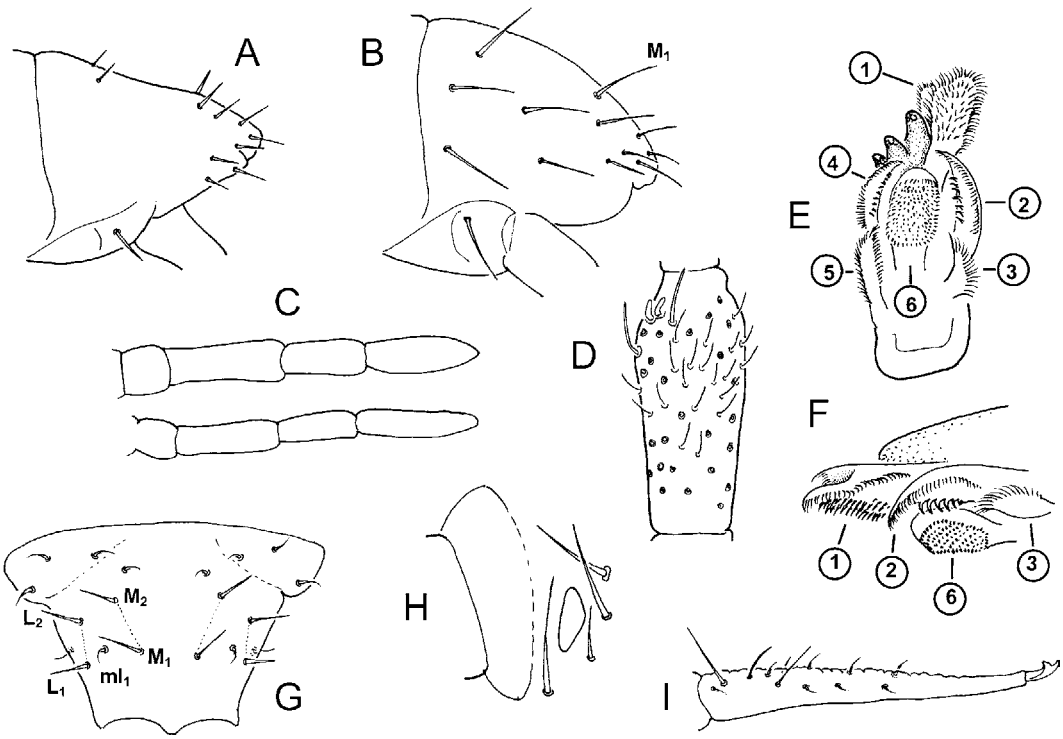


Fig. 19. *Folsomia candida*: (A–B) Abd.4–6 in reproductive male (A) and female (B); (C) antenna in reproductive male (below) and female (above); (D) dorsal side of ant.3 with many additional hair-like sensilla (reproductive male); (E–F) left maxilla from inner side (E) and in lateral view (F); (G) primary chaetotaxy on dorsal side of manubrium, 1.instar juvenile; (H) PAO and antennal base; (I) dens and mucro.

*Description.* – Size up to 2.5 mm or larger. White, no ocelli. Body shape slender, abdomen slightly expanded towards tip. PAO oval, small (Fig. 19H). Ant.1 with 3–5 ventral sensilla. Lateroapical sensillum present on ant.2–3, on ant.3 spine-like. Large specimens with elongated antennal segments, particularly in males (Fig. 19C) which also have many additional hair-like sensilla dorsally on ant.3 (Fig. 19D). Females may have a few such sensilla on ant.3. Large specimens of both sexes have numerous hair-like sensilla dorsally on ant.4. Prelabral setae 4. Frontoclypeal field with up to 13 setae in large specimens. Maxilla as Fig. 19E. Lam.1 apically expanded, flattened and undulating, with long ciliation along the edges and several irregular rows of curved filaments on the inner face. Head with 4–5 postlabial setae. Th.3 with 2–3 setae on each side of midline. Ventral tube in large specimens with more than 10 + 10 distal setae, posterior side with 7–8 setae. Distribution of macrochaetae and sensilla as in *fimetaria* (cf. Fig. 18A, C). Macrochaetae slightly serrated. $M_1$ on abd.4–6 about 2 times (1.8–2.3) as long as inner unguis in females. In reproductive males shorter (1.6). The ground cover of hairs is dense all over the dorsal side of abd.4–6. Furca strong, manubrium with more than 20 ventral setae in large specimens. Dorsal side of manubrium with $ml_1$ present, also in 1.instar juveniles (Fig. 19G). In adults the number of dorsal setae on manubrium is increased. Dens with up to 13 dorsal setae (Fig. 19I). Claws with a small inner tooth. Reproductive males are clearly epitokous, having abd.4–6 conically pointed and macrochaetae much shortened (Fig. 19A).

*Discussion.* – Easily identified by the high number of ventral setae on manubrium. Small specimens with fewer setae may be confused with *fimetaria*, but the presence of ventral setae on th.3 in *candida* is decisive.

*Distribution and ecology.* – Only few outdoor records, in thick organic litter in rich forests and in compost. Once in a mouse nest. The animal is much used in laboratory test work and may sometimes escape and establish indoor populations in flower pots and similar. General distribution: Cosmopolitan.

## 182. *Folsomia stella* Grow & Christiansen, 1976

Fig. 20A–F

*Folsomia stella* Grow & Christiansen, 1976, Revue Ecol. Biol. Sol 13: 616.

*Description.* – Size up to 1.8 mm. Colour white, no ocelli. Body shape slender, cylindrical. PAO narrow elongate, of variable size. Ant.1 with 3 ventral sensilla. Ant.3 with a lateroapical hair-like sensillum (absent in juveniles) in addition to the spine-like sensillum (Fig. 20D). Prelabral setae 4. Frontoclypeal field with up to 8 se-

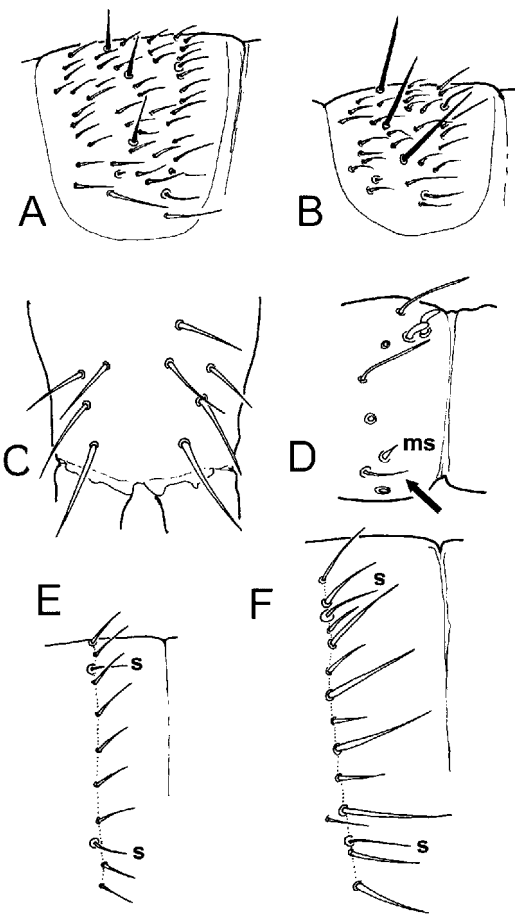


Fig. 20. *Folsomia stella*: (A–B) Left side of abd.1 in large (1.6 mm) reproductive male (A) and small (1.3 mm) reproductive female (B); (C) manubrium, ventroapical setae; (D) right ant.3 organ; (E–F) sensilla and posterior seta row on left side of abd.2 in specimens from Spitsbergen (E) and southern Norway (F).

tae. Maxilla as in *candida* (Fig. 19F), with strongly expanded lam.1 having many irregular rows of coarse filaments on the inner side. Head with 4–6 postlabial setae. Body with smooth macrochaetae of variable length. $M_1$ of abd.4–6 up to 2.5 as long as inner edge of the last claw. Sensillary equipment as in *fimetaria*. Th.3 with up to 6 setae on each side of the ventral line. Ventral tube with up to 13 distal setae on each side, and up to 10 caudal setae. Manubrium with 4–6 (usually 5 + 5) ventroapical setae on each side, arranged in irregular lines (Fig. 20C). Dorsal side of manubrium with increased number of setae, $ml_1$ present. Dorsal side of dens with 3 + 2 setae. All tibiotarsi with increased number of setae (more than 3 whorls), claws with a variable inner tooth. Males present.

*Discussion.* – The species displays an unusual allometric epitoky, affecting reproductive males. Large reproductive males (>1.5 mm) have very short macrochaetae on the tergites, only detectable by their erect positions (Fig. 20A). On abd.4–6 the macrochaeta $M_1$ is only 0.6 as long as inner edge of the last claw. In smaller reproductive males (0.8 mm) $M_1$ is about 1.5 as long as the claw (in females 2.5 as long as the claw). Large males also have the last antennal segment elongated with increased number of hair-like sensilla. Apparently the species is related to *candida*, sharing the presence of ventral setae on th.3, increased number of ventral sensilla on ant.1, same type of maxilla, increased number of setae on ventral tube and epitokous males. However, *stella* differs from *candida* by having much less ventral setae on manubrium. Also the epitokous males have a normal shape of the abdominal tip, not conically pointed as in *candida*. In North Norway (FN: Vardø), Jan Mayen, Svalbard (Nordaustlandet) and Taimyr a slightly smaller form is present (max. size 1.0 mm), differing by shorter macrochaetae ($M_1$ of abd.4–6 is 1.5–1.8 as long as inner edge of last claw) and in particular by having a homochaetotic p-row of setae on abd.1–3, contrasting the heterochaetosis displayed by the main form (Fig. 20E, F). Also ant.3 lacks the additional lateroapical hair-like sensillum, ant.1 normally has only 2 ventroapical sensilla, and the number of ventroapical setae on manubrium is regularly 3 + 3. Females predominate, and only one male is seen (non-epitokous). The holotype and 3 paratypes of *stella* from a cave in Clayton, Indiana, were checked in 1999. Maxilla is of the *candida*-type (expanded lam.1 with many rows of cilia), the $M_1$ macrochaetae on abd.4–6 are 2.2–2.5 as long as inner edge of the last claw, manubrium has two irregular ventroapical longitudinal rows with 3–5 setae in each, on posterior side the $ml_1$ seta is present. The p-rows of setae on abd.2–3 appear homochaetotic. The general condition of the type specimens is such that a definite conclusion about the status of the Nordic forms is not possible. It is, however, quite possible that one or two species – may be not *stella* – are present in our area.

*Distribution and ecology.* – Widely distributed along the Nordic coasts, often abundant in grassy seashore meadows, under wrack and other debris. Some records from debris on shores of lakes and streams and in hardwood forest litter. Also in arctic tundra. General distribution: Holarctic.

## 183. ***Folsomia dovrensis*** Fjellberg, 1976

Figs 17B, K, 21A, B

*Folsomia dovrensis* Fjellberg, 1976, Norw. J. Ent. 23: 127.

*Description.* – Size 0.5 mm. Colour white, ocelli absent. Body shape slender, cylindrical, with a short furca having dens shorter than manubrium. PAO narrow elongate. Ant.1 with two ventral sensilla. Lateroapical sensillum present on ant.2–3, on ant.3 spine-like. Anterior two rows of labral setae spine-like, roofing above the labral anterior edge. Frontoclypeal setae 4. Prelabral setae 3. Maxilla as in *fimetaria* (cf. Fig. 18F), with lam.1 having two discrete fringes of cilia only. Maxillary palp bifurcate with 4 sublobal hairs. Head with 3 + 3 postlabial setae. Subterminal row on posterior part of head with short setae, of same length. Macrochaetal chaetotaxy as in *fimetaria* (Fig. 18A, C). Macrochaetae smooth, short. $M_1$ on abd.4–6 about 1.5 as long as inner unguis. Number of setae along each side of dorsal midline of th.2–abd.3 as 75/333 with some variation on thorax. Macrosensilla distributed as 43/2228. Spine-like microsensilla as 10/000. Median sensilla on th.2–3 in front of the p-row, on abd.1–3 in the p-row. On abd.4–6 the sensilla $S_{1-3}$ are curved and blunt, while $S_{4-7}$ are erect

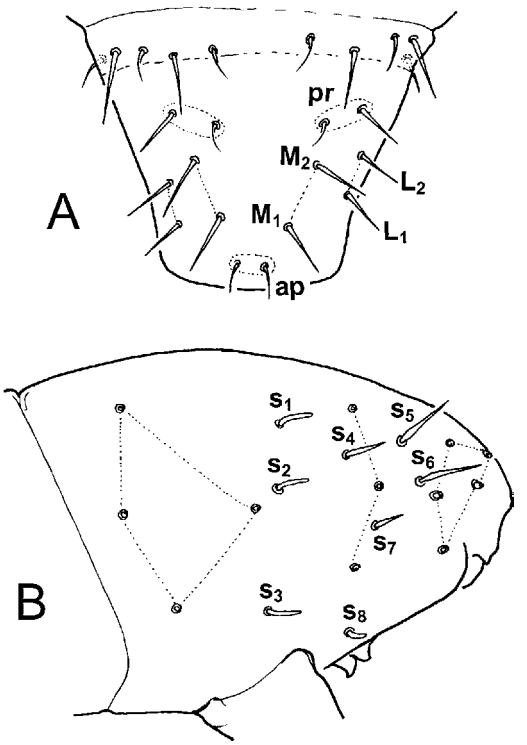


Fig. 21. *Folsomia dovrensis*: (A) Chaetotaxy of manubrium, dorsal side; (B) distribution of macrochaetae and sensilla (s) on abd.4–6.

and pointed dagger-like. Laterogenital sensillum ($S_8$) small, blunt (Fig. 21B). Thorax without ventral setae. Ventral tube with 4 + 4 distal and 5–6 caudal setae. Manubrium with 1 + 1 ventroapical setae. Dorsal side of manubrium as Fig. 21A. Dens with two dorsal setae at base only, ventral side with 7–8 setae (Fig. 17B). Tib.1–2 with regular chaetotaxy (whorls A, B and C with 7 setae each). Tib.3 with a few additional setae at base. Claws short, without teeth. Males unseen.

*Discussion.* – The small size and short dens with only two dorsal setae readily identify the species.

*Distribution and ecology.* – Widely distributed, but never abundant. In various habitats from seashores to alpine heaths (meadows, stream banks, forest litter, sand dunes), apparently avoiding acidic coniferous substrates. General distribution: Palaearctic.

## 184. ***Folsomia bisetosa*** Gisin, 1953

Fig. 22A–C

*Folsomia bisetosa* Gisin, 1953, Ann. Mag. nat. Hist. (12) 6: 233.

*Description.* – Size 0.8 mm. Colour white, no ocelli. Body shape slender, cylindrical. PAO narrow elongate (Fig. 22C). Antennae as in previous species. Prelabral setae 4. Frontoclypeal field with 4–6 setae. Head with 4 + 4 postlabial setae. Sensillary equipment on tergites as in *fimetaria*. Sensilla thin, hair-like. Macrochaetae short, smooth (Fig. 22A). On abd.4–6 chaeta $M_1$ about twice as long as inner edge of claw. Thorax without ventral setae. Ventral tube with 4–5 distal and 4–6 caudal setae. Manubrium with 2 + 2 (sometimes 2 + 1) ventroapical setae (Fig. 22B). Dens about as long as manubrium, dorsal side with 3 setae near base and two in the middle. Ventral side with about 15 setae. Dorsal side of manubrium without ml setae. Tib.1–2 with 3 complete whorls of setae (A–C), tib.3 with a few additional D-setae at base. In large specimens two dorsal D-setae may also be present on tib.1–2. Claws without teeth. Males not seen.

*Discussion.* – The 2 + 2 ventroapical manubrial setae in combination with 4 prelabral setae and presence of the microsensillum on abd.1 will normally identify this species. Four samples from damp habitats in S. Norway (VE, TEI) and Sweden (Up, Dlr) differ from typical specimens in having seta $ml_1$ present on the manubrium. Bödvarsson's (1961a, 1963) specimens of *Folsomia inoculata* Stach, 1947, from Kullaberg in Southern Sweden also belong to this form (a sample with many individuals from 'Djupadalsrännan, nära havet. Tät veg. m. gräs, *Geum*, *Galium*, *Hypericum*. Halvtorrt. 5.7.57. K-53' was checked in 1999). One sample from a river bank in the mountains in S. Norway (STI: Oppdal) has individuals with 2, 3 or 4 prelabral setae, otherwise as typical *bisetosa*.

*Distribution and ecology.* – Due to confusion with the following species, the distribution is not well known. All arctic samples (Svalbard, Jan Mayen, Bjørnøya) belong to *bisetosa*, and verified specimens are also seen from North Norway and North Sweden (Abisko). The true *bisetosa* is probably an arctic/subarctic species while populations in Southern Scandinavia are

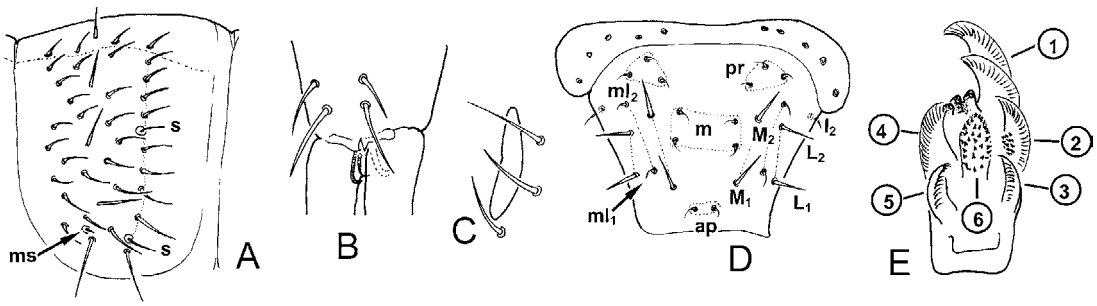


Fig. 22. *Folsomia bisetosa* (A–C) and *F. bisetosella* (D–E): (A) Position of sensilla (s) on left side of abd.1; (B) manubrium/dens; (C) PAO; (D) chaetotaxy of dorsal side of manubrium; (E) maxilla.

either *bisetosella* or belong to an undescribed species of unclear status (see above). In Iceland both species are equally common, but *bisetosella* prefers dry sandy habitats while *bisetosa* is more frequent in humus rich soils (forests, shrubs). Common in arctic tundra. Probably parthenogenetic as no males are seen. General distribution: Holarctic (northern).

## 185. ***Folsomia bisetosella*** Fjellberg, 2005

Fig. 22D, E

*Folsomia bisetosella* Fjellberg, 2005, Norw. J. Ent. 52: 111.

*Description.* – Size 0.7 mm. Very similar to *bisetosa*, but smaller. The only sharp differences are number of prelabral setae which is 3 in *bisetosella* and 4 in *bisetosa*, and the microsensillary formula: 10/000 (*bisetosa*: 10/100). The absence of the abd.1 microsensilla is a sharp diagnostic character, while the number of prelabral setae are not always easy to observe and may vary in *bisetosa* (see above). On the posterior side of manubrium the median field usually has 4 m-setae (2 in *bisetosa*) and the seta $ml_1$ and $ml_2$ are generally present in *bisetosella* and absent in *bisetosa* (Fig. 22D). The maxilla is slightly longer and more narrow, in particular the capitular teeth are finer, lam.1 is longer and lam.6 is more elongated (Fig. 22E). Males present, not epitokous.

*Distribution and ecology.* – Apperently widely distributed along the Nordic coasts, being abundant in dry sandy meadows along the beaches. Most former records of '*bisetosa*' from southern districts are in reality *bisetosella*. General distribution: Palaearctic.

## 186. ***Folsomia litsteri*** Bagnall, 1939

Fig. 23G

*Folsomia litsteri* Bagnall, 1939, Entomologist's mon. Mag. 75: 56.
*Folsomia lawrencei* Rusek, 1984.

*Description.* – Size up to 0.7 mm, sexually mature from 0.5 mm. Colour white, no ocelli. Very similar to *bisetosa*, differing by smaller size, 3 + 3 ventroapical manubrial setae and presence of 2–3 setae on each side of the ventral line of th.3. Prelabral setae two (4 in *bisetosa*). Chaetotaxy of posterior side of manubrium as in *bisetosa* ($ml_1$-setae absent). The maxilla differs from both *bisetosa* and *bisetosella* in having a strongly expanded and fan-shaped lam.1 which has two regular fringes of long cilia (Fig. 23G). From the *stella* complex it differs by having only two prelabral setae, absence of $ml_1$-setae and smaller body size. Males present, not epitokous.

*Discussion.* – A small but well-marked species. Could possibly be confused with juveniles of *stella* having few ventral setae on manubrium. The evidence provided by Steve Hopkin (http://www.stevehopkin.co.uk/collembolamaps/Entomobryomorpha/267FOlit/, accessed 19 December 2006) is the basis for considering *litsteri* to be a senior synonym of *lawrencei*.

*Distribution and ecology.* – A southern species with scattered Nordic records, but probably overlooked. Usually in rich forest soil (rotten

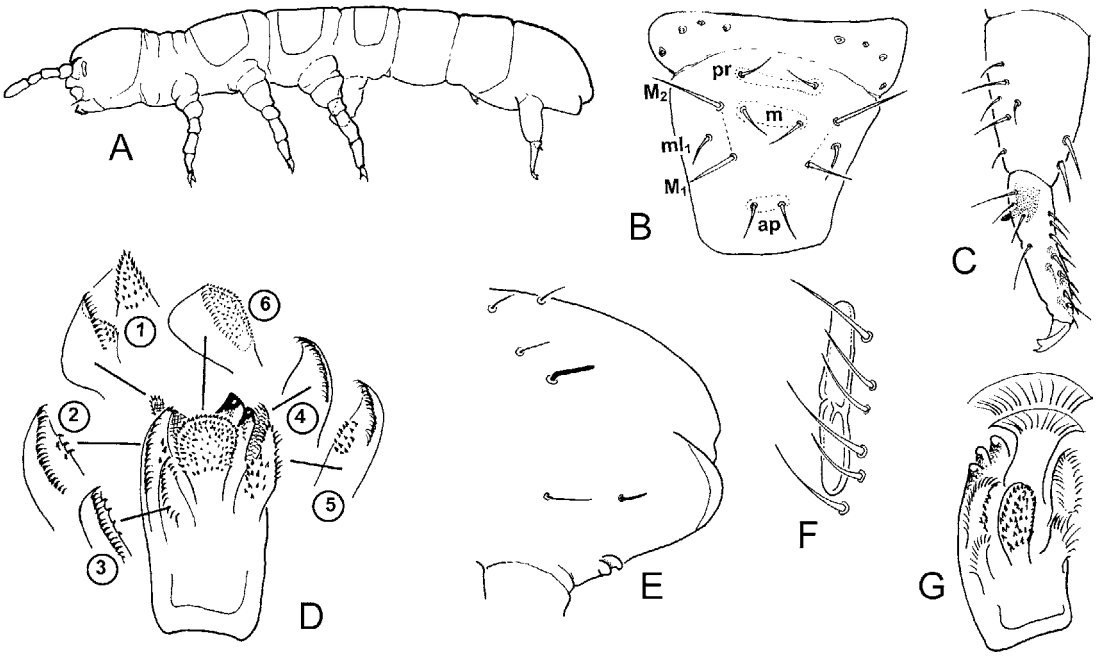


Fig. 23. *Folsomia inoculata* (A–F) and *F. litsteri* (G): (A) habitus; (B) dorsal chaetotaxy of manubrium; (C) furca; (D) maxilla; (E) distribution of sensilla on abd.4–6; (F) PAO; (G) maxilla.

wood, litter, ant hills), but also in meadows and seashore wrack and debris. General distribution: Palaearctic.

## 187. ***Folsomia inoculata*** Stach, 1947

Fig. 23A–F

*Folsomia inoculata* Stach, 1947: 145.
*Folsomia ezoensis* Yosii, 1965.

*Description.* – Size 1.5 mm. Colour white. Ocelli absent. Body shape stout, with a big bulldog-like head (Fig. 23A). Antennae short, not longer than head diagonal. Ant.1 with two ventroapical thick sensilla. Ant. 4 with many dorsal sensilla, of which 5–6 are notably thicker than others. PAO narrow, longer than width of ant.1, with a distinct constriction in the middle (Fig. 23F). Prelabral setae 4. Mandibles and maxillae heavily sclerotised, dark brown. Mandibles with a few strong teeth along ventral edge, dorsal part of molar plate with a dense pack of almost filamentous, long teeth. Maxilla (Fig. 23D) with short lamellae. Lam.1 not reaching beyond the strong capitular teeth, with small denticles only, no long marginal ciliation. Lam.2–3 with short marginal ciliation and a few denticles. Lam.4 with short marginal ciliation only, no denticles. Lam.5 with short marginal ciliation and a few denticles. Lam.6 swollen, pad-shaped, covered with delicate denticles. Head with 5–6 postlabial setae. Sensillary equipment of tergites normal, with 10/100 microsensillae. Upper sensilla on abd.1–3 set within the p-row. One of the lateral sensilla on abd.5–6 enlarged, elongate (Fig. 23E). Macrochaetae of the tergites distinct but short. Median macrochaetae on th.2–3 developed. Longest macrochaeta on abd.6 are 2.0–2.3 as long as inner length of claw 3. Th.3 with 3–4 ventral setae on each side of median line. Ventral tube with 4–5 laterodistal setae and 6–8 posterior setae. Manubrium normally with $2 + 2$ ventroapical setae. Dorsal chaetom of manubrium reduced, lateral setae absent apart from $ml_1$ (Fig. 23B). Dens about as long as manubrium. Dorsal side with 3 basal and one median seate. Ventral side with about 10 (8–12) setae. Basal hooks of dens particularly strong (Fig. 23C).

Mucro slender, with two teeth. Claws without teeth.

*Discussion.* – The presence of 2 + 2 ventroapical manubrial setae in combination with presence of ventral setae on th.3 is matched by no other species in the *fimetaria* group. The presence of only one mid-dorsal seta on dens is a unique character in the group. The stout body shape with the large head is also characteristic. The big, strong head with unusually robust chewing parts probably indicate a chewing/crushing mode of feeding habit.

*Distribution and ecology.* – Numerous specimens were found in a single sample from forest litter (*Acer*, *Sambucus*) in a city park in Torshavn, Faroe Islands (1.IX.2004, A. Fjellberg leg.). Bödvarsson (1961, 1963) reported *inoculata* from Sweden (SK: Kullaberg), but his specimens are *bisetosa* (see above). However, several specimens were found in leaf litter compost in Botaniska Trädgården in Lund (26.V.2006, A. Fjellberg leg.). Davidsson (1996) reported the species from Iceland. Due to possible confusion with other species a verification is needed. General distribution: Holarctic.

## *sensibilis* group

Members of this species group are unique by presence of 2 + 2 expanded leaf-like sensilla on the fused abd.4–6. There are several holarctic species in this group, but in our area only two are present.

### 188. *Folsomia coeruleogrisea* (Hammer, 1938)

Figs 17J, 24A–F

*Isotoma coeruleogrisea* Hammer, 1938, Zool. Anz. 121: 43.
*Isotomina gracilis* Stach, 1962.
*Folsomia alpha* Grow & Christiansen, 1977.
*Folsomia janstachi* Potapov & Babenko, 2000; syn. nov.

*Description.* – Size up to 1.2 mm. Colour white, or with very scattered pigmentation. Ocelli absent. Body shape curved, *Isotoma*-like (Fig. 24A). PAO elongate (Fig. 24F). Ant.1 with two ventroapical sensilla. Ant.2–3 both with a hair-like lateroapical sensillum, ant.3 in addition with a spine-like sensillum. Ant.3-organ normal. Ant.4 with many setaceous sensilla, of which two dorsal are slightly thicker than others. Prelabral setae 4. Central part of frontoclypeal field with 4 setae. Maxilla as Fig. 24C, lam.1, 2 and 4 with long marginal ciliation in addition to an irregular field of coarse cilia. Head with 4–5 postlabial setae. Body macrochaetae smooth, rather weakly differentiated from ordinary setae. $M_1$ on abd.4–6 about 1.8 as long as inner edge of last claw. Macrosensilla distributed as 33/2228, of which the two lateral ones on abd.4–6 are leaf-like expanded (as Fig. 17L). Microsensilla 10/100. Th.3 with 2–4 setae on each side of the ventral line. Ventral tube normally with 4 + 4 distal and 4–6 caudal setae. Furca strong, with long and slender dens which has 4 setae in the basal part, two outer (lateral) and one inner setae in the middle part (Fig. 24D). In addition there is a tiny dorsal setula near apex. Manubrium with 11–15 ventroapical setae (Fig. 24E). Dorsal side as Fig. 24B, though variation is frequent. Characteristic is the presence of the short setae $ml_1$ and $l_1$. A short ventrolateral (vl) setae is often present. Claws simple, untoothed. Males present.

*Discussion.* – The species was originally described from East Greenland. Specimens from the Norwegian arctic (Spitsbergen) have been compared with recent material from E. and W. Greenland, without finding any significant differences apart from degree of pigmentation. Greenland specimens are usually distinctly pigmented, though variable, while Norwegian specimens are white or at most with traces of dark pigment. Both have the upper abd.1–3 sensilla set distinctly in front of the p-row. Specimens from Spitsbergen (Hornsund) had subsequently been described as a new species – *Isotomina gracilis* – by Stach (1962). These specimens are *Folsomia*, and Potapov & Babenko (2000) renamed Stach's species to *Folsomia janstachi* because the combination *Folsomia gracilis* was already occupied by Latzel (1922) (*Folsomia quadrioculata gracilis* Latzel, 1922, from Austrian alps). These authors did not check Greenlandic specimens, but suggested that *coeruleogrisea* might be a senior synonym of *alpha* which was described from Alaska and also present in NE Siberia. The latter species was said to differ from *janstachi* by presence of

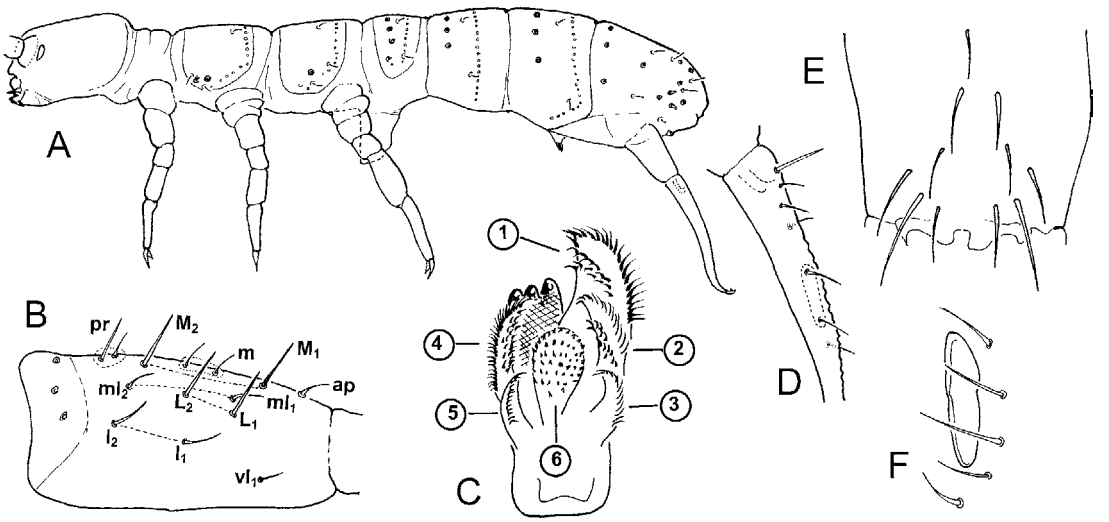


Fig. 24. *Folsomia coeruleogrisea*: (A) Distribution of dorsal sensilla and macrochaetae; (B) dorsal chaetotaxy of manubrium, left side; (C) maxilla; (D) dens; (E) ventroapical setae of manubrium; (F) PAO.

diffuse body pigmentation and a posterior – but variable – position of the upper abd.1–3 sensilla. Considering that the Greenland and Spitsbergen populations belong to the same species – and there is little evidence for the contrary – these new taxa fall as junior synonyms to Hammer's old *coeruleogrisea*, which probably also includes *alpha*.

*Distribution and ecology.* – Present in different types of arctic tundra in Jan Mayen and Svalbard (Fjellberg, 1994). General distribution: Holarctic (circumpolar).

## 189. ***Folsomia sensibilis*** Kseneman, 1936

Figs 17L, 25A

*Folsomia sensibilis* Kseneman, 1936, Sb. čsl. Akad. zeměd. Věd. 11: 106.

*Description.* – Size 0.6 mm. Colour white, unpigmented. Ocelli absent. Body shape slender, cylindrical. PAO broadly oval, rather large (Fig. 25A). Ant.1 with two ventroapical sensilla. Ant.2 with a hair-like lateroapical sensillum. Ant.3 in anterolateral position only with the spine-like sensillum. Ant.3 organ normal. Ant.4 with 8–9 curved, distinctly thickened sensilla. Prelabral setae 4. Central frontoclypeal field with 4 setae. Maxilla similar to that of *coeruleogrisea* (Fig. 24C). Head with 4–5 setae on each side along the ventral line. Body macrochaetae short and smooth, $M_1$ on abd.4–6 about 1.5 as long as inner length of last claw. Macrosensillae setaceous, distributed as 33/2228. Those on the fused abdominal segments very poorly differentiated from ordinary setae, except the 2 club-shaped sensilla on each side (Fig. 17L). Upper sensilla on th.2–abd.3 set in front of the p-row. Microsensilla 10/100. Th.3 with 1–2 setae on each side of the ventral line, usually $1+1$. Ventral tube with $4+4$ distal and 5–6 caudal setae. Manubrium usually with $2+2$ ventroapical setae (1–3 on each side, variable). Posterior side without setae $ml_1$ and $l_1$. Dens with 6 dorsal setae (only one outer/lateral in the middle part) and one small setula near apex. Claws simple, untoothed. Males not observed.

*Discussion.* – The $2+2$ enlarged sensilla on abd.4–6 makes the species easy to identify, only matched by the arctic *coeruleogrisea* which differs by larger size and more setae on manubrium and dens. The distributions of the two species do not overlap in our area.

*Distribution and ecology.* – Common in soil/litter in various forest types, both hardwood and conifers. Ascending to the lower alpine thickets

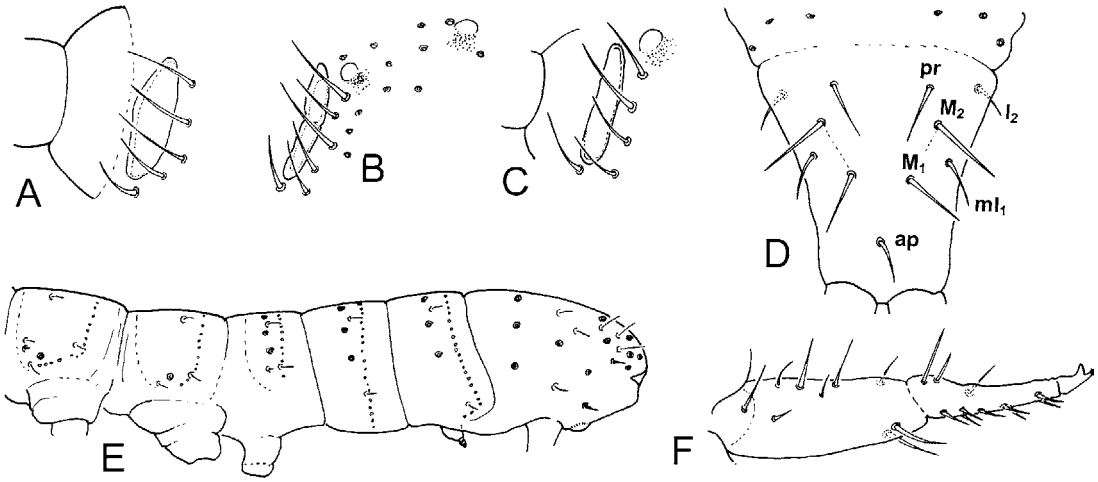


Fig. 25. *Folsomia* spp.: (A–C) PAO and eye-field in *sensibilis* (A), *quadrioculata* (B) and *palearctica* (C); (D–F) *quadrioculata*, chaetotaxy on dorsal side of manubrium (D), distribution of dorsal sensilla and macrochaeta (E), furca (F).

and meadows. A boreomontane species, widely distributed in northern districts. Apparently absent from Denmark and southern Sweden. General distribution: Palaearctic.

## *quadrioculata* group

Upper sensilla on abd.1–3 set in front of the p-row, between macrochaetae $M_1$ and $M_2$ (Fig. 17I). Manubrium with 1 + 1 ventroapical setae. Five species.

### 190. *Folsomia quadrioculata* (Tullberg, 1871)

Figs 17D, 25B, D–F, 26

*Isotoma quadrioculata* Tullberg, 1871, Öfv. K. Vet.-Akad. Förhandl. 27: 152.

*Description.* – Size up to 2.0 mm, sexually mature from about 1.0 mm. Body shape lender, cylindrical. Ocelli 2 + 2, PAO narrow, elongated (Fig. 25B). Pigmentation brownish grey, of variable intensity. Eye-spots darker. White, unpigmented specimens may occur. Ant.1 with two ventroapical sensilla. Lateroapical setaceous sensilla present on ant.2. Ant.3 with a lateroapical spine-like sensillum, the setaceous sensillum absent. An erect dorsobasal microsensillum is present on ant.3. Ant.4 with many

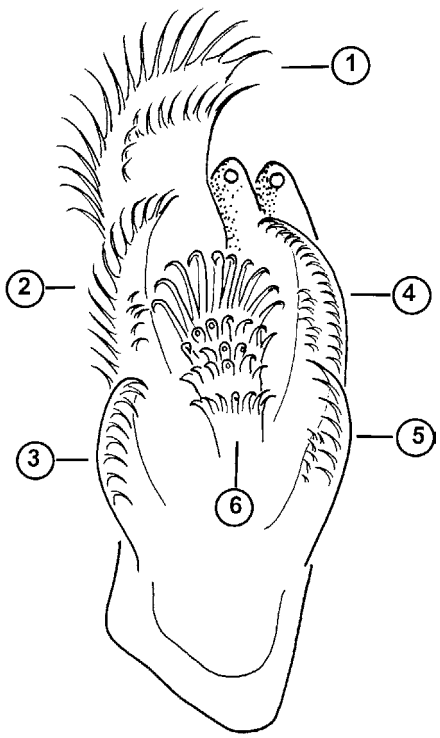


Fig. 26. *Folsomia quadrioculata*, maxilla.

curved, pointed sensilla which are only moderately thickened. Prelabral setae 4. Central part of frontoclypeal field with up to 10 or more setae (in large specimens). Maxilla as Fig. 26,

lamellae with strong, curved marginal ciliations. Lam.1 with a regular subapical fringe of cilia in addition to the marginals. Lam.6 with an apical rake of very long coarse cilia and a regular transverse row of cilia near base. The central part with 2–3 irregular rows of cilia. Maxillary palp bifurcate, 4 sublobals. Head with 4–5 setae on each side along the ventral line. Body with long erect macrochaetae which are smooth. On abd.4–6 seta $M_1$ is about 3 times (2.5–4.5) as long as inner edge of the last claw. Also the general ground cover of hairs is composed of long, coarse setae, in particular those in the p-rows of the tergites. Macrosensilla distributed as 43/2228 (Fig. 25E). Median sensilla of th.2–abd.3 in front of the p-row, on th.2 even closer to the a-row than the p-row. Mesothorax with the hind corner sensillum set slightly in front of the p-row (Fig. 17D). On abd.4–6 sensilla $S_{1-3}$ are short and setaceous, $S_{4-6}$ are long and setaceous, while $S_{7-8}$ are short and slightly spine-like (cf. Fig. 21B). Thorax without ventral setae. Ventral tube with $3 + 3$ distal and 6–8 posterior setae. Furca as Fig. 25D, F, dens usually with 8 setae on the anterior side and 3 setae on the posterior side (the middle part only with an inner seta). Manubrium with $1 + 1$ ventroapical setae. Posterior side as Fig. 25D, with only 11 seate and $3 + 3$ in the basal part. The apical seta (ap) is sometimes doubled. The lateral macrochaetae ($L_1$, $L_2$) are absent. Proximal group only with the $1 + 1$ primary setae. The low number of setae is due to almost no neochaetosis during the postembryonic development. In stages after the 1.instar juvenile only the setae $ap_0$ and $l_2$ are added. Tibiotarsi with additional setae in the basal part. Claws simple, without teeth. Males present.

*Discussion.* – This very common species is easily identified by the $2+2$ ocelli, $1+1$ ventroapical manubrial setae and long body hairs. Earlier often confused with the following *manolachei*, which differs by smaller body size, usually darker pigmentation and shorter body hairs. The backward position of the hind corner sensillum on mesothorax is a clear diagnostic character of *manolachei* (Fig. 17E).

*Distribution and ecology.* – Probably distributed all over our area, including high mountains and arctic islands. The species occurs in a variety of habitats, without any clear preferences. General distribution: Holarctic.

## 191. ***Folsomia manolachei*** Bagnall, 1939

Fig. 17E

*Folsomia manolachei* Bagnall, 1939, Entomologist's mon. Mag. 75: 58.

*Description.* – Size usually not above 1.0 mm. Colour spotted brownish grey, usually rather dark. Mesothorax with the hind corner sensillum set within the p-row (Fig. 17E). Body macrochaetae shorter than in previous species. On abd.4–6 macrochaeta $M_1$ is 2.0–2.5 as long as inner length of the last claw. Dens usually with 7 anterior setae. Seta $ap_0$ on posterior side of manubrium often absent. Males present.

*Discussion.* – Very similar to *quadrioculata*, and not clearly separated from this species until Deharveng (1982) pointed to the different position of the th.2 hind corner sensillum. Although specimens of *manolachei* are usually smaller, darker and more short-haired than *quadrioculata*, most body characters – except the th.2 sensillum – are overlapping. The details of the maxilla are the same in the two species.

*Distribution and ecology.* – Often collected together with *quadrioculata*, but usually in drier habitats than this species. Probably distributed in most of our area, but incompletely known due to confusion with *quadrioculata*. Apparently absent from the arctic islands. General distribution: Palaearctic.

## 192. ***Folsomia palaearctica*** Potapov & Babenko, 2000

Fig. 25C

*Folsomia palaearctica* Potapov & Babenko, 2000, Eur. J. Ent. 97: 57.
*Folsomia diplophthalma* auct. nec Axelson, 1902.

*Description.* – Size 0.7 mm. Pale greyish brown, eye-spots darker. Ocelli $1+1$, PAO narrow elongate (Fig. 25C). Body slender, cylindrical. Ant.3 without dorsobasal microsensillum. Other antennal characters, mouthparts, head chaetotaxy, sensillary equipment, ventral tube, furca and legs as in previous two species. On th.2 the hind corner sensillum set in front of the p-row (as Fig. 17D). Body hairs are generally

shorter and more sparse than in *quadrioculata* and *manolachei*. On abd.4–6 macrochaeta $M_1$ is about two times (1.9–2.2) as long as inner length of the last claw. Sensilla $S_{7-8}$ on abd.4–6 (cf. Fig. 21B) distinctly thickened. Posterior side of manubrium usually with 1 + 1 ap-setae. Dens usually with 7 anterior setae. On the two first pair of legs the tibiotarsi normally have only the three complete A, B and C whorls of setae, while tib.3 have a few additional D-setae at base.

*Discussion.* – Normally easily identified by the 1 + 1 ocelli and the small body size. The absence of the dorsobasal sensillum on ant.3 is a decisive character. Potapov & Babenko (2000) showed that the species which normally has been called *diplophthalma* in Europe (Gisin, 1960), differed from the original types of that species. The true *diplophthalma* has 4 + 4 ventroapical manubrial setae, increased number of anterior setae on dens (up to 17) and a sensillary chaetotaxy of the *sexoculata* type (cf. Fig. 29A). It is recorded eastwards from the Russian Karelia and not seen in Fennoscandia.

*Distribution and ecology.* – A boreomontane species, present in Iceland and the Faroes, absent in Denmark and southern Sweden. A characteristic species in alpine meadows in S. Norway, descending to sea level in the north. General distribution: Northern Holarctic.

## 193. ***Folsomia brevicauda*** Agrell, 1939

Fig. 27A–H

*Folsomia brevicauda* Agrell, 1939, Opusc. ent. 4: 162.

*Description.* – Size 0.8 mm. Colour greyish brown or black, of variable intensity. Ocelli 2 + 2. PAO narrow elongate. Body shape rather stout, cylindrical, with shortly curved abdominal tip (Fig. 27A). Ant.1 with 3 ventroapical sensilla (Fig. 27F). Ant.2 with a lateroapical setaceous sensillum. Ant.3 with a lateroapical setaceous sensillum in additional to the spine-like sensillum. Dorsobasal microsensillum absent on ant.3. Ant.4 with a distinct globular subapical sensillum. Prelabral setae 4. Central part of the frontoclypeal field with 7–10 setae. Maxilla as Fig. 27H. Lam.1 short, not reaching beyond tip of capitulum. Only with short marginal ciliations. Lam.2–5 with short, simple marginal ciliations. Head with 4 + 4 postlabial ventral setae. Dorsal side of the body with a peculiar "dotted" integument, with regularly spaced ring-like structures (Fig. 27E). Macrochaeta short, only poorly differentiated from ordinary setae. $M_1$ on abd.4–6 only 1.5 times as long as inner length of the last claw. Macrosensilla distributed as 43/2228. The sensilla $S_{4-7}$ on abd.4–6 distinctly thickened. Other sensilla thinner, curved and much shorter than ordinary setae (Fig. 27E). Hind corner sensillum on Th.2 and the median sensilla on th.2–abd.3 well in front of the p-row. Microsensilla only present on th.2 (10/000). No ventral seta on thorax. Ventral tube with 3 + 3 distal and 5–6 posterior setae. Retinaculum with 4–5 setae (Fig. 27G). Furca short, dens much shorter than manubrium (Fig. 27D). Manubrium with 1 + 1 long ventroapical setae. Posterior side without lateral setae (L, l, ml), but quite variable in numbers of the other setae (Fig. 27B). The first and second juvenile instars only with 8 posterior setae on manubrium (Fig. 27C). Dens with 3 anterior and 3 posterior setae. Tib.3 with some additional D-setae at base. Claws simple, unarmed. Males present.

*Discussion.* – The species takes an isolated systematic position with its unique skin structure, short maxillary lamellae and increased number of setae on retinaculum.

*Distribution and ecology.* – Common in the open humid heath land along the west coast of Norway, ascending well into the alpine. More rare in forest litter. Absent from Denmark and Finland, present in Iceland and Faroe Islands. In Sweden only in the north, connecting to the Norwegian distribution area. General distribution: Palaearctic.

## 194. ***Folsomia taimyrica*** Martynova et al., 1973

Fig. 28A, B

*Foslomia diplophthalma* f. *taimyrica* Martynova et al., 1973, Ent. Obozr. 52: 83.

*Description.* – Size 1.5 mm. Colour white, ocelli absent. Body shape cylindrical, slender. PAO narrow elongate, longer than width of ant.1 which has two ventroapical sensilla. Ant.2 with

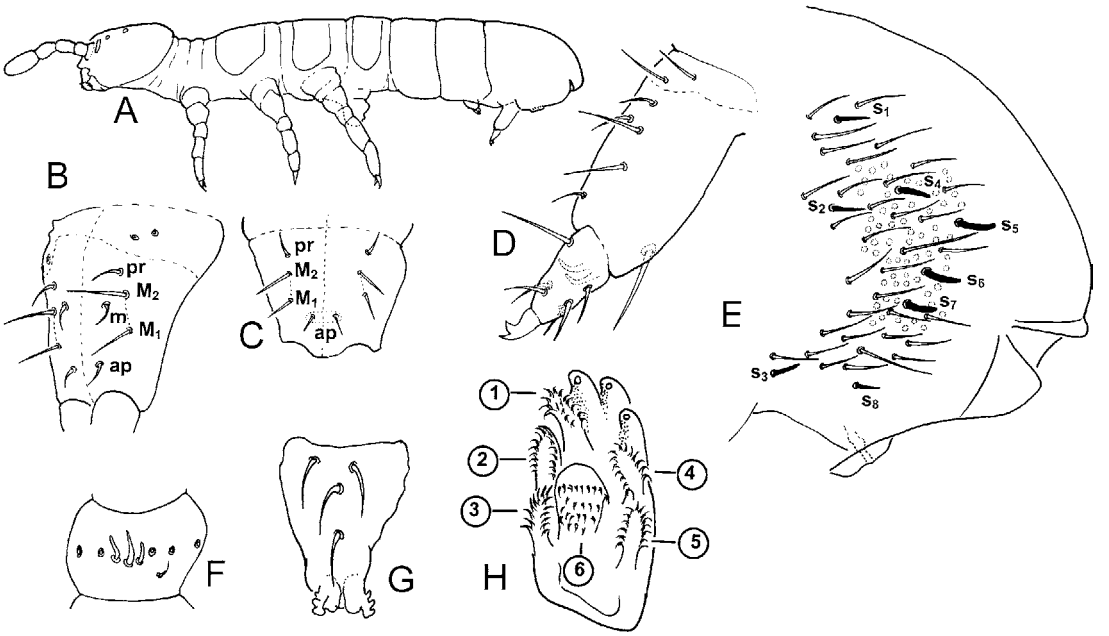


Fig. 27. *Folsomia brevicauda*: (A) Habitus; (B) dorsal chaetotaxy of manubrium, adult; (C) ditto, 1.instar juvenile; (D) furca; (E) detail of sensilla, setal cover and integumental structure on abd.4–6; (F) sensilla of right ant.1, ventral; (G) retinaculum; (H) maxilla.

a lateroapical setaceous sensilla. Ant.3 with two lateroapical sensilla (Fig. 28A). Prelabral setae 4. Central part of frontoclypeal field with 5–8 setae. Maxilla similar to that of *quadrioculata* (Fig. 26). Head with 4–5 setae on each side of the ventral line. Macrochaetae well developed, $M_1$ on abd.4–6 is 2.4–2.6 as long as inner length of the last claw. Macrosensilla as in *quadrioculata* (Fig. 25E). Microsensilla as 11/111, those of th.3–abd.3 very small. No ventral setae on thorax. Ventral tube with $4 + 4$ distal and 4–6 caudal setae. Retinaculum with $4 + 4$ teeth and one seta. Manubrium with $1 + 1$ ventroapical setae. Dorsal side as Fig. 28B, somewhat variable, in particular in the median (m) and proximal (pr) groups. Dens with 3 dorsal and 8–9 ventral setae. Mucro with two teeth. Claws simple, unarmed. Tibiotarsi with additional D-setae at base. Males present.

*Discussion.* – Similar to a pale *quadrioculata*, but the absence of eyes and presence of microsensilla on all tergites from th.2–abd.3 readily identify the species. Also it differs from *quadrioculata* by $4+4$ distal setae on the ventral tube and increased number of setae on posterior side of manubrium.

*Distribution and ecology.* – A species of the arctic tundra, in our area only from Spitsbergen. General distribution: Palaearctic.

## *binoculata* group

Upper sensilla on abd.1–3 set in front of the p-row, between macrochaetae $M_1$ and $M_2$. Manubrium with $2 + 2$ or more ventroapical setae. Four species.

### 195. *Folsomia binoculata* (Wahlgren, 1899)

Fig. 28C–E

*Isotoma binoculata* Wahlgren, 1899, Öfv. K. vet.-Akad. Förhandl. 56: 338.
*Folsomia regularis* auct. nec Hammer, 1953.

*Description.* – Size 1.7 mm. Colour white, normally with scattered black pigmentation. Ocelli

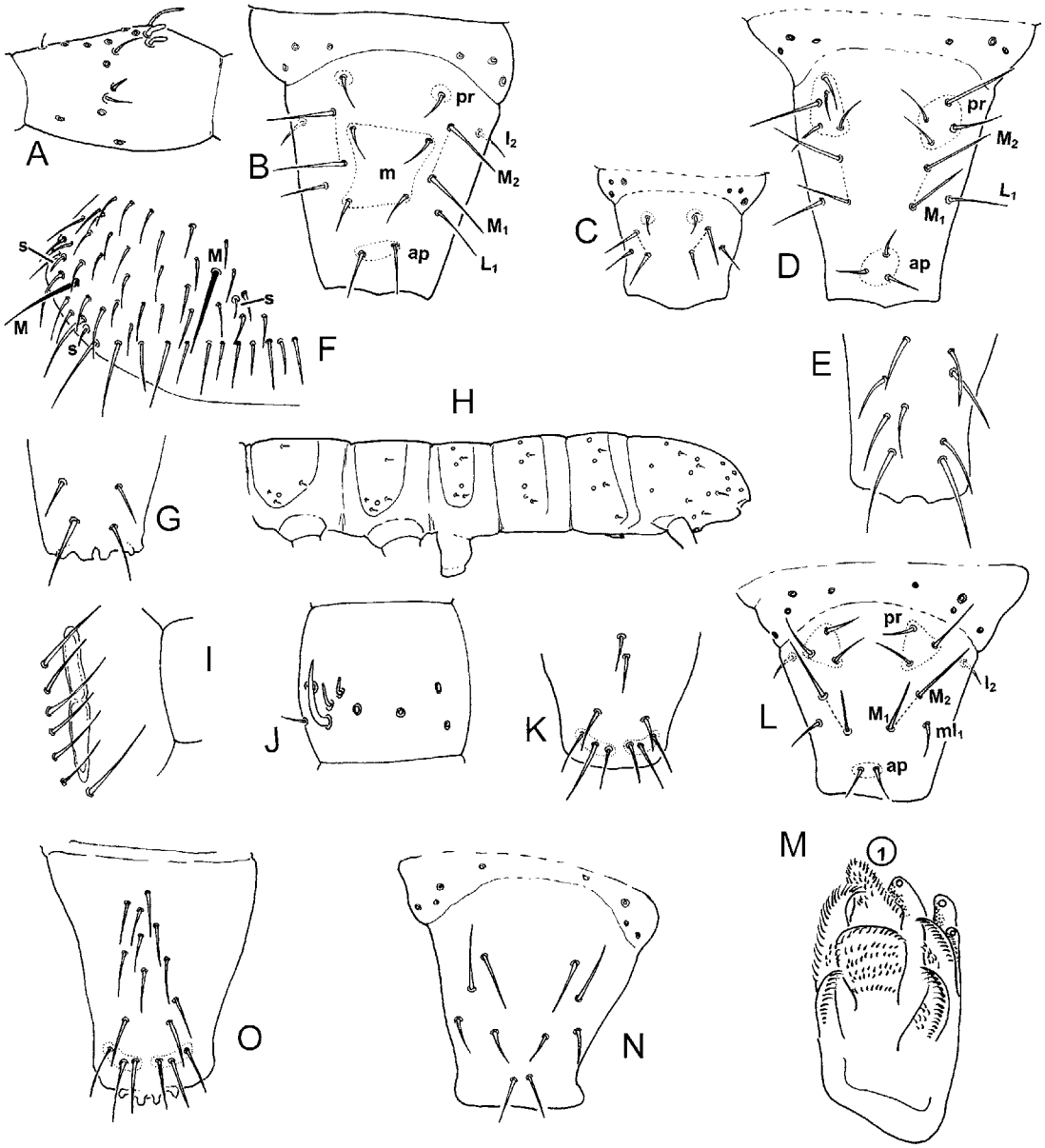


Fig. 28. *Folsomia* spp.: (A–B) *taimyrica*, sensilla on right ant.3 (A), chaetotaxy on manubrium, dorsal (B); (C–E) *binoculata*, chaetotaxy of manubrium (dorsal) in 1.instar juvenile (C) and adult (D), ventroapical setae on manubrium (E); (F–G) *agrelli*, chaetotaxy on the.3, left side, (F), ventroapical setae on manubrium (G); (H–M) *spinosa*, distribution of dorsal sensilla and macrochaetae (H), PAO, right side (I), sensilla on left ant.1, ventral (J), ventroapical setae on manubrium (K), dorsal chaetotaxy of manubrium (L), maxilla (M); (N–O) *penicula*, dorsal (N) and ventral (O) setae on manubrium.

1 + 1, on dark spots. Body shape slender, cylindrical. PAO narrow, slightly longer than width of ant.1. Ventral side of ant.1 with 2–3 apical sensilla. Ant.3 in lateroapical position only with the spine-like sensillum. Ant.2 with a setaceous lateroapical sensillum. Prelabral setae 4. Central part of the frontoclypeal field with more than 10 setae in large individuals. Maxilla as in

*quadrioculata* (Fig. 26). Head with 4–5 setae on each side of ventral line. Sensillary equipment of the tergites as in *quadrioculata* (Fig. 25E). Macrochaetae well developed, $M_1$ on abd.4–6 is about 2.3–3.0 as long as inner length of the last claw. No ventral setae on thorax. Ventral tube with 4 + 4 distal and up to 11 caudal setae. Retinaculum with 4 + 4 teeth and one seta. Chaetotaxy of manubrium very variable, ventroapical field as Fig. 28E, with 2–6 setae on each side. Posterior side as Fig. 28D, but very variable. Apical group with 1–3 setae. $M_1$, $M_2$ and $L_1$ always present, $ml_1$ absent, m-setae usually absent. One or two l-setae present or absent. Proximal group with 4–5 setae. Basal groups always with 3 setae. The 1.instar juveniles as Fig. 28C. Dens with 7–9 ventral and 3 dorsal setae. Mucro with 2 teeth. Tibiotarsi with increased number of setae near base (D-setae present). Claws simple, unarmed.

*Discussion.* – The old name *binoculata* was re-introduced for this species by Potapov & Babenko (2000). The interpretation of Wahlgren's (1899) name has been dubious, but I agree with the cited authors that the only possible candidate for *binoculata*, living on the type locality (Kvitøya, Giles Land), must be the species which until now has been called *regularis* in the Norwegian arctic (Fjellberg, 1994). Potapov and Babenko (1999) restrict the name *regularis* for the Nearctic and east Palaearctic populations of this complex, which differ by a more strongly developed median macrochaeta on th.3.

*Distribution and ecology.* – In arctic tundra, Svalbard only. General distribution: Palaearctic (arctic islands and Taimyr).

## 196. ***Folsomia agrelli*** Gisin, 1944

Figs 17G, 28F, G

*Folsomia agrelli* Gisin, 1944, Mitt. schweiz. ent. Ges. 19: 154.
*Folsomia quadrioculata 2-punctata*-Typus Agrell, 1939.

*Description.* – Size 1.5 mm. Colour white, black pigment only present under the 1 + 1 ocelli. Similar to the previous species, differing by fewer ventroapical manubrial setae (2 + 2, sometimes 1 + 2 or 3 + 2, Fig. 28G) and presence of a median macrochaeta on th.3 (Fig. 28F). The latter character may indicate that *binoculata* and *agrelli* possibly belong to one species with geographical variation in manubrial chaetotaxy.

*Distribution and ecology.* – An alpine species being present in snowbeds and damp moss along melt water streams in the highest mountains in Sweden and Norway, descending to about 800 m at the west coast of Norway. Bödvarsson (1957) reports several Icelandic records, and it was recorded in mountains at Eyafjördur in 2006 (A. Fjellberg). General distribution: Palaearctic (recent specimens seen from the west coast of Greenland).

## 197. ***Folsomia spinosa*** Kseneman, 1936

Fig. 28H–M

*Folsomia spinosa* Kseneman, 1936, Sb. čsl. Akad. zeměd. Věd. 11: 105.

*Description.* – Size 1.2 mm. Colour whitish, with scattered granular black pigmentation of variable intensity. Body shape slender, cylindrical (Fig. 28H). Ocelli absent. PAO very long, narrow, longer than width of ant.1 (Fig. 28I). Ant.1 with two short and one long ventroapical sensillum (Fig. 28J). Ant.2 with a setaceous lateroapical sensillum. Ant.3 in lateroapical position only with the spine-like sensillum. Dorsal sensilla of ant.4 only moderately thickened, curved and pointed. Subapical organ with a long, club-shaped sensillum. Prelabral setae 4. Frontoclypeal field with 6–7 setae. Maxilla as Fig. 28M. Lam. 2–3 and 4–5 with coarse marginal ciliations. Lam.1 tongue-shaped, reaching only slightly beyond tip of capitulum. Its apical half covered with long, fine ciliation. Lam.6 with fine denticles. Head with 4 + 4 postlabial setae. Body macrochaetae long, also in anterior part of abdomen. Macrochaeta $M_1$ on abd.4–6 is 3.0–3.5 as long as inner length of last claw. Macrosensilla distributed as 43/2225 (Fig. 28H). Upper sensilla on th.2–abd.3 and the hind corner sensillum on th.2 set well in front of the p-row. On abd.4–6 one sensillum is enlarged, while the upper posterior group of 3 sensilla are not distinguished (absent or not separable from ordinary setae). Microsensilla present on all segments from th.2–abd.3 (11/111). Thorax without ventral setae. Ventral tube with 4 + 4

distal and 7–9 posterior setae. Manubrium with 10–12 ventral setae, with 3 + 3 arranged in characteristic oblique apical rows (Fig. 28K). Posterior side as Fig. 28L. The short $ml_1$ is present, but macrochaetae $L_1$–$L_2$ are absent. Apical setae paired. Tibiotarsi with additional D-setae in the basal part. Claws usually with distinct lateral teeth. Males not seen (few samples only).

*Discussion.* – This long-haired blind species is easily recognised by the very long PAO, presence of body pigmentation and the presence of microsensilla on all segments from th.2 to abd.3.

*Distribution and ecology.* – A lowland species, probably widely distributed in southern Fennoscandia. Usually in compost heaps and in rich organic deposits in broadleaf forests. General distribution: Palaearctic.

## 198. *Folsomia penicula* Bagnall, 1939

Fig. 28N, O

*Folsomia penicula* Bagnall, 1939, Entomologist's mon. Mag. 75: 57.

*Description.* – Size 1.6 mm. Colour whitish with a spotted black pigmentation scattered all over body, eye-spots distinct. Body slender, cylindrical. Ocelli 2 + 2, but posterior pair small. PAO narrow, slightly longer than width of ant.1. Ventral side of ant.1 with two apical and one basal microsensilla, dorsal side with two. Ant.2 with a setaceous lateroapical sensillum and two basal (ventral/dorsal) microsensilla. Ant.3 in lateroapical position with a spine-like sensillum only. Ant.4 with 4–5 slightly thickened curved sensilla. Prelabral setae 4. Head with 4 + 4 postlabial setae. Maxilla very similar to that of *spinosa* (Fig. 28M). Macrochaeta on body long, macrochaeta $M_1$ on abd.4–6 is 3.0–3.5 as long as inner length of last claw. Microsensilla on th.2–abd.3 distributed as 11/111. Upper macrosensilla on abd.1–3 in mid-tergal position. Macrosensilla on abd.4–6 as in *spinosa* (Fig. 28H), with lower posterior sensillum enlarged. Thorax without ventral setae. Ventral tube with 5 + 5 distal and 6–7 posterior setae. Claws with a pair of lateral teeth near base, unguiculus only half as long as inner edge of claw. Manubrium with 15–20 anterior setae, 3 + 3 in apical rows (Fig. 28O). Posterior side as Fig. 28N. Dens with 4 posterior setae.

*Discussion.* – By presence of 2 + 2 ocelli, long macrochaetae and granular dark pigmentation, the species looks much like *quadrioculata*. However, the abundance of ventral setae on manubrium readily identifies *penicula* (1 + 1 setae in *quadrioculata*).

*Distribution and ecology.* – Abundant in leaf litter compost in Botaniska Trädgården in Lund, Sweden (2006, many collections, A. Fjellberg leg.). Possibly widespread in similar habitats. General distribution: Palaearctic.

## *sexoculata* group

Upper sensilla on abd.1–3 set in front of the p-row, between macrochaetae $M_2$ and $M_3$. Three species.

## 199. *Folsomia sexoculata* (Tullberg, 1871)

Fig. 29A–G

*Isotoma sexoculata* Tullberg, 1871, Öfv. K. vet.-Akad. Förhandl. 28: 152.

*Description.* – Size up to 2.0 mm. Colour dark brownish grey, with a violet wash and some paler spots. Body shape cylindrical, slender. Ocelli 3 + 3. PAO narrow elongate, much shorter than width of ant.1 (Fig. 29G). Ant.1 with 1 long and two shorter ventroapical sensilla. Ant.2 with a setaceous lateroapical sensillum. Ant.3 in lateroapical position only with the spine-like sensillum. The sensillum of the subapical organ of ant.4 not projecting. Prelabral setae 4. Central part of the frontoclypeal field with more than 10 setae in large specimens. Maxilla as Fig. 29E. Lam.1 reaching well beyond tip of capitulum, with long marginal ciliation and a dense field of cilia on the inner face. A "tooth brush" projects from the base of the lamella. Lam.2–5 with long marginal ciliation and a few denticles on the inner side. Lam.6 with long, coarse ciliation around apex and a strong field of denticles. Head with 4–6 postlabial setae on each side. Body with a dense cover of short setae, macrochaetae short, erect. Macrochaeta $M_1$ on abd.4–6 only 1.2–1.5 as long as inner edge of the last claw. Macrosensilla hardly differentiated from ordinary setae, distributed as 43/2228 (Fig. 29A). The upper sensilla of th.2–abd.3 and the hind

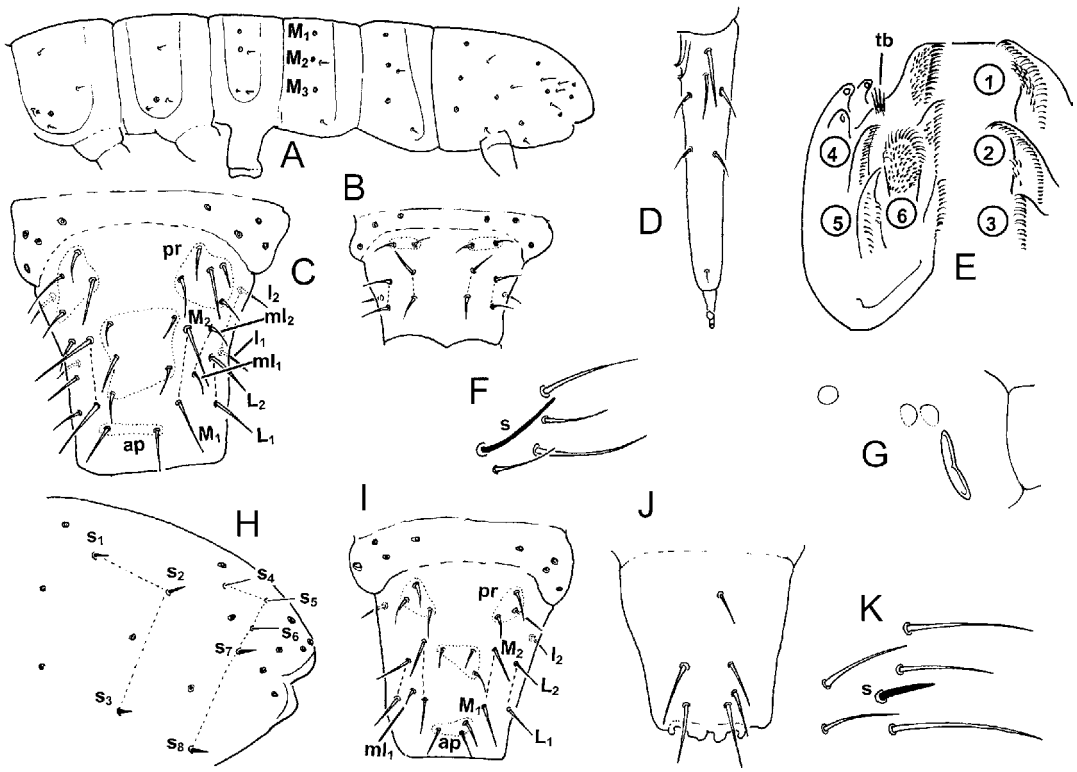


Fig. 29. *Folsomia sexoculata* (A–G) and *microchaeta* (H–K): (A) Distribution of dorsal sensilla and macrochaetae; (B–C) chaetotaxy on dorsal side of manubrium in 2.instar juvenile (B) and adult (C); (D) dorsal setae on dens; (E) maxilla with "tooth brush" (tb); (F) sensillum (s) in left hind corner of th.2; (G) PAO and ocelli; (H) distribution of sensilla and macrochaetae on abd.4–6; (I) dorsal chaetotaxy of manubrium; (J) ventral setae on dens; (K) sensillum (s) in left hind corner of th.2.

corner sensillum of th.2 situated well in front of the p-row (Fig. 29F). The upper sensillum on abd.1–3 is set between macrochaeta $M_2$ and $M_3$ (as Fig. 17H). Microsensilla as 10/100. Thorax without ventral setae. Ventral tube with 4–5 distal and 6–7 caudal setae. Retinaculum with 0–2 setae, usually 1. Furca long, dens with 6 dorsal setae and one subapical setula (Fig. 29D). Ventrally with about 15 setae. Manubrium with two oblique subapical rows of 1–3 setae each, and usually 1–3 setae in the mid-ventral section. Dorsal side with a variable number of setae (Fig. 29C). Characteristic is the presence of the lateral macrochaeta $L_1$–$L_2$ and two short lateral setae $l_1$ and $l_2$. Small juveniles as Fig. 29B. Tibiotarsi with additional D-setae at base. Claws with small lateral teeth. Males present.

*Discussion.* – Easily identified by eye number, short body hairs and the unusual position of the upper sensilla on abd.1–3.

*Distribution and ecology.* – An exclusive marine littoral species which is widely distributed along the Nordic coasts, including the Arctic. The delicate mouthparts with strongly fringed maxillary lamellae probably reflects a feeding habit involving filtering of organic particles in suspension. General distribution: Palaearctic.

## 200. ***Folsomia thalassophila*** Bagnall, 1940

Fig. 17H

*Folsomia thalassophila* Bagnall, 1940, Entomologist's mon. Mag. 76: 98.
*Folsomia norvegica* Altner, 1963; syn. nov.

*Description.* – Size 1.6 mm. Colour white, with scattered dark pigmentation. Very similar to *sexoculata*, but separated by the very scanty pigmentation and by generally longer body hairs.

On abd.4–6 macrochaeta $M_1$ is about 2.5–3.5 as long as inner edge of the last claw. Maxilla, sensillary equipment and furcal characters are the same in the two species.

*Discussion.* – Measurements from two Scottish syntypes of *thalassophila*, made in May 2005, proved that the long abdominal macrochaetae are 3.3–3.5 as long as mucro, which are well into the values given by Altner (1963) for *norvegica*. Thus there are no characters separating the two taxa and *norvegica* falls as a junior synonym.

*Distribution and ecology.* – Like previous species an exclusive marine littoral form. The two may be found together, though the distribution of *thalassophila* appears to be more western as there are no records from Sweden, Finland and Denmark while it is present in Norway, Iceland, the Faroes and the British Isles. General distribution: Palaearctic.

## 201. ***Folsomia microchaeta*** Agrell, 1939

Fig. 29H–K

*Folsomia microchaeta* Agrell, 1939, K. fysiogr. Sällsk. Lund Förh. 9: 179.

*Description.* – Size 1.7 mm. Body shape similar to the two previous species, but the body is entirely white apart from dark spots under each of the 2 + 2 ocelli. Like in our two other species in the *sexoculata* group the upper sensilla on abd.1–3 are set between macrochaetae $M_2$ and $M_3$, but the sensilla are shorter, more spine-like. The hind corner sensillum on th.2 is set almost in the p-row (Fig. 29K). On abd.4–6 the sensilla $S_{1-3}$ and $S_{7-8}$ are spine-like, while $S_{4-6}$ are setaceous (Fig. 29H). Body hairs short as in *sexoculata*, macrochaeta $M_1$ on abd.4–6 is 1.2–1.4 as long as inner length of the last claw. Maxilla is similar to *sexoculata*/*thalassophila*. Manubrium has 3 + 3 (2) ventroapical setae set in almost straight rows, and often a further 1–2 setae in the middle part (Fig. 29J). Posterior side of manubrium with $l_1$ absent, $l_2$ present. Seta $ml_1$ sometimes present (Fig. 29I). Dorsal side of dens with 5 setae (3 in the basal part) and one subapical setula. Other body characters do not differ significantly from the previous two species.

*Discussion.* – Easily identified by the 2 + 2 ocelli in combination with more than 1 + 1 ventroapical manubrial setae and the sensillary distribution.

*Distribution and ecology.* – A northern alpine species, in our area only from north Norway and Sweden. In alpine meadows and moss/lichens on rocks. Agrell's (1939) report of '*Folsomia microchaeta 2-punctata*-Typus' from Finland (Ta) and Karelia (Kr), described from Linnaniemi's material, must be another species. General distribution: Holarctic.

## ***fimetarioides*** group

Unlike other *Folsomia* mucro has 3 teeth, not two. One species.

## 202. ***Folsomia fimetarioides*** (Axelson, 1903)

Fig. 30A–G

*Isotoma fimetarioides* Axelson, 1903, Acta Soc. Fauna Fl. fenn. 25: 8.

*Description.* – Size up to 1.3 mm. Colour white, ocelli absent. Body shape as Fig. 30A. PAO narrow elongated, slightly longer than width of ant.1. Ant.1 with two ventroapical sensilla, the one is much larger than the other (Fig. 30F). Ant.2 with a lateroapical setaceous sensillum. Ant.3 only with one lateroapical sensillum (spine-like). Ant.4 with 6–7 curved, thickened and blunt-tipped sensilla. Subapical sensillum stalked, club-shaped. Prelabral setae 4. Central part of the frontoclypeal field with 6–8 setae. Labium complete, apart from absence of guard seta $e_7$ (Fig. 30B). Maxilla as Fig. 30D. Lam.1 reduced, weak, not reaching beyond tip of capitulum. Lam.2–5 with short marginal ciliation, strongest in lam.2. Lam.6 with very fine denticles all over the surface. Both maxilla and the mandibles have very short, stout apical teeth. Head with 4 + 4 postlabial setae. Macrochaetae strong, smooth. On abd.4–6 the macrochaeta $M_1$ is 2.7–2.8 as long as inner length of the last claw. The setae of the p-rows of the tergites are of very different length (heterochaetotic). Macrosensilla thin and setaceous, distributed as 43/2228. The median sensilla of th.2–3 and the hind corner sensillum of th.2 are all set well in front of

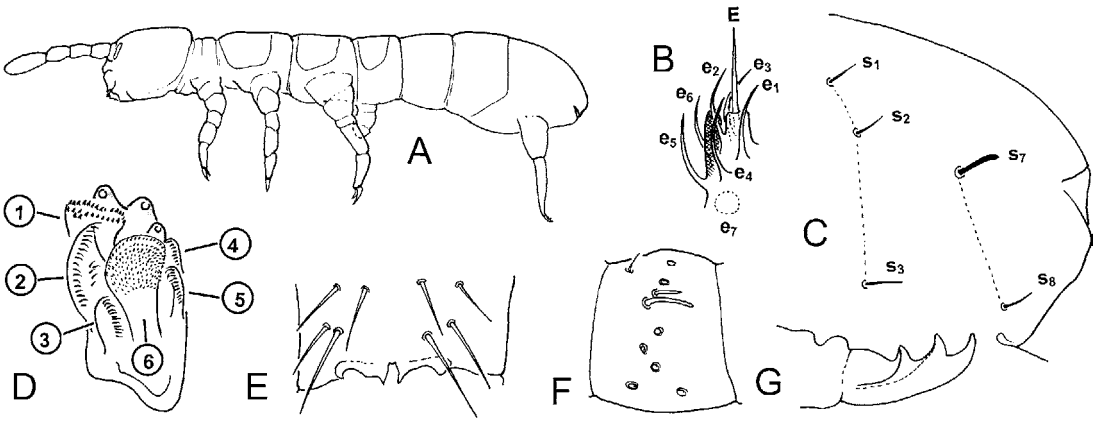


Fig. 30. *Folsomia fimetarioides*: (A) Habitus; (B) labial papilla E, guard $e_7$ absent; (C) sensilla on abd.4–6; (D) maxilla; (E) ventroapical setae on dens; (F) ventral sensilla on left ant.1; (G) mucro.

the p-row. Median sensilla of abd.1–3 set in the p-row. One of the macrosensilla on abd.4–6 enlarged (Fig. 30C). Microsensillum only present on th.2 (10/000). Thorax without ventral setae. Ventral tube with 4–5 distal setae on each side, and 5–6 posterior setae. Furca strong, dens longer than manubrium, with more than 20 anterior setae and only 3 posterior setae, all basal. Mucro 3-toothed with lateral lamella running on the outer side from the basal tooth and on the inner side from the subapical tooth. Manubrium with up to 10 ventroapical setae (Fig. 30E). Dorsal side as in *microchaeta* (Fig. 29I), setae $ml_1$ and $l_2$ present. All tibiotarsi with some additional D-setae at base. Claws simple, unarmed.

*Discussion.* – The 3-toothed mucro at once identifies the species from all other *Folsomia* in our area. Also the single large sensillum on abd.4–6, the maxilla (reduced lam.1) and the peculiar arrangement of sensilla on the tergites are characteristic traits.

*Distribution and ecology.* – An eastern species, widespread in Sweden and Finland, not observed in other Nordic countries. Usually in mixed forest litter, mostly coniferous. General distribution: Palaearctic.

## Genus *Folsomina* Denis, 1931

*Folsomina* Denis, 1931, Boll. Lab. Zool. gen. agr. R. Scuola Agric. Portici 25: 128. Type species: *Folsomina onychiurina* Folsom, 1931, by original designation.

One Nordic species present.

### 203. *Folsomina onychiurina* Denis, 1931

Fig. 31A–F

*Folsomina onychiurina* Denis, 1931, Boll. Lab. Zool. gen. agr. R. Scuola Agric. Portici 25: 128.

*Description.* – Body size 0.5 mm. White, PAO and ocelli absent (Fig. 31C). Abd.4–6 fused. Body shape like a slender, cylindrical *Folsomia*. Ant.1 with two ventroapical (on slim, one thick) sensilla and one dorsal and one ventral microsensillum near base. Ant.2 with one ventrolateral sensillum and one dorsal and one ventral microsensillum near base. Ant.3 organ normal. Ant.4 apically with 5 thick curved sensilla and two large leaf-like sensilla (Fig. 31F). Labrum with 554 setae, 4 prelabrals. Labral edge with 4 back curved spines. Labium with a complete set of papillae, proximal setae 3, papilla E with 6 guards ($e_7$ absent). Labial base with 4 median and 5 lateral setae. Head with 3 + 3 postlabial setae. Mandibles normal, strong. Maxilla (Fig. 31D) with longest lamella passing tip of capitulum. Lam.1 with apical and subapical fringes of cilia. Lam.6 with apical ciliation and a denticulate proximal field. Lam.2–5 with

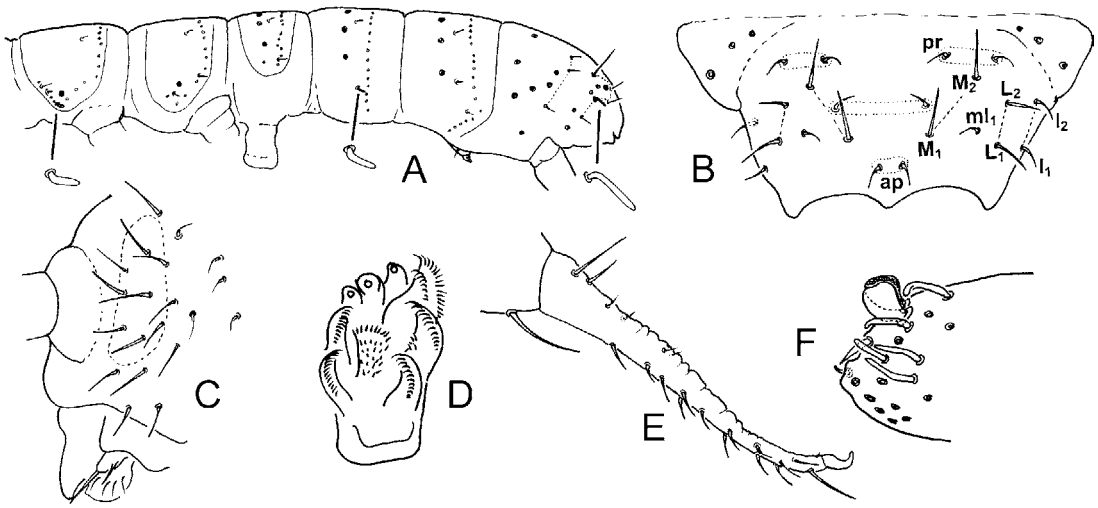


Fig. 31. *Folsomina onychiurina*: (A) Distribution of sensilla and macrochaeta; (B) dorsal chaetotaxy of manubrium; (C) head with setae occupying the area where PAO is present in related genera (position indicated); (D) maxilla; (E) dens; (F) tip of ant.4 with two enlarged flattened sensilla.

marginal ciliation only. Body macrochaetae distinct, on th.2–3 only the lateral macrochaetae are developed. $M_1$ on abd.4–6 about 2.5–3.0 as long as inner edge of last claw. Macrosensilla distributed as 33/2228 (Fig. 31A). Lateral sensillum on th.2 and abd.2 thickened, like $S_8$ on abd.4–6. Spinelike microsensilla as 10/001. No ventral setae on thorax and abd.2. Ventral tube with $1 + 1$ frontal, $4 + 4$ lateral and 4 caudal setae. Retinaculum with $4 + 4$ teeth and one seta. Manubrium ventrally with $1 + 1$ long apical setae. Dorsal chaetotaxy of manubrium as Fig. 31B, $1 + 1$ apical setae and $ml_1$ present. Dens about 1.5 as long as manubrium, dorsal side with 4 basal setae, two in the middle and one subapical rudimentary seta near base of mucro (Fig. 31E). Mucro hooked, without teeth. Tibiotarsi with 7 apical setae. Claws simple, without teeth on unguis and unguiculus.

*Discussion.* – An unmistakable species with the hooked simple mucro, the two enlarged apical sensilla on ant.4, and the absence of PAO.

*Distribution and ecology.* – Probably introduced in Europe and established in greenhouses (Potapov, 2001). In our area only from Iceland where it appears to be naturalised in warm soils near hot springs and fumaroles (Geysir and Myvatn, several records, A. Fjellberg leg.). General distribution: Cosmopolitan.

## Genus *Isotomodes* Axelson, 1907

*Isotomodes* Axelson, 1907, Acta. Soc. Sci. fenn. 34: 129. Type species: *Isotoma producta* Axelson, 1906, by monotypy.

The three Nordic members of this genus are quickly recognised by their unusually elongated body shape with an abruptly curved profile of the last abdominal segments which bear some long macrochaetae (Fig. 32A).

### Key to species

1 Median field of abd.5 with $5 + 5$ short setae only (Fig. 33C). Dens with two ventroapical setae (Fig. 33B) . . . . . 205. *bisetosus* Cassagnau

– Median field of abd.5 with macrochaeta or spines in addition to the $5 + 5$ short setae. Dens with one or two ventroapical setae . . . . . 2

2 Abd.5–6 with short, spine-like macrochaetae (Fig. 33A). Dens with two ventroapical setae (as Fig. 33B) . . . . . 206. *armatus* Naglitsch

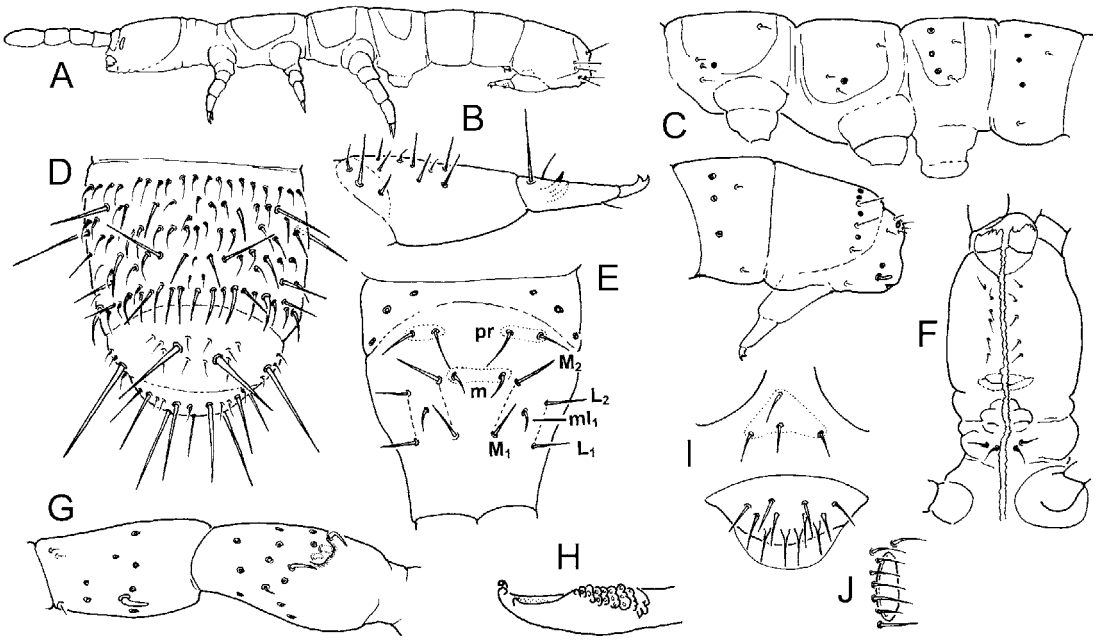


Fig. 32. *Isotomodes productus*: (A) Habitus; (B) furca; (C) distribution of sensilla and macrochaetae on th.2–abd.2 (above) and abd.3–6 (below); (D) dorsal setal cover of abd.4–6; (E) dorsal chaetotaxy of manubrium; (F) ventral side of head and th.1; (G) sensilla of right ant.2–3; (H) mandible; (I) labrum and frontoclypeal field (encircled); (J) PAO.

– Abd.5–6 with long, slender macrochaetae (Fig. 32D). Dens with one ventroapical seta (Fig. 32B) . . . . . 204. *productus* (Axelson)

## 204. ***Isotomodes productus*** (Axelson, 1906)

Figs 2M, 32A–J

*Isotoma producta* Axelson, 1906, Acta Soc. Fauna Flora fenn. 28: 11.

*Isotoma elongata* Axelson, 1903, nec MacGillivray, 1896.

*Description.* – Size 0.9 mm. White, ocelli absent. Body shape long and slender, profile of abd.5–6 strongly down curved (Fig. 32A). PAO elongate, rather large, with many setae along posterior edge. Ant.1 with 12 ordinary setae, dorsal side with two microsensilla near base, ventral side with two apical long sensilla and one basal microsensillum. Ant.2 with 3 basal microsensilla (two dorsal, one ventral) and one long ventrolateral sensillum. The two middle sensilla of the ant.3 organ covered by an integumentary fold, flanked by one guard sensillum on each side. A short sensillum present in lateral position (Fig. 32G). Ant.4 without apical papillae, with many curved, moderately thickened sensilla. Labrum with 444 thin, unmodified setae. Prelabrals absent, frontoclypeals 4 (Fig. 32I). Maxillary palp simple, one sublobal hair. Labial palp with 4 apical papillae, papilla C is lost (Fjellberg, 1999). Each papilla with two guard setae only. Proximal setae 3. Basal labial fields with 4 + 5 setae. Head with 4–5 postlabial setae. Mandibles short, with strong apical teeth and a small molar area with a few coarse cups set on transverse ridges (Fig. 32H). Maxillary head with 3 teeth. The maxillary lamellae short, with fine denticles, not projecting beyond tip of the maxillary head. Body hairs in general short an fine, smooth. Macrochaetae moderately developed in anterior part of the body, becoming longer towards tip of abdomen. In particular the 1 + 1 median macrochaetae on abd.5 are stiff and spine-like (Fig. 32D). Sensillary chaetotaxy of th.2–abd.3 as 43/222, of which one in the anterolateral group of th.2 is a microsensillum (Fig. 32C). The upper sensilla on abd.1–3 are set in the p-row. The lower sen-

sillum on abd.2 is set in ventrolateral position, near anterior edge of the segment. Abd.4 has one short lateral sensillum, and two long, thin setae in the p-row which possibly are sensilla. Abd.5 has two short (one thicker than the other) lateral sensilla and 5 short setae around each of the median macrochaetae, which may also be sensilla. Abd.6 also has several short sensilla-like setae among the macrochaetae. Head with 5–6 setae along the ventral line (Fig. 32F). Th.1–3 with 223 setae on each side of the ventral line. These setae are absent in small juveniles. Ventral tube with 4 posterior and 4–5 distal setae on each side. Retinaculum with 3 + 3 teeth and one seta. Furca as Fig. 32B, dens with 2 posterior (basal) setae and one anteroapical. The retinacular ridges at base of dens strong, projecting. Mucro with two teeth, no lateral seta. Manubrium without ventroapical setae, dorsal side with 20–22 setae (Fig. 32E). Tibiotarsi with 7 setae in the apical whorl (T-setae absent). Modified apical tenent hairs absent. Claws simple, unarmed. Unguiculus usually shorter on the two first pairs of legs than on the last. Males are not seen in the Nordic samples, but the material is small.

*Discussion.* – Easily identified by body shape and the key characters.

*Distribution and ecology.* – A southern thermophilic species with scattered distribution in warm, dry habitats like seashore meadows, sand dunes and inland rock vegetation and S-exposed slopes with sand or gravel substrate. General distribution: Cosmopolitan.

## 205. *Isotomodes bisetosus* Cassagnau, 1959

Figs 2N, 33B, C

*Isotomodes bisetoseus* Cassagnau, 1959, Vie Milieu 10: 84.

*Description.* – In most characters similar to previous species, but differing by absence of the median pair of macrochaetae on abd.5 (Fig. 33C) and presence of one more apical seta on dens (Fig. 33B). Macrochaetae on tip of abdomen slightly serrated. Males not observed.

*Distribution and ecology.* – A characteristic species in sandy habitats (meadows, sand dunes) along the coast. No inland records. Sometimes together with *productus*, but distributed further to the north. General distribution: Holarctic.

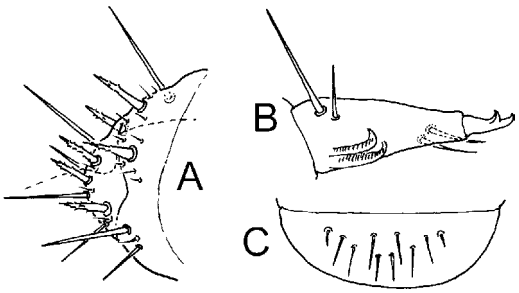


Fig. 33. *Isotomodes armatus* (A) and *I. bisetosus* (B–C): (A) Abd.5–6; (B) dens; (C) dorsal setae on abd.5.

## 206. *Isotomodes armatus* Naglitsch, 1962

Fig. 33A

*Isotomodes armatus* Naglitsch, 1962, Wiss. Z. Karl-Marx-Univ. Leipzig, Math.-nat. Reihe 11 (3): 618.

*Description.* – Size up to 0.7 mm. Similar to previous species, but differing by chaetotaxy of abd.6 which has 4 posterior short spine-like serrated setae, where the other two species have normal long macrochaetae (Fig. 33A). The two median macrochaetae on abd.5 are also spine-like, shorter than in *productus*. Retinaculum with 2 + 2 teeth and one seta (3 + 3 teeth in other species). Dens with two dorsal and two ventroapical setae. Males are seen in a sample from Latvia.

*Distribution and ecology.* – Only a single sample with a few juvenile specimens from farmland at Askov Forsøgsstation in S. Jutland (DK: SJ). General distribution: Palaearctic.

# Genus *Isotomiella* Bagnall, 1939

*Isotomiella* Bagnall, 1939, Entomologist's mon. Mag. 75: 95. Type species: *Isotoma minor* Schäffer, 1896, by original designation.

The single Nordic species is usually identified already under low magnification by its white colour, absence of eye-spots and long abdominal macrochaetae. The absence of the postantennal

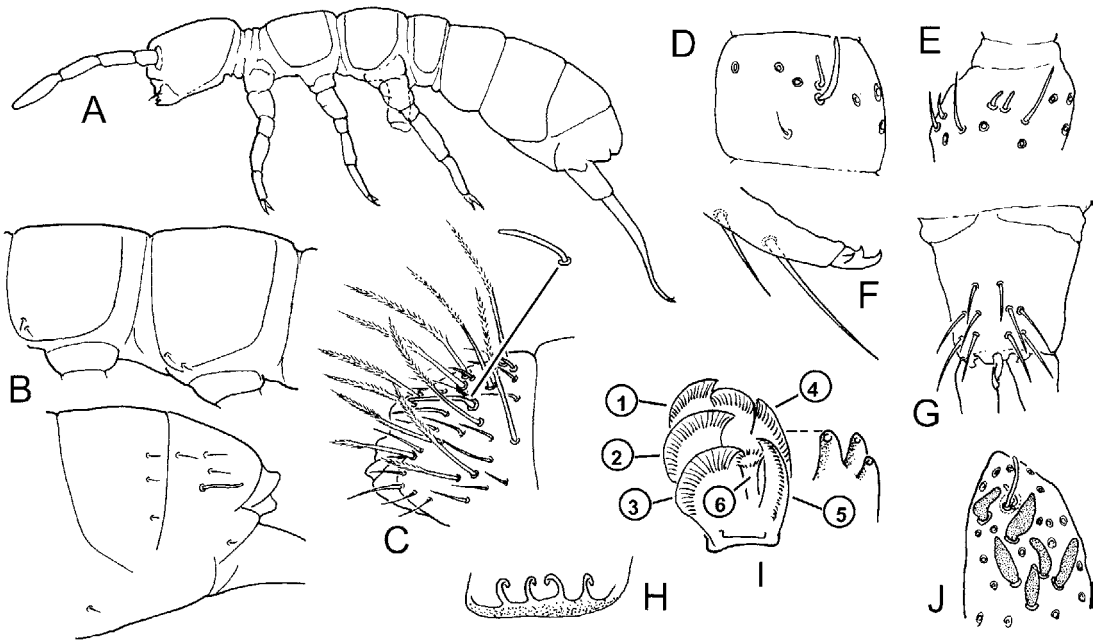


Fig. 34. *Isotomiella minor*: (A) Habitus; (B) distribution of sensilla on th.2–3 (above) and abd.3–6 (below); (C) abd.5–6 with detail of enlarged sensillum; (D) ventral sensilla on ant.1; (E) ant.3 organ; (F) mucro and apical part of dens; (G) manubrium, ventral; (H) apical papillae of labrum; (I) maxilla; (J) apical part of ant.4.

organ is shared only with *Folsomina* among our Isotomidae.

## 207. ***Isotomiella minor*** (Schäffer, 1896)

Fig. 34A–J

*Isotoma minor* Schäffer, 1896, Mitt. naturhist. Mus. Hamb. 13: 182.

*Description.* – Size up to 1.1 mm. White, eyes and postantennal organ absent. Body shape like a typical *Isotoma* (Fig. 34A). Ant.1 with two ventroapical sensilla (one enlarged, Fig. 34D), about 18 ordinary setae and two basal microsetae (dorsal, ventral). Ant.2 with many ordinary setae and two basal microsetae (ventral, dorsal), no sensilla. Sensorial organ of ant.3 consists of two slender, freely exposed sensilla flanked by long guard setae, and two ventrolateral short sensilla (Fig. 34E). Ant.4 with many curved slender sensilla and a distinct group of usually 6 thick apical sensilla in dorsolateral position. The apical organ of ant.4 consists of a short straight sensillum and a long curved sensorial hair (Fig. 34J). Apex of ant.4 pointed, without apical papillae. Labrum with three rows of 544 setae, of which the anterior four are spine-like enlarged. Anterior labral edge with 4 slender, back curved papillae (Fig. 34H). Prelabral setae 4. Frontoclypeal field with 6 setae. Labial palp with a complete seta of papillae and guard setae. Terminal sensilla of papillae A and B blunt-tipped. Proximal setae 3, basal fields with 4 + 5 setae. Head with 3 postlabial setae. Maxillary palp bifurcate, with 4 sublobal hairs. Mandibles strong, of normal shape. Maxillary capitulum with 3 strong teeth. Maxillary lamellae 1–5 with long marginal ciliations only, no denticulate fields. Lam.6 much reduced (Fig. 34I). Head, thorax and the two first abdominal segments with an elaborate dorsal system of branched integumentary channels which connect to the ventral side of the body and coxal parts of the legs. General cover of body hairs strong, with smooth setae. Macrochaetae long, coarsely serrated (1 + 1 in anterior corners of th.2–3, 3 + 3 on abd.1–4, higher numbers on the fused segments of abd.5–6). In addition some of the longer ordinary setae of abd.4–6 and basal

parts of the legs are serrated. Number of dorsal sensilla reduced in anterior part of the body, corresponding to the formula 22/00135 (Fig. 34B). No microsensilla. Abd.5–6 fused, one of the sensilla enlarged (Fig. 34C). Ventral side of thorax without setae. Ventral tube on each side with 3–4 frontal setae and 4–5 lateroapical setae. Back side with 4–5 setae. Retinaculum with 4 + 4 teeth and one seta. Furca long and slender. Manubrium usually with 10 ventral setae (Fig. 34G). Manubrial thickening blunt. Dens long, ringed. Dorsal side with 6 setae in the basal 1/3 only. Ventral side with numerous setae, distal hair prolonged. Mucro 3-toothed, without lateral seta (Fig. 34F). Tibiotarsi with 7 distal setae (T-setae absent). Tenent hairs not developed. Claws and unguiculi simple, untoothed. Males not observed.

*Distribution and ecology.* – One of the most common Nordic species in a variety of habitats, apparently with a preference for humid forest soils. Not in high mountains, uncommon in the Arctic. General distribution: Holarctic.

## Genus *Archisotoma* Linnaniemi, 1912

*Archisotoma* Linnaniemi, 1912, Acta Soc. Sci. fenn. 40 (5): 118. Type species: *Isotoma besselsi* Packard, 1877, by monotypy.

All species of this genus have a slender, cylindrical body shape. They live in the marine littoral zone, the smaller ones are interstitial among sand and may occur some distance away from the wet zone. Like other species living in close contact with water, they show peculiar morphological adaptations affecting the extremities and mouth apparatus.

The sensorial equipment of the antennae is similar in all species. Ant.1 has two small ventral sensilla. Ant.2 without sensilla. The two main sensilla of the ant.3 organ are associated with two dorsal guard sensilla and one small ventral sensillum. The lower (ventral) guard is absent (Fig. 35H). Ant.4 has many curved, moderately thickened sensilla and an apical organ consisting of two ventrolateral sensilla and two guards (Fig. 35F). The antennal tip is blunt with two indistinct lobes. Mandibles of all species are normal, with strong molar plates and a slender distal part with teeth at apex. The maxillae are modified in all species, with reduction of the toothed maxillary head (capitulum) and strong development of the lamellae. The external feeding apparatus (labrum, labium, maxillary outer lobe, hypostomal setae) forms a vestibule in which the individual parts are modified in various ways. In all species labrum has 5-5-4 setae, and the two anterior rows (a, m) are integrated at the distal edge of the lip. Prelabral setae are always 2, and the frontoclypeal field has 0–8 (or more) setae, depending on species. The labial palps are modified in all species, with increased number of setae in the proximal, basomedian and basolateral fields (Fig. 35D). Ventral setae are always absent from thorax. Ventral tube with setae only on the lateral flaps. Retinaculum always with 4 + 4 teeth and no seta. Manubrium without ventral setae. Tibiotarsi have a characteristic set of apical setae, but the following interpretation is tentative (Fig. 35Q–S): On tib.1 $A_7$ is lost, while $A_2$ and all four T-setae are present ($A_2$ often spine-like). On tib.2 $A_2$ is lost while $A_7$ and all T-setae are present. On tib.3 $A_2$ is lost and $A_7$ present (usually spine-like). In some species $T_2$ is also lost. Femur of last pair of legs with an apical fleshy spur (Fig. 35P).

### Key to species

1 Dens long, with more than two dorsal and one ventral seta. Ocelli at least 6 + 6 . . . . 2
– Dens short, with two dorsal and one ventral seta (Fig. 37I). Ocelli 2 + 2 . . . . . 213. *quadrioculata* Fjellberg
2 Tib.3 without apical spur ($A_7$ slender, Fig. 35S) . . . . . 3
– Tib.3 with apical spur (Fig. 36F) . . . . . 4
3 Maxillary lam.1, 4 and 6 with long ciliation along the edges (Fig. 35L). Reproductive males unmodified . . . . . 208. *megalops* (Bagnall)
– Maxillary lamellae without distinct ciliations (Fig. 39J). Reproductive males with enlarged antennae and spine-like macrochaetae (Fig. 39I) . . . . . 209. *pulchella* (Moniez)
4 Small species (0.5 mm), no frontoclypeal setae, only two prelabral setae (Fig. 37G) . . . . . 5

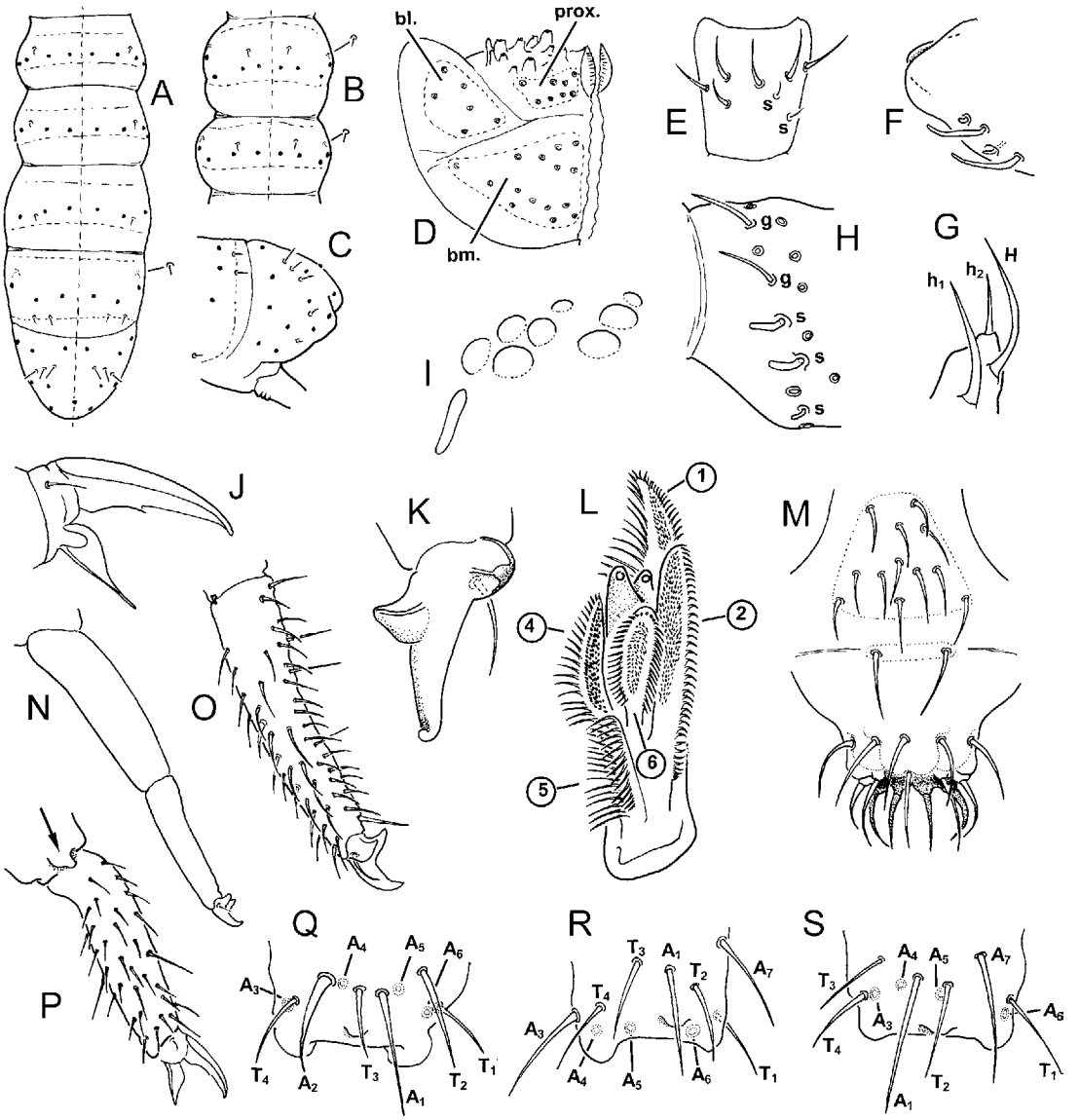


Fig. 35. *Archisotoma megalops*: (A–C) Distribution of sensilla and macrochaeta on abd.1–6 (A), th.2–3 (B), and abd.4–6 (C); (D) right labium with proximal, basolateral (bl.) and basomedian (bm.) fields; (E) ventral sensilla (s) on ant.1; (F) sensilla on tip of ant.4; (G) hypostomal papilla; (H) left ant.3 organ with three sensilla (s) and two guards (g); (I) left PAO and eye-field; (J) claw; (K) mucro; (L) maxilla; (M) labrum with two prelabral setae and frontoclypeal field encircled; (N) furca; (O) dens and mucro; (P) left hind leg with fleshy spur on femur marked (arrow); (Q–S) apical chaetotaxy of left tib.1 (Q), tib.2 (R), and tib.3 (S).

– Larger species (>0.6 mm), frontoclypeal field at least with two setae above the prelabral pair (Fig. 38E) . . . . . 6

5 Mucro normal, with 3 strong teeth, much less than half the length of dens. Mucronal seta absent (Fig. 37E, F)
. . . . . 211. *theae* Fjellberg

– Mucro strongly in-curved, about half as long as dens, inner basal tooth very small

(Fig. 39K–M). Mucronal seta present
. . . . . 212. *martae* Fjellberg & Jucevica

6 Abd.5–6 with trichobothria $t_a$, $t_m$, $t_p$ set in transversely oblique rows (Figs 2L, 36B). Maxillae at least with 4 distinct lamellae (Fig. 36C). Capitulum with 2 apical teeth
. . . . . 7

– Abd.5–6 with $t_a$ and $t_m$ set almost longitudinally (Fig. 39A). Maxillae only with 3 lamellae. Capitulum forming a long, simple stylet (Fig. 39C, D)
. . . . . 215. *interstitialis* Delamare

7 Frontoclypeal field with 2–3 setae. Maxillary lam.2 with "striate" inner side (Fig. 36C). Th.2 with dorsal sensilla much longer than surrounding setae (Fig. 36D)
. . . . . 210. *besselsi* (Packard)

– Frontoclypeal field with 4–8 setae (Fig. 38E). Max. lam.2 "flossy" (Fig. 38A). Dorsal sensilla on th.2 not longer than surrounding setae
. . . . . 214. *polaris* Fjellberg & Poinsot

## 208. ***Archisotoma megalops*** (Bagnall, 1939)

Fig. 35A–S

*Archisotoma megalops* Bagnall, 1939, Entomologist's mon. Mag. 75: 99.
*Archisotoma subbrucei* Delamare Deboutteville, 1953.

*Description.* – Size up to 1.5 mm. Colour greyish brown. Ocelli large, two posterior reduced in size. PAO narrow (Fig. 35I). Ventroapical sensillum on ant.1 much shorter than surrounding setae (Fig. 35E). Labrum with 554 setae, anterior two rows set close to apex. The 2 + 2 anterolateral setae thicker than others (Fig. 35M). Frontoclypeal field with up to 15 setae (Fig. 35M). The 4 sublobal hairs on the maxillary outer lobe are set apart, not rooted in a bundle. Hypostomal setae simple, unmodified, not prolonged (Fig. 35G). Ventral side of head with many postlabial setae along each side of the ventral line. Maxillae modified, with strongly developed lamellae (Fig. 35L). Maxillary head with 2 apical teeth. Lam.1–2 reaching beyond tip of maxillary teeth. Lam.1 with long and coarse ciliation along dorsal edge. Ventral edge with finer ciliation. Inner side with a narrow field of fine denticles in apical part. Lam.2 with an extensive field of fine denticles on the inner side, ventral edge with long ciliation. Lam.3 appears lost. Lam.4 with long ciliation along dorsal edge, inner side with an extensive field of spine-like denticles. Lam.5 flap-like, with long, delicate marginal ciliation only. Lam.6 with long marginal ciliation and a narrow field of denticles on the inner face. Body with a dense cover of short hairs, macrochaetae are clearly differentiated on the fused abd.5–6 but hard to detect on the other tergites. On each side of the fused abd.5–6 are 4 long, erect sensilla and one short sensillum (Fig. 35C). Other sensilla of the tergites are hard to distinguish, but apparently there are 2 + 2 in the p-row of abd.4 and one on each side near the anterior corner of abd.4, 1 + 1 on abd.1–3 which are set in mid-tergal position on abd.1–2 and just in front of the p-row on abd.3. Th.2–3 with a short sensillum in the anterior dorsolateral corner, outside the macrochaeta, and 1 + 1 in mid-tergal position. These mid-tergal sensilla on thorax are slightly shorter than surrounding ordinary setae. (Fig. 35A, B). Ventral tube with 6–8 setae on each side. Furca strong, dens with numerous dorsal and ventral setae almost to the base (Fig. 35N, O). Mucro with lateral seta (Fig. 35K). Tibiotarsi with a distinct outer macrochaeta in the middle part (Fig. 35P). Tib.3 without apical spur-hair (A7 slender, Fig. 35S). Claws variable, inner tooth absent or present (Fig. 35J).

*Discussion.* – The species has a much less advanced mouth apparatus than other Nordic species in this genus. The apical setae of labrum are less modified, the sublobal hairs of the maxillary outer lobe are not set close together and the hypostomal setae are unmodified. Compared to other species the maxilla has stronger capitulum and more extensive denticulate fields on lam.1, 2 and 4. Also the sensillary set on the tergites are less reduced than in other species of the genus. All this points to a plesiomorphic status of the species.

*Distribution and ecology.* – Scattered records from the coasts of Denmark and Norway, also from Iceland, Faroes and Svalbard. Not seen in samples from Sweden and Finland. May occur in large swarms at low tide on seashores with an abundance of seaweeds and organic deposits. General distribution: Palaearctic.

## 209. *Archisotoma pulchella* (Moniez, 1890)

Fig. 39I, J

*Isotoma pulchella* Moniez, 1890, Revue biol. N. Fr. 2: 431.
? *Archisotoma vareli* Sterzynska & Ehrnsberger, 2000.

*Description.* – A large species, up to 1.9 mm. Similar to *megalops*, but details of the sensillary equipment are unknown. The maxillae (Fig. 39J) and the characteristic epitokous males with extremely developed antennae (Fig. 39I) easily identify the species. The long maxillary lamellae (1, 2, 4, 6) are densely covered with fine denticles while the marginal ciliations are reduced.

*Discussion.* – The slender $A_7$ seta on tib.3 is shared only with *megalops*, but *pulchella* differs by having maxillary lamellae without long ciliation. The peculiar antennae of the reproductive males are unique. The recently described species *A. vareli* Sterzynska & Ehrnsberger, 2000 from the German North Sea coast near Wilhelmshafen is not clearly distinguished from *pulchella* and may be a junior synonym.

*Distribution and ecology.* – On muddy and sandy tidal flats. Although not yet recorded, the species is very likely present along the west coast of Jutland as it is found on the German North Sea coast as far north as Sylt. General distribution: Palaearctic.

## 210. *Archisotoma besselsi* (Packard, 1877)

Figs 2J–L, 36A–H

*Isotoma besselsi* Packard, 1877, Am. Nat. 11: 52.
*Isotoma janmayensis* Wahlgren, 1900.

*Description.* – Size up to 1.5 mm, sexually mature from about 0.8 mm. General body shape as Fig. 36A. Colour greyish brown, often very dark. Ocelli 8 + 8, of normal size, two posterior ones reduced in size. PAO narrow elongate. The ventroapical sensillum on ant.1 as long as surrounding setae. Labrum as Fig. 36E. Labral setae $a_2$ set on strong basal papillae, recurved (Fig. 36E). Hypostomal setae enlarged and modified, seta H strongly hooked (Fig. 36G). Frontoclypeal field with 2–3 setae above the two prelabrals. Maxillary outer lobe with simple palp and 4 sublobal hairs, of which three are set close together in a bundle. Head with 8–9 postlabial setae on each side along ventral line. Maxillae (Fig. 36C) strongly modified, with a small hook-like capitulum which has two apical teeth. Lam.1 and 2 much longer than capitulum. Dorsal edge of lam.1 with a fringe of coarse ciliations. Ventral edge fringed with much finer cilia. Apical 1/3 of the lamella on the inner sides densely covered with fine short cilia ("flossy" appearance). Dorsal edge of lam.2 with some coarse ciliation at base, otherwise with several parallel fringes of short cilia. Inner side "flossy", densely covered with minute cilia. Lam.3 absent. Lam.4 with fine marginal ciliations only. Lam.5 flap-like, with long delicate ciliation. Lam.6 narrow, without marginal ciliations, covered with short denticles. Body hairs short, macrochaetae only clearly differentiated on abd.5–6. The sensilla on the tergites of thorax and anterior abdomen are poorly differentiated, the only visible ones are 2 + 2 on th.2: One in the anterior corner and one in the middle of the tergite which are curved and much longer than the surrounding setae (Fig. 36D). Abd.4–6 with a sensillary complex as Fig. 36B. Those on abd.6 are erect, those on abd.4–5 are curved. The upper ones on abd.5 are set in the p-row. Ventral tube with 5–7 setae on each side. Furca strong, dens with many dorsal and ventral setae. No ventral setae in the basal 1/3. Mucro with lateral seta. Apical chaetotaxy of tibiotarsi as in *megalops*, but tib.3 with spine-like $A_7$ (Fig. 36F). Claws without teeth. Males present.

*Discussion.* – This common species is readily identified by its dark colour, low number of frontoclypeal setae and details of mouthparts and abdominal sensilla.

*Distribution and ecology.* – Widely distributed along the Norwegian coast, also from Iceland and Svalbard. Only scattered records from other Nordic countries. Linnaniemi (1912) reports the species from the shores of Lake Pallasjärvi in Finnish Lappland, more than 200 km from the coast. The record should be verified. General distribution: Holarctic.

## 211. *Archisotoma theae* Fjellberg, 1980

Fig. 37A–H

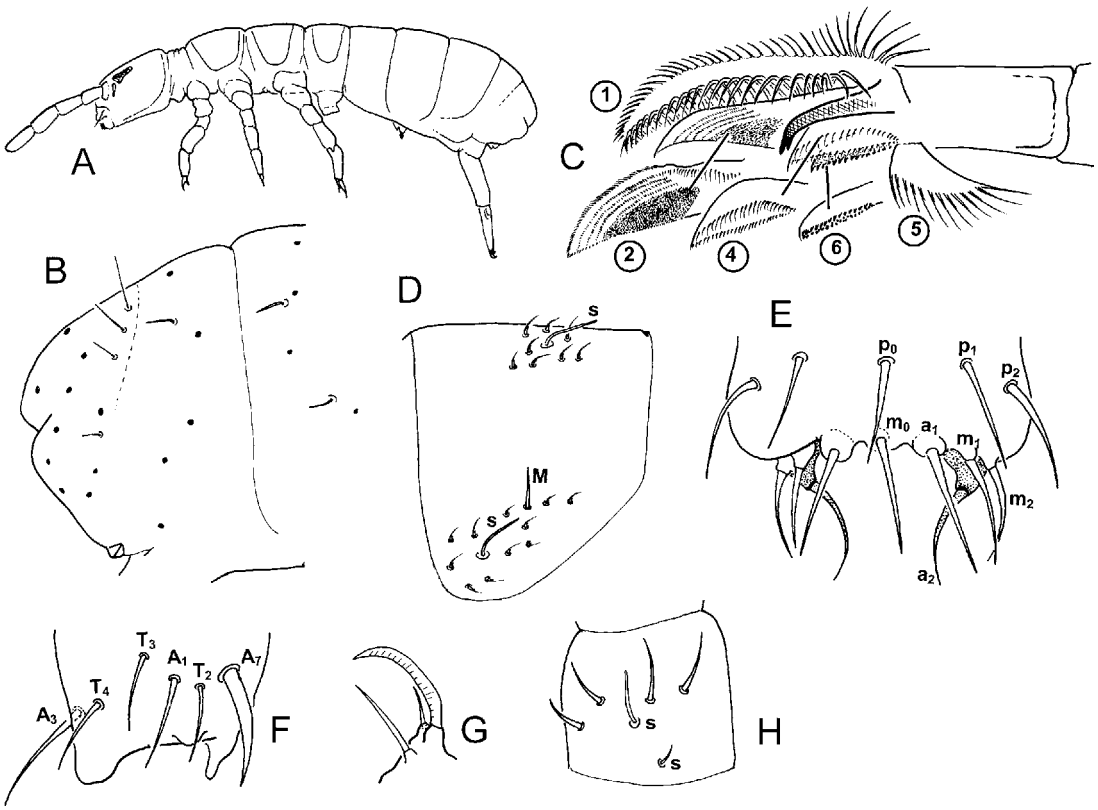


Fig. 36. *Archisotoma besselsi*: (A) Habitus; (B) distribution of sensilla and macrochaetae on abd.4–6; (C) maxilla; (D) sensilla (s) and surrounding setae on th.2; (E) apical part of labrum; (F) apical setae on left tib.3; (G) hypostomal papilla; (H) ventral sensilla (s) on ant.1.

*Archisotoma theae* Fjellberg, 1980, Ent. scand. 11: 154.

*Description.* – Size 0.5 mm. Body with sparse greyish pigmentation. A small, slender species with rather short and thick extremities (Fig. 37A). PAO and ocelli as Fig. 37C, ocelli rather small. Ventroapical sensillum on ant.1 shorter than ordinary setae. Labrum with modified frontal setae, $a_1$, $a_2$ and $m_2$ set on basal sockets (Fig. 37G). Prelabral setae two, frontoclypeal setae absent. The main hypostomal seta hook-like, apex flattened, thin (Fig. 37D). Basolateral field of labium with 5 setae, basomedian with 5–6 setae. Maxillary outer lobe with 4 sublobal hairs of which three are set close together in a bundle. Maxillae strongly modified, capitulum reduced to a short stylet (Fig. 37B). Lam.1 and 2 strongly developed, other lamellae hard to distinguish. Lam.1 with long fringes of cilia along dorsal and ventral edges. Apex with 1–2 short rows of fine cilia on the inner side, no denticles. Lam.2 with a fringe of fine cilia in the basal part of the ventral edge, otherwise smooth. Lam.4 and 6 short and narrow, adpressed to the stylet, appears to be smooth. Lam.5 flap-like, hyaline, hard to detect. Lam.3 appears to be lost. Head with 4–5 postlabial setae on each side of the median line. Body setae very short, macrochaetae and sensilla poorly differentiated. Th.2 with a curved sensillum in the anterior corner, and one short sensillum (not longer than ordinary setae) on each side of the midline of th.2. Sensillary complex of abd.4–5 as Fig. 37H. Abd.4 with short sensilla in dorsolateral and lateral position. Abd.5–6 with one short sensillum in addition to the $3 + 3$ erect ones. Ventral tube with $4 + 4$ lateral setae. Furca as Fig. 37E, F. Dens much shorter than manubrium, with 6 dorsal setae ($2 + 3 + 1$) and 4 ($3 + 1$) ventral setae

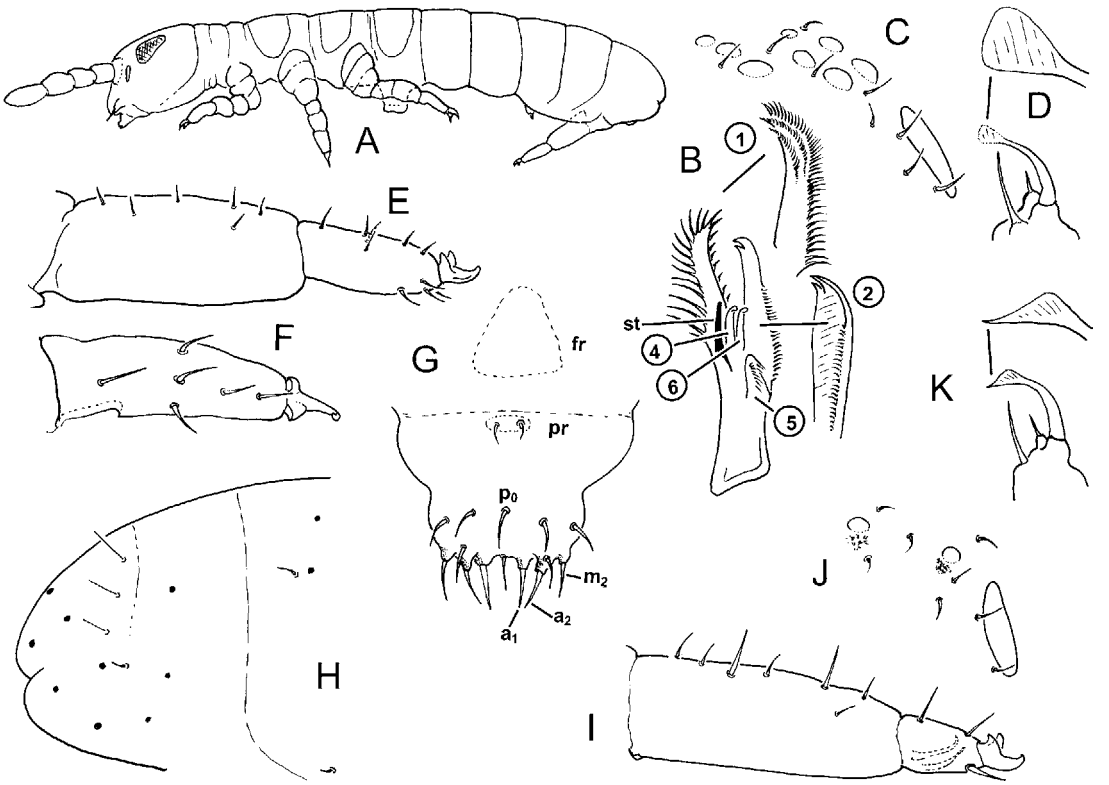


Fig. 37. *Archisotoma theae* (A–H) and *A. quadrioculata* (I–K): (A) Habitus; (B) maxilla (st: stylet); (C) PAO and eyes; (D) hypostomal papilla; (E) furca; (F) dens and mucro, dorsal; (G) labrum with prelabral (pr) and frontoclypeal (fr) fields; (H) distribution of sensilla and macrochaetae on abd.4–6; (I) furca; (J) PAO and eyes; (K) hypostomal papilla.

set in the apical 1/3. Apical chaetotaxy of tibiotarsi as in *besselsi*, tib.3 with $a_7$ spine-like. Inner side of tibiotarsi with only two transverse rows of setae (A and B whorls). No macrochaeta on outer side of tibiotarsi. Claws short, unarmed. Males present.

*Discussion.* – This small full-eyed species is easily identified by absence of setae in the frontoclypeal field and by absence of the mucronal seta. It may easily be taken for a juvenile *besselsi* as the two species often occur together, but juvenile *besselsi* have long dorsal sensilla on thorax (Fig. 36D).

*Distribution and ecology.* – In sandy substrate in the marine littoral zone. Apparently widely distributed, but so far not seen from Finland. General distribution: Palaearctic (including west coast of Greenland). Southernomost record: Greece (Crete).

## 212. ***Archisotoma martae*** Fjellberg & Jucevica, 2000

Fig. 39K–M

*Archisotoma martae* Fjellberg & Jucevica, 2000, Norw. J. Ent. 47: 21.

*Description.* – Size 0.5 mm. Diffusely brownish grey, eye-spots darker. Body slender, tubular, short extremities. Ocelli 8 + 8. PAO elongate, about 3 times longer than nearest ocellus. Body hairs short, macrochaetae not differentiated. Integument with sharp granules. Labrum normal for the genus, frontoclypeal setae absent. Maxilla long and narrow, with capitulum reduced to a small hook-like tooth. Longest lamella with a dorsal and ventral row of delicate cilia. Labial palp with 3 proximal setae. Hypostomal papilla with longest seta apically flattened (as *theae*, Fig. 37D). Ventral tube with 4 + 4 lateral setae. Abd.6 with 3 + 3 erect hair-like sensilla in

transverse rows (as *theae*, Fig. 37H). Furca with a short dens bearing 8 dorsal and 4 ventral setae (set in apical 1/3). Mucro about half as long as dens, incurved (Fig. 39K–M). The inner basal tooth appears as a small hook in the middle of the dorsal edge. Tib.1 and 3 with a dorsoapical thickened $A_7$ seta.

*Discussion.* – The small size, short dens and modified mucro which is half as long as dens, readily identify the species.

*Distribution and ecology.* – Originally described from the Baltic coast of Latvia, and recently (Nov. 2006) collected in sandy seashore meadows near Halmstad (Sweden: Halland). General distribution: Palaearctic.

## 213. *Archisotoma quadrioculata* Fjellberg, 1988

Fig. 37I–K

*Archisotoma quadrioculata* Fjellberg, 1988, Fauna norv. Ser. B 35: 35.

*Description.* – Size 0.5 mm. Body sparsely pigmented, the 2 + 2 ocelli as discrete spots (Fig. 37J). A small, slender species with short extremities. Very similar to *theae*, sharing the characteristics of labrum, frontoclypeal field (no seta), mandible, maxilla, maxillary outer lobe, sensillary equipment of thorax and abd.4–6, ventral tube, tibiotarsal apical chaetotaxy, claws, mucro. Apart from the reduced number of eyes, it differs significantly by the shortened dens with only two dorsal and one ventral seta (Fig. 37I). The hypostomal "hook" is pointed and obliquely expanded at tip (Fig. 37K). Males present.

*Discussion.* – The small size, short furca and presence of only 2 + 2 ocelli readily identify this species, although it may easily be taken for an immature form of other species.

*Distribution and ecology.* – In sandy substrate in the marine littoral zone, sometimes penetrating the meadow zone inside the high tide mark. Apparently common in Norway and Denmark, in Sweden only from the south coast of Scania. No records from Finland. General distribution: Palaearctic.

## 214. *Archisotoma polaris* Fjellberg & Poinsot, 1975

Fig. 38A–G

*Archisotoma polaris* Fjellberg & Poinsot, 1975, Norw. J. Ent. 22: 109.

*Description.* – Size 1.9 mm. Colour paler or darker brownish grey. Ocelli 8 + 8, but G and H are almost completely reduced (Fig. 38F). Ventroapical sensillum on ant.1 shorter than surrounding setae. Labrum as Fig. 38C, setae $a_2$ and $m_2$ are slightly modified. Frontoclypeal field with 4–8 setae. Maxillary outer lobe with 3 of the 4 sublobal hairs set in a bundle (Fig. 38D). Hypostomal hooks moderately developed, curved and simply pointed (Fig. 38B). Maxilla as Fig. 38A. Capitulum reduced to a strong hook with two apical teeth. Lam.1 with long dorsal and short ventral ciliation along the edges. Inner side with some apical striations of very delicate cilia, no denticles. Lam.2 with a blunt tip, ventral edge with fine ciliation which becomes longer towards the base. Apical part "flossy" from very fine ciliation. Lam.3 absent. Lam.4 with short ciliation along dorsal edge, inner side covered with fine denticles. Lam.5 is a membranous flap with very long marginal ciliation. Lam.6 tonguelike, covered with very fine denticles. No marginal ciliation. Body hairs short and fine, macrochaetae poorly developed, only distinct on last abdominal segments. Abd.5 and 6 more clearly separated than in other species. Median sensillum on th.2 subequal to surrounding setae. Sensillary complex of abd.4–6 as in *besselsi* (Fig. 36B). Ventral tube with 6–8 setae on each side. Furca strong, lateral seta present on mucro. Proximal 1/3 of dens free of ventral setae (Fig. 38G). Tib.3 without apical seta $T_4$, seta $A_7$ enlarged. Claws unarmed. Males present.

*Discussion.* – This large arctic species is similar to *besselsi* in most characters, but is recognised by pale colour, increased number of frontoclypeal setae and details of maxilla (lam.2).

*Distribution and ecology.* – In our area only recorded from Spitsbergen (type locality) where it may swarm in enormous numbers on tidal mud flats. Also from Ellesmere Island in arctic Canada. General distribution: Holarctic.

## 215. *Archisotoma interstitialis* Delamare, 1954

Fig. 39A–H

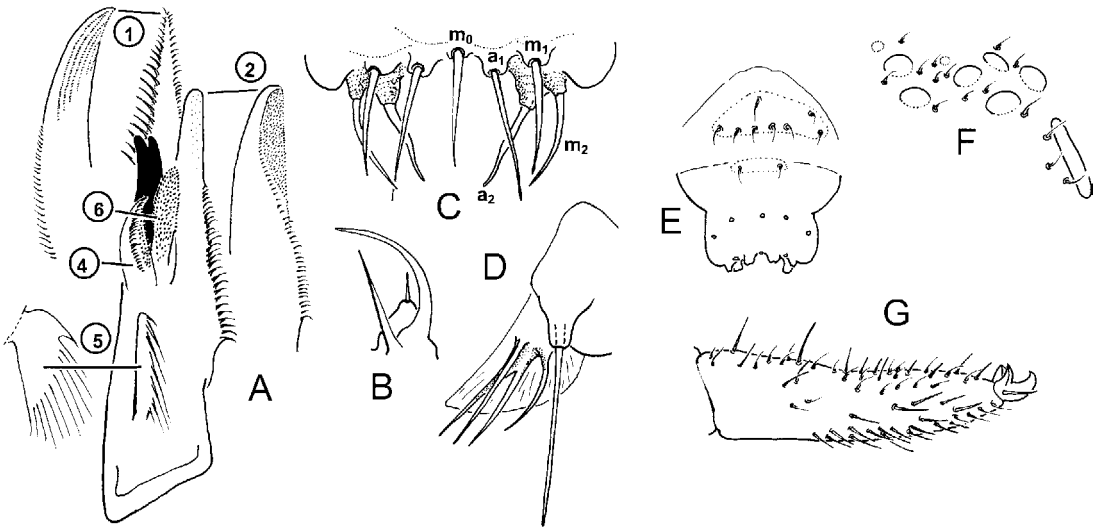


Fig. 38. *Archisotoma polaris*: (A) Maxilla; (B) hypostomal papilla; (C) apical setae of labrum; (D) maxillary outer lobe; (E) labrum with prelabral and frontoclypeal setae marked; (F) PAO and eyes; (G) dens and mucro.

*Archisotoma interstitialis* Delamare, 1954, Vie Milieu 4: 309.

*Description.* – Size 0.6 mm. Pale greyish. Ocelli 8 + 8, G and H not much smaller than others (Fig. 39E). PAO elongate, rather broad. Ant.1 with ventroapical sensillum smaller than surrounding setae. Labrum as Fig. 39H, anterior setae ($a_1$, $a_2$) set on large papillae, but seta not modified. Prelabral setae two, frontoclypeal field with two setae. Hypostomal hooks prominent, slightly expanded at tip (Fig. 39F). Maxillary outer lobe with sublobal hairs set in a bundle. Maxillae strongly modified, consisting of only three lamellae and a styliform capitulum (Fig. 39C). The large lam.1 has a fringe of long ciliation along dorsal and ventral edges, ventral face with several rows of very fine cilia. Lam.2 is similar to lam.1, but only dorsal edge bears a fringe of cilia. The last lamella is interpreted as lam.4 and bears long cilia along ventral and dorsal edges. The two cilia rows have crossing directions and may possibly represent two optically inseparable lamellae (lamellae 4 and 6). None of the lamellae have denticles. The reduced capitulum, in the shape of a simple stylet, reaches the tip of lam.2 and 4. Head with 4–6 postlabial setae along each side of the ventral line. Body hairs short, macrochaetae only differentiated on the last abdominal segments. Sensilla of abd.4–6 as Fig. 39A. Sensilla $t_a$ and $t_m$ very long, subequal, set one after the other. A short, erect $t_p$ is set in lateral position. The dorsal portion of abd.5 very short, with a break in setal cover in front of sensillum $t_a$ (Fig. 39A). Dorsal sensillum on th.2 as long as surrounding setae. Ventral tube with 4 + 4 lateral setae. Furca as Fig. 39B. Dens with about 8 dorsal setae and 10–12 ventral setae. Mucronal seta present. Manubrium with a distinct lateral expansion. Apical setae of tibiotarsi as in *besselsi*, though seta $T_4$ is absent on tib.3 which has a spiniform seta $A_7$. Claws unarmed.

*Discussion.* – The species belongs to a group of mainly southern forms characterised by the peculiar arrangement of sensorial setae on abd.5–6, in which $t_a$ and $t_m$ are set after each other, unlike all other northern species. From southern Sweden (Falsterbo) are samples with individuals being reproductive at 0.5–0.6 mm size which have trichobothrium $t_m$ only half as long as $t_a$ (Fig. 39G). Maxilla does not differ. Possibly an undescribed species.

*Distribution and ecology.* – Probably rare in our area, only a few samples from sandy seashores in Denmark, Norway and Sweden. General distribution: Palaearctic.

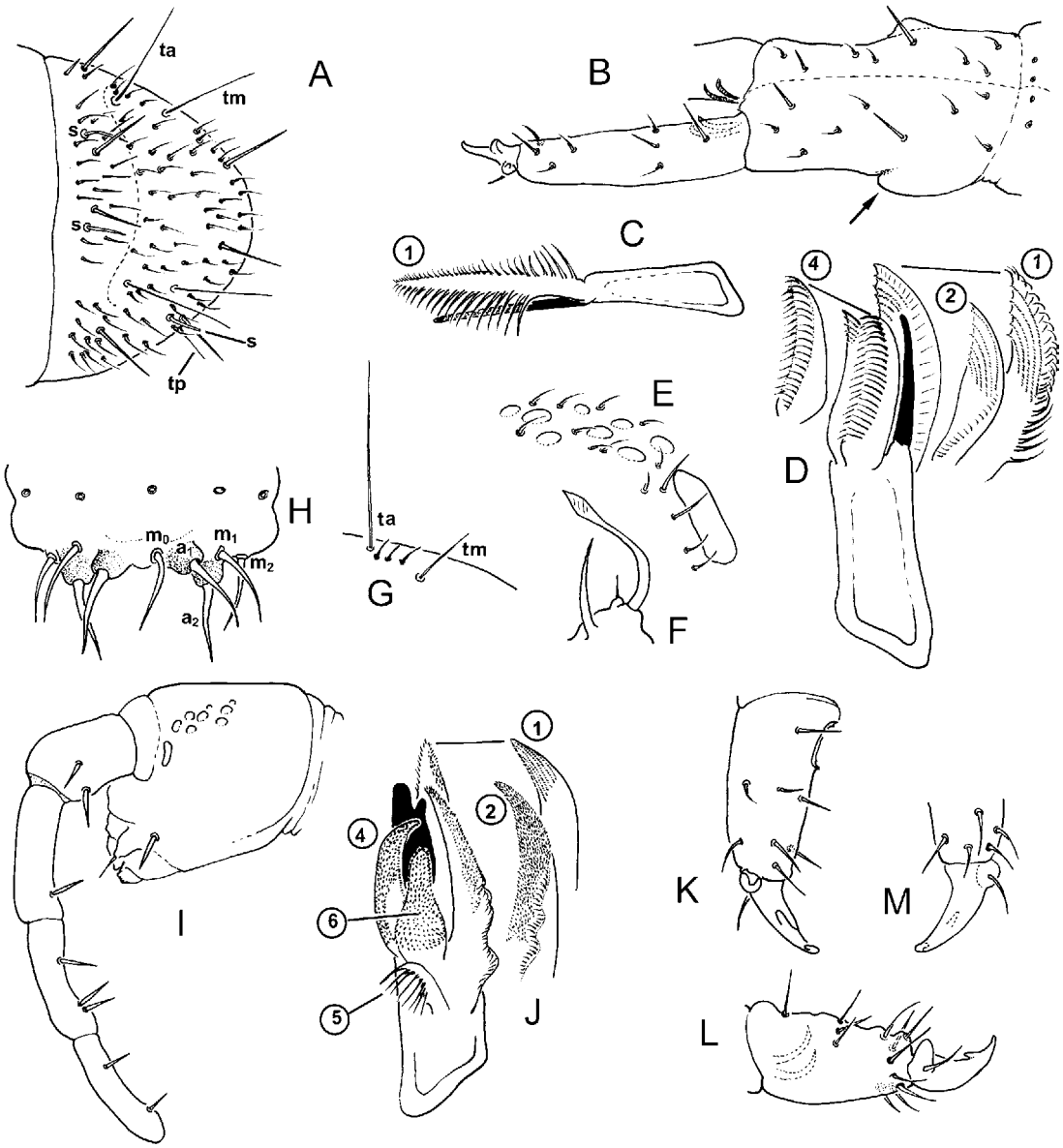


Fig. 39. *Archisotoma interstitialis* (A–H), *A. pulchella* (I–J), *A. martae* (K–M): (A) Chaetotaxy of abd.5–6 (s: sensillum, ta: anterior trichobothrium, tm: median t., tp: posterior t.); (B) dorsal view of furca, note lateral papilla of manubrium (arrow); (C) maxilla, showing outer edge (lateral) of lam.1; (D) maxilla, all lamellae; (E) PAO and eyes; (F) hypostomal papilla; (G) trichobothria on abd.6 in a specimen from Falsterbo, Sweden; (H) apical edge of labrum; (I) head and antenna of reproductive (epitokous) male; (J) maxilla; (K–M) furca in dorsal (K), lateral (L) and ventral (M) views.

## Genus *Folsomides* Stach, 1922

*Folsomides* Stach, 1922, Annls hist.-nat. Mus. natn. hung. 19: 17. Type species: *Folsomides parvulus* Stach, 1922 by original designation.

Members of this genus are easily identified by the long and cylindrical body which has a characteristic "bend" between abd.4–5 (Figs 2H, 40B). Furca present, dens shorter than manubrium. Ocelli 5 + 5 or less. PAO present.

Sensillary complex of the antenna (Fig. 40C) consists of three ventral sensilla on ant.1, three ventral and one dorsal on ant.2, and a normal set on ant.3 (two dorsolateral thick sensilla flanked by guards, one ventrolateral spine-like sensillum). Ant.4 with many curved dorsal sensilla and a subapical organite. Antennal tip blunt, without distinct lobes or bulbs. Labrum with 554 setae, the anterior four stronger than others. Prelabral setae two, frontoclypeal field with a few setae. Maxillary palp bifurcate in Nordic species, with three sublobal hairs. Maxilla and mandibles unmodified. Labial palps unmodified, proximal setae 3. Basomedian field with 4 setae, basolateral with 5. Head with 3 + 3 postlabial setae. Thorax without ventral setae. Ventral tube with 3 + 3 distal setae, two caudal and no frontals. Tibiotarsi in Nordic species with 20-20-22 setae. Inner side of tib.1–2 with an unpaired seta ($B_{4/5}$, Fig. 40E). Seta X on tib.3 not thickened. Claws simple, without teeth. Unguiculus with a basal lamella and a short apical filament. Body tergites in Nordic species with 33/22224 macrosensilla and 10/001 microsensilla (Fig. 40A). Body integument smooth, macrochaetae weak, anal spines absent. Mucro without lateral seta.

The European species were revised by Fjellberg (1992). The three Nordic species are covered by Potapov (2001).

## Key to species

1 Ocelli 5 + 5. Body pigment present or absent . . . . . 2
– Ocelli 2 + 2. Body white, pigment only in eyes . . . . . 218. *parvulus* Stach
2 Pigment present only in eyes. Dens with 3 posterior and one anterior seta. Retinaculum with 4 + 4 teeth . . . . . 216. *angularis* (Axelson)
– Whole body pigmented. Dens with two dorsal setae only. Retinaculum with 3 + 3 teeth . . . . . 217. *marchicus* (Frenzel)

## 216. ***Folsomides angularis*** (Axelson, 1905)

Fig. 40A–F, J, K

*Isotoma angularis* Axelson, 1905, Zool. Anz. 28: 791.

*Description.* – Body shape as Fig. 40B, size up to 0.6 mm. White, apart from the 5 + 5 dark ocelli. PAO and eyes as Fig. 40F. Frontoclypeal field with 3 setae. Maxilla as Fig. 40D, all lamellae shorter than the 3-toothed capitulum. Lam.1–5 with rather coarse ciliation along the edges, no denticles on the inner face. Lam.6 with weak ciliation along anterior edge and a few denticles behind. Body macrochaetae poorly differentiated from ordinary setae, distinct only on the last abdominal segments. Distribution of sensilla as Fig. 40A. The two lower sensilla on abd.5 thicker than the two upper. The upper abd.4 sensillum set at a distance from the macrochaeta (Fig. 40J). Retinaculum with 4 + 4 teeth and one seta. Furca as Fig. 40K, dens with 3 dorsal and one ventral seta. Asymmetric variation in setal number may occur. Mucro 2-toothed.

*Discussion.* – A well-marked species which is identified by the unpigmented body apart from the dark eye-spots bearing 5 + 5 ocelli.

*Distribution and ecology.* – A xeric species which is locally common in dry and warm habitats, in particular in thin mats of vegetation (*Allium*, *Sedum*) on exposed sunny rocks. Not yet recorded from Sweden, but probably present. The species may survive periods of draught by anhydrobiosis. Specimens from East Norway regained their life functions after wetting a soil sample which had been kept dry at room temperature for a period of 16 months (53 adults and subadults were extracted from a handful of soil 32 hours after adding water to the sample). General distribution: Holarctic.

## 217. ***Folsomides marchicus*** (Frenzel, 1941)

Fig. 40M

*Proisotoma marchica* Frenzel, 1941, Märkische Tierw. 4: 321.

*Description.* – Body shape as in *angularis* (Fig. 40B), size 0.9 mm. Colour greyish blue or brown. Ocelli 5 + 5. Maxilla as in previous species, frontoclypeal field with 3–4 setae. Retinaculum with 3 + 3 teeth and one seta. Dens with two dorsal setae only (Fig. 40M).

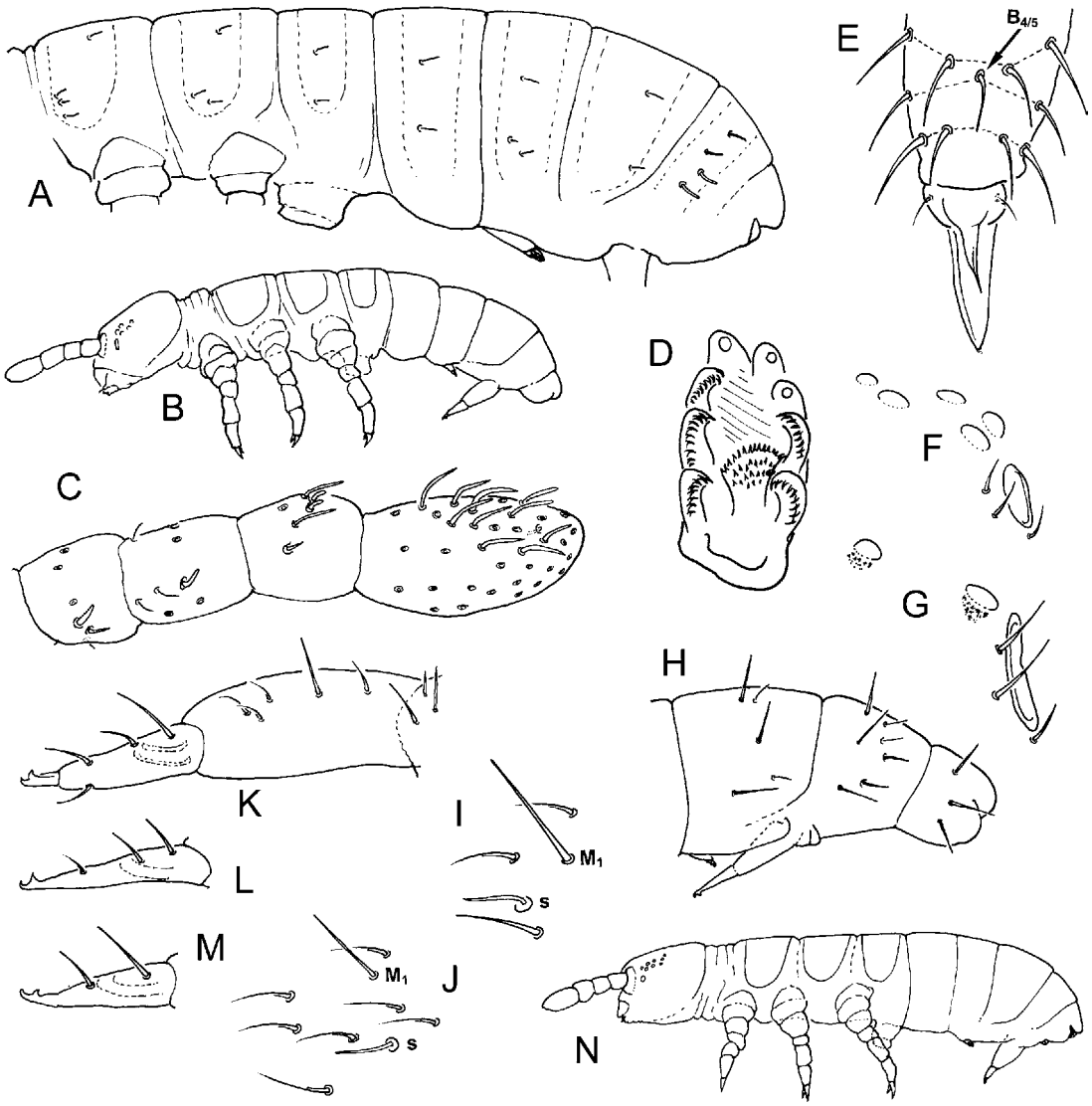


Fig. 40. *Folsomides* spp. (A–M) and *Subisotoma navacerradensis* (N): (A–F) *angularis*, sensillary chaetotaxy (A), habitus (B), antennal sensilla (C), maxilla (D), setae on inner side of tib.2 (E), PAO and eyes (F); (G–I) *parvulus*, PAO and eyes (G), macrochaetae and sensilla on abd.4–6 (H), upper sensillum and macrochaeta on abd.4 (I); (J–K) *angularis*, upper sensillum and macrochaeta on abd.4 (J), furca (K); (L) *parvulus*, dens and mucro; (M) *marchicus*, ditto; (N) *Subisotoma navacerradensis*, habitus.

*Discussion.* – Very similar to *angularis*, but easily distinguished by the pigmented body and reduced number of setae on dens. According to Potapov (2001) the normal number of posterior setae on dens is 3, while two or 2/3 (asymmetric) is sometimes seen. The Nordic specimens invariably have two posterior setae on dens.

*Distribution and ecology.* – The species has been collected in abundance from sparse crevice vegetation on dry calcareous rocks near Möckelmosse at Öland, Sweden. Also from similar habitats from the inner islands of the Oslofjord, Norway. So far there are no other Nordic records. General distribution: Palaearctic.

## 218. *Folsomides parvulus* Stach, 1922

Fig. 40G–I, L

*Folsomides parvulus* Stach, 1922, Annls hist.-nat. Mus. natn. hung. 19: 17.

*Description.* – Body shape very long and tubular, size up to 0.9 mm. Abd.5–6 prolonged (Fig. 40H). PAO narrow elongate. Ocelli 2 + 2 (Fig. 40G). White, dark spots only under the ocelli. Frontoclypeal field and maxilla as in previous species. Macrochaetae well developed, also on anterior abdominal segments. Lower two pairs of sensilla on abd.5 not thicker than upper pairs. The upper abd.4 sensillum set close to the macrochaeta (Fig. 40I). Retinaculum with 3 + 3 teeth, no seta. Furca with long and slender dens which has only 3 dorsal setae, no ventral (Fig. 40L). Mucro with two teeth. Only females are seen. Nordic samples appear always to have 2 + 2 ocelli. In other populations individuals with 1 + 1 ocelli may occur (Fjellberg, 1992).

*Discussion.* – Easily identified by the slender white body with only 2 + 2 ocelli.

*Distribution and ecology.* – Like the two previous species *parvulus* is a xeric form with limited distribution in the Nordic countries, although it is recorded near the Arctic Circle on the Norwegian west coast. Usually found in warm sunny slopes with sand/gravel and thermophilic vegetation. General distribution: Cosmopolitan.

# Genus *Subisotoma* Stach, 1947

*Subisotoma* Stach, 1947: 11. Type species: *Isotoma pusilla* Schäffer, 1900, by original designation.

The single Nordic species differs from all *Folsomides* by a full set of eyes (8 + 8 ocelli), macrosensilla on abd.1–3 set in the p-row and ventral tube with 4 + 4 distal setae. Body shape cylindrical, less slender than *Folsomides*. The absence of ventral setae on manubrium separate this genus from *Proisotoma*. Only one Nordic species.

## 219. *Subisotoma navacerradensis* (Selga, 1962)

Fig. 40N

*Folsomides navacerradensis* Selga, 1962, Publnes Inst. Biol. apl., Barcelona 33: 35.

*Description.* – Size up to 0.6 mm. Body shape as Fig. 40N. A sparse bluish pigmentation present on dorsal side. Maxillary palp bifurcate, with 3 sublobal hairs. Head with two prelabral setae. PAO broad, about twice as long as diameter on an ocellus. Ventral tube with 4 + 4 distal and two posterior setae. Retinaculum with 3 + 3 teeth and one seta. Tib.1–2 with unpaired inner seta $B_{4/5}$ present (20 setae in all), apical tenent hairs simple, not clavated. Claws without teeth. Dens with 2–4 dorsal setae, one ventral. Mucro short, with two teeth.

*Discussion.* – A second species of the genus, *S. pusilla* (Schäffer, 1900) is found in Poland and may show up in the Nordic countries. It differs from *navacerradensis* by simple maxillary palp, 4 sublobal hairs, clavate tibiotarsal tenent hairs and presence of separate $B_4$ and $B_5$ setae on inner side of tib.1–2 (21 setae in all).

*Distribution and ecology.* – Only reported once from Denmark, collected in sand dunes at the Hansted Reserve (Petersen, 1965). – Total distribution: Palaearctic.

# Genus *Cryptopygus* Willem, 1901

*Cryptopygus* Willem, 1901, Annls Soc. ent. Belg. 45: 260. Type species: *Cryptopygus antarcticus* Willem, 1901 by original designation.

Nordic species of *Cryptopygus* are recognised by the following set of characters: Isotomidae with fused abd.5–6, furca fully developed with slender dens and manubrium having 1 + 1 (or 2 + 2, one species) ventroapical setae, mucro with 2–3 teeth and no lateral seta, tibiotarsi with 7 apical setae (T-setae absent). Labial palps unmodified, proximal setae 3, basal fields with 4 median and 5 lateral setae.

Given the definition above *Cryptopygus* comes very close to *Proisotoma*, differing principally by the fusion of the two terminal segments of abdomen. The species now associated with

*Cryptopygus* form a heterogeneous group, some of which are very distant to the type species (*antarcticus*) and will certainly end up in other genera in the future. In the present treatment two species (*clavata* and *nidicola*) are transferred from *Proisotoma* in accordance with the above definition (fused abd.5–6).

## Key to species

1 Ocelli present, dark pigment present at least in the eye-spot . . . . . 2
– Ocelli absent, no pigment . . . . . 5
2 Ocelli 1 + 1, body pigment absent apart from the small eye-spot. Abd.5 with one thickened sensillum on each side (Fig. 41F). Th.3 with 1 + 1 ventral setae . . . . . 220. *bipunctatus* (Axelson)
– Ocelli 7 + 7 or 8 + 8, body with dark pigment. Abd.5 with slender sensilla only. Th.3 without ventral setae . . . . . 3
3 Tip of abd. with macrochaetae having a collar of fine cilia slightly beyond middle (Fig. 43A). Prelabral setae 4, maxillary palp bifurcate . . . . . 221. *thermophilus* (Axelson)
– Tip of abd. with simple macrochaetae, no collar. Prelabral setae 2–3, maxillary palp simple . . . . . 4
4 Tibiotarsi with a knobbed apical seta (Fig. 44G). Mucro with two teeth, dens with more than 10 dorsal and ventral setae. Prelabrals two. Marine littoral species . . . . . 222. *clavatus* (Schött)
– Tibiotarsi with simply pointed apical setae. Mucro with 3 teeth, dens with 5 dorsal and 5 ventral setae. Prelabrals 3. Not marine littoral species . . . . . 223. *nidicola* (Agrell)
5 Dens dorsally with at least 6 setae. Maxillary palp bifurcate . . . . . 6
– Dens dorsally with two setae in basal part and one subapical setula (Fig. 46N). Maxillary palp simple . . . . . 226. *excilis* (Gisin)
6 Abd.5 with 4 thickened sensilla on each side (Fig. 46F). Manubrium with 1 + 1 ventroapical setae. Abd.2 only with one sensillum on each side (Fig. 42) . . . . . 224. *scapellifer* (Gisin)
– Abd.5 with slender, hair-like sensilla only (Fig. 46I). Manubrium in adults with 2 + 2 ventroapical setae (Fig. 46K). Abd.2 with two sensilla on each side (Fig. 42) . . . . . 225. *albaredai* (Selga)

## 220. ***Cryptopygus bipunctatus*** (Axelson, 1903)

Figs 41A–O, 42

*Isotoma bipunctata* Axelson, 1903, Acta Soc. Fauna Flora fenn. 25: 9.

*Description.* – Size 0.7 mm. White, apart form a small dark spot under each of the 1 + 1 ocelli. Body shape slender, *Isotoma*-like (Fig. 41A). Integument smooth, the primary hexagons appear unmodified. PAO narrow, elongate (Fig. 41N). Sensillary equipment of antennae as Fig. 41B. Ant.1 with two unequal ventroapical sensilla and one ventral and one dorsal setula. Ant.2 with one ventroapical sensillum and one dorsal and one ventral setula. Males in addition with 2–3 erect, slender and blunt-tipped sensilla on ventral side (Fig. 41L). Ant.3 with two short apical sensilla flanked on each side by a guard sensillum. A short sensillum also in ventrolateral position. In males this is always associated with a guard sensillum which is usually absent in females (Fig. 41O). Ant.4 with many curved sensilla of which 6–7 are thicker than others. Tip of antenna simple, no apical bulbs. Labrum with 554 unmodified setae. Frontoclypeal field with 4 setae, prelabrals 3 (Fig. 41C). Maxillary palp bifurcate, 4 sublobal hairs. Mandibles normal, unmodified. Maxilla as Fig. 41J. Capitulum with 3 teeth, lamellae with strong ciliations along the edges, no denticulate fields on the inner sides. The ciliations of lam.3, 5 and 6 merge together, forming a veritable "racket" covering the inner side of the maxilla. Lam.6 with two rows of cilia. Head with 3 + 3 postlabial setae. Body hairs smooth, acuminate. Dorsal macrochaetae moderately developed on abd.1–6, on abd.1 about 1.5 as long as surrounding setae. Median macrochaeta on abd.5 about 1.7 as long as inner length of claw 3. Sensilla of the body distributed as Fig. 42. Macrosensillary formula as 33/22232, spine-like microsensilla 10/000. Median pair of sensilla of th.2–3 set in front of the p-row, separated by 3 + 3 normal setae (Fig. 41G). Median pair of sensilla on abd.1–3

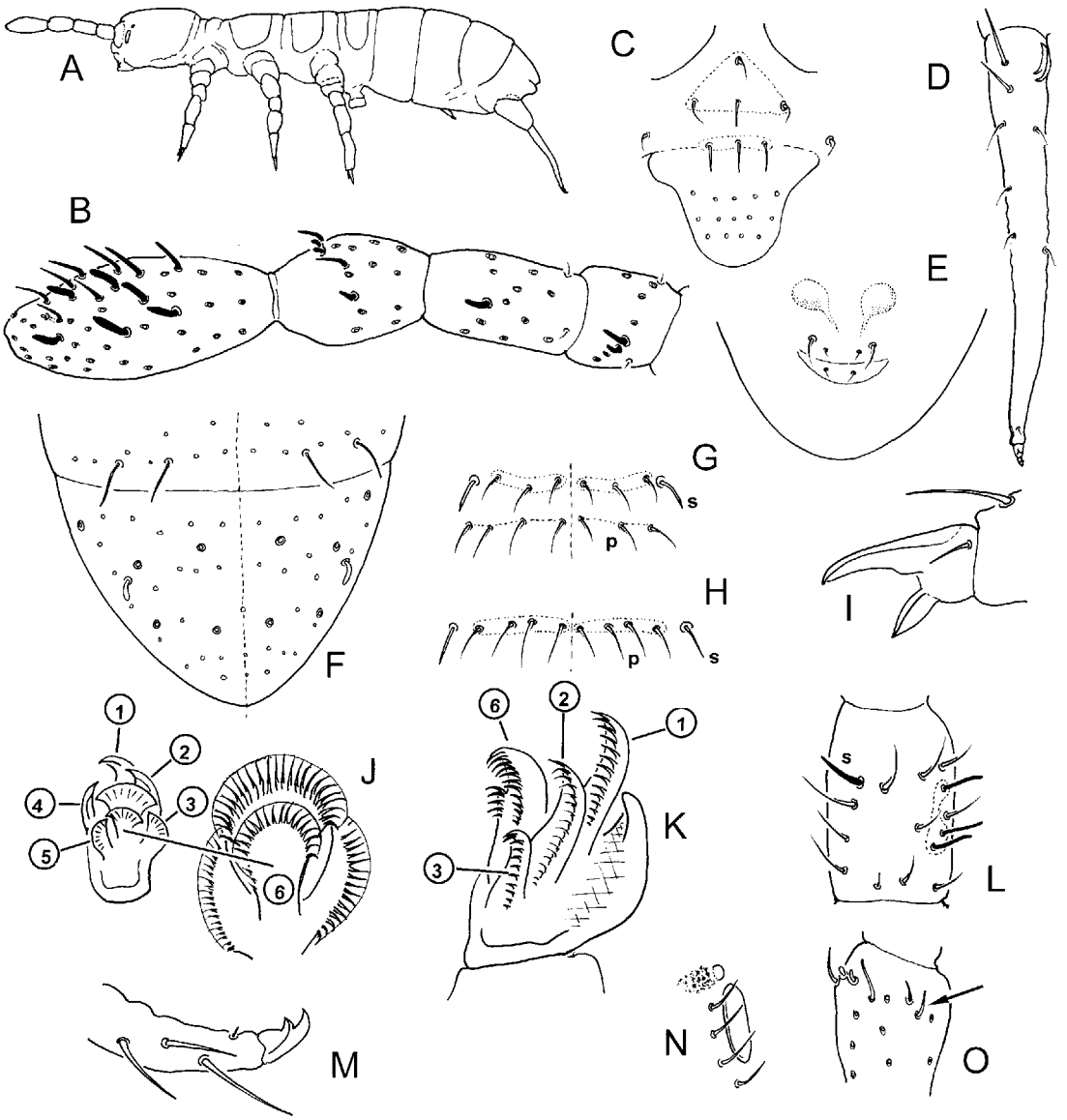


Fig. 41. *Cryptopygus bipunctatus*: (A) Habitus; (B) antennal sensilla; (C) labrum with 3 prelabral and 4 frontoclypeal setae encircled; (D) dorsal setae on dens; (E) genital field of reproductive female with interior vesicles; (F) chaetotaxy layout of abd.4–6; (G–H) median pair of sensilla on th.3 (G) and abd.1 (H); (I) claw; (J) maxilla with detail of "racket" formed by lamellae 3, 5 and 6; (K) left maxilla, ventral view; (L) ventral sensilla on ant.2 with erect male sensilla encircled; (M) mucro and apical part of dens; (N) PAO and eye; (O) right ant.3 organ in male, arrow marks guard sensillum which is absent in females.

set in the p-row, separated by $4 + 4$ normal setae (Fig. 41H). Upper sensillum on abd.5 enlarged, the lower one set just above the genital field (Figs 41F, 42). Th.3 with $1 + 1$ ventral setae. Ventral tube without frontal setae, with $4 + 4$ lateral and 2 caudal setae. Retinaculum with one seta and $3 + 3$ teeth. Furca long, manubrium with $1 + 1$ ventroapical setae. Dens slender, dorsally crenulated, with 25–30 ventral setae and 6–7 dorsal setae in the proximal half, one dorsal setula near apex (Fig. 41D). Mucro with two teeth (Fig. 41M). Coxa 1 with one seta at

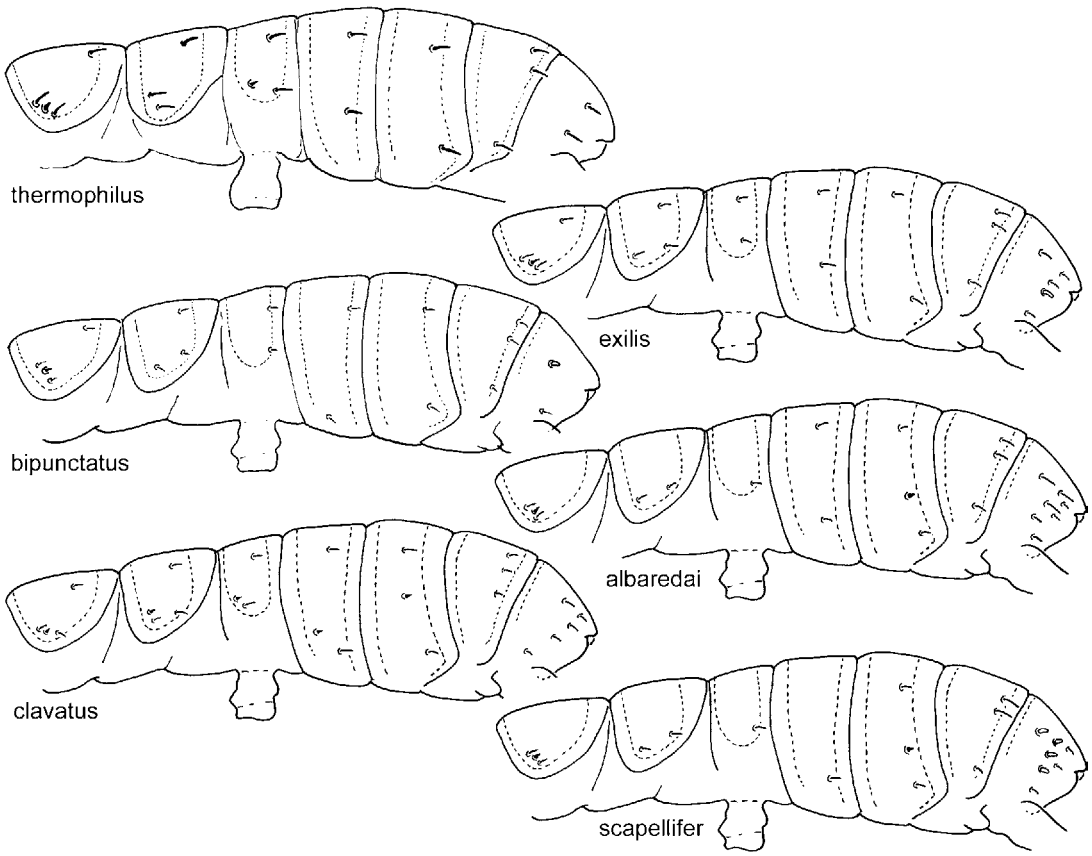


Fig. 42. *Cryptopygus* spp.: Schematic presentation of sensillary patterns on th.2–abd.6.

base. Tibiotarsi with 7 setae in the apical ring, T-setae absent. Tib.1 with 21 setae in all. Tib.2 and 3 with additional setae towards base. Tenent hairs ($A_1$) acuminate, not prolonged. Seta x absent from tib.3. Claws without teeth, unguiculus broad, lanceolate (Fig. 41I). Males present. Reproductive females with a pair of globular vesicles which open into the genital tract (Fig. 41E).

*Discussion.* – A well-defined species due to the presence of 1 + 1 ocelli and fused abd.5–6. No other Nordic Isotomidae has this combination of characters.

*Distribution and ecology.* – The characteristic habitat of the species is dry, sandy meadows along the coast, but also in dry inland habitats. Widely distributed, but not in northern districts and the mountains. General distribution: Holarctic.

## 221. ***Cryptopygus thermophilus*** (Axelson, 1900)

Figs 42, 43A–G

*Isotoma thermophila* Axelson, 1900, Meddn Soc. Fauna Flora fenn. 26: 9.

*Description.* – Size 1.0 mm. Body slender, cylindrical, with a long furca. Colour greyish, intensity of pigmentation variable. Ocelli 8 + 8. PAO elongate, with a constriction in the middle (Fig. 43E, F). Sensillary equipment of antennae includes two ventroapical sensilla (long and short) and two small setulae near dorsal/ventral base on ant.1. Ant.2 with an apical slender hair-like sensillum in ventrolateral position and two basal setulae (dorsal/ventrolateral). Ant.3-organ consists of two short, thick sensilla flanked on each side by a long, slender guard sensillum. Near apex, on the outer side, a small

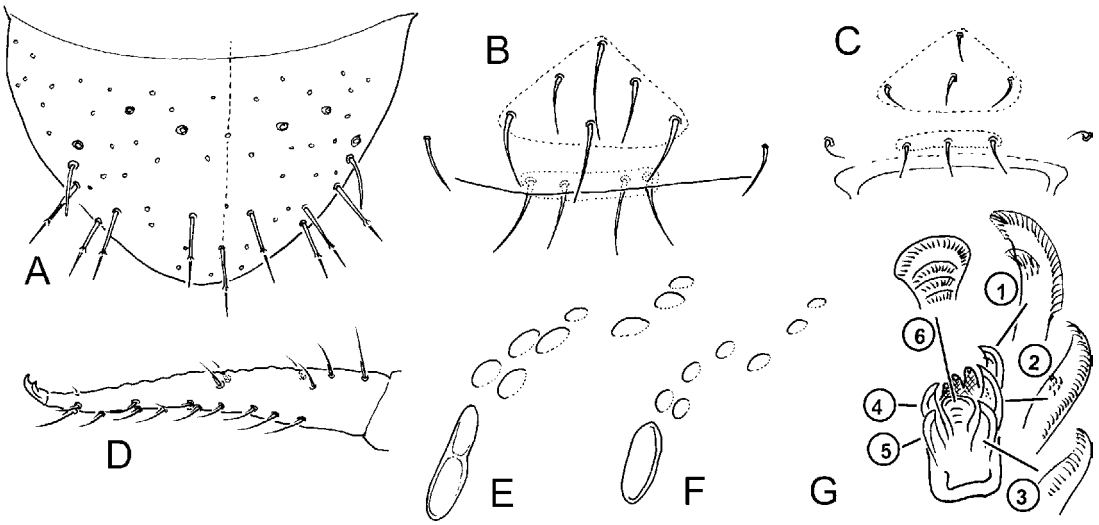


Fig. 43. *Cryptopygus thermophilus*: (A) Sensilla and ciliate "collar" setae on abd.5–6; (B–C) prelabral setae and frontoclypeal field in specimens from compost (B) and seashore sand dunes (C); (D) dens and mucro; (E–F) PAO and eyes in specimens from compost (E) and seashore sand dunes (F); (G) maxilla.

spine-like sensillum without guard is present. Males in addition have 2–3 erect, slender sensilla ventrally on ant.2–3. Ant.4 with many curved, pointed, moderately thickened sensilla, none of which are distinctly thicker than others. Subapical sensillum rod-shaped. Labrum with 554 setae. Prelabral setae 4. Frontoclypeal field with 6 setae (Fig. 43B). Maxillary palp bifurcate, 4 sublobal hairs. Mandibles normal. Maxilla as Fig. 43G. Capitulum with 3 teeth. Lam.1 with a long ventral edge ciliation continuing shortly around apex, inner side with a small ciliated lobe. Lam.2–3 with ciliation along ventral edge, lam.2 in addition with a few denticles on the inner side. Lam.4–5 similar to lam.2–3. Lam.6 with a fringe of cilia around the anterior edge and some irregular rows of denticles on the inner face. Head with 4–5 postlabial setae on each side of the ventral line. Integument smooth. Body hairs short and fine, smooth, acuminate. Erect macrochaetae on anterior abdominal tergites only slightly longer than ordinary setae, on abd.5–6 longer. Median pair of macrochaetae on abd.5 about 1.9 as long as inner edge of claw 3. Abd.6 with 9 erect setae bearing a "collar" of cilia about $1/3$ from apex (Fig. 43A). Sensilla of the tergites as Fig. 42. Macrosensilla all slender, distributed as $33/22232$. Microsensilla spine-like, $10/100$. On th.3 both lateral sensilla are set in the front corner. Upper sensilla on abd.1–3 set well in front of the p-row. Thorax without ventral setae. Ventral tube with 3–4 lateral setae on each side and two caudal setae. Retinaculum with 4 teeth and one seta. Furca long and slender, manubrium with $1 + 1$ ventroapical setae and more than 30 dorsal setae. Dens with many dorsal crenulations, one dorsal setula near apex and 6–7 dorsal setae in the basal half (Fig. 43D). Ventral side with up to 20 setae. Mucro 2-toothed, slender, without seta at the base. Tibiotarsi with 7 A-setae in the apical ring, T-setae absent. Tenent hair ($A_1$) acuminate, not prolonged. Claws with a variable tooth in the middle of the inner edge. Unguiculus pointed, about $2/3$ of claw inner edge. Basal lamella distinct.

*Discussion.* – The species displays much variation in the quality of the hair cover, notably in length of macrochaetae and the "collar setae" on tip of the abdomen. Also size and position of the ocelli vary. In Norway and Sweden a particular form has been collected in coastal sand dunes. It differs from the typical form in having only $7 + 7$ ocelli (Fig. 43F), 3 (rarely 4) prelabral setae and 4 frontoclypeal setae. Body size is smaller (mature from 0.5–0.6 mm) and pigmentation weaker. Seashore specimens have also been reported from Denmark (Petersen, 1965),

Germany (Strenzke, 1955) and 'cosmopolitan' (Thibaud & Christian, 1997). The status of this form remains unclear, but it could be *orientalis* (Stach, 1947) which is reported from 'xerothermic' habitats in central and southern Europe (Potapov, 2001).

*Distribution and ecology.* – The main form usually occurs in compost heaps and other disturbed habitats with a high organic content. The sand-form is locally common in southern coastal habitats. The compost-form with scattered records. General distribution: Cosmopolitan.

## 222. *Cryptopygus clavatus* (Schött, 1893)

Figs 42, 44A–M

*Isotoma clavata* Schött, 1893, K. svenska VetenskAkad. Handl. 25: 73.

*Proisotoma admaritima* Murphy, 1953; syn. nov.

*Description.* – Body size 1.3 mm. Colour dark violet blue, extremities slightly paler. Body shape slender, cylindrical, abd.5–6 fused (Fig. 44A). Integument smooth, primary hexagons fused, giving a granular appearance with an amber-like lustre. Ocelli 8 + 8. PAO oval, small, slightly longer than diameter of nearest ocellus (Fig. 44M). Ant.1 with 19–21 setae, including two ventroapical sensilla and 3–4 dorsal p-setae (Fig. 44C, D). Lateroapical sensillum on ant.2 slender. Ant.3 organ with 4 widely spaced sensilla, the guards only slightly longer and thinner than the two central sensilla. Lateral sensillum spine-like, without guard (Fig. 44L). Accessorial sensilla absent, males without erect ventral sensilla. Ant.4 with many slender, curved, hair-like sensilla. Subapical organ with a projecting rod-like sensillum, not set in a pit. Labrum with 554 setae, setae of the two apical rows thicker, curved. Prelabral setae two. Maxillary palp simple, 3 sublobal hairs. Labium with a complete set of papillae and guards (papilla E with 7 guards). Mandibles normal, strong. Maxilla (Fig. 44E) with 3 strong capitular teeth and 6 short lamella which do not pass beyond tip of capitulum. Lam.1 very short, with a few serrations around apex only. Lam.2 and 4 with marginal ciliations and a field of serrations on the inner side. Lam.3 and 5 with marginal ciliations only. Lam.6 packed with sharp denticles like a rasp. Head with 4 + 4 postlabial setae. Body with a dense cover of short, strong setae. Macrochaetae not developed. Some of the larger setae at base of legs, on inner side of femora and at tip of abdomen with some serrations. Macrosensilla very short, only half as long as ordinary setae, distributed as 33/22235. Microsensilla 11/111. On abd.5 one sensillum is moved forward (Fig. 44F). Upper sensilla on abd.1–3 set in front of the p-row. Thorax and abd.2 without ventral setae. Ventral tube with 3 + 3 lateral and 5–6 caudal setae. Retinaculum with 4 + 4 teeth and one seta. Furca strong, manubrium slightly longer than dens, with more than 50 dorsal setae and 1 + 1 ventroapical setae. Manubrial condyles continuous (Fig. 44J). Dens dorsally crenulated, normally with 11 dorsal setae and 18–19 ventral setae. Mucro with two teeth, subapical tooth strongest. Ventral edge broad, hyaline (Fig. 44K). No mucronal seta. Tibiotarsi with increased number of setae in basal part. Apical whorl with 7 setae, T-setae absent. Seta $A_1$ strongly prolonged on each leg, distinctly knobbed and curved at apex (Fig. 44G). Inner side of femur with a strong macrochaeta. Males with erect, thin $B_5$ and x on inner side of tib.3. Claws long and slender, unarmed. Unguiculus small, only half as long as inner unguis (Fig. 44G).

*Discussion.* – The fused abd.5–6, 2-toothed mucro and the single, clavate tibiotarsal apical seta readily identify this species. Also the presence of only 3 sublobal hairs is unique among Nordic *Cryptopygys* and *Proisotoma.* Schött's (1893) description of *Isotoma clavata* as a short-haired bluish black species with one clavate tibiotarsal hair and a 2-toothed mucro, creeping in masses along the shoreline of the east coast of Sweden (Bohuslän), rendered little doubt that the taxon was a senior synonym of *admaritima*. In 2006 seven syntypes ('Riksmuseets Entomologiska Afdelning, *Isotoma clavata* Schött, Boh. Grebbestad, colleg. H. Schött, Determ. H. Schött') were found in the collections of Naturhistoriska Riksmuséet, Stockholm. The specimens are clear '*Proisotoma admaritima*' which then falls as a junior synonym. A lectotype (alcohol) and 6 paralectotypes (1 slide, 5 alcohol) are designed. Although the name *admaritima* has been in general use since it was

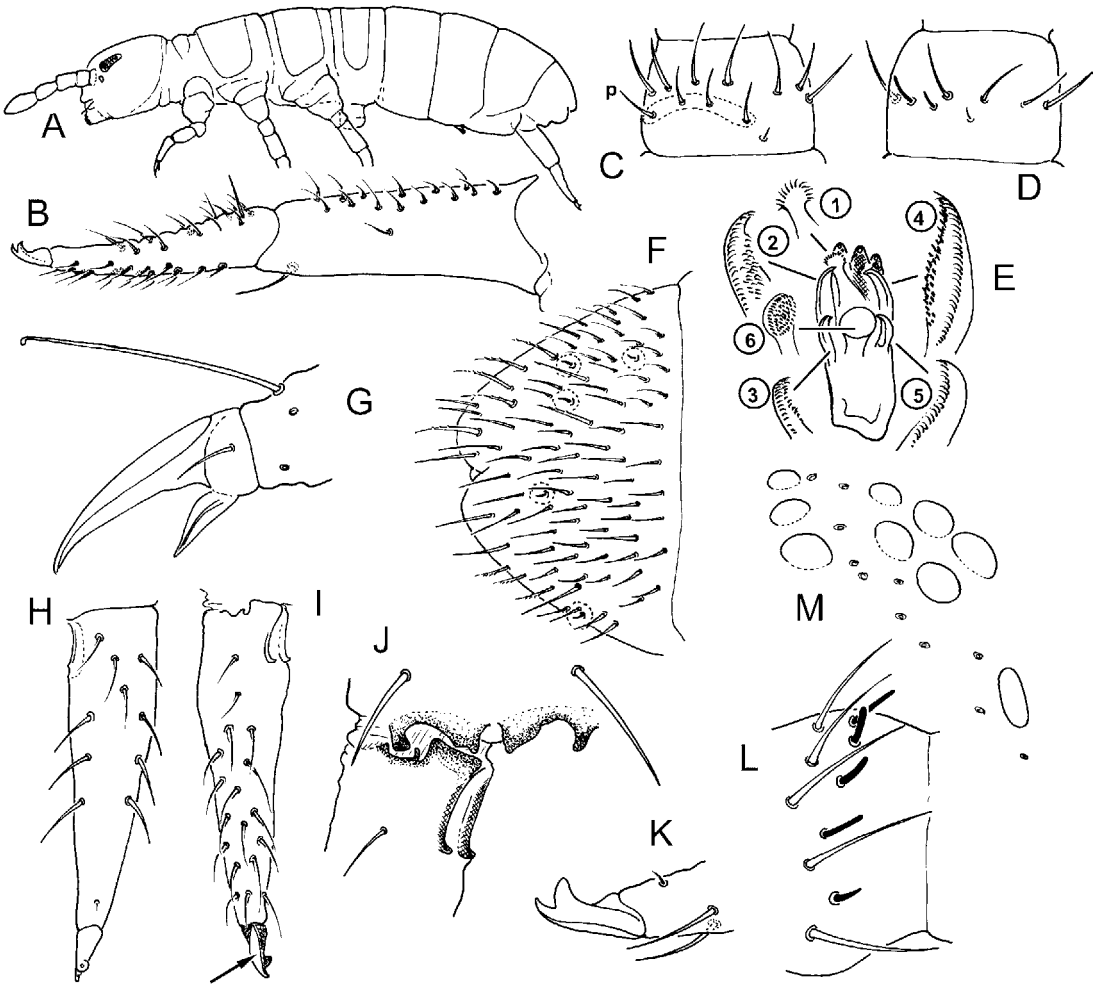


Fig. 44. *Cryptopygus clavatus*: (A) Habitus; (B) furca; (C) right ant.1, dorsal (p-setae marked); (D) right ant.1, ventral; (E) maxilla; (F) abd.5–6 with sensilla marked; (G) claw with clavate apical seta; (H) dens and mucro, dorsal; (I) ditto, ventral. Broad ventral edge of mucro marked (arrow); (J) manubrium/dens articulation; (K) mucro; (L) ant.3 organ; (M) PAO and eyes.

published, the senior synonym was used by several of the early 1900 authors (Wahlgren, 1906; Schille, 1912) and as late as 1964 (Salmon 1964: 384), and I see no good reasons to take actions to have the name suppressed. Gisin (1960: 196) placed the name as a questionable synonym of *Proisotoma tenella* (Reuter, 1895).

*Distribution and ecology.* – A characteristic species in the rocky marine littoral zone where it grazes algae on wet surfaces. The cuticle is not water repellent and specimens may be observed creeping on bottom of brackish rock pools and under the water film on rocks after rain (own observations). The strong maxilla with short lamella is probably an adaptation for a grazing/rasping feeding habit. Only scattered records, but probably widely distributed along the rocky Nordic coasts. General distribution: Palaearctic.

## 223. ***Cryptopygus nidicola*** (Agrell, 1939)

Fig. 45A–C

*Proisotoma nidicola* Agrell, 1939, Opusc. ent. 4: 164.

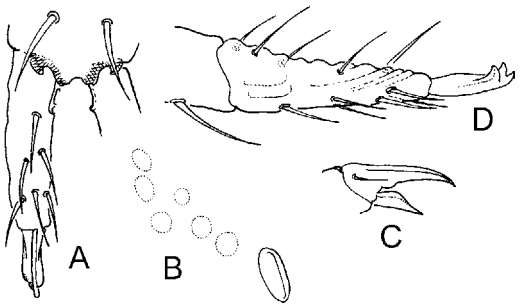


Fig. 45. *Cryptopygus nidicola*, type specimens: (A) Dens and apical part of manubrium, ventral; (B) PAO and eyes (not distinct!); (C) claw; (D) dens and apical part of manubrium, lateral.

*Description.* – Body size 0.8 mm. Colour grey, ocelli 8 + 8. PAO elongate, about twice as long as diameter of nearest ocellus. Abd.5–6 fused. Body hairs short. Ant.1 with two ventral sensilla, one thicker than the other. Dorsal side with one p-seta. Labrum with 554 setae, anterior row much stronger than the others. Prelabrals 3. Mandibles normal, strong. Maxilla with 3-toothed capitulum. Longest lamella with ciliated edges, clearly passing tip of capitulum. Maxillary palp simple, 4 sublobals. Head with 3 + 3 postlabial setae along ventral line. Th.2 with spine-like microsensillum present, probably absent on th.3. Abd.2 without mid-ventral setae. Retinaculum with 3 + 3 teeth and one seta. Manubrium with 1 + 1 ventroapical setae. Manubrial condyles continuous. Dens dorsally crenulated, with oblique longitudinal ridges in distal half. Dorsal side with 5 setae, ventral side with 5, the apical three set close together (Fig. 45A, D). Mucro strong, in ventral view quite broad with keel-like ventral edge (Fig. 45A). Mucronal teeth 3, basolateral tooth unusually strong. Mucronal setae absent. Tibiotarsi with 7 apical setae (T-setae absent).

*Discussion.* – A slide with the holotype and an unmarked syntype is present in Zool. Mus., Lund, and was examined in 2005 ('*Proisotoma nidicola* sp. n. Lund, IV-34. Musebo. Leg. N.A. Kemner, det. Agrell'). In the original description Agrell (1939: 164) says that abd.5–6 are completely fused. The type specimens are somewhat wrinkled, but in the holotype an incision line between the segments is indicated. Other characters, now observed for the first time, indicate a position in the *Proisotoma minuta* group (3 prelabral setae, simple maxillary palp, long maxillary lamella, 7 apical setae on tibiotarsi). Ocelli are not clear in the type specimens, but distribution of eye pigment indicates that their numbers are 6 or 7 on each side.

In a provisional splitting of the *Proisotoma* complex Potapov (2001) puts this species in *Appendisotoma* due to the 3-toothed mucro and fused abd.5–6. That character combination hardly matches generic boundaries and *Cryptopygus* seems to be a better host for the species. The final diagnosis and generic position of *nidicola* must be based on freshly collected specimens.

*Distribution and ecology.* – The species was originally described from a mouse nest in Lund, Sweden, and has later been reported from Germany and Switzerland. General distribution: Palaearctic.

## 224. ***Cryptopygus scapellifer*** (Gisin, 1955)

Figs 42, 46A–H

*Proisotoma (Isotomina) scapellifera* Gisin, 1955, Mitt. schweiz. ent. Ges. 28: 140.

*Description.* – Size 0.5 mm. White, without eyes. PAO large, oval, as long as width of ant.1 (Fig. 46D). Ant.1 with two ventroapical sensilla (one large, one small). Ant.2 with a ventrolateral curved acuminate large sensillum near apex. Ant.3 organ with two short, thick sensory clubs, flanked on each side by a big guard sensillum. A spine-like sensillum, without guard, is found in ventrolateral position on ant.3. Ant.4 with 9–10 curved sensilla, of which 4 are thicker than others. Subapical organ with rod-shaped sensillum. Subapical pin-seta simple. Labrum with 554 stiff and spiny setae, 3 prelabrals. Frontoclypeal field with 4 setae (Fig. 46E). Maxillary palp bifurcate, 4 sublobals. Basal fields of labium with 4 + 5 setae. Head with 3 + 3 setae along ventral line. Maxilla (Fig. 46B) with 3 teeth and 6 lamellae. Lam.1 reaching far beyond the teeth, split in two branches. The main branch has long ciliation along the ventral edge, and short ciliation along the dorsal edge. The secondary branch has ciliation along the dorsal edge only. Lam.2–3 with ciliation along ventral edge, lam.2 also with a few serrations on the inner side. Lam.4–5 similar to

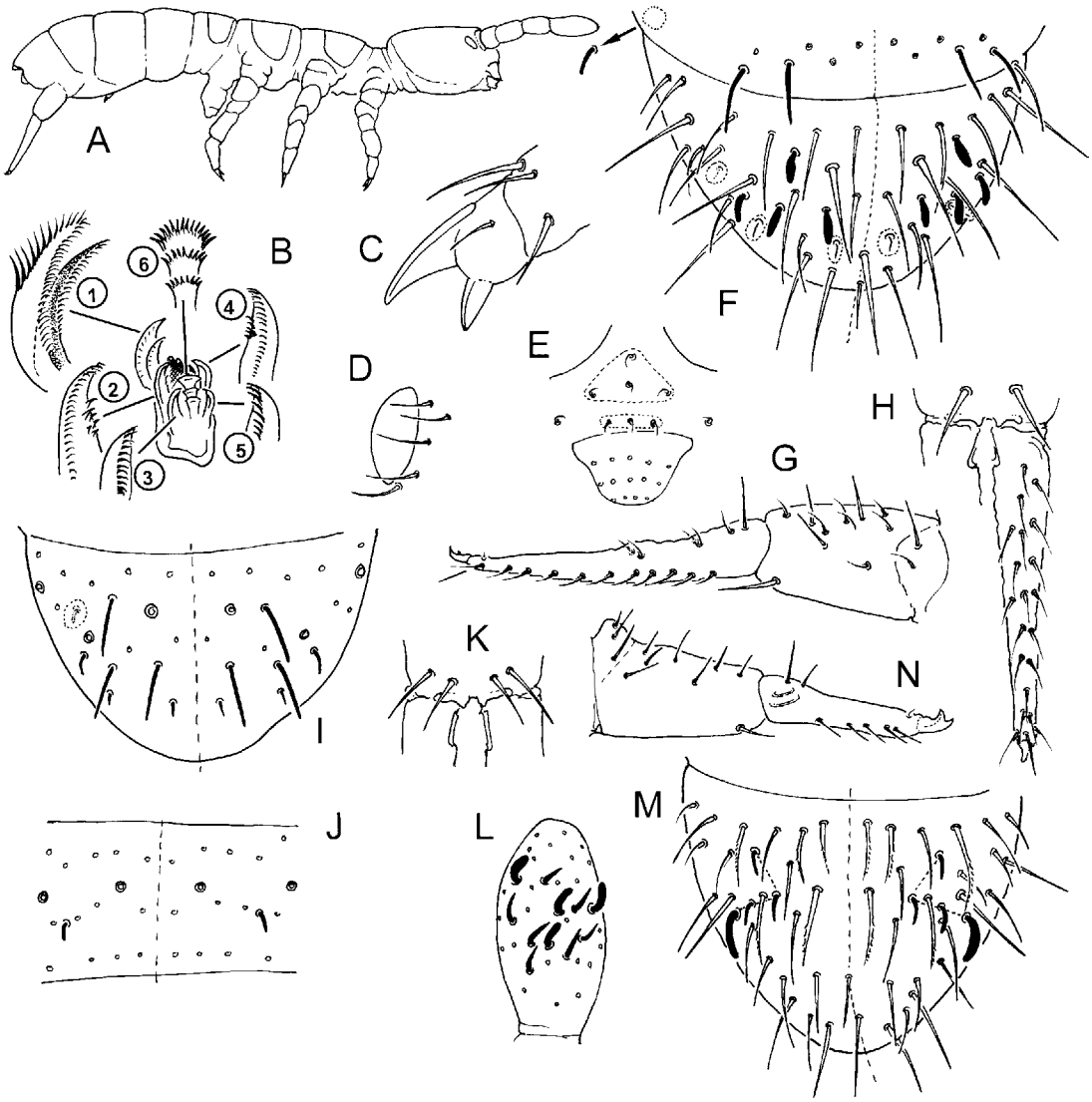


Fig. 46. *Cryptopygus* spp.: (A–H) *scapellifer*, (I–K) *albaredai*, (L–N) *exilis*; (A) habitus, (B) maxilla, (C) claw, (D) PAO, (E) labrum with prelabral and frontoclypeal setae marked, (F) abd.4–6 general setal cover and sensilla (black and encircled), (G) furca, lateral, (H) dens and apical manubrium, ventral; (I) abd.5–6 sensilla, (J) median pair of sensilla on abd.2, (K) manubrium/dens with 2 + 2 ventroapical setae; (L) sensilla on ant.4, (M) abd.5–6, general setal cover and sensilla (black), (N) furca, lateral.

2–3. Lam.6 long, with 3 transverse rows of serrations. Mandibles normal. Body hairs stiff and spiny, acuminate, smooth. In large specimens macrochaetae at base of legs (subcoxa/coxa) may have a few serrations. Macrochaetae erect, becoming increasingly longer towards tip of abdomen. Those of abd.5–6 about 2.5 as long as inner edge of claw 3. Number of short setae along mid-dorsal line of th.2–abd.4 as 65/3333. Abd.5–6 fused. Macrosensilla 22/11237, microsensilla 10/001. On th.2–abd.2 only the lateral sensilla present. Abd.4 on each side of the midline with two hair-like sensilla which are twice as long as the sensillum in the lower corner. Abd.5 with 3 thin sensilla (the lower one, set near base of manubrium, is distinctly thicker

than the two upper ones) and 4 thick sensilla of which one is set in anterior position (Figs 42, 46F). Thorax without ventral setae. Ventral tube with 4 + 4 lateral and 5 caudal setae, no frontals. Retinaculum with 3 + 3 teeth and one seta. Manubrium with 1 + 1 ventroapical setae and about 20 dorsal setae. Dens clearly longer than manubrium, with 6 dorsal setae in basal half and one dorsal setula near apex. Ventral side with 20–25 setae, the apical ones slightly prolonged. Mucro 2-toothed, with a large hook-like apical tooth. No mucronal seta. Tib.1–2 with regular chaetotaxy, each with 21 setae in 3 complete whorls. T-setae absent. Tib.3 with increased number of setae (25–27), seta x absent. Claws without teeth, unguiculus pointed, triangular, about 2/3 as long as inner edge of unguis (Fig. 46C).

*Discussion.* – The species is unmistakable due to the characteristic set of abd.5 sensilla.

*Distribution and ecology.* – Scattered records in southern parts of Norway, Denmark and Sweden. Usually in sand dunes and other sandy seashore habitats, but also in sandy inland sites (meadows, forests). General distribution: Palaearctic.

## 225. ***Cryptopygus albaredai*** (Selga, 1962)

Figs 42, 46I–K

*Isotomina albaredai* Selga, 1962, Eos 38: 311.

*Description.* – Size 0.5 mm. White, without eyes. Similar to *scapellifer* in most characters (head, mouthparts, antennae, general body chaetotaxy, legs, furca, retinaculum). Manubrium differs by having 2 + 2 ventroapical setae (Fig. 46K). Formula of macrosensilla also differs: 22/12237 (Fig. 42). The upper sensillum is present on abd.2, set in front of the p-row (Fig. 46J). Microsensilla as in *scapellifer* (10/001). On abd.5 all sensilla are slender, the three upper ones longer than others (Fig. 46I). Macrochaetae in Nordic specimens smooth.

*Discussion.* – Following Potapov's (2001) key the Nordic specimens would go to the species *delamarei* Poinsot, 1970 (France, Spain) because of the smooth macrochaetae. In *albaredai* the macrochaetae are said to be slightly serrated. There are also reported differences in number of abd.5 sensilla, but previous authors probably did not observe the complete set of sensilla. Until the status of these taxa has been better funded the senior name is applied to the Nordic populations.

*Distribution and ecology.* – Only a few records from Denmark and southern Sweden, all from sand dunes and sandy seashore meadows (roots of *Ammophila*, *Rosa rugosa*). General distribution: Palaearctic.

## 226. ***Cryptopygus exilis*** (Gisin, 1960)

Figs 42, 46L–N

*Isotomina exilis* Gisin, 1960, Revue suisse Zool. 67: 320.

*Description.* – White, without eyes. PAO broad, as long as width of ant. 1. Ventral side of ant.1 with two unequal sensilla. Ant.2 without differentiated sensilla. Ant.3 organ with two short, thick sensilla flanked on each side by a long guard sensillum. Lateroapical sensillum absent. Ant.4 with 4 thick, curved sensilla and 5–6 slender ones (Fig. 46L). Labrum with 554 setae, the two apical rows more spiny than the proximal. Prelabral setae 3. Maxillary palp simple, 4 sublobals. Head with 3 + 3 postlabial setae. Mandibles normal. Maxilla was figured by Bernard (1977), showing a 3-toothed head with 6 fringed lamellae of which one reaches far beyond tip of the ungular teeth. Body integument smooth, slightly granular at tip of abdomen. Body hairs smooth, acuminate. Some of the short curved hairs on abd.5–6 distinctly serrated. Macrochaetae short. Number of short setae on each side of the midline on th.2–abd.4 as 64/3334. Macrosensilla as 33/22235, microsensilla 10/000 (Fig. 42). Upper sensilla on abd.1–3 set well in front of the p-row. The spine-like microsensillum on th.2 as long as the macrosensilla. One of the sensilla on abd.5 is thick and curved (Fig. 46M). Thorax without ventral setae, ventral tube with 4 + 4 lateral and two caudal setae, no frontals. Retinaculum with 3 + 3 teeth and one seta. Furca as Fig. 46N, dens about as long as manubrium. Manubrium with 1 + 1 ventroapical setae. Dorsal side of dens with two basal setae and one subapical setula. Ventral side with 7 setae (3-2-1-1). Manubrium with about 20 dorsal setae. Mucro with two teeth, no seta.

Two first pair of legs with 20 tibiotarsal setae, $B_4$ is missing. No T-setae present. Tenent hairs ($A_1$) not differentiated. Claws untoothed, unguiculus pointed, with high basal lamella.

*Discussion.* – This small, white species is recognised by the single large sensillum on abd.5 and the reduced number of setae on dens. The simple maxillary palp is unique among Nordic members of the genus.

*Distribution and ecology.* – Only one Nordic record from Norway (AK: Eidsvoll), in sand on the river bank at Minnesund, S of the bridge, 7 Aug. 1994, many specimens. A. Fjellberg leg. General distribution: Palaearctic.

## Genus *Mucrosomia* Bagnall, 1949

*Mucrosomia* Bagnall, 1949, Ann. Mag. nat. Hist. (12) 2: 91. Type species: *Folsomia garretti* Bagnall, 1939, by original designation.

The single Nordic species in this genus is similar to *Cryptopygus* in most respects, but is easily identified by the long 5-toothed mucro which is unlike any other Nordic Isotomidae.

### 227. *Mucrosomia garretti* (Bagnall, 1939)

Fig. 47A–G

*Folsomia garretti* Bagnall, 1939, Entomologist's mon. Mag. 75: 26.
? *Bathyterra bipartita* Rusek, 1996.

*Description.* – Size 1.5 mm. White, without eyes. PAO small, elongate, shorter than width of ant.1 (Fig. 47F). Body slender, cylindrical, *Folsomia*-like. Abd.5–6 fused (Fig. 47A). Integument smooth. Ant.1 with two ventroapical unequal sensilla and two microsensilla (dorsal and ventral). Ant.2 with one long pointed ventrolateral sensillum and two microsensillae (dorsal and ventral). Ant.3 organ with two short sensilla flanked by one slender guard sensillum on each side. A spine-like small sensillum present in ventrolateral position. Ant.4 with many pointed slender sensilla, none of them clearly differentiated from others. Subapical organite rod-like. Labrum with 554 setae, 3 prelabrals. Frontoclypeal field with 10–12 setae. Labial palps complete, with 3 proximal setae, papilla E with guard $e_7$ present. Hypostomal group with $h_1$–$h_2$ curved, longer than H (Fig. 47G). Labial base with 5 median and 5 lateral setae. Head with 4–5 postlabial setae on each side along ventral line. Maxillary palp bifurcate, 4 sublobals. Mandibles normal. Maxilla (Fig. 47D) with 3-toothed head and 6 lamellae. Lam.1 bears dorsal and ventral fringes of cilia along the outer edge and a large ciliated lobe on the inner side. Lam.2–4 with short marginal ciliation only. Lam.5 covered with denticles and a few long serrations at base. Lam.6 tongue-shaped, blunt, covered with fine denticles. Body hairs smooth, macrochaetae well differentiated. Longest macrochaeta on abd.5 more than twice as long (2.0–2.5) as inner edge of claw 3. Sensillary chaetotaxy as Fig. 47A. Macrosensilla 43/22235, microsensilla 10/100. Upper sensilla on abd.1–3 set well in front of the p-row. The upper three sensilla on abd.5 longer than others. Thorax without ventral setae. Ventral tube with 5–7 lateral and 8–10 caudal setae, no frontals. Retinaculum with $4 + 4$ teeth and 1–2 setae. Furca as Fig. 47C. Manubrium with $1 + 1$ ventroapical setae and about 25 dorsal setae. Dens with 10–12 ventral and 5 dorsal setae. Mucro long, with 3 large teeth and two small ones at base (Fig. 47E). Tibiotarsi with increased number of setae (>21). Apical whorl with 7 A-setae, T-setae absent. Tenent hairs undifferentiated. Claws slender, inner edge of unguis with a small – sometimes indistinct – tooth in the middle (Fig. 47B).

*Discussion.* – Specimens from the Danish sample (see below) have been compared with specimens from British caves (Somerset and Surrey) and no significant differences could be found. PAO and claw shape vary within samples and the status of the other European species, *M. bipartita* (Rusek, 1996), is doubtful. The presence of 5 basomedian labial setae is unusual and not seen in any *Cryptopygus* or *Folsomia* which have 4 basomedians and are supposed to be close to *Mucrosomia*.

*Distribution and ecology.* – Only a single Danish sample (many specimens) from the Skovlund purification plant at Ølgod, associated with sewage water (17.VIII.1999, J. Kryger leg.), and two juvenile specimens from the greenhouse in Botaniska Trädgården in Lund, Sweden (23

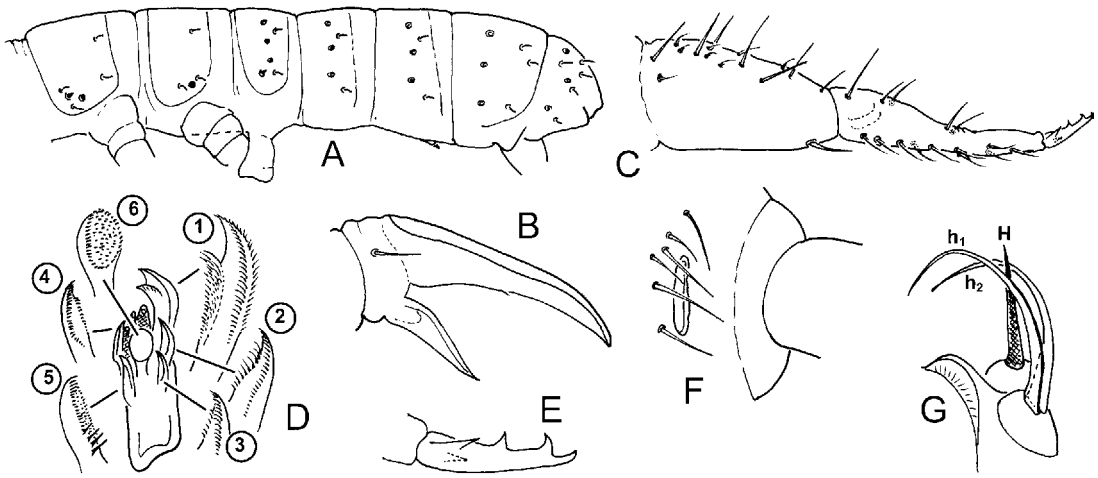


Fig. 47. *Mucrosomia garretti*: (A) Distribution of sensilla and macrochaeta; (B) claw; (C) furca, lateral; (D) maxilla; (E) mucro; (F) PAO and antennal base; (G) hypostomal papilla.

Febr. 2006). Probably introduced. General distribution: Palaearctic.

## Genus *Appendisotoma* Stach, 1947

*Appendisotoma* Stach, 1947: 13. Type species: *Proisotoma vesiculata* Folsom, 1937 by original designation.

Among members of the *Proisotoma* complex our single Nordic species of *Appendisotoma* is recognised by fused abd.5–6, full set of eyes, upper sensilla on abd.1–3 set in the p-row, mucro with 3 teeth and tibiotarsi with all T-setae present (apical whorl with 11 setae).

### 228. *Appendisotoma abiskoensis* (Agrell, 1939)

Fig. 48A–J

*Proisotoma abiskoensis* Agrell, 1939, Opusc. ent. 4: 163.
*Appendisotoma europaea* Törne, 1955.

*Description.* – Body size up to 1.1 mm. Colour bluish grey. Body shape as Fig. 48A. Abd.5–6 fused. Integument smooth, primary hexagons modified, giving the integument a finely spotted appearance. Ocelli 8 + 8, large. PAO large, oval, about 1.6 as long as diameter of nearest ocellus (Fig. 48J). Ant.1 with 23 setae, of which 3 are ventroapical sensilla (two small, one large) and one ventrolateral setula. Ant.2 with a curved, setae-like sensillum in ventrolateral position near apex. Ant.3 organ as Fig. 48F. Ant.4 with many curved, acuminate and moderately thickened sensilla on dorsal side. Ventral side with many erect, thin sensilla. Subapical organ with a small rod-shaped sensillum in a pit. Ventroapical pin-seta deeply bifurcated. Labrum with 554 slender setae, prelabrals 4. Labium with a full set of papillae and guards, basomedian field with 4 setae. Maxillary palp simple, 4 sublobal hairs. Mandibles normal, strong. Maxillary head with 3 teeth and 6 unmodified lamellae, all covered with denticles and without long marginal ciliations (Fig. 48I). Lam.1. reaches tip of longest capitular tooth. Head with 3–4 postlabial setae. Body hairs smooth and acuminate, rather coarse, giving the animal a slightly "spiny" look. Macrochaetae short, median pair on abd.5 about 1.5–1.9 as long as inner edge of last claw. Macrosensilla short and thin, distributed as 44/33335. Microsensilla 10/001. Upper sensilla on abd.1–3 set in the p-row. On abd.5 one sensillum in anterior position, the others in the p-row (Fig. 48D, H). Thorax without ventral setae. No frontal setae on ventral tube, lateral setae 4 + 4, caudal 3. Retinaculum with 4 + 4 teeth (lower tooth smaller than others) and two setae. Manubrium slightly longer than dens, with 3–4 ventroapical setae on each side in addition to 4–5 mid-ventral setae (Fig. 48E). Ventroapical thickening of manubrium distinct,

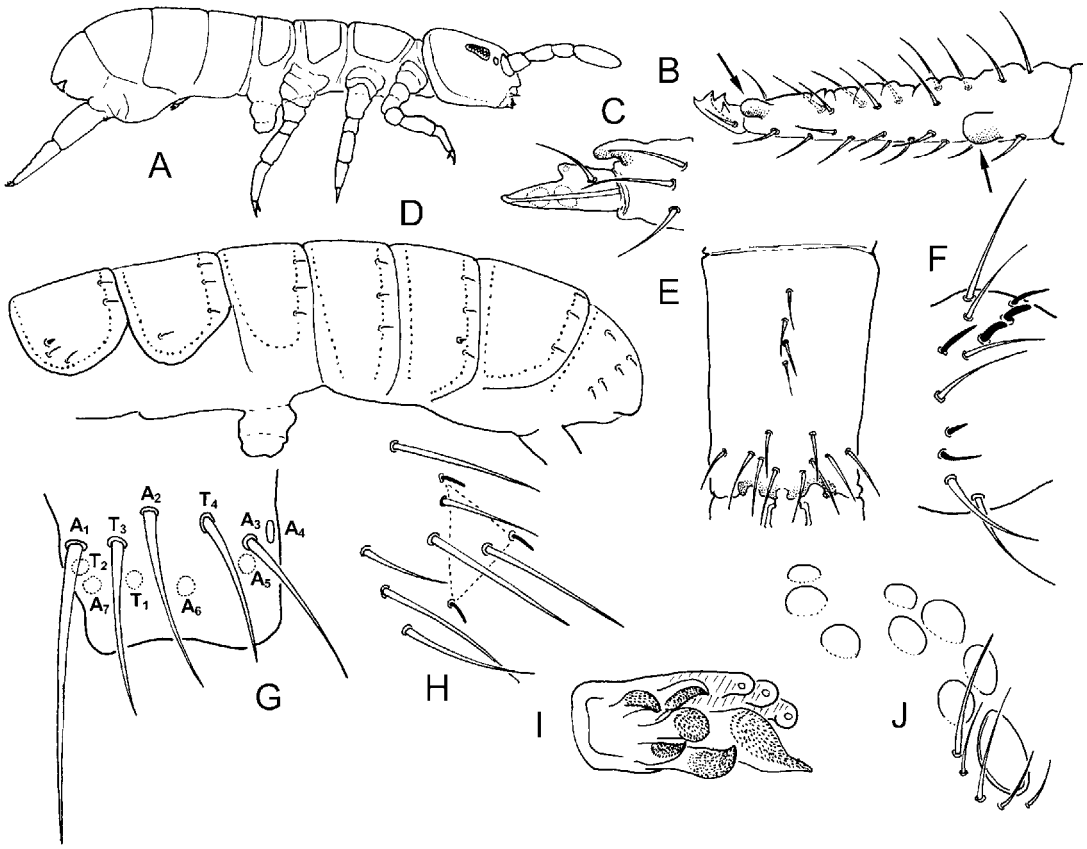


Fig. 48. *Appendisotoma abiskoensis*: (A) Habitus; (B) dens and mucro, lateral lobes marked (arrows); (C) mucro and apical part of dens, ventral; (D) sensillary distribution on th.2–abd.6; (E) manubrium, ventral; (F) ant.3 organ; (G) apical setae of tibiotarsus; (H) upper three sensilla and surrounding setae on abd.5, left side; (I) maxilla; (J) PAO and eyes.

with blunt teeth. Dens dorsally crenulated, with 10–11 dorsal and 22–23 ventral setae. Dens also with variable (sometimes invisible) external lobes near apex and near base (Fig. 48B). Mucro with 4 teeth, inner basal on line with subapical and apical teeth, apical smallest (Fig. 48C). Lateral seta present on mucro. Ventral edge of mucro narrow, sharp. Tibiotarsi with 11 setae in the apical whorl, all four T-setae present (Fig. 48G). Tenent hair ($A_1$) prolonged, acuminate. Tib.3 without seta x on inner side. Unguis and unguiculus with small teeth.

*Discussion.* – Easily identified by the generic characters. In particular the presence of a full set of apical setae (11) on tibiotarsi is significant (Fig. 48G). Three paratypes (Zool. Mus., Lund) and a small number of specimens from northern Finland, Sweden and Norway are the base of the above description. A single specimen of *A. bulbosa europaea* from Peggau, Austria (Christian, 1986: 176) was compared with the Nordic samples, and no significant differences were found. Thus I regard *europaea* to be synonymous with *abiskoensis*, in accordance with Potapov (2001). Whether the N. American *A. bulbosa* (Folsom, 1937) is also the same – and thus a senior synonym to *abiskoensis* – is not clear at present. Schulz (1995) reports ecomorphic juveniles of *abiskoensis* from Germany (Oberlausitz) having 5 spines on abd.5.

*Distribution and ecology.* – An uncommon species with a few records from boreal parts of Norway, Sweden and Finland. In forest litter, rotten wood and debris at shore of lakes. General distribution: Palaearctic.

## Genus *Ballistura* Börner, 1906

*Ballistura* Börner, 1906, Mitt. Naturh. Mus. Hamb. 23: 172. Type species: *Isotoma schoetti* Dalla Torre, 1895, by original designation.

The absence of ventral manubrial setae in combination with thick, cylindrical dens and presence of an unpaired mid-ventral seta ($B_{4/5}$) on tibiotarsi identify species belonging to this genus. Two species present in our area.

### Key to species

1 Few ventral setae on dens, only in apical 1/3 (Fig. 49E) .... 229. *borealis* (Axelson)

– Dens with many ventral setae almost to base (Fig. 50I) ..... 230. *schoetti* (Dalla Torre)

### 229. *Ballistura borealis* (Axelson, 1905)

Fig. 49A–H

*Isotoma boralis* Axelson, 1905, Zool. Anz. 28: 791.
*Isotoma incisa* Wahlgren, 1906.

*Description.* – Body size 1.0 mm. Colour dark violet blue. Body shape rather stout, with strongly rounded abd.5–6 profile (Fig. 49A). Furca relatively short with manubrium longer than dens. Integument smooth, primary hexagons unmodified. Ocelli 8 + 8. PAO small, roundish, only slightly longer than diameter of nearest ocellus (Fig. 49H). Ant.1 with about 15 setae, including 3 ventroapical sensilla (one short thick, one slender curved, one micro) and one dorsal p-seta. Ant.2 with a thickened lateroapical sensillum. Sensillary complex of ant.3 consists of two dorsal sense clubs flanked by two slender guard sensilla and a lateral spine-like sensillum. Accessorial sensilla and male sensilla absent. Ant.4 sensilla slender, curved. Apical organ with a small peg-like sensillum in a deep pit. Ventroapical pin-seta simple. Labrum with 554 setae. Setae of the two apical rows thicker, on more distinct basal sockets than basal row. Prelabrals two. Maxillary palp bifurcate, 3 sublobal hairs. Labial palp complete, apart from loss of guard seta $e_7$. Mandibles normal, strong. Maxillary head with 3 teeth and 6 lamellae not reaching beyond tip of capitulum (Fig. 49F). Lam.1–5 only with short marginal ciliation, no denticles on inner face. Lam.6 covered with fine denticles. Head with a variable number of postlabial setae along ventral line (usually 3 + 3). Body hairs short and uniform, macrochaetae only developed on abd.5–6. Macrosensilla of the tergites as 33/22225, microsensilla 11/111. Macrosensilla curved, short, about half as long as surrounding setae. Upper sensillum on abd.1–3 set in the p-row or slightly forward. On abd.5 the two posteriomedian sensilla are shorter than others (Fig. 49B). Ventral setae absent on thorax and abd.2. Ventral tube with 5 + 5 lateral and two caudal setae. Retinaculum with 4 + 4 teeth, one seta. Manubrium with more than 40 dorsal setae, no ventroapicals. Manubrial thickening discontinuous, with a median pair of blunt teeth and a lateral pair of smooth knobs articulating with a sclerotised plate on dens (Fig. 49G). Dens with large, roundish humps along dorsal side, with 16–19 dorsal and usually 7 ventral setae in apical 1/3 (Fig. 49D, E). Mucro with two teeth, apical tooth smallest. Two lateral lamella run from the subapical tooth to base. Ventral edge sharp, keel-like. No lateral seta on mucro. Tibiotarsi with 20-20-22 setae. Tib.1–2 with unpaired inner seta $B_{4/5}$ (Fig. 49C). In males setae $B_5$ and x are slightly modified (erect, curved at tip) on tib.3. Claws unarmed, unguiculus with high basal lamella. Apical whorl of tibiotarsi with 7 setae (T-setae absent). Tenent hairs 1-2-2 ($A_1$ and $A_1$–$A_2$), weakly clavate.

*Discussion.* – The key character easily separates this species from the following *schoetti*.

*Distribution and ecology.* – A boreal species with scattered records from Norway, Sweden and Finland. All records from shores of inland lakes and stream banks (organic debris, under stones, among plant roots). Flotation is a particularly efficient method for getting this species. General distribution: Palaearctic.

### 230. *Ballistura schoetti* (Dalla Torre, 1895)

Fig. 50A–I

*Isotoma schötti* Dalla Torre, 1895, Programm k.k. Staats-Gymn. Innsbruck 46: 10.

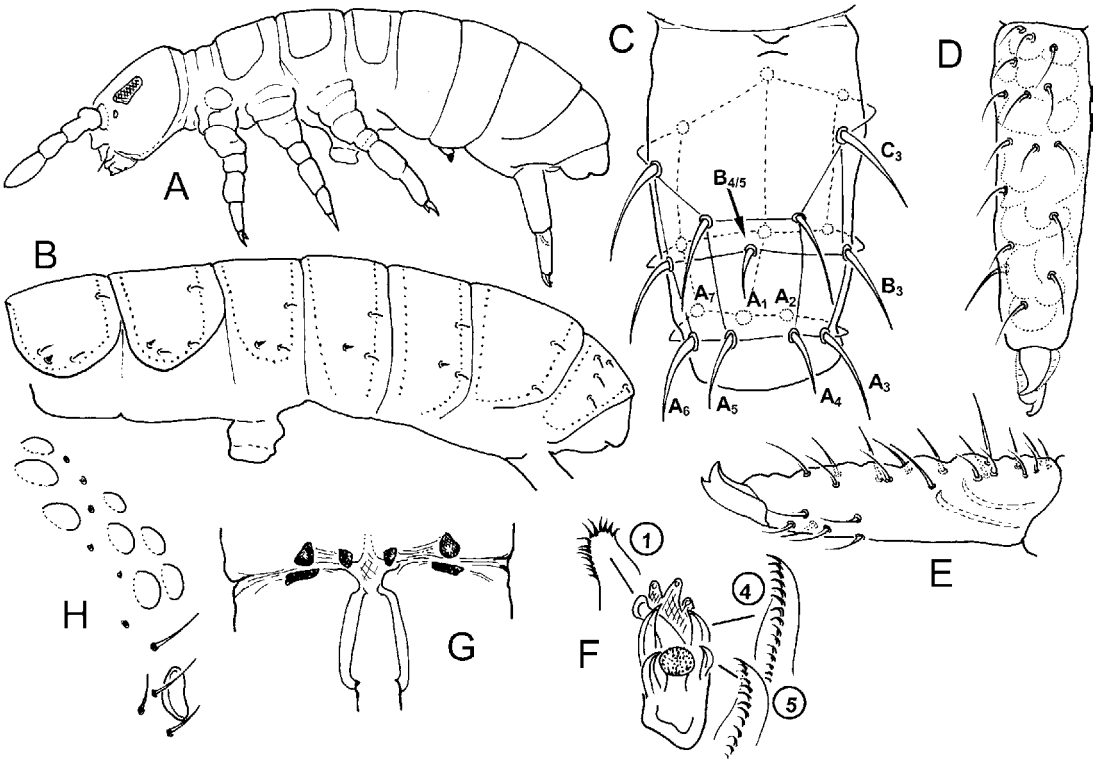


Fig. 49. *Ballistura borealis*: (A) Habitus; (B) sensillary distribution on th.2–abd.5; (C) chaetotaxy of inner side of left tib.2; (D–E) dens and mucro in dorsal (D) and lateral (E) views; (F) maxilla; (G) manubrium/dens articulation; (H) PAO and eyes.

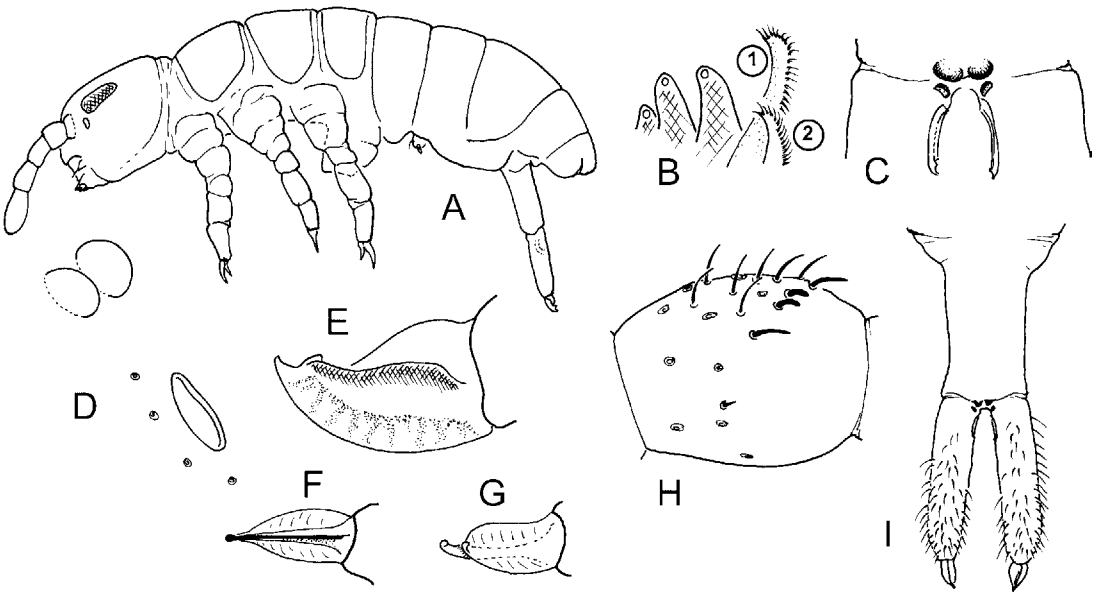


Fig. 50. *Ballistura schoetti*: (A) Habitus, (B) tip of maxilla; (C) manubrium/dens articulation; (D) PAO and two nearest ocelli; (E–G) mucro in lateral (E), ventral (F) and dorsal (G) views; (H) ant.3 organ with additional dorsal sensilla; (I) furca, ventral.

*Description.* – Body size up to 2.5 mm, adults from 1.4 mm. Colour dark blue, freshly collected specimens violet brown, anterior part of head paler. Body shape stout, furca long with subequal dens and manubrium (Fig. 50A). In large specimens thorax notably broader than width of head. Integument smooth. Ocelli 8 + 8. PAO elongate, slightly longer than diameter of nearest ocellus (Fig. 50D). Sensillary equipment of antenna as in the previous species, but ant.3 with some dorsal accessorial sensilla (Fig. 50H). Labrum, labial palp and maxillary outer lobe as in *borealis*. Head with a variable number of postlabial setae, usually 4 + 4. Mandibles normal. Maxilla much like that of *borealis* but lam.1 reaches clearly beyond tip of capitulum (Fig. 50B) and lam.4 has a few denticles on the inner face. Body with a dense cover of short uniform setae, macrochaetae not developed. Macrosensilla of th.2–abd.4 as 33/2222. On abd.5 there is up to 10 macrosensilla on each side, in 1.instar juveniles 6–7. On abd.1–3 the upper macrosensilla are set slightly forward to the p-row. Microsensilla 11/111. No ventral setae on thorax. Ventral tube without frontal setae, with up to 10 + 10 lateral setae and two caudal setae. Retinaculum with 3 + 3 teeth and one seta. Furca strong, manubrium and dens of equal length. Manubrium with many dorsal setae, no ventral. Ventroapical thickening reduced to two smooth knobs articulating with two smaller knobs at base of dens (Fig. 50C). Dens stout, cylindrical, with numerous setae and no dorsal crenulations or buckles (Fig. 50I). Mucro compact, with small apical and subapical teeth and two broad lateral lamellae. Ventral edge keel-like, prominent (Fig. 50E–G). Tibiotarsi with 7 apical setae, T-setae absent. Seta $B_{4/5}$ present on inner side of tib.1–2. Tenent hairs as in *borealis*, but pointed at tip. Males with modified (blunt-tipped) setae $B_5$ and x on inner side of tib.3. Claws unarmed, unguis twice as long as the pointed unguiculus which has high, curved basal lamella.

*Discussion.* – Easily identified by the key characters and the characteristic body shape. Specimens in culture show a strong tendency of clumping together, bowing their heads in a characteristic way.

*Distribution and ecology.* – Usually found in organic debris along lakes and seashores and in salt marshes. Abroad also reported from sewage treatment facilities. Scattered records from Denmark, Sweden and Finland. General distribution: Cosmopolitan.

## Genus *Pachyotoma* Bagnall, 1949

*Pachyotoma* Bagnall, 1949, Ann. Mag. nat. Hist. 12 (2): 83. Type species: *Isotoma crassicauda* Tullberg, 1871 by original designation.

The secondary granulation of the integument in combination with the long, haired dens readily identify the single Nordic species belonging to this genus.

### 231. *Pachyotoma crassicauda* (Tullberg, 1871)

Figs 2F, G, 51A–I

*Isotoma crassicauda* Tullberg, 1871, Öfvers. K. Vet.-Akad. Förhandl. 27: 152.

*Description.* – Body size 1.5 mm. Colour bluish black. Body shape short and stout with a strong furca (Fig. 2F). Integument distinctly granulated (Figs 2G, 51E). Ocelli 8 + 8. PAO elongate, about 1.5 as long as diameter of largest ocellus (Fig. 51E). Ant.1 with two ventroapical sensilla. Ant.2 with a hair-like lateroapical sensillum, sometimes also a short, thicker sensillum above the other. Ant.3 organ consists of two short sensilla flanked by longer guard sensilla, a lateral spine-like sensillum and a thicker small sensillum in lateroventral position. Males in addition have a few hair-like, erect sensilla ventrally on ant.2–3. Dorsal accessorial sensilla absent on ant.3. Ant.4 with many curved, slender sensilla. Subapical organ with a small rod in a pit. Labrum with 554 setae, 4 prelabrals. Labial palp with a complete set of papillae and guards. Maxillary palp bifurcate, with 4 sublobal hairs. Head with 3 + 3 setae along ventral line. Mandibles normal, strong. Maxilla (Fig. 51F) with 3-toothed capitulum and 6 lamella of which one reaches beyond tip of capitulum. Lam.1–5 with short marginal ciliations, lam.3–4 in addition with some denticles on inner side. Lam.6 densely packed with fine denticles. Body hairs very short and fine, macrochaetae not developed. Macrosensilla slightly shorter than

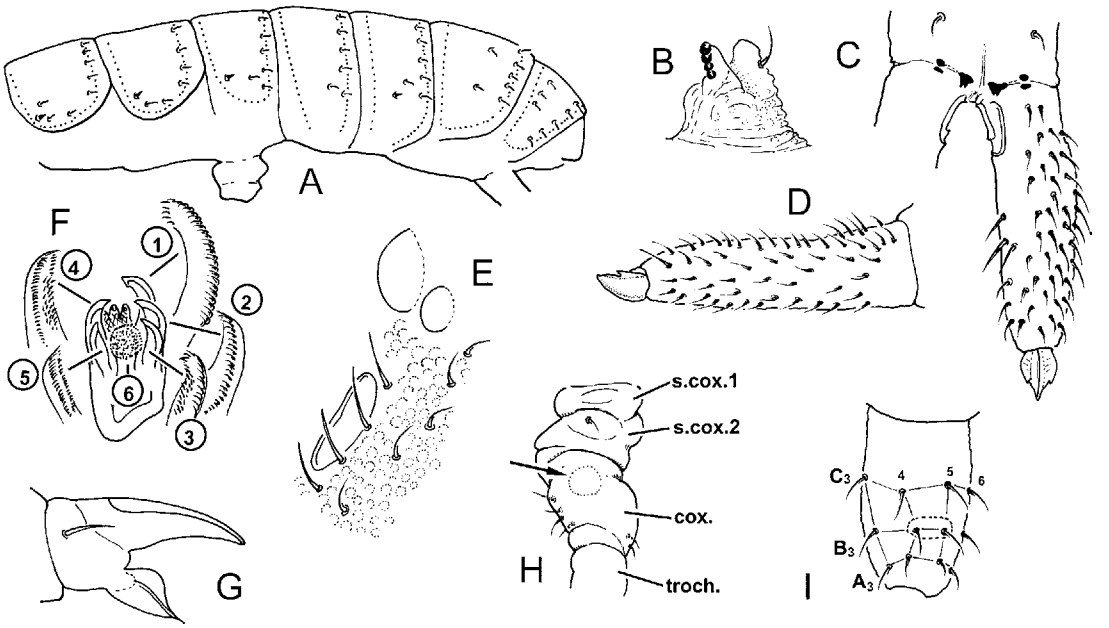


Fig. 51. *Pachyotoma crassicauda*: (A) Sensillary distribution on th.2–abd.5; (B) retinaculum; (C) apical part of furca, ventral; (D) dens and mucro, lateral; (E) PAO and two nearest ocelli; (F) maxilla; (G) claw; (H) basal parts of left foreleg, note absence of coxal seta (arrow); (I) right tib.2, chaetotaxy on inner side. Note presence of both $B_4$ and $B_5$ (encircled).

ordinary setae. Their numbers are variable, usually around 89/66687 (Fig. 51A). Microsensilla 11/101. Upper sensilla on abd.1–3 set in the p-row. Thorax without ventral setae. Ventral tube without frontal setae, with 7–8 lateral and 4–5 caudal setae. Retinaculum with 4 + 4 teeth and a single seta set on a fleshy anterior lobe (Fig. 51B). Furca strong. Manubrium slightly longer than dens, with numerous dorsal setae and 1–3 pairs of ventroapical setae. Manubrial thickening discontinuous. Median parts with 2–3 teeth, lateral elements in the shape of small sclerotised knobs. Dens cylindrical, densely pilose (Fig. 51C). Mucro broad, with toothed lateral lamella and sharp ventral keel. No lateral seta. First pair of legs without external basolateral seta on coxa (Fig. 51H). Tibiotarsi with 7 setae in the apical whorl (T-setae absent). $A_1$ longer than others, acuminate. Inner side of tib.1–2 with separate $B_4$ and $B_5$ (Fig. 51I). Seta $B_5$ and x on tib.3 unmodified in males. Claws unarmed, unguiculus pointed, with high basal lamella (Fig. 51G).

*Discussion.* – Easily identified by the generic characters.

*Distribution and ecology.* – In damp seashore habitats, in bogs and humid forests. Apparently most common in Finland, few records from other countries.

## Genus *Proisotoma* Börner, 1901

*Proisotoma* Börner, 1901, Abh. naturw. Ver. Bremen 17: 134. Type species: *Isotoma minuta* Tullberg, 1871, by subsequent designation by Börner (1903).

Members of this genus form a quite heterogeneous group, but may be recognised by the following set of characters: Isotomids with well-developed furca, eyes and pigment present. Manubrium with 1 + 1 or 3 + 3 (one species) ventroapical setae, other ventral setae absent on manubrium. Abd.5–6 not fused. Abd.1–3 without microsensilla (species with 3-toothed mucro), or these microsensilla are present (two species with 2-toothed mucro, though sensillary conditions unknown in *tenella*). Coxa on foreleg with outer macrochaeta present, tibiotarsi with 7

apical setae (T-setae absent). Skin smooth, without distinct granulation.

The old concept of the genus *Proisotoma*, as conceived by Gisin (1960) and Fjellberg (1980), is now much refined and many species have been allocated to other genera (Potapov, 2001). Acts for further splitting and regrouping of species were taken by Potapov et al. (2006) who adopted a narrow definition of *Proisotoma*, admitting only those species sharing essential characters with the type species of the genus (*minuta*, *subminuta*, *clavipila*, *minima*, and some others not present in our area). In the present treatment a slightly more conservative view is taken, partly because the cited authors did not find a generic position for two of the Nordic species (*ripicola*, *tenella*) which are here kept as *Proisotoma*.

## Key to species

1 Mucro with 3 teeth . . . . . 2
– Mucro with 2 teeth . . . . . 5
2 Ventral setae present on th.3 and abd.2 (Fig. 52H). Ant.3 with accessorial sensilla (s′) (Fig. 52C) . . . . . 3
– Ventral setae absent on th.3 and abd.2 (Fig. 52I). Ant.3 without accessorial sensilla . . . . . 4
3 Th.2 without ventral setae. Retinaculum with 1 seta. Dens longer (Fig. 52G) . . . . . 232. *minuta* (Tullberg)
– Ventral setae present on th.2. Retinaculum with more than one seta. Dens shorter, with dorsoapical group of seta set close together (Fig. 52F) . . . . . 234. *clavipila* (Axelson)
4 Ocelli 5+5. Microsensillum absent on th.2. Retinaculum with 3 + 3 teeth. Ant.1 with one dorsal p-seta (Fig. 52D). Small species, less than 1 mm . . . . . 235. *minima* Absolon
– Ocelli 7 + 7. Microsensillum present on th.2. Retinaculum with 4 + 4 teeth. Ant.1 with two dorsal p-setae (Fig. 52E). Larger species, more than 1 mm . . . . . 233. *subminuta* Denis
5 Manubrium with 1 + 1 ventroapical setae . . . . . 236. *ripicola* Linnaniemi
– Manubrium with 3 + 3 ventroapical setae . . . . . 237. *tenella* (Reuter)

## 232. ***Proisotoma minuta*** (Tullberg, 1871)

Figs 52C, G, H, 53A–E, I, N

*Isotoma minuta* Tullberg, 1871, Öfvers. K. VetenskAkad. Förh. 28: 152.

*Description.* – Body size 1.3 mm. Colour greyish brown of variable intensity. Body shape slender, cylindrical (Fig. 53A). Integument smooth, unmodified. Ocelli 8 + 8. PAO elongate, more than twice as long as diameter of nearest ocellus (Fig. 53E). Ant.1 usually with 15 setae, of which there are two slender ventroapical sensilla, one ventral setula and one dorsal p-seta. Ant.2 usually with 23–24 setae, including 3 setulae in basal part and one hair-like sensillum in lateroapical position. Males in addition have an erect, thin ventral sensillum. Ant.3 usually with 24 ordinary setae (Fig. 53N). Ant.3 organ consists of two blunt sensilla flanked by two slender guard sensilla ($g_1$ and $g_2$) and a small spine-like lateroapical sensillum with an associated guard ($g_3$ in Figs 52C, 53N). In addition there are 4–7 accessorial hair-like sensilla (s′) on dorsal and lateral sides. Males usually have 3 short, erect sensilla in ventral position (x in Figs 52C, 53N). Ant.4 with many hair-like sensilla and a small rod-shaped subapical sensillum in a pit. Labrum with 554 setae, prelabrals 3. Labial palp with reduced numbers of guard setae ($e_7$ and $e_4$ lost). Proximal setae 3. Basal fields with 4 median and 5 lateral setae. Maxillary palp simple, 4 sublobal hairs. Head with 4 + 4 postlabial setae along ventral line. Mandibles normal. Maxilla with a 3-toothed capitulum and 6 lamella, of which the longest reaches well beyond tip of capitulum (Fig. 53C). Lam.1 with marginal ciliation and a fringed lobe on the inner side. Lam.2 and 4 with marginal ciliation and some coarse serrations on the inner side. Lam.3 and 5 with marginal ciliations only. Lam.6 with 6–7 rows of denticles in addition to the marginal serrations. Body hairs short and uniform (smooth, acuminate), macrochaetae only developed on abd.5–6. Macrosensilla slender, subequal to surrounding hairs, distributed as 33/22224. Microsensilla 10/000 (Fig. 53B). Upper sensillum on abd.1–3 in p-row. Th.3 with 1 + 1 ventral seta, th.2 without. Ventral tube with 4 + 4 lateral and 5–6 caudal setae. Abd.2 usually with a transverse row of 4 mid-ventral setae. Retinaculum with 4 + 4 teeth and one seta. Furca strong, manubrium

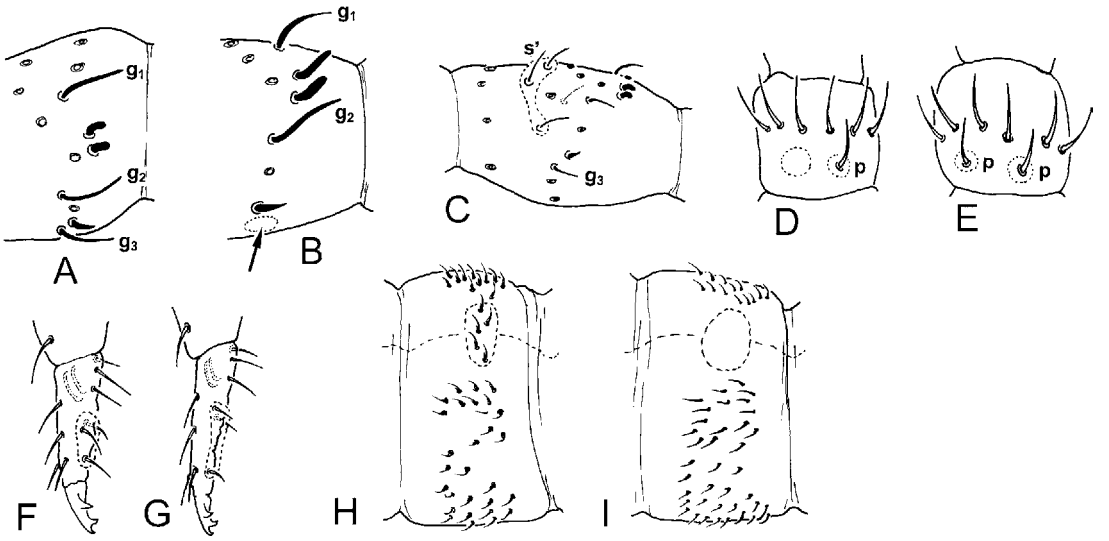


Fig. 52. *Proisotoma* spp. (A, C–I) and *Scutisotoma* (B): Ant.3 organ in *subminuta* (A) and *armeriae* (B); (C) *minuta*, ant.3 with additional sensilla (s′); (D–E) dorsal side of ant.1 in *minima* (D) and *subminuta* (E); (F–G) dens (lateral) of *clavipila* (F) and *minuta* (G); (H–I) ventral side of abd.2 in *minuta* (H) and *subminuta* (I).

slightly longer than dens, with many dorsal and 1 + 1 ventroapical setae. Ventroapical thickening continuous, with blunt apical condyles. Dens slender, dorsally crenulated with 6 (3-2-1) dorsal and 6 (1-2-3) ventral setae. The three ventroapical setae are set close together (Fig. 53D, I). Mucro slender, with 3 teeth. Coxa on first leg with an outer setae (cf. Fig. 51H). Tibiotarsi with 7 setae in the apical whorl (T-setae absent). Tenent hairs not developed, acuminate. Males without modified seta on tib.3. Claws unarmed. Unguiculus pointed, with high basal lamella, 2/3 as long as inner unguis.

*Discussion.* – The above key characters readily identify this species which is our most common *Proisotoma*.

*Distribution and ecology.* – Common in rich organic deposits (compost, rotten fungi, manure, sewage deposits), often in enormous numbers, sometimes indoor in flower pots. Widespread in our area, but not in alpine and arctic environments. General distribution: Cosmopolitan.

## 233. ***Proisotoma subminuta*** Denis, 1931

Figs 52A, E, I, 53F, J, L, M

*Proisotoma subminuta* Denis, 1931, Boll. Lab. Zool. gen. agr. R. Scuola Agric. Portici 25: 112.

*Description.* – Body size 1.3 mm. Colour spotted grey, ventral side paler. Pigmentation generally rather weak. Ocelli 7 + 7 (Fig. 53F). Ant.1 with 16 setae, dorsal side with two p-setae (Fig. 52E). Lateroapical sensillum on ant.2 thickened, spine-like. Ant.3 without accessorial sensilla. Males with several short, erect sensilla ventrally on ant.2–3 (Fig. 53M). Maxilla similar to *minuta*, but lam.1 more strongly expanded at apex (Fig. 53L). Thorax and abd.2 without ventral setae (Fig. 52I). The three ventroapical setae on dens not set very close together (Fig. 53J). Other body marks as in *minuta*.

*Discussion.* – The species has been confused with *minuta*, but the absence of ventral setae on thorax and abd.2 are sharp diagnostic characters. Also the chaetotaxy of antenna is notably different: Ant.1 has one additional dorsal p-seta, lateroapical sensillum on ant.2 is much thicker and ant.3 lacks the accessorial sensilla. Finally the three ventroapical setae on dens are set more wider apart. The identity of Nordic *subminuta* was checked with one of Denis' original slides containing several syntypes ('Proisotoma No.3, subminuta, Costa Rica. San José. VI.1915. Mat.

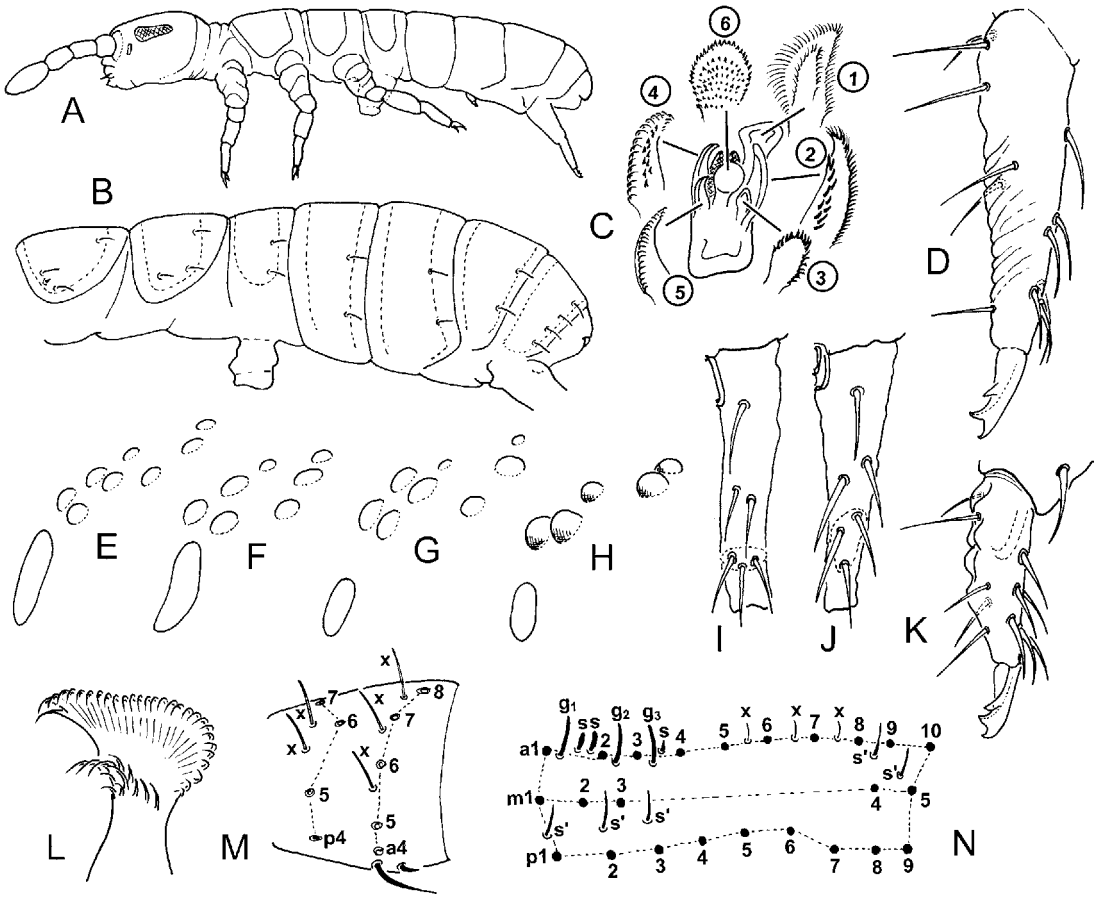


Fig. 53. *Proisotoma* spp.: (A–D) *minuta*, (A) habitus, (B) sensillary distribution on th.2–abd.5, (C) maxilla, (D) dens and mucro; (E–H) PAO and eyes in *minuta* (E), *subminuta* (F) *clavipila* (G), *minima* (H); (I–J) ventral side of dens in *minuta* (I) and *subminuta* (J); (K) *minima*, dens and mucro; (L) *subminuta*, apex of maxillary lam.1; (M) *subminuta*, ventral side of left ant.3 showing erect male setae (x); (N) *minuta*, layout of right ant.3 chaetotaxy showing sensilla (s), additional sensilla (s′), guards (g) and male setae (x).

Silv. 1930. T.10', deposited at Mus. Nat. Hist. Nat., Paris).

*Distribution and ecology.* – Probably a thermophilic species, in our area only recorded from compost in Norway and Sweden and along a thermal spring in Iceland (Geysir, 28.IV.2004, A. Fjellberg leg.). General distribution: Cosmopolitan.

## 234. ***Proisotoma clavipila*** (Axelson, 1903)

Figs 52F, 53G

*Isotoma clavipila* Axelson, 1903, Acta Soc. Fauna Flora fenn. 25: 7.

*Description.* – Body size 1.3 mm. Colour spotted greyish, paler ventrally. Ocelli 8 + 8, small. PAO oval, twice as long as nearest ocelli (Fig. 53G). Ant.1 with 15 setae, one dorsal p-seta. Lateroapical sensillum of ant.2 slender, hair-like. Ant.3 with up to 10 hair-like accessorial sensilla. Males with 1–3 short erect sensilla ventrally on ant.3. Subapical organ of ant.4 with a globular projecting sensillum. Maxilla similar to *minuta*. Th.2 with 2–4 setae on each side of the ventral line, th.3 with up to 10 setae on each side. Retinaculum with 4 + 4 teeth and

3–5 setae. Dens relatively short and thick, with 6 dorsal and 6 ventral setae in same arrangement as in *minuta*, but more closely packed (Fig. 52F). Tibiotarsi usually with seta $A_1$ faintly knobbed at apex, sometimes also $A_2$ and $A_7$. Other body marks as in *minuta*.

*Discussion.* – The species is easily separated from *minuta* by the increased number of ventral setae on thorax and retinaculum. Dens is relatively shorter with larger mucro than in *minuta*. Distance between the dorsoapical and the middorsal setae of dens is equal to length of the dorsoapical seta in *clavipila*. In *minuta* the distance is twice as long (Fig. 52F, G).

*Distribution and ecology.* – A characteristic species under rotten bark on trees. Probably widely distributed in Norway, Sweden and Finland, but few records. Also in Iceland. General distribution: Palaearctic.

## 235. ***Proisotoma minima*** Absolon, 1901

Figs 52D, 53H, K

*Proisotoma minima* Absolon, 1901, Zool. Anz. 24: 33.

*Description.* – Body size 0.8 mm. Pale greyish blue, sometimes almost without pigment. Ocelli 5 + 5, of variable size (Fig. 53H). PAO oval, about twice as long as nearest ocellus. Ant.1 with 15 setae, one dorsal p-seta (Fig. 52D). Lateroapical sensillum on ant.2 slightly thickened. Ant.3 without accessorial sensilla, males with 3 ventral erect sensilla. Ant.4 with many moderately thickened dorsal sensilla. Subapical organ with small peg-like sensillum. Maxilla similar to *minuta*, but lam.2 and 4 shorter, not reaching beyond tip of capitulum. Other mouth parts as in *minuta.* Body hairs short. Sensillary equipment as in *minuta*, but th.2 without microsensillum (00/000). Thorax and abd.2 without ventral setae. Retinaculum with 3 + 3 teeth and one seta. Furca rather short. Dens with 5 (4) dorsal and 6 ventral setae (Fig. 53K). Mucro with 3 teeth of variable shape. Tibiotarsi with 7 setae in the apical whorl, $A_1$ and $A_7$ sometimes prolonged and clavate. Claws unarmed. Other body marks as in *minuta*.

*Discussion.* – This small and pale species is recognised by the 5 + 5 ocelli, 3 + 3 retinacular teeth and loss of the microsensillum on th.2 which appears to be unique in the genus. Possibly our concept of *minima* covers more than one species. Specimens collected in rotten wood and under bark have coarser body hairs, mucro is stronger with large apical tooth, dens has some large dorsal humps (Fig. 53K) and tenent hairs on tibiotarsi are prolonged (longer than claws) and clavate. Some of these individuals have exceptionally protruding eyes (Fig. 53H), others not. The species also occurs regularly in sandy seashore habitats with individuals having finer body hairs, smaller eyes and tenet hairs not prolonged (much shorter than claws). A single sample from rotten wood has several subadult females with only 3 dorsal setae on dens. The material at hand does not permit a final conclusion about these forms.

*Distribution and ecology.* – Common under bark and in rotten wood, but also in sandy seashore meadows and sand dunes. Widely distributed. General distribution: Palaearctic.

## 236. ***Proisotoma ripicola*** Linnaniemi, 1912

Fig. 54A–H

*Proisotoma ripicola* Linnaniemi, 1912, Acta Soc. Sci. fenn. 40: 128.

*Description.* – Body size 1.2 mm. Greyish blue. Body shape slender, with a long furca (Fig. 54A). Integument smooth, primary hexagons unmodified. Ocelli 8 + 8. PAO elongate, about twice as long as nearest ocellus (Fig. 54D). Ant.1 with 22–25 setae, of which are two ventroapical sensilla and up to 10 dorsal p-setae (Fig. 54H). Lateroapical sensillum of ant.2 slender, hair-like. Ant.3 organ consists of two short, thick sensilla flanked by two slender guards. Lateroapical sensillum small, spine-like, without guard. Acessorial sensilla absent. Males with up to 8 erect thin sensilla ventrally on ant.2–3. Ant.4 with many hair-like sensilla. Subapical organ with a small rod-like sensillum. Labrum with 554 setae. Seta of the two apical rows thicker and more strongly curved than seta of the basal row. Prelabral setae 4. Maxillary palp bifurcate, 4 sublobal hairs. Labial palp with a complete set of papillae and guards (7 e-guards).

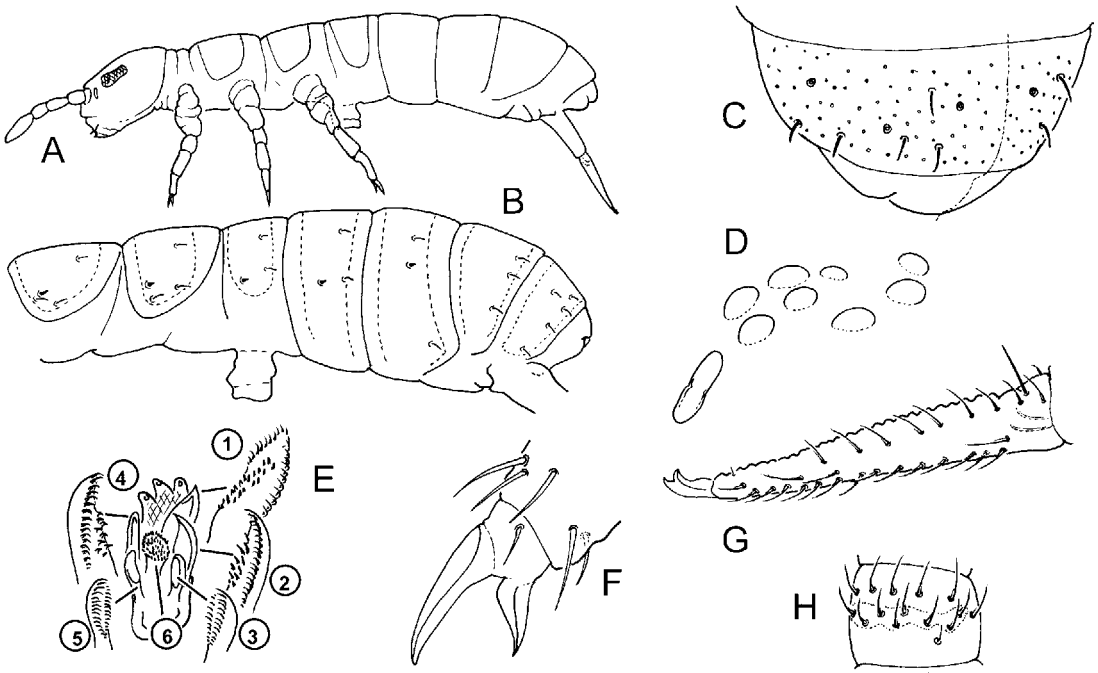


Fig. 54. *Proisotoma ripicola*: (A) Habitus; (B) sensillary distribution on th.2–abd.5; (C) abd.5 sensilla; (D) PAO and eyes; (E) maxilla; (F) claw and apical tibiotarsal setae; (G) dens and mucro; (H) dorsal setae on right ant.1, p-setae encircled.

Proximal setae 3. Basal fields with 4 median and 5 lateral setae. Maxilla with 3-toothed capitulum and 6 lamella which do not pass beyond tip of capitulum (Fig. 54E). Lam.1 with a fringe of cilia continuing around apex, and a small field of serrations on the inner side. Lam.2 and 4 with marginal ciliations and some coarse serrations on inner side. Lam.3 and 5 with marginal ciliations only. Lam.6 densely packed with small denticles. Head with 4 + 4 postlabial setae. Body hairs short and fine, making a dense uniform cover. Macrochaetae not longer than ordinary setae, only recognised by their erect posture. Macrosensilla thin, slightly shorter than ordinary setae, distributed as 33/22235. Microsensilla 11/111 (Fig. 54B). Upper sensilla on abd.1–3 set slightly in front of p-row. Abd.5 with one sensillum in forward position (Fig. 54C). Thorax and abd.2 without ventral setae. Ventral tube with 5 + 5 (6) lateral and 5–7 caudal setae. Retinaculum with 4 + 4 teeth and 2 (1) setae. Furca strong, manubrium with more than 50 dorsal setae and 1 + 1 ventroapical setae. Manubrial condyles continuous and sclerotised. Dens slightly longer than manubrium, slender, with many dorsal crenulations and 15–17 dorsal setae. Ventral side with 20–30 setae (Fig. 54G). Tibiotarsi with increased number of setae in basal part (whorls A–B regular, with 7 each). Tenent hairs short, unmodified (Fig. 54F). Reproductive males with seta $B_5$ and x on tib.3 prolonged, thin and erect, curved and pointed at apex. Claws unarmed. Unguiculus pointed, with high basal lamella (Fig. 54F).

*Discussion.* – The species is readily identified by 2-toothed mucro and long and richly haired dens, in combination with 4 prelabral setae and bifurcate maxillary palp. It is the only member of the genus with more than 16 ant.1 setae.

*Distribution and ecology.* – Usually in sandy habitats along inland lakes and streams. Few records from S. Norway, Finland and Sweden. General distribution: Palaearctic.

## 237. ***Proisotoma tenella*** (Reuter, 1895)

*Isotoma tenella* Reuter, 1895, Acta Soc. Fauna Flora fenn. 11: 28.

*Description.* – Body size 0.9 mm, grey, with 8 + 8 ocelli. PAO elongate, about twice as long as ocellus, slightly constricted in the middle. Abd.5–6 not fused. Body hairs moderately long, becoming increasingly longer towards tip of abdomen. On abd.5–6 about 2.5 as long as ordinary setae. Retinaculum with 4 + 4 teeth and one seta. Furca reaching middle of abd.2. Manubrium with 3 + 3 ventroapical setae. Dens dorsally crenulated, with 9–10 dorsal setae and about 23 ventral setae. Mucro bidentate, subapical tooth strongest. Tibiotarsus with one clavate tenent hair. Claws unarmed, unguiculus lanceolate, more than half as long as inner unguis.

*Discussion.* – The above description is based on Stach's (1947) redescription of Polish specimens, referred to in Potapov (2001). Reuter's original description of Finnish specimens is very general and inconclusive in modern terms. However, presence of 3+3 manubrial setae in combination with bidentate mucro and a clavate tenent hair will characterise this species among Nordic *Proisotoma*.

*Distribution and ecology.* – Only reported from Finland, Sweden and the Faroe Islands. Agrell (1939) reported a mass occurrence in a greenhouse in S. Sweden. General distribution: Possibly cosmopolitan, but records are dubious due to unclear taxonomic status. Agrell (1939) reports the species from Greenland. In the Lund collection there is a slide of *tenella* marked 'Anrmagssalik, 12/9-33'. That individual belongs to a series of 194 specimens collected at Ammassalik on the SE coast of Greenland during July–Sept. 1933, reported by Hammer (1944: 198). Her specimens might be a mixture of forms, but the Lund specimen is *Cryptopygus roberti* (Fjellberg, 1991), and *tenella* should be deleted from the Greenland list.

## Genus *Scutisotoma* Bagnall, 1948

*Scutisotoma* Bagnall, 1948, Ann. Mag. nat. Hist. (12) 1: 535. Type species: *Proisotoma titusi* Folsom, 1937, by original designation.

After having been listed among the many synonyms of *Proisotoma* by most recent authors, Potapov et al. (2006) gave *Scutisotoma* new generic status and allocated an heterogenous assemblage of 26 Holarctic species to the taxon. Our two Nordic species differ from the *Proisotoma* species by a 3-toothed mucro combined with presence of microsensilla on abd.1–3 and presence of bluish body pigment.

### Key to species

1 Prelabral setae 4. Maxillary palp bifurcate. Macrosensilla 44/33334. Abd.5 with one of the sensilla moved forward (Fig. 55D). Not alpine species . . . . . 238. *armeriae* (Fjellberg)

– Prelabral setae 3. Maxillary palp simple. Macrosensilla 33/22224. All abd.5 sensilla in posterior position (Fig. 56B). Alpine species . . . . . 239. *subarctica* (Gisin)

### 238. *Scutisotoma armeriae* (Fjellberg, 1976)

Figs 52B, 55A–G

*Proisotoma armeriae* Fjellberg, 1976, Ent. scand. 7: 233.

*Description.* – Body size 0.8 mm. Colour bluish grey, ventral side also dark. Ocelli 8 + 8. Body slender, cylindrical, with relatively short furca. Integument smooth. PAO elongate, about 3 times as long as nearest ocellus (Fig. 55B). Ant.1 with 15 setae, including 2 ventroapical sensilla and one dorsal p-seta. Ant.2 with a hair-like lateroapical sensillum. Ant.3 organ with two short sensilla flanked by two guards, and a lateroapical spine-like sensillum without guard. In addition there are 4–5 accessorial sensilla on dorsal side and males have two ventroapical short erect sensilla. Ant.4 with many curved hair-like slender sensilla. Subapical organ with projecting rod-shaped sensillum. Labrum with 554 setae, 4 prelabrals. Maxillary palp bifurcate, 4 sublobal hairs. Labial palp with a complete set of papillae and guards. Mandibles normal, strong. Maxilla (Fig. 55D) with 3-toothed capitulum and 6 lamella. Lam.1 reaches well beyond tip of capitulum. Lam.1–5 with marginal ciliation and some serrations/denticles on inner side. Lam.6 packed with small denticles. Head usually with 3 + 3 (4) postlabial setae. Body hairs short, uniform. Macrochaetae only differentiated on abd.5–6. Macrosensilla distributed as 44/33334,

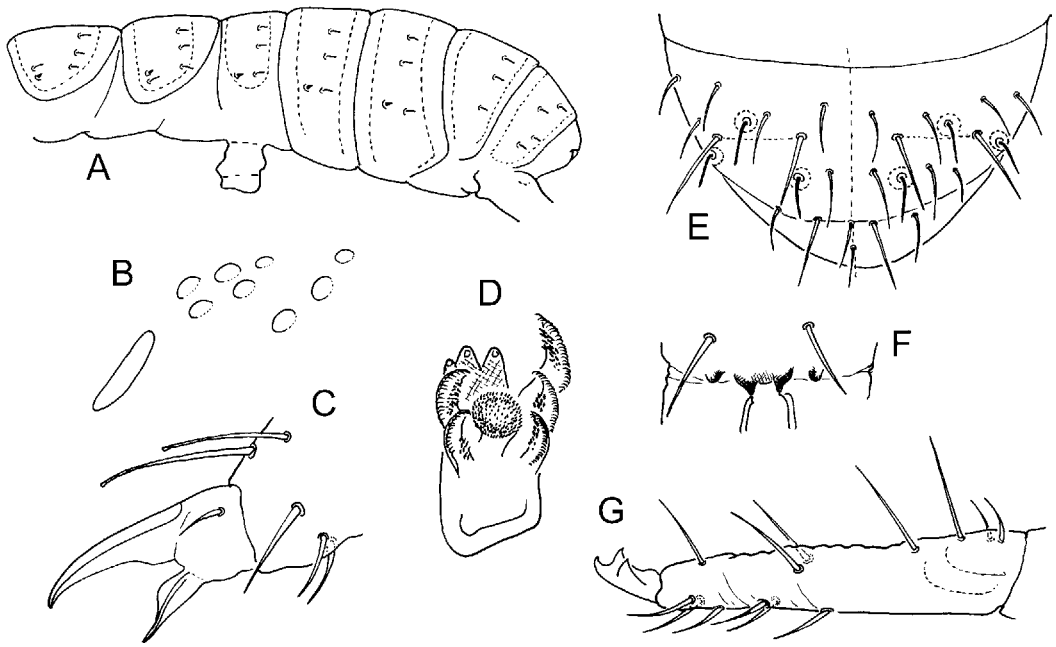


Fig. 55. *Scutisotoma armeriae*: (A) Sensillary distribution on th.2–abd.5; (B) PAO and eyes; (C) claw and apical tibiotarsal setae; (D) maxilla; (E) abd.5–6 with sensilla marked (juvenile); (F) manubrium/dens articulation; (G) dens and mucro.

microsensilla 11/111 (Fig. 55A). Macrosesilla slender, subequal to normal setae, inserted in the mid-section of the tergites on abd.1–3. On abd.5 one of the sensilla is moved to a forward position, in front of a line connecting the macrochaetae $M_1$–$M_2$ (Fig. 55E). Thorax and abd.2 without ventral setae. Ventral tube with 4 + 4 lateral and 6–7 caudal setae. Retinaculum with 4 + 4 teeth and one seta. Manubrium with 1 + 1 ventroapical setae and more than 20 dorsal setae. Manubrial condyles discontinuous, lateral part like a blunt knob (Fig. 55F). Dens with weak dorsal crenulations, normally with 7 (6–8) dorsal setae and 6 ventral in distal half (Fig. 55G). Mucro with 3 teeth, no seta. Ventral edge sharp, keel-like. Tibiotarsi with 21-21-24 setae, apical whorls without T-setae. Tenent hairs 1-2-2, slightly knobbed at apex ($A_1$ and $A_1/A_2$). Setae $B_5$ and x on tib.3 modified (thin, erect) in reproductive males. Claws unarmed, unguiculus pointed, with high basal lamella (Fig. 55C).

*Discussion.* – The species is characteristic by the increased number of macrosensilla on tergites. None of the other species of *Proisotoma*/*Scutisotoma* have as many as 4 on th.2–3 and 3 on abd.1–3. Also a bifurcated maxillary palp in combination with 4 sublobal hairs is only seen in *P. ripicola* which differs by having only two mucronal teeth and much more setae on dens.

*Distribution and ecology.* – Scattered records from Norway and Sweden in dry, rocky seashore habitats, but also in dry pine forest and on goose shit in a bog. General distribution: Palaearctic.

## 239. *Scutisotoma subarctica* (Gisin, 1950)

Fig. 56A–H

*Proisotoma subarctica* Gisin, 1950, Mitt. schweiz. ent. Ges. 23: 415.
*Proisotoma pseudominuta* Agrell, 1943, nec Schött, 1927.

*Description.* – Body size 1.1 mm. Colour bluish black. Body shape as Fig. 56A. Integument smooth. At higher magnification the primary hexagons appear to fuse to form a more irregular rugose pattern, giving the cuticle an amber-like shine. Ocelli 8 + 8. PAO elongate,

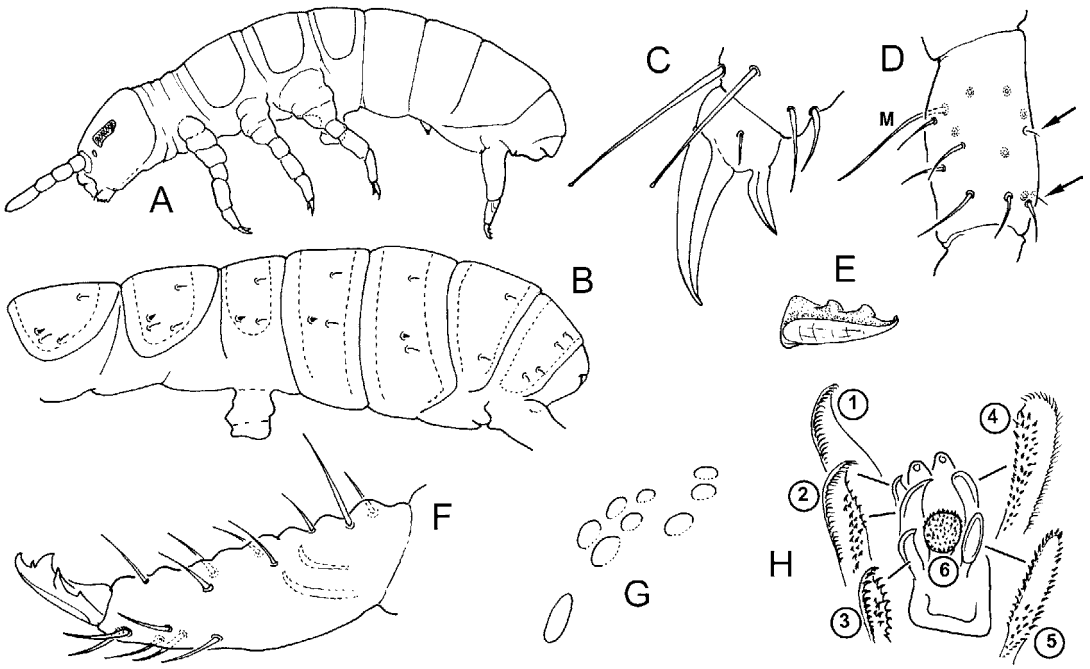


Fig. 56. *Scutisotoma subarctica*: (A) Habitus; (B) sensillary distribution on th.2–abd.5; (C) claw and apical tibiotarsal setae; (D) femur on right fore leg showing inner macrochaeta (M) and two outer setulae (arrows); (E) mucro, ventrolateral; (F) dens and mucro; (G) PAO and eyes; (H) maxilla.

about 1.5 as long as nearest ocellus (Fig. 56G). Ant.1 with 15 setae, of which two are ventroapical sensilla and one dorsal p-seta (small). Ant.2 with a thickened lateroapical sensillum. Ant.3 apical organ consists of two small sensilla flanked by two short guards. Lateroapical sensillum small, spine-like, without associated guard. Accessorial sensilla absent. Males with a few erect sensilla ventrally on ant.2–3. Ant.4 with many curved sensilla which are only slightly differentiated from ordinary setae. Subapical organ with a small rod-shaped sensillum. Labrum with 554 setae. Setae of the two apical rows thicker, more curved than the basal row. Prelabrals 3. Maxillary palp simple, 4 sublobal hairs. Labium with a full set of papillae and guards, except for the loss of guard $e_7$. Proximal setae 3. Basal fields with 4 median and 5 lateral setae. Mandibles normal, strong. Maxilla with 3 strong capitular teeth and 6 short lamella not reaching beyond tip of capitulum (Fig. 56H). Lam.1 unusually small, with a fleshy base and a short row of marginal ciliation near apex, no denticles/serrations. Lam.2–5 with marginal ciliations and serrations on the inner side. Lam.6 covered with fine denticles. Body hairs short, uniform. Macrochaetae only differentiated on abd.5–6. Macrosensilla 33/2224, microsensilla 11/111 (Fig. 56B). The macrosensilla are short and thin, only half as long as ordinary setae. Upper sensilla on abdominal tergites set well in front of the p-row. Thorax and mid-section of abd.2 without ventral setae. Ventral tube with $3 + 3$ lateral and 3–4 caudal setae. Retinaculum with $4 + 4$ teeth (lower tooth sometimes indistinct) and 1–2 setae. Manubrium with $1 + 1$ ventroapical setae and more than 30 dorsal setae. Manubrial ventroapical condyles continuous, sclerotised. Dens with large dorsal humps, 7–8 dorsal and 6–7 ventral setae in apical half (Fig. 56F). Mucro with 3 large teeth, sometimes one or two small additional teeth. Ventral edge of mucro blunt and rounded, completely smooth, without granules, similar to the dorsal edge of the claws (Fig. 56E). Tibiotarsi with 21-21-26 setae, tenent hairs prolonged, clavate (1-2-2, $A_1$ and $A_1/A_2$). Inner side of tib.3 with modified setae $B_5$ and x (erect, blunt-tipped) in reproduc-

tive males. Inner side of femora with a long, thin macrochaeta. Outer side of fem.1 with two short setula (Fig. 56D). Claws unarmed, unguiculus short (Fig. 56C).

*Discussion.* – The species is well characterised by the key characters. Also the long ventral macrochaeta on femur is characteristic. The broad ventral hyaline "nail" on mucro is matched by no other *Scutisotoma*/*Proisotoma*, but is similar to what is seen in *Crypropygus clavatus* (Fig. 44K). Finally the maxilla is characteristic by the poorly developed lam.1.

*Distribution and ecology.* – Only in wet alpine habitats near snowfields and cold streams in Norway and Sweden. General distribution: Holarctic/circumpolar (Russian Arctic, Ellesmere Island).

## Genus *Strenzketoma* Potapov et al., 2006

*Strenzketoma* Potapov, Babenko & Fjellberg, 2006, Zootaxa 1382: 63. Type species: *Proisotoma buddenbrocki* Strenzke, 1954, by original designation.

Within the *Proisotoma* complex the monotypic genus is characterised by strong apomorphies including reduction of the mouthparts (maxilla, sublobal hairs, prelabral setae), reduced sensillary set (no sensilla on th.3–abd.1) and short legs with reduced number of setae. Some of these characters are probably related to an interstitial marine littoral way of life and are matched by conditions observed among other species with a similar life style, but the character combination described below is unique.

### 240. *Strenzketoma buddenbrocki* (Strenzke, 1954)

Fig. 57A–J

*Proisotoma buddenbrocki* Strenzke, 1954, Veröff. Inst. Meeresforsch. Bremerh. 3: 52.

*Description.* – Body size 0.8 mm. Large specimens with diffuse greyish or olive pigmentation, smaller specimens almost white. Ocelli 8 + 8. Eye-spots large, dark. Ant.4 with a distinct bluish spot near tip. Body cylindrical, with rather short extremities (Fig. 57A). Integument smooth, but the meshwork of primary hexagons coarser than usual, easily visible at high magnification. PAO elongate, with two posterior setae. A distinct integumentary lobe partly covers the posterior edge of PAO (Fig. 57G). Ant.1 with 15 setae, of which there are two ventral sensilla, one setula and one dorsal p-seta. Ant.2 with 19 setae, lateroapical sensillum thickened, spine-like. Ant.3 with 21 setae in addition to the 6 sensilla of the apical organ and 3 erect ventral sensilla in males (Fig. 57I). No accessorial sensilla. Ant.4 with many curved dorsal sensilla, of which 2–3 are thicker than others. Subapical organ with a small rod-shaped sensillum. Labrum with 553 thin, unmodified setae. One prelabral seta. Maxillary palp simple, one sublobal hair. Labial palp without guards $e_7$ and $e_4$, proximal field with 3 setae, basal fields with 4 median and 5 lateral setae. Head with 3 + 3 postlabial setae. Mandibles short with a small molar field having some very large teeth (Fig. 57H). Maxilla specialised (Fig. 57J). Capitulum with 3 teeth, the dorsal one weaker than the others. The 6 lamellae are of unusual shape: Lam.1 reaches tip of capitulum, tongue-shaped (roundish cross section), covered with very fine denticles, no marginal ciliation. Lam.2 only with some delicate ciliation along ventral edge. Lam.3 reduced, only visible as an irregular flap at base of lam.2. Lam.3–4 narrow, with long apical hooks and 4–5 coarse serrations. Lam.6 narrow, with 3–4 small teeth along inner edge. Body hairs short and fine. Macrochaetae erect, but not reaching above the general hair cover. Macrosensilla much shorter than ordinary setae, distributed as 30/02224 (Fig. 57C). Upper sensilla on abd.2–3 set in p-row. Lower pair of sensilla on abd.5 shorter and thicker than upper pair (Fig. 57D). Microsensilla as 10/001. No ventral setae on thorax. Abd.2 without midventral setae. Ventral tube with 4 + 4 (3) lateral and 4 caudal setae, no frontal. Retinaculum with 3 + 3 teeth and one seta. Manubrium with 1 + 1 ventroapical setae and more than 20 dorsal setae. Manubrial condyles sclerotised, continuous, blunt. Dens slightly shorter than manubrium, with broad dorsal humps, 11 dorsal setae and 6 ventral setae in apical half only (Fig. 57B). Mucro short, with large lamellate subapical tooth and a small apical tooth. Mucronal seta absent. Ventral edge sharp, keel-like. Subcoxae 1 with 0-1-2 setae, subcoxae 2 with 1-5-5, coxae

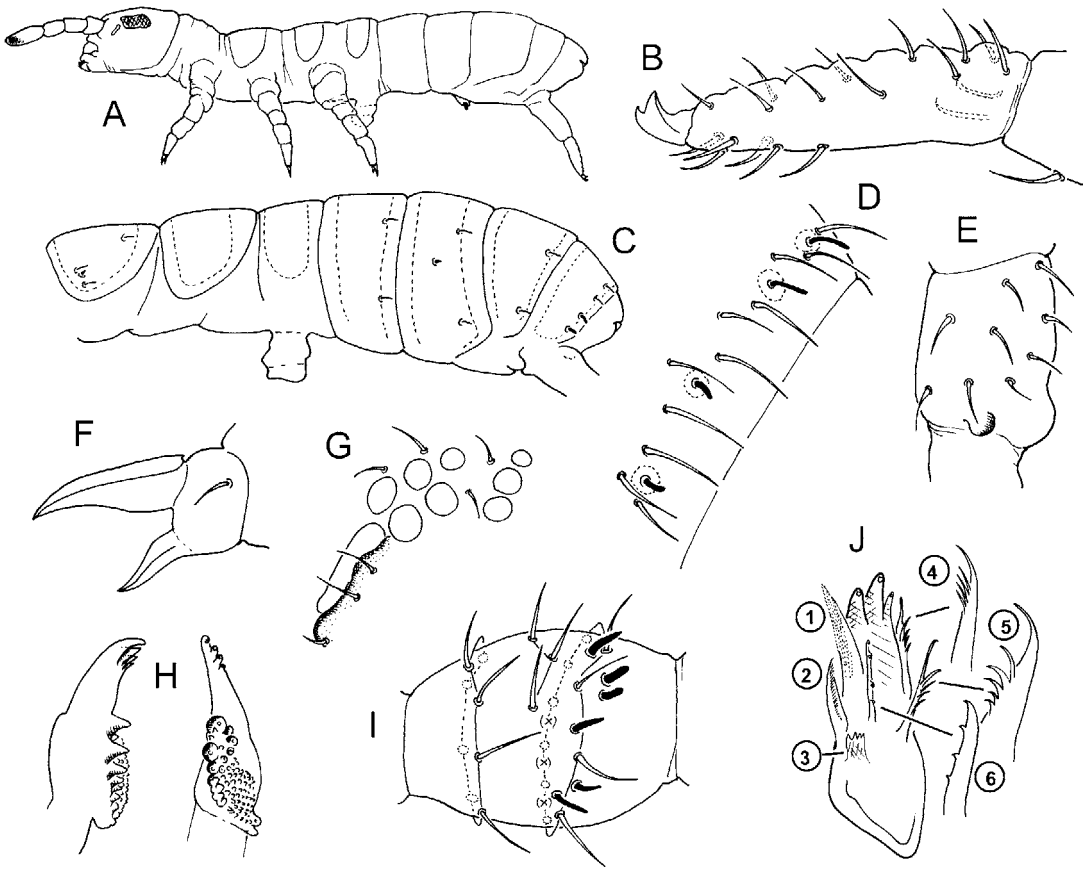


Fig. 57. *Strenzketoma buddenbrocki*: (A) Habitus, (B) dens and mucro; (C) sensillary distribution on th.2–abd.5; (D) sensilla along posterior edge of abd.5; (E) femur of hind leg; (F) claw; (G) PAO and eyes; (H) mandible, different views; (I) right ant.3 with male setae (x) indicated; (J) maxilla.

with 3-7-7, trochanters with 7-5-4, femurs with 11-11-12 setae. Tibiotarsi with 18-18-19 setae, apical whorl with 7 setae (T-setae absent). Tenent hairs ($A_1$ on tib.1, $A_1$ and $A_2$ on tib.2–3) slightly prolonged, curved at tip, not clavate. On tib.1–2 setae $C_{4-5-6}$ absent. On tib.3 whorls A and B complete, C-whorl irregular, with 4 setae. Males with unmodified seta x. Femur on last pair of legs with an apical roundish lobe on the outer side (Fig. 57E). Claws short, unarmed. Unguis very little curved, unguiculus pointed with weak basal lamella (Fig. 57F).

*Discussion.* – Easily spotted by characteristic habitus and the generic characters.

*Distribution and ecology.* – An uncommon species occurring in wrack beds on sandy seashores, sometimes along streams some way up from the sea. Probably widely distributed, but few records. General distribution: Palaearctic.

## Genus *Agrenia* Börner, 1906

*Agrenia* Börner, 1906, Mitt. naturh. Mus. Hamb. 23: 171. Type species: *Isotoma bidenticulata* Tullberg, 1876, by original designation.

A long subapical seta on dens (Fig. 58B) and claws bearing a tunica (Fig. 58F) are unique features among Nordic isotomids. Absence of sublobal hairs on the maxillary outer lobe is also an exceptional character (Fig. 3K).

## Key to species

1 Mucro slender, with a lateral seta (Fig. 58D) 241. *bidenticulata* (Tullberg)

– Mucro more compact, lateral seta absent (Fig. 58E) . . . . . 242. *riparia* Fjellberg

## 241. *Agrenia bidenticulata* (Tullberg, 1876)

Figs 3C, 58B–D, F

*Isotoma bidenticulata* Tullberg, 1876, Öfvers. K. VetenskAkad. Förh. 33: 35.

*Description.* – Body size up to 1.9 mm. Colour variable from dark olive green to dirty yellowish. Dorsal side of th.2–abd.3 usually darker, like the narrow mid-dorsal part of abd.4–6. Sometimes specimens are of a more uniform dark colour. Body shape slender, with long extremities (as Fig. 58A). Antennae often twice as long as head diagonal. Integument smooth. Head with 8 + 8 ocelli. PAO oval, about as long as an ocellus. Antenna with many curved, thin sensilla ventrally on ant.1 and on dorsal and ventral sides of ant.2–4. Ant.3 organ with enlarged sensilla, of same shape as guards. In lateroapical position a spine-like sensillum and a normal guard are present. Tip of ant.4 with a pair of blunt papillae. Apical pin-seta shortly bifurcated, subapical organ rod-shaped. Labrum with 554 setae, 4 prelabrals. Labral edge with 4 large, square folds, ventroapical ciliation brush-like. Labial palp with a complete set of papillae and guards. Proximal and basomedian fields with increased number of setae (8–10). Maxillary palp trifurcate, sublobal hairs absent. Mandibles normal, strong. Maxilla with 3-toothed capitulum and 6 lamellae which are densely packed with denticles and without long marginal ciliations. Lam.1 not passing tip of capitulum (Fig. 58C). Body hairs short and fine, smooth. Macrochaetae not developed on tergites. Inner side of femora with one particularly long macrochaeta. Sensillary equipment of tergites irregular, increased in numbers. Spine-like microsensilla distributed as 11/111. Macrosensilla short, setaceous. Small juveniles (2.instar) with 5–6 on each side of th.2–abd.3 tergites, with 8–9 on each side of abd.4–5. On abd.1–3 the sensilla are set in the p-row, on abd.4–5 some sensilla also in middle and anterior positions. Head with more than 10 + 10 postlabial setae. Thorax without ventral setae. Ventral tube with numerous (>20) caudal and lateral setae, frontal setae up to 12 on each side, rarely absent. Retinaculum with 4 + 4 teeth and more than 20 setae. Furca strong, dens and manubrium with numerous short setae. Dorsal side of dens with many wart-like papillae. A long subapical setae present on inner side, projecting far beyond tip of mucro (Fig. 58B). Mucro with lateral seta. Apical and subapical teeth subequal (Fig. 58D). Ventral edge narrow, sharp. Tibiotarsi with 11 setae in the apical whorl (T-setae present). Tenent hairs not differentiated. Claws long and narrow, without teeth. Unguiculus with high lamellae. Unguis with a serrated tunica, formed by the fused basal teeth (Fig. 58F). Males present, reproductive individuals without epitokous modifications. Cyclomorphosis absent, no special winter morphs.

*Discussion.* – Only to be confused with the following species (see below).

*Distribution and ecology.* – Common in wet arctic and alpine habitats (snow fields, along streams and lakes). In Norway following streams down to the forest region. General distribution: Holarctic.

## 242. *Agrenia riparia* Fjellberg, 1986

Figs 3K, 58A, E

*Agrenia riparia* Fjellberg, 1986, Ent. scand. 17: 103.

*Description.* – Body size up to 1.6 mm, slender, with long extremities (Fig. 58A). Colour dark olive or brownish, ventral side and extremities paler. Antennae 1.5–1.8 as long as head diagonal. Ventral tube usually without frontal setae. Mucro compact, without lateral seta (Fig. 58E). Claws rather short, in particular in winter specimens. Reproductive males have slightly shorter and finer hairs on abd.4–6 (epitoky). Other body marks as in *bidenticulata*.

*Discussion.* – The absence of mucronal setae and the compact mucro with the small apical tooth readily identify this species. The species is cyclomorphic with winter animals having shorter claws with relatively larger tunica and smaller apical tooth on mucro.

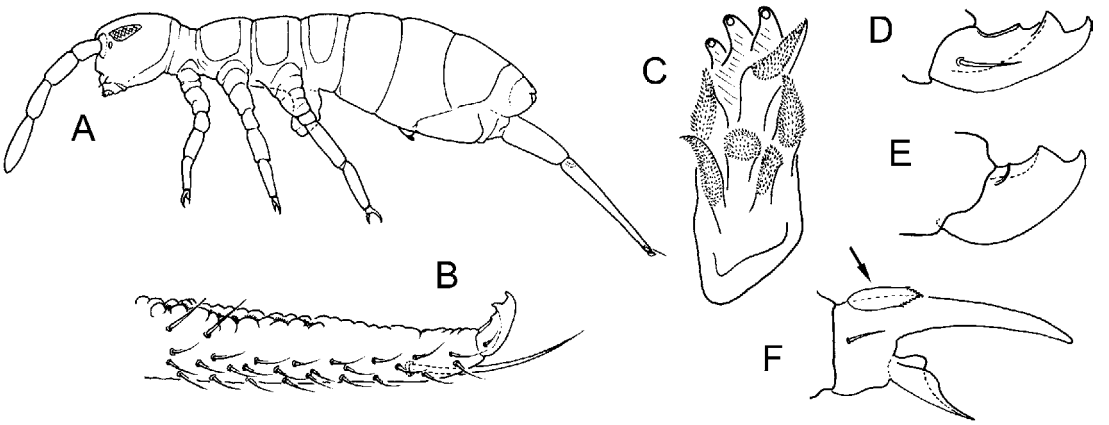


Fig. 58. *Agrenia riparia* (A, E) and *A. bidenticulata* (B–D, F): (A) Habitus; (B) apical part of dens and mucro, (C) maxilla, (D) mucro; (E) mucro; (F) claw, tunica marked (arrow).

*Distribution and ecology.* – A typical inhabitant in wet moss on stony river banks of the forest region, not alpine or arctic. So far only seen from Norway, but probably present also in Sweden and Finland. The old Finnish records from Kolari and Utsjoki (Linnaniemi, 1912: 174) may actually be *riparia*, but specimens are not checked. – General distribution: Holarctic.

## Genus *Isotomurus* Börner, 1903

*Isotomurus* Börner, 1903, Sber. Ges. naturf. Freunde Berl. 1903 (3): 171. Type species: *Podura palustris* Müller, 1776, by original designation.

Members of this genus are very similar in appearance to species of *Isotoma*, but differs by presence of trichobothria on abd.2–4 (except in one species which differs from all *Isotoma* by having no more than 3 + 3 lateral setae on ventral tube). Also head shape is different, with more prominent mouth cone. In the long-haired *Isotomurus* the 3 macrochaetae on each side of abd.4 are set in a triangle, while they are all lined up in *Isotoma* (Fig. 59C, D). Common characters of Nordic *Isotomurus*: Ocelli 8 + 8. Labrum with 554 slender setae, 4 prelabrals. Apical edge of labrum with 4 sharp folds, ventroapical ciliation like a dense brush. Maxillary outer lobe bifurcated, with 4 sublobal hairs. Labium with increased number of setae in the proximal field of the palp (>4) and in the basomedian field (>5). Mandibles normal, strong. Maxilla with strongly serrated lamellae, mostly unmodified. Tibiotarsi with 8 primary setae in the apical whorl ($A_{1-7}$, $T_1$, best seen in small juveniles). Abd.2–4 with 331 trichobothria (absent in *antennalis*), in 1.instar juveniles only 011. Abd.5 with 7 + 7 ordinary sensilla, the 2 + 2 median ones prolonged.

Intensified research on the European *Isotomurus*, including molecular methods, has detected new species and given new status to many forms which were regarded as colour morphs until recently (Carapelli et al., 1995a, 1995b; Carapelli et al., 2001). But still there are unsolved problems among the Nordic species, and the present arrangement of taxa may not have found its final form.

### Key to species

1 Dens dorsally crenulated (Fig. 59B) . . . . . 2

– Dens dorsally tuberculated (Fig. 59A) . . . . . 250. *stuxbergi* (Tullberg)

2 Trichobotria present on abd.2–4, abdominal macrochaetae usually distinct. Ventral tube with 3 + 3 or more laterodistal setae (Fig. 59H, I) . . . . . 3

– Trichobotria absent, abdominal macrochaetae not developed. Ventral tube with 3 + 3 laterodistal setae. Colour characteristic (Pl. 2: 1) . . . . . 252. *antennalis* Bagnall

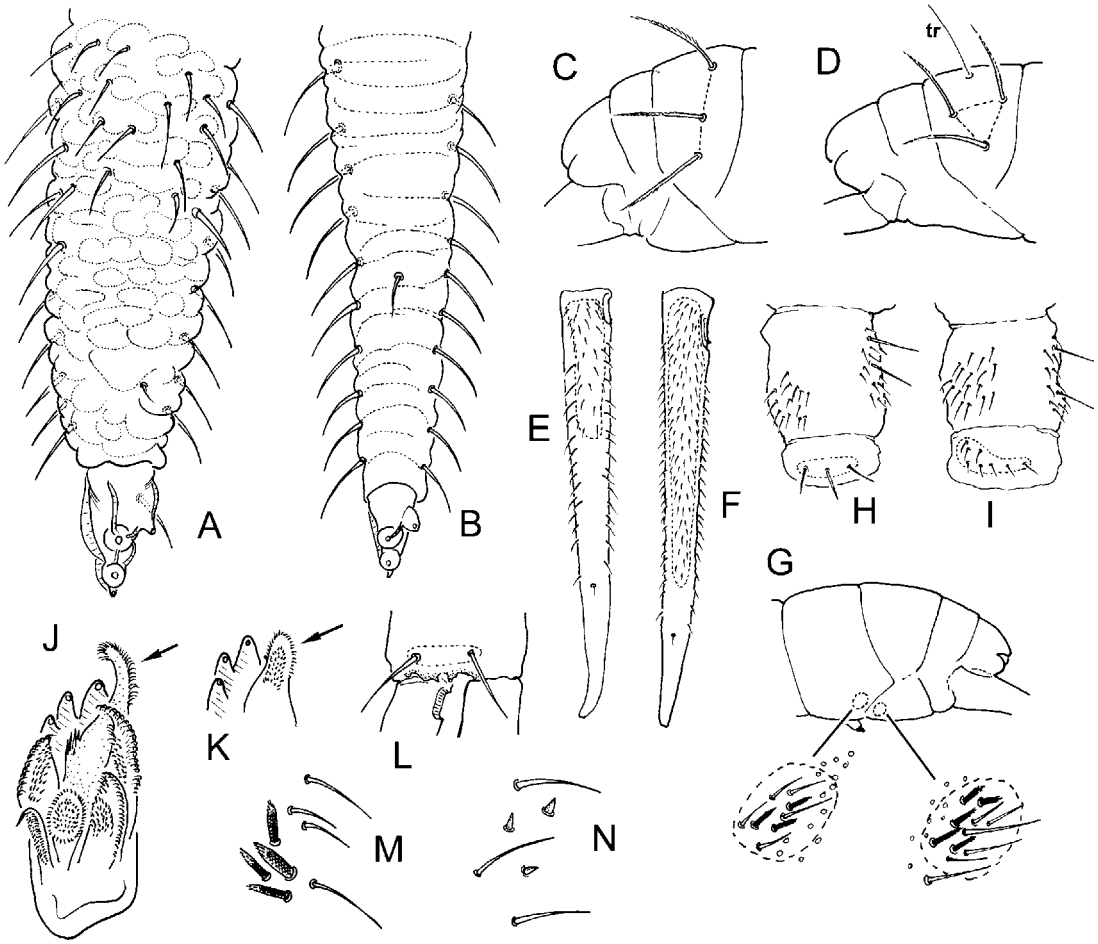


Fig. 59. *Isotomurus* spp. (A–B, D–N) and *Isotoma anglicana* (C): (A–B) Apical part of dens and mucro (dorsal) in *stuxbergi* (A) and *palustris* (B); (C–D) position of macrochaetae on abd.4 in *Isotoma anglicana* (C) and *Isotomurus palustris* (D, tr: trichobothrium); (E–F) dorsal pilosity of dens in *italicus* (E) and *fucicola* (F); (G) *fucicola*, modified seta on abd.3–4 in reproductive male; (H–I) laterodistal setae (encircled) on ventral tube in *italicus* (H) and *plumosus* (I); (J) *fucicola*, maxilla with long lam.1 (arrow); (K) *italicus*, ditto, with short lam.1; (L) *italicus*, 1.instar juvenile with 1 + 1 ventroapical setae on manubrium; (M–N) *italicus*, modified lateral setae on abd.4 in reproductive (M) and unreproductive (N) male.

3 Lateral seta present on mucro. Ventral tube with more than 3 + 3 laterodistal setae. Short body hairs of abdomen serrated or ciliate . . . . . 4

– Mucronal seta absent. Ventral tube with 3 + 3 laterodistal setae (rarely with a few more). Short body hairs smooth . . . . . 5

4 Colour pattern as three sharp longitudinal lines (Pl. 2: 5) . . . . . 249. *plumosus* Bagnall

– Colour patterns as broad transverse bands (Pl. 2: 2) . . . . . 251. *balteatus* (Reuter)

5 Colour uniformly reddish brown/blue . . . . 6

– Colour uniformly green or patterned . . . . . 7

6 Abd. macrochaeta short, smooth. Dens with sparse dorsal cover of setae (Fig. 59E). Max. lam.1 not longer than capitulum, with denticles on inner side (Fig. 59K). Males with modified setae in lateral part of abd.4 only. 1.instar juveniles with 1 + 1 ventroapical manubrial setae (Fig. 59L) . . . . . 245. *italicus* Carapelli et al.

– Abd. macrochaetae long, ciliate. Dens with more dorsal setae (Fig. 59F). Max. lam.1 longer than capitulum, inner side without denticles (Fig. 59J). Males with modified setae in lateral parts of abd.3–4 (Fig. 59G). 1.instar juveniles without ventroapical manubrial setae . . . . . 246. *fucicola* (Schött)

7 With longitudinal or spotted patterns. Clypeal edge contrastingly dark . . . . . 8

– Uniform greenish, clypeal edge not darkened . . . . . 248. *graminis* sp. nov.

8 Dorsal pattern as longitudinal lines or patches (Pl. 2: 4, 6–10). Abd.4 without crown-like figure . . . . . 9

– Dorsal patches not clearly arranged in lines. Abd.4 with a crown-like figure (Pl. 2: 3) . . . . . 244. *maculatus* (Schäffer)

9 Dorsolateral patches on th.2–abd.2 separated from the dark coxal parts of legs and ventrolateral pigmentation on abd.1–2 by unpigmented fields (Pl. 1: 8). Males without modified setae on abd.2–3 . . . . . 243. *palustris* (Müller)

– Dorsolateral pigmentation on th.2–abd.2 fused with the ventrolateral patterns (Pl. 1: 10). Males with spine-like setae on abd.3–4 (as Fig. 59G) . . . 247. *unifasciatus* (Börner)

## 243. ***Isotomurus palustris*** (Müller, 1776)

Figs 59B, D, 60A, B, H, M, N, P; Pls 1: 8, 2: 4

*Podura palustris* Müller, 1776, Zoologiae Danicae prodromus: 184.

*Description.* – Body size up to 2.5 mm or larger, pigment pattern as Pls 1: 8, 2: 4. Ground colour of body pale, yellowish white. Pigmentation bluish grey to bluish violet. Pattern in full grown adults consist of a broad mid-dorsal band which is darker on th.2–abd.1 and particularly on abd.4–5. A dorsolateral pattern consisting of large, diffuse patches with many pale spots are found as discrete elements on th.2–abd.2, being separate from the mid-dorsal band and the lateral pigmentation. Backwards from abd.2 the dorsolateral elements more or less fuse with the mid-dorsal and lateral pigmentation. Most of abd.5 is dark, with a large pale spot on each side of the dark midline. Abd.6 with large lateral spots, midline unpigmented. Legs with bluish pigmentation, darkest in coxal parts, extending to ventrolateral parts of th.2–3. The ventrolateral pigmentation on thorax continues backwards on the sides of abdomen, merging into the dorsolateral elements backwards from abd.3. Also ventral side of the body with diffuse bluish pigment. Ventral and lateral sides of head with diffuse bluish pigmentation, including the mouth parts. Frontoclypeal area diffusely darkened. Head with a dark mid-dorsal spot behind the eyes. Antennae bluish, including the basal sockets. Last segment more reddish. PAO small, oval, not longer than diameter of nearest ocellus. Body shape *Isotoma*-like, with prominent mouth cone. Body integument smooth, with a dense cover of dark setae. Clearly differentiated macrochaetae only developed on the three last abdominal segments. Macrochaetae densely ciliated. Some of the shorter hairs of abdomen may have a few ciliations in basal part. All antennal segments with many hair-like sensilla. Ant.2–4 in lateral parts with some blunt, short sensilla (Fig. 60M). Ant.3-organ with blunt sensilla. Individual variation in sensillary equipment frequent, depending on size/age. Mandibles normal, strong. Maxilla with 3-toothed capitulum an 6 short lamellae covered with sharp denticles/serrations (Fig. 60A, B). Lam.1 not longer than capitulum, with a small group of denticles on the inner side. Sensillary equipment of tergites in small juveniles as 77/66787, with some variation. Ventral tube with 3 + 3 laterodistal setae, many setae in frontal and caudal groups. Retinaculum with 4 + 4 teeth and more than 20 setae in large specimens. Furca strong, dorsal pilosity of dens extends more than halfway to apex (as in *fucicola*, Fig. 59F). Dens with dorsal, transverse crenules. Mucro with reduced apical tooth in ventral position, no lateral seta. Lamellae associated with the teeth absent (Fig. 60H). Tibiotarsi in juveniles with 8 primary setae in the apical whorl ($A_{1-7}$, $T_1$), increased number in adults. Claws with a pair of strong basolateral teeth and a single dorsomedian tooth near base. Unguiculus pointed, with strong corner tooth. No inner tooth on unguis (Fig. 60P). Modified male setae absent on lateral parts of abd.3–4.

*Discussion.* – The colour pattern described above is typical in most Nordic populations. Particularly characteristic is the bluish coloration

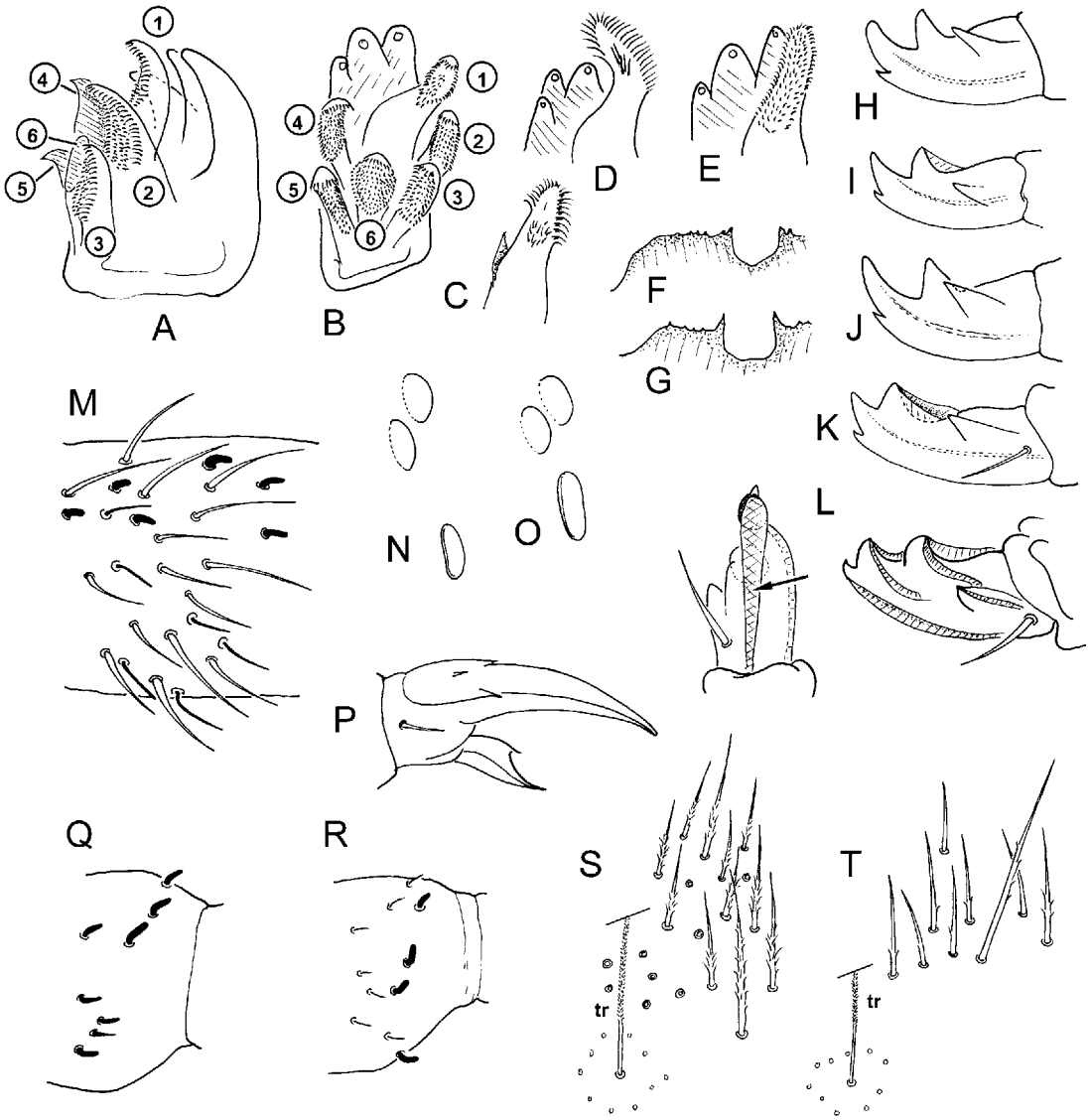


Fig. 60. *Isotomurus* spp.: (A–B) *palustris*, maxilla; (C–E) maxillary lam.1 in *unifasciatus* (C), *plumosus* (D) and *antennalis* (E); (F–G) ventroapical manubrial thickening in *italicus* (F) and *fucicola* (G); (H–L) mucro in *palustris* (H), *unifasciatus* (I), *italicus* (J), *plumosus* (K) and *stuxbergi* (L, ventral view to the left with arrow pointing to the broad ventral lamella); (M) *palustris*, short blunt sensilla in mid-section of ant.4; (N–O) PAO and two nearest ocelli in *palustris* (N) and *italicus* (O); (P) *palustris*, claw; (Q–R) right ant.3 organ and associated sensilla in *antennalis* (Q) and *plumosus* (R); (S–T) *plumosus*, trichobothrium (tr) and associated setae on left side of abd.4, two different specimens from the same sample.

of the basal parts of the legs and ventrolaterally on abd.1–2, which is sharply set off from the dorsolateral elements of thorax and abdomen and the pale yellowish white unpigmented background. Also the dark mouth cone is typical. In smaller individuals only diffuse shades of the colour patterns are developed, but parts of the midline and the dark spots on abd.5–6 are usually present. Very small individuals are unpatterned. In some populations even adults have a very weak coloration but parts of the pattern will usually be seen in some individuals.

In dubious cases the lack of modified setae on abd.3–4 in reproductive males will exclude *graminis/pseudopalustris*. A well-coloured female neotype, selected from a Danish population by Carapelli et al. (2001), was checked in May 2005 and found to be in accordance with the colour pattern described above.

*Distribution and ecology.* – Common and widely distributed. Usually in damp sites with some standing water (ponds, lakes, stream banks, bogs, wet meadows). Exact distribution not known due to confusion with other species. General distribution: Unclear (revision needed).

## 244. ***Isotomurus maculatus*** (Schäffer, 1896)

Pls 1: 7, 2: 3

*Isotoma palustris* f. *maculata* Schäffer, 1896, Mitt. naturh. Mus. Hamb. 13: 186.

*Description.* – Body size up to 3 mm. Similar to *palustris* in all essential body marks, including maxilla and sensillary equipment of antennae and abdomen. The only practical way of separating the two species relies on colour pattern. While *palustris* usually has a continuous dark dorsal band running from th.2–abd.5, and weaker dorsolateral marks, the dorsal band of *maculatus* becomes diffuse or absent on abd.2–4. Instead the abdominal tergites have an enclosed unpigmented "cell" in the mid-dorsal area. The dorsolateral and lateral marks are equally strong as the dorsal marks. Very characteristic is a dark pentagonal or crown-like figure in the mid-section of abd.4 (Pl. 2: 3). Numerous unpigmented spots are set in symmetric positions on each side of the midline, giving the animal a very "maculated" appearance. The dark blue pigment is particularly notable on the broad lateral edges of abd.5–6. On the legs the femora are usually paler than the purplish tibiotarsi and the blue coxae/subcoxae. On the two last pairs of legs the coxae/subcoxae are bluish on their anterior sides, pale on back sides. The characteristic abdominal colour pattern is most evident in moderately pigmented animals, less so in very dark specimens, and obliterated in pale adults and small juveniles. Males without modified ventrolateral setae on abd.3–4.

*Discussion.* – Based on allozymes and mithocondrial DNA analysis, Carapelli et al. (1995b) concluded that *palustris* and *maculatus* are genuine species.

*Distribution and ecology.* – Probably a southern species in our area, in Norway only near Bergen. In Finland only reported from greenhouses, but the old records of Linnaniemi (1912) need verification. Found in city parks and gardens with damp soil (disturbed habitats) in Sweden and Denmark. Present in the Faroe Islands. General distribution: Unclear (revision needed).

## 245. ***Isotomurus italicus*** Carapelli et al., 1995

Figs 59E, H, K–N, 60F, J, O; Pl. 1: 6

*Isotomurus italicus* Carapelli et al., 1995a, Eur. J. Soil Biol. 31: 94.

*Description.* – Body size up to 2.0 mm. Colour greyish brown all over body (Pl. 1: 6). Head with a dark spot in the midline behind the eyes, which is prolonged as a narrow band between the eyes. Antennae and antennal bases are darker than rest of the body. Frontoclypeal area not darkened. PAO elongate, clearly longer than diameter of nearest ocellus (Fig. 60O). Maxilla with lam.1 not reaching beyond tip of capitulum, with marginal ciliation and a field of fine denticles on the inner face (Fig. 59K). Labial palp with 5–6 proximal setae, basomedian field with 7–8. Abdominal macrochaetae rather short, almost without ciliation. Median macrochaeta on abd.5 about 2.5–3.0 as long as inner length of claw 3. Ventral tube usually with 3 + 3 laterodistal setae, sometimes a few more in large individuals. Retinaculum with 8–10 setae. Manubrial apical condyles truncate, with a few small, short teeth (Fig. 60F). Dens with a sparse cover of dorsal setae, in basal 1/3 only (Fig. 59E). Mucro with a rather long and slender subapical tooth, apical tooth reduced, on the ventral edge (Fig. 60J). Claws with small basolateral teeth, corner tooth of unguiculus small or absent. Reproductive males with 4–5 modified, spine-like setae laterally on abd.4, none on abd.3. In unreproductive males these setae are reduced to small, indistinct cones (Fig. 59M, N). First instar juveniles with 1 + 1 ventroapical manubrial setae (Fig. 59L). Other body marks as in *fucicola.*

*Discussion.* – Apart from *fucicola*, this species is the only Nordic member of the *palustris* group which has a uniform brownish body colour. The hair cover is less dense with shorter macrochaetae than in other species. A unique character is the presence of 1 + 1 manubrial setae in the 1.instar juvenile (0 + 0 in other species). Carapelli et al. (2001) synonymised *italicus* with Reuter's *fucicola*, based on specimens from Italy, Norway and Finland (syntypes). At that time we were not aware that two different Nordic species were hiding among the uniformly coloured specimens and apparently the diagnostic characters of *fucicola* (long ciliated macrochaetae and specialised maxillary lam.1) were overlooked in the syntypes. The taxon *italicus* is reestablished here.

*Distribution and ecology.* – Probably widely distributed, but not well known. Often collected in disturbed habitats (gardens, farmland) which are not very wet. General distribution: Palaearctic.

## 246. ***Isotomurus fucicola*** (Schött, 1893)

Figs 59F, G, J, 60G; Pl. 1: 4

*Isotoma palustris* var. *fucicola* Schött, 1893, K. svenska VetenskAkad. Handl. 25: 66.

*Designation of lectotype.* – One specimen (1.1 mm, probably juvenile) selected from a series of 14 alcohol syntypes in the Zool. Mus., Helsinki, labelled: '*Isotomurus fucicola* Schött, 1893, Lectotype, A. Fjellberg design. 2005' and 'Finland. Pargas. Reuter.'.

*Description.* – Body size up to 2.5 mm. Colour uniformly greyish or violet brown, sometimes narrowly darkened along posterior edges of abd.4–6 (Pl. 1: 4). Smaller specimens more reddish. Antennae slightly darker than rest of body. Antennal bases dark, as well as the neck region and a mid-dorsal spot behind the eyes. Frontoclypeal field not darkened. PAO oval, about 1.5 as long as diameter of nearest ocellus (as in *italicus*, Fig. 60O). Ant.1 with a group of 2–4 short ventroapical sensilla. Ant.2 and ant.4 with several short, blunt sensilla in lateral position. Labial palp with 8–10 proximal setae. Basomedian field with 8–9 setae. Ventral side of head with up to 15 postlabial setae on each side of ventral line. Maxilla with 3-toothed capitulum and 6 lamellae (Fig. 59J). Lam.1 projects beyond tip of capitulum, with coarse serrations along the edges, no serration on the inner face except some delicate filaments ("tooth-brush") near base. Lam.2–6 with serrations both along the edges and on the inner face. The serrations are finer on lam.5 than on the others. Body with a dense cover of dark setae, macrochaetae of the legs and last three abdominal segments densely ciliated. Short setae smooth. Median macrochaeta on abd.5 are 3.2–3.4 as long as inner length of claw 3. Sensillary equipment of tergites normal. Ventral tube with 3 + 3 laterodistal setae (sometimes a few more in large individuals), frontal and caudal setae numerous. Retinaculum with 8–11 setae. Manubrium with sharp ventroapical teeth (Fig. 60G). 1.instar juveniles with 0 + 0 ventroapical manubrial setae. Dorsal pilose field on dens extends at least halfway to apex, sometimes more in large specimens (Fig. 59F). Mucro as in *italicus* (Fig. 60J). Claws with small basolateral teeth, unguiculus with a small corner tooth which is sometimes absent. Reproductive males with thick apically serrated setae in lateral position on abd.3–4 (Fig. 59G). In unreproductive males these setae are very short, spine-like, hardly visible.

*Discussion.* – The body colour matches that of *italicus* which differs by having shorter, almost smooth macrochaetae, less dorsal setae on dens, short maxillary lamella 1 with denticulate inner field (smooth in *fucicola*), and presence of 1 + 1 ventroapical setae on manubrium in the 1.instar juvenile. Moreover the modified male setae are absent on abd.3 in *italicus*. In the original syntypes the maxilla was dissected and observed in one specimen. The long, ciliated abdominal macrochaetae were fallen off in most specimens, but clearly visible in the lectotype designated above.

*Distribution and ecology.* – Probably widely distributed, but not much known (Norway, Iceland, Faroe Islands, Denmark, Finland, Russia, Germany). Old records may also include *italicus*. Apparently the species prefers very wet habitats along the shores of lakes and rivers, some records also from marine seashores near stream outlets. General distribution: Palaearctic.

## 247. *Isotomurus unifasciatus* (Börner, 1901)

Fig. 60C, I; Pls 1: 10, 2: 6–10

*Isotoma palustris unifasciata* Börner, 1901, Abh. naturw. Ver. Bremen 17: 50.
? *Isotoma palustris* ab. *bimaculata* Ågren, 1903.

*Description.* – Size up to 2.7 mm. Colour very variable, due to variable intensity of pigmentation (Pls 1: 10, 2: 6–10). In the palest specimens the body is almost uncoloured or uniformly pale bluish or greenish grey, including head and extremities, usually with a dark mid-dorsal bluish or brownish line running from th.2–abd.5. The dorsal line often becomes diffuse towards end of the abdomen, or it is completely absent or it is present but not darker than the sides of the body. Diffuse brownish patches are sometimes seen on the sides of abdomen. Lateral edges of abd.6 usually dark. Head always with a bluish spot behind eyes. The neck region, frontoclypeal field and antennal bases bluish. Antennae often reddish towards apex. Small juveniles almost unpigmented apart from the head markings. Sensillary equipment of antennae normal. Ant.2–4 with some short, blunt sensilla in lateral and ventral parts. Labial palps with 8–10 setae in the proximal area, basomedian field with 7–10 setae. Maxillary lamellae with strong serrations along the edges and on the inner faces. Lam.1 slightly longer than capitulum, inner face with a small group of curved serrations (Fig. 60C). Abd.4–6 with long, ciliated macrochaetae. Setae in the ground cover of hairs dark, often finely serrated/ciliated (high magnification). Ventral tube with 3 + 3 laterodistal setae. Retinculum with about 10 setae. First instar juveniles with 0 + 0 ventroapical setae on manubrium. Dorsal pilose field of dens reaching middle part. Mucro usually with a small hyaline lamella on the large basal tooth (Fig. 60I). Claws with weak basolateral teeth, unguiculus with small corner tooth. Males with modified setae laterally on abd.3–4, spine-like and serrated in reproductive individuals, small and indistinct in unreproductive (as in *fucicola*, Fig. 59G).

*Discussion.* – Well-coloured specimens are easily distinguished from *palustris* by having the dark pigment evenly distributed from coxa to the dorsolateral side of thorax, and from ventral to dorsal side of abdomen. In *palustris* the dark coxal pigment does not pass on to the dorsal side of the tergites, and a pale unpigmented band always separates the lateral/ventral elements from the dorsolateral patches. The presence of modified male setae on abd.3–4 definitely separates the species from *palustris/maculatus*, in which these setae are absent. Young, unpigmented specimens and very pale adults may be confused with *graminis*, but are recognised by their frontoclypeal patch which is always dark and distinct. The form with presence of only the mid-dorsal band and the abd.6 spots probably corresponds to *bimaculata* (Ågren, 1903). Carapelli et al. (2001) found biochemical and molecular evidences for separating *unifasciatus* from *pseudopalustris* Carapelli et al., 2001, which has a similar colour pattern but generally with more distinct lateral spots.

*Distribution and ecology.* – In Norway a typical inhabitant along ponds and puddles in forests, rarely in open land. The species is certainly mixed up with *palustris* in the records of the old authors (Wahlgren, 1906; Linnaniemi, 1912). General distribution: Unclear (revision needed).

## 248. *Isotomurus graminis* sp. nov.

Pl. 1: 5

*Isotomurus prasinus* auct., nec Reuter, 1891.

*Type material.* – Holotype (alc., specimen not sexed) from 'Norway. VE: Tjøme. Hvasser. Wet meadow, 6 Jan. 1998. A. Fjellberg leg.'. Paratypes: 4 specimens (alc.) from the holotype sample, one reproductive male (slide) from 'Sweden. SK: Klippan. Söderåsen Nat. Pk., Klövhallar, 22.IV.2005. Soil/litter, cold spring. A. Fjellberg 05.146', one reproductive male (slide) from 'Russia 04-4. Smolensk reg., nr. Gagarin, July 2004. At pool in garden. L. Vanyavina leg.'. All deposited at Tromsø Museum, Dept. of Zoology, Tromsø.

*Description.* – Body size 2.5–3.0 mm. Colour uniformly green of variable intensity, including legs and furca (Pl. 1: 5). Often darkened on the last abdominal segments. Dorsal dark stripes or patches not present. Abd.6 often with some bluish pigments at the hind corners. Head with dark neck region, occipital spot and antennal bases. Frontoclypeal field at most with diffuse bluish pigment, never with a distinct dark

patch. The two terminal segments of antenna often darkened (reddish). In very dark specimens pigment is often concentrated in a narrow band along posterior edges of the tergites. Small specimens and juveniles may be completely pale yellowish, without green pigmentation.

*Discussion.* – Apart from colour indistinguishable from *unifasciatus*, sharing the detailed characters of maxilla, labium, antennal sensilla, furca, mucro, claws and male setae. In dubious cases the absence of blue pigment on the clypeal edge will distinguish *graminis* from *unifasciatus*. In Norway the two species may be found in the same area – *graminis* in open humid grassland, *unifasciatus* along forest ponds.

This is the species which has been called *prasinus* by most recent authors (Deharveng & Lek, 1993; Carapelli et al., 2001). However, Babenko & Bulavintsev (1993) examined the Siberian types of *prasinus* and found them to be almost identical to what we have usually called *ciliatus* Stach, 1947 (now *stuxbergi*, see below). Thus our '*prasinus*' must be renamed. There might be some available older synonyms in the literature but most of these, like Schäffer's (1896) *Isotomurus palustris* var. *pallida*, have an unclear taxonomic status. Therefore the best solution seems to be the formal description of a new species. The name *graminis* describes both the typical habitat (grass fields) and the green colour of the animal.

*Distribution and ecology.* – Often in large numbers in humid disturbed open grasslands (lawns, golf courses, meadows/fields), more rare in forests or along standing waters (ponds, lakes) or streams. Distribution not well know due to confusion with other species, but apparently widely distributed. Outside our area also seen from Russia (Smolensk). General distribution: Unclear (revision needed).

## 249. ***Isotomurus plumosus*** Bagnall, 1940

Figs 59I, 60D, K, R–T; Pls 1: 9, 2: 5

*Isotomurus plumosus* Bagnall, 1940, Entomologist's mon. Mag. 76: 101.
? *Podura aquatilis* Müller, 1776.
? *Isotoma trifasciata* Bourlet, 1839.

*Description.* – Body size 2.0–2.5 mm. Body with a characteristic pattern of a sharply defined bluish black mid-dorsal band and a lateral band including the sides of abdomen and thorax, as well as coxae of the legs and side of the head (Pls 1: 9, 2: 5). The lateral bands merges into the mid-dorsal band on abd.5. Abd.6 completely dark. Sometimes the lateral pigmentation is more greenish than the dorsal. Antennae usually darkened towards the tip, in dark specimens all segments become bluish black. Mouth cone diffusely darkened. Neck region, occipital spot and antennal bases dark, but no dark pigment between the eyes. In small juveniles the lateral bands become diffuse while the dorsal band is retained. PAO oval, as long as diameter of nearest ocellus or slightly longer. Ant.1 with 4–5 short, spine-like sensilla in ventroapical position. Blunt sensilla absent on ant.2 and 4, but many short pointed sensilla are present all over the segments. Ant.3 organ consists of one dorsal blunt sensillum, two dorsolateral and one ventrolateral (Fig. 60R). Labial palps with up to 10 proximal setae in large specimens, basomedian field with 7–8 setae. Maxilla with coarsely serrated lamellae, both along the edges and on the inner face. Lam.1 much longer than capitulum, with a small group of a few long serrations on the inner face (Fig. 60D). Body hairs brownish, macrochaetae on abd.4–6 long, densely ciliated. Seta of the ground cover of abdomen with variable ciliation, sometimes dense, other times more sparse (Fig. 60S, T). The degree of ciliation is not related to sex or reproductive state (epitoky), but ciliated specimens appear to have a coarser and longer ground cover in general, giving the animal a "woolly" appearance. Ventral tube with up to $10 + 10$ laterodistal setae and numerous frontal and caudal setae (Fig. 59I). Retinaculum with more than 15 setae in large specimens. First instar juveniles without ventroapical manubrial setae. Dens dorsally crenulated, dorsal pilosity covering proximal half or more. Mucro with a lateral seta, the large basal tooth with two distinct lamellae (Fig. 60K). Claws with weak basolateral teeth. Unguiculus without corner tooth. Males without modified lateral setae on abd.3–4.

*Discussion.* – Easily identified by the 3-lined colour pattern in combination with increased number of laterodistal setae on the ventral tube ($>3 + 3$) and presence of a mucronal seta. Contrary to species of the *palustris* group, *plumosus*

never has more than one blunt ventrolateral sensillum in ant.3 organ (Fig. 60R).

*Distribution and ecology.* – Common along shores of streams, lakes and ponds with standing water. General distribution: Palaearctic.

## 250. *Isotomurus stuxbergi* (Tullberg, 1876)

Figs 59A, 60L; Pl. 1: 3

*Isotoma stuxbergi* Tullberg, 1876, Öfvers. K. VetenskAkad. Förh. 33: 35.
*Isotoma stuxbergi* var. *prasina* Reuter, 1891, Öfvers. finska VetenskSoc. Förh. 22: 229.
*Isotomurus ciliatus* Stach, 1947.

*Description.* – Body size up to 2.5 mm. Colour violet blue or greenish, without sharp markings. Generally darkest on head and ventrolateral parts of abdomen and in basal parts of legs (Pl. 1: 3). The broad mid-dorsal part of thorax and abdomen usually diffusely darkened. Antennae and legs often slightly reddish towards tip. Head with dark neck region and a dark spot between and behind the eyes. Antennal bases not darkened. PAO elongate, shorter than diameter of nearest ocellus. Ant.1 with 3–4 short spine-like ventroapical sensilla. Ant.3 organ consists of 4 blunt sensilla (1 dorsal, 2 dorsolateral, 1 ventrolateral). A few similar blunt sensilla are also found ventrolaterally on ant.2 and 3 in addition to many short, pointed sensilla. Ant.4 without blunt sensilla, but with many pointed short sensilla. Labial palps with more than 10 proximal setae, 7–8 setae in the basomedian field. Maxilla with short lamella, lam.1 not passing tip of capitulum. Lam.1 with marginal ciliation only, no denticles on inner face. Body hairs in Scandinavian specimens smooth, apart from the ciliated macrochaetae and some of the medium-sized setae of abd.4–6 which may have a few serrations in basal half. Ventral tube in large specimens with more than 20 + 20 laterodistal setae and numerous anterior and caudal setae. Retinaculum with up to 30 setae. Furca strong, dens thick, not much tapering towards apex. Dorsal side tuberculated (Fig. 59A), densely pilose almost to tip (only 1/8–1/10 without dorsal setae in large specimens). Mucro with an elaborate system of lamellae, extending from the teeth towards the base (Figs 59A, 60L). Ventral edge expanded as a horizontal lamella towards the small apical tooth. Lateral seta present. Claws with small lateral teeth, no dorsomedian tooth. Unguiculus sharply pointed, with or without a corner tooth. Reproductive males without setal modifications.

*Discussion.* – This is the only Nordic species with a tuberculated dorsal side of dens, and thus easily identified. The increased number of setae on lateral flaps of ventral tube and the presence of a mucronal seta is shared only with *plumosus*, which differs by the trilineate colour pattern and the crenulated dens. In the original description of *ciliatus* from Poland Stach (1947) says that the ordinary setae of the abdomen are ciliated (like in *plumosus*). Our specimens from Denmark, Norway, Sweden and Finland are mixed. Some have smooth macro- and mesochaetae (abd.5), others have ciliated. There seems to be much variation within local populations. According to Babenko & Bulavintsev (1993) the ciliated form corresponds to *stuxbergi* (Tullberg, 1876), while the smooth form is *prasinus* (Reuter, 1891). The Nordic material indicates that there is only one variable species present, therefore the oldest name is here applied for the species. The question should, however, be settled with genetic methods. In any case *prasinus* as redefined by Deharveng & Lek (1993) and Carapelli et al. (2001) is not identical with Reuter's taxon and needs another name (*graminis* sp. nov., described above).

*Distribution and ecology.* – Widely distributed, but only in wet habitats along shores of inland lakes and larger streams, small temporary ponds are avoided. The specialised mucro probably represents an adaptation for jumping on water. A similar expansion of the ventral edge of mucro is also seen in certain species of *Agrenia* and in *Hydroisotoma schaefferi* (Krausbauer, 1898). Linnaniemi's (1912) records from Finland (as *Isotomurus palustris* var. *prasina*) is probably mostly *graminis*, but *stuxbergi* may also be involved. Until Finnish museum material is revised, details of the distribution in Finland can not be given. General distribution: Unclear (revision needed).

## 251. *Isotomurus balteatus* (Reuter, 1876)

Pls 1: 2, 2: 2

*Isotoma balteata* Reuter, 1876, Meddn Soc. Fauna Flora fenn. 1: 86.

*Description.* – Body size 1.8 mm. Body with a characteristic colour pattern with broad, dark blue transverse bands on the tergites (Pls 1: 2, 2: 2). Abd.5–6 entirely dark. Labial palp with about 10 proximal setae. Basomedian field with 5–6 setae. Maxilla with lam.1 reaching slightly beyond tip of capitulum, only with marginal ciliation, no inner denticles. Ventral tube with more than 10 + 10 laterodistal setae. Most short setae of abdomen distinctly serrated (like in *plumosus*). Dens dorsally crenulated, dorsal pilosity covers about 2/3. Mucro with lateral seta, inner basal tooth with distinct lamella. Reproductive males not seen.

*Discussion.* – Only two Polish specimens were available for description. Apart from the characteristic colour pattern, the species is hardly separable from *plumosus*. The Polish specimens do not differ from the recent description of specimens from the Arkhangelsk and St Petersburg areas (Potapov & Starostenko, 2002). On a world basis there are probably several species having similar transverse banding. Originally described from eastern Finland.

*Distribution and ecology.* – Mostly collected from ponds and puddles, but also in wetland along streams and lakes. Apparently an eastern boreal distribution in our area. Outside Finland only from N. Norway. General distribution: Unclear (revision needed).

## 252. ***Isotomurus antennalis*** Bagnall, 1940

Fig. 60E, Q; Pls 1: 1, 2: 1

*Isotomurus antennalis* Bagnall, 1940, Entomologist's mon. Mag. 76: 101.

*Description.* – Body size up to 2.5 mm, reproductive from about 1.5 mm. Colour brownish red or dark blue on pale background (Pls 1: 1, 2: 2). In dark specimens most of thorax and abdomen pigmented, with broad unpigmented transverse band along posterior edges of th.2–abd.2. A narrow unpigmented mid-dorsal line runs from th.2–abd.3. Legs pale beyond coxae, basal parts dark, contrasting. Ventrolateral parts of abd.1–2 also dark, like bases of legs. Head dark behind and between eyes, posterior part unpigmented apart from the dark neck spot. Antennal bases contrastingly dark. Frontoclypeal area not darkened. Antennae darkened, reddish. In less pigmented specimens the dark colour of the leg bases and ventrolateral sides of abd.1–2 is retained, while the dorsal pigment becomes diffuse, mainly in mid-sections of the tergites. In particular th.2–3 have contrastingly pale dorsolateral parts. PAO oval, about as long as diameter of nearest ocellus. Ant.1 with a ventroapical group of 3–4 short spine-like sensilla. Ant.3 apical organ as Fig. 60Q, with increased number of blunt, thick sensilla. Such sensilla absent on ant.2 and 4 which have many short, hair-like sensilla dispersed over the surface. Ant.1–3 in addition with some thin erect sensilla which are often bent at tips. Labial palps with increased number of proximal setae (about 10), basomedian field with 5–7 setae. Postlabial setae 4–6 on each side of ventral line. Maxilla with six ciliated/serrated lamellae. Lam.1 short, not passing tip of capitulum, covered with small denticles. Marginal ciliation short (Fig. 60E). Body with a uniform cover of short, stiff setae. Macrochaetae hardly differentiated. Median macrochaeta on abd.5 only 1.2–1.3 as long as inner length of last claw. The primary sensillary chaetotaxy of juveniles is not observed, but half grown adults have 7 + 7 on abd.5 (as in other *Isotomurus*), while the number is increased on abd.4 (10–15 on each side). Trichobothria absent. Ventral tube with 6–7 frontal setae on each side, 3 + 3 laterodistal setae and 15–20 caudal setae. Retinaculum with 10–15 setae. Dorsal side of dens with a sparse cover of setae covering proximal half only. Mucro as in *unifasciatus* (cf. Fig. 60I), without lateral seta. Inner basal tooth with a small lamella. Ventral edge sharp, narrow. Tibiotarsi with 8 primary apical setae ($T_1$, $A_{1-7}$). Claws with small lateral teeth, no inner tooth. Unguiculus sharply pointed, no corner tooth. Reproductive males without modified setae laterally on abd.3–4.

*Discussion.* – Unlike other species of *Isotomurus*, the maxillary lam.1 is densely covered with fine denticles on the inner side (absent or reduced in other *Isotomurus*). Also the marginal ciliations on lam.1–2 are much shorter than in other species. Despite the absence of trichobothria, the general impression of the species is that of an *Isotomurs* (head shape, increased number of setae on labium, 3 + 3 laterodistal setae

of ventral tube, mucro). The darkest specimens develop a transverse banding similar to that of *balteatus* (compare Pls 1: 1, 2: 2). This pattern – as well as the longitudinal bands of *ciliatus* – probably has adaptive significance, but the function is as yet unknown.

*Distribution and ecology.* – Only a few Nordic records, mostly in damp moss in rocky habitats. Sometimes in mossy rock pools near seashore where it may be very abundant. General distribution: Unclear (revision needed).

## Genus *Vertagopus* Börner, 1906

*Vertagopus* Börner, 1906, Mitt. naturh. Mus. Hamb. 23: 171. Type species: *Desoria cinerea* Nicolet, 1842, by original designation.

Members of the genus *Vertagopus* are medium sized (1–2 mm) isotomids with a well-developed furca. The presence of distinctly clavate tibiotarsal hairs in combination with separate abd.5–6 are distinctive characters. Common characters: Ocelli 8 + 8, G and H smaller. Maxillary palp bifurcate, 4 sublobal hairs. Labrum with 554 setae, 4 prelabrals. Labial palp with 4 proximal setae, guard seta $e_7$ absent. Basomedian field with 4 setae. Maxilla with short, denticulate lamellae. There seems to be no differentiation in maxilla among the species (Fig. 61C). Mandibles normal, strong. PAO oval, usually about 1.5 as long as diameter of nearest ocellus. Macrosensilla of th.2–abd.5 either 44/33356 or 55/44456. The number of sensilla on abd.4 may be variable (4–7). Spine-like microsensilla invariably 10/001. Abd.5–6 not fused. Tibiotarsi with 11 setae in the apical whorl, clavate tenent hairs 2-3-3 ($A_1$, $A_7$ on tib.1, $A_1$, $A_2$, $A_7$ on tib.2–3, Fig. 3E). Mucro with 4 teeth, lateral seta absent. Manubrium with relatively few ventral setae.

### Key to species

1 Th.3 and abd.2 with some ventral setae . . 2
– Ventral setae absent on th.3 and abd.2 . . . 6
2 Stouter species, usually not corticole (except *westerlundi*). Colour not uniformly brownish grey. Macrosensilla of th.2–abd.3 as 44/333. Mucro symmetric with subequal basal teeth (Fig. 61H). Ventral tube with only two setae in the apical transverse row (as Fig. 61D) . . . . . 3
– Slender corticole species of uniform brownish grey colour. Macrosensilla as 55/444. Mucro strongly asymmetric with the small outer basal tooth laterally displaced (as Fig. 61F). Ventral tube with 4 setae in the apical transverse row (Fig. 61E) . . . . . 255. *cinereus* (Nicolet)
3 Ant.4 with blunt or indistinct apical papillae . . . . . 4
– Ant.4 with small, balloon-like apical papillae (Fig. 61L) . . . 257. *westerlundi* (Reuter)
4 Dens with less than 25 ventral setae, di/de setae 2 + 2 (Fig. 61M). Males with short dorsolateral sensilla on ant.1. Not arctic/alpine species . . . . . 256. *haagvari* Fjellberg
– Dens with more than 30 ventral setae, di/de setae 3 + 3 (as Fig. 61B). Males without dorsolateral sensilla on ant.1. Arctic/alpine species . . . . . 5
5 Pale species with dark mid-dorsal longitudinal band (Fig. 61O). If more uniform dorsal colour, then antennal sockets always unpigmented. Reproductive males epitokous, with swollen, spined frons (Fig. 61N) and short abdominal macrochaetae . . . . . 258. *sarekensis* (Wahlgren)
– Uniform bluish species, antennal sockets always dark. Reproductive males unmodified . . . . . 259. *arcticus* Martynova
6 Ventral tube with less than 5 caudal setae, only two in apical row (Fig. 61D). Dens with more than 40 ventral setae in large specimens, dorsal setae 11–13 (Fig. 61B) . . . . . 253. *arboreus* (Linnaeus)
– Ventral tube with 8–10 caudal setae, apical transverse row with 4 or more setae. Dens with less than 30 ventral setae, dorsal setae 8–9 . . . . . 254. *pseudocinereus* Fjellberg

### 253. *Vertagopus arboreus* (Linnaeus, 1758)

Figs 3E, 61A–D, F; Pl. 3: 4

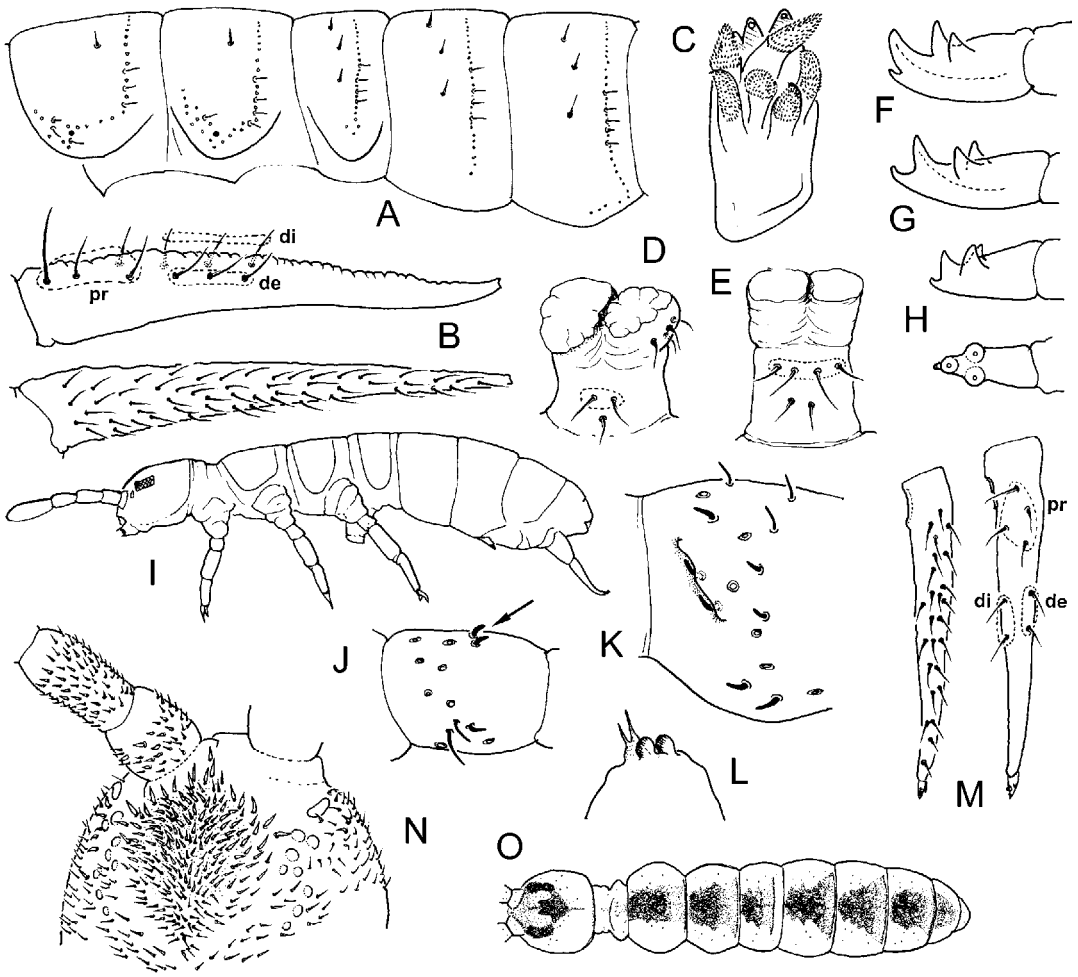


Fig. 61. *Vertagopus* spp.: (A–D) *arboreus*, (A) distribution of sensilla and macrochaetae on th.2–abd.3 in a Danish specimen, (B) setae on dens, dorsal (above) and ventral (below), pr: proximal, di: dorsointernal, de: dorsoexternal; (C) maxilla, (D) ventral tube, posterior side; (E) *cinereus*, posterior side of ventral tube; (F–H) mucro in *arboreus* (F), *arcticus* (G) and *westerlundi*, lateral and dorsal (H); (I) *cinereus*, habitus; (J) *haagvari*, right ant.1 with dorsoapical group of sensilla marked (arrow); (K–L) *westerlundi*, (K) left ant.3 organ with sensilla partly hidden, (L) tip of ant.4; (M) *haagvari*, dens, dorsal (left) and ventral (right); (N–O) *sarekensis*, (N) head of reproductive male with spine-like seate on frons and ant.1–2, (O) dorsal colour pattern.

*Podura arborea* Linnaeus, 1758, Systema naturae, 10th ed.: 609.

*Description.* – Body size up to 1.7 mm. Colour violet blue, legs and furca pale (Pl. 3: 4). Antennae dark. Body shape slender, *Isotoma*-like with abdomen widening towards tip. Sensillary set of antenna normal. Ant.4 with blunt apical lobes, a bifurcate pin-seta and a small roundish sensillum in the subapical organ. Maxillary head short and compact, with 6 short lamellae densely packed with fine denticles (Fig. 61C). Lam.1 not passing tip of capitulum. Marginal ciliation short. Body hairs rather short and fine, abdominal macrochaetae hardly differentiated from ground cover in anterior segments, becoming increasingly longer on abd.4–6. Lateral macrochaeta on abd.2–3 only slightly longer than surrounding setae. Median macrochaeta on abd.5 about twice as long as inner length of last claw. Longest macrochaetae on abd.5–6 slightly serrated. Macrosensilla of th.2–abd.3 as 55/444 or 44/333 (see below). Thorax and abd.2 with-

out ventral setae. Ventral tube usually with 1 + 1 frontal setae (may be absent), 4 + 4 lateral and 3–5 caudal setae of which there are only two in the apical transverse row (Fig. 61D). Retinaculum with 4 + 4 teeth and 6–7 setae. Furca about as long as the antenna, not reaching ventral tube. Dens in large specimens with more than 40 ventral setae. Dorsal setae usually 11–13, with 3 + 3 setae in the di/de groups – rarely two on one of the sides (Fig. 61B). Mucro with short apical tooth. Subapical and inner basal teeth on line, outer basal tooth laterally displaced (Fig. 61F). Claws with a pair of lateral teeth at base and a single inner tooth. Unguiculus with a variable corner tooth. Reproductive males without modifications of hair cover. First instar juveniles without anterior manubrial setae.

*Discussion.* – Specimens from W. Norway, Iceland and Faroe Islands usually have 44/333 macrosensilla on the tergites of th.2–abd.3 (1.instars and adults), while Danish, Swedish and Belgian specimens invariably have 55/444 (Fig. 61A). No other differences could be detected. The southern populations probably represents the original species of Linnaeus ('Habitat in Europae Sylvis', cf. Potapov (2001)), while the western populations may belong to an undescribed species.

*Distribution and ecology.* – In moss on tree trunks and rocks, under bark on dead trees, sometimes also in the forest floor. Apparently the distribution is southwestern, with no reports from Finland. General distribution: Palaearctic. Records outside this region need verification.

## 254. *Vertagopus pseudocinereus* Fjellberg, 1975

*Vertagopus pseudocinereus* Fjellberg, 1975, Ent. scand. 6: 212.

*Description.* – Body size up to 1.7 mm. Body shape cylindrical, like *cinereus*. Colour bluish grey. Antennal sensilla normal, tip of ant.4 with two blunt lobes. Abdominal macrochaetae short, increasingly longer on abd.5–6. Lateral macrochaeta on abd.2–3 much longer than surrounding setae. Median macrochaeta on abd.5 about 1.3 (reproductive males) to 2.5 as long as inner length of last claw. Macrosensilla of th.2–abd.3 as 55/444. Thorax and abd.2 without ventral setae. Ventral tube usually with 5 + 5 lateral setae and 8–10 caudal setae (4 or more in the apical transverse row), no frontal setae. Retinaculum with up to 11 setae. Furca slightly shorter than the antenna. Dens in large specimens with less than 30 ventral setae (usually about 25), dorsal setae usually 8–9 (only 2 + 2 in the di/de groups, as Fig. 61M). Mucro as in previous species (*arboreus*). Claws with an inner tooth and a pair of lateral teeth. Unguiculus with distinct corner tooth. Reproductive males are moderately epitokous with shorter abdominal macrochaetae.

*Discussion.* – The species shares the absence of ventral setae on thorax and abd.2 only with *arboreus*, from which it differs by increased number of caudal setae on ventral tube (>5), less setae on dens and more cylindrical body shape. Several samples from moss on tree trunks and bark on dead hardwood (*Salix* spp.) in S. Norway have specimens with longer abdominal macrochaetae and more posterior setae on ventral tube. Chaetotaxy of dens is the same but the body is less cylindrical than in typical *pseudocinereus*, more like *arboreus*. This may possibly be an undescribed species.

*Distribution and ecology.* – Only recorded from East Finnmark in N. Norway, collected under bark on dead birch. Also seen under bark on imported logs in Spitsbergen. The status of specimens from S. Norway remains unclear (see above). General distribution: Holarctic, but more than one species may be involved.

## 255. *Vertagopus cinereus* (Nicolet, 1842)

Fig. 61E, I; Pl. 3: 3

*Desoria cinerea* Nicolet, 1842, Neue Denkschr. Allg. schweiz. Ges. ges. Naturw. 6 (3): 60.

*Description.* – Body size up to 1.8 mm. Colour brownish grey. Body shape cylindrical, with short furca (Fig. 61I; Pl. 3: 3). Sensillary equipment of antennae normal, apical papillae blunt. Body hairs short, smooth. The long macrochaetae on abd.5–6 with some small serrations. Median macrochaeta of abd.5 about 2.5–3.0 as long as inner length of last claw. Macrosensilla on th.2–abd.3 as 55/444. Th.3 with some

ventral setae, in large specimens with up to 10 on each side of the ventral line. Abd.2 with a mid-ventral group of about 5–10 setae. Ventral tube with 5–6 lateral setae and 7–8 caudal setae of which 4 are set in the apical transverse row (Fig. 61E). No frontal seta. Retinaculum with up to 8 setae. Furca short, about 2/3 as long as antenna. Dens usually with 8 dorsal setae (2 + 2 in the di/de group), ventrally with less than 30 setae. Mucro with small apical tooth, as in *arboreus* (Fig. 61F). Claws with inner tooth and a pair of lateral teeth. Unguiculus with a corner tooth. Reproductive males with slightly shortened macrochaetae on abd.5–6.

*Discussion.* – Appears to be a well-marked species which is easily identified by the key characters. The slender body and short extremities may be an adaptation to living in the narrow space under bark on dead wood in early stages of decay.

*Distribution and ecology.* – In the Nordic countries this is the most common *Vertagopus* species, usually found in quantities under bark on dead trees in early stages of decay. In later stages – when humus develops – the species is gone. Both conifers and hardwood. General distribution: Palaearctic.

## 256. ***Vertagopus haagvari*** Fjellberg, 1996

Fig. 61J, M

*Vertagopus haagvari* Fjellberg, 1996, Misc. Zool. 19: 100.

*Description.* – Body size up to 1.1 mm. Colour violet blue, darkest on abd.5–6. Body shape as in *arboreus*, not as cylindrical as in *cinereus*. Furca shorter than antenna. Sensillary equipment of antenna normal, but males have a dorsoapical group of 2–4 short curved sensilla on ant.1 which is not observed in other species (Fig. 61J). Abdominal macrochaeta long, curved and distinctly serrated. Median macrochaeta of abd.5 about 2.8 as long as inner length of last claw. Macrosensilla of th.2–abd.3 as 44/333. Th.3 with 3–6 setae on each side of the ventral line. Abd.2 with 5–11 setae in a mid-ventral group. Ventral tube with 4–5 lateral and 5–7 caudal setae, of which there are only two in the apical transverse group. Retinaculum with up to 7 setae. Dens normally with 8 dorsal setae (2 + 2 in di/de groups), ventrally with less than 25 (Fig. 61M). Mucro with the two basal teeth almost on same level (symmetric). Claws with small lateral teeth and one inner tooth. Unguiculus with a small corner tooth.

*Discussion.* – Similar to *cinereus*, but differing by more bluish colour, more conspicuous abdominal macrochaetae, different sensillary formula, symmetrically shaped mucro and only two apical setae on posterior side of the ventral tube. The dorsoapical short sensilla on ant.1 in males is a unique character.

*Distribution and ecology.* – Collected under bark on dead trees and in forest floor litter. Probably widely distributed, but generally overlooked. General distribution: Palaearctic (NW Europe).

## 257. ***Vertagopus westerlundi*** (Reuter, 1898)

Fig. 61H, K, L; Pl. 3: 1

*Isotoma westerlundi* Reuter, 1898, Meddn Soc. Fauna Flora fenn. 23: 44.

*Description.* – Body size up to 1.9 mm. Colour greyish or bluish brown with narrow, darkened posterior edges of the tergites (Pl. 3: 1). Head pale with dark pigment between the eyes and the antennae and in a central spot behind the eyes. Ventral side almost unpigmented. Body shape cylindrical, furca shorter than antenna. Ant.3 organ with apical sensilla partly hidden by an integumentary fold (Fig. 61K). Apical papillae of ant.4 small, balloon-like (Fig. 61L). Abdominal macrochaetae faintly serrated in apical half. Median macrochaeta on abd.5 about 3 times as long as inner length of last claw. Macrosensilla of th.2–abd.3 as 44/333. Sensilla very short, spine-like. Th.3 with 4–8 setae on each side of the ventral line. Abd.2 with about 10 ventromedian setae. Ventral tube without frontal setae, with 4–7 lateral and 6–8 caudal setae, two in apical row (as Fig. 61D). Retinaculum with up to 8 setae. Dens with 7–8 dorsal setae (2 + 2 in di/de groups), ventral side with less than 25 setae. Mucro almost symmetrical, with a small apical tooth. The two basal teeth and the subapical tooth large, subequal (Fig. 61H). Claws and unguiculus with distinct teeth. Reproductive males without modifications of setal cover.

*Discussion.* – The colour and the balloon-like apical papillae on ant.4 readily identify this species.

*Distribution and ecology.* – Common in moss and lichens on tree trunks and large stones. Mainly in boreal and alpine/montane districts, rare in lowland forests. In winter active on snow around the trees where it lives. General distribution: Palaearctic.

## 258. *Vertagopus sarekensis* (Wahlgren, 1906)

Fig. 61N, O; Pl. 3: 2

*Isotoma sarekensis* Wahlgren, 1906, Ent. Tidskr. 27: 257.
*Isotoma sarekensis* f. *obscura* Wahlgren, 1906.

*Description.* – Body size up to 1.6 mm. Ground colour yellowish brown, with a dark violet blue mid-dorsal band from th.2–abd.6 (Fig. 61O). The mid-dorsal band usually composed of large confluent triangular spots, but the dark colour may expand to cover most of the dorsal side (Pl. 3: 2) (f. *obscura* (Wahlgren, 1906)). Extremities pale, antennae darker towards tip. Characteristic is the unpigmented antennal bases (sockets), contrasting the dark area of the surrounding head. Head otherwise with a dark arrow-shaped figure between and behind the eyes. Body shape rather stout. Furca as long as antenna. Antenna with a normal sensillary set. Ant.4 with distinct apical papillae. Body with strong macrochaetae, in particular on abd. 5–6, laterally on th.2–abd.4 and on the basal parts of the legs. Most macrochaetae finely serrated. Median macrochaeta on abd.5 about twice as long as inner length of last claw, in reproductive males about 1.5 as long. Macrosensilla of th.2–abd.3 long and slender, distributed as 44/333. Th.3 with 1–2 setae on each side of ventral line. Abd.2 with 2–8 setae in the mid-ventral field. Ventral tube with 8–13 lateral setae, 5–10 caudal setae (two in apical row), no frontal setae. Retinaculum with up to 9 setae. Dens usually with 9 dorsal setae (8–11), 3 + 3 in di/de groups. Ventral side of dens with more than 30 setae in large specimens. Mucro much like that of *westerlundi* (cf. Fig. 61H), apical tooth slightly larger. Claws with distinct basal and inner teeth, unguiculus with corner tooth present. Reproductive males strongly epitokous, with shortened macrochaetae of the body. Frons between the eyes swollen, densely covered with short spine-like setae (Fig. 61N). A few such setae may also be present dorsally on ant.1–2.

*Discussion.* – When typically coloured, easily identified. Dark specimens may be confused with *westerlundi*, but they never have the balloon-like swollen apical papillae on ant.4 as in the latter species. Also the strong epitoky with swollen frons with spine-like setae in reproductive males is an unique feature of *sarekensis*.

*Distribution and ecology.* – A characteristic species in moss/lichens on rocks in the alpine zone in the Scandinavian mountains. It does not penetrate into the forest zone. General distribution: Palaearctic (so far not reported outside Scandinavia).

## 259. *Vertagopus arcticus* Martynova, 1969

Fig. 61G; Pl. 3: 5

*Vertagopus arcticus* Martynova, 1969, Zool. Zh. 58: 1344.

*Description.* – Body size up to 1.5 mm. Colour violet blue, with paler antennae and extremities (Pl. 3: 5). Antennal bases (sockets) dark, contrasting the pale first antennal segment. Body shape *Isotoma*-like, furca as long as the antenna. Antenna with normal sensillary equipment, apical papillae blunt. Longest macrochaetae of the body distinctly serrated. Median macrochaeta on abd.5 about twice as long as inner length of last claw. Macrosensilla of th.2–abd.3 as 44/333. Th.3 with 1–3 setae on each side of the ventral line. Abd.2 with up to 9 mid-ventral setae. Ventral tube with up to 10 lateral setae on each side, with 4–6 caudal setae (two in apical row), no frontal seta. Retinaculum with up to 9 setae. Dens usually with 9 dorsal setae (3 + 3 in the di/de groups), ventrally with more than 30 in large specimens. Mucro rather slender, with longer apical tooth than in other species (Fig. 61G). Claws with small inner and lateral teeth, unguiculus with a small corner tooth. Reproductive males not epitokous.

*Discussion.* – Similar to *sarekensis* in most body marks, but normally separated by colour. *V. arcticus* is always uniformly bluish, never pale with a dark longitudinal dorsal band as in *sarekensis*. Also the antennal base is always dark, while it is pale in *sarekensis*. Moreover males of *arcticus* are not epitokous.

*Distribution and ecology.* – Only in the arctic islands and in the highest Scandinavian mountains, in damp habitats along snowfields. In Finnmark almost to sea level along snow fields which persist during the summers. Total distribution: Holarctic (circumpolar).

## Genus *Pseudisotoma* Handschin, 1924

*Pseudisotoma* Handschin, 1924, Denkschr. schweiz. naturf. Ges. 60: 111. Type species: *Isotoma sensibilis* Tullberg, 1876 by monotypy.

Our two *Pseudisotoma* species are recognised by the fused abd.5–6 and presence of clavate tibiotarsal hairs. Unlike previous genus the small T-setae are absent on each side of seta $A_1$ on tibiotarsi (Fig. 3F). Tibiotarsi with 8 apical setae ($A_{1-7}$, $T_1$). Macrosensilla on thorax and abdomen distributed as 55/44446, spine-like microsensilla 11/111 (1.instar juveniles). Setal bases glandular. Mucro with 3 teeth, lateral seta absent.

### Key to species

1 Tibiotarsi with 2-3-3 distinctly clavate apical tibiotarsal hairs (Fig. 62A). Colour bluish or brownish blue, usually dark . . . . . 260. *sensibilis* (Tullberg)

– Tibiotarsi with only one clavate apical hair (Fig. 62B). Colour usually pale bluish grey . . . . . 261. *monochaeta* (Kos)

### 260. *Pseudisotoma sensibilis* (Tullberg, 1876)

Fig. 62A, C

*Isotoma sensibilis* Tullberg, 1876, Öfvers. K. VetenskAkad. Förh. 33: 36.

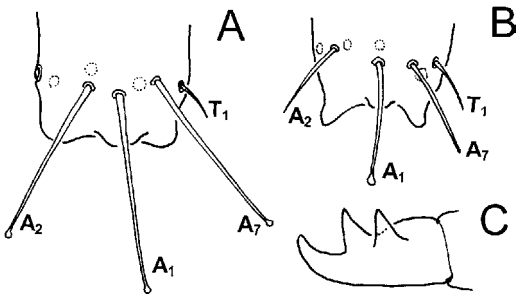


Fig. 62. *Pseudisotoma sensibilis* (A, C) and *P. monochaeta* (B): (A–B) Apical setae of left tib.2; (C) mucro.

*Description.* – Body size up to 1.7 mm, body slightly pear-shaped. Colour blue or brownish blue of variable intensity. Ocelli 8 + 8, G and H smaller. PAO oval, as long as diameter of nearest ocellus. Sensillary equipment of antennae normal, sensilla slender, setaceous. Labrum with 554 setae, 4 prelabrals. Labral edge with 4 sharp apical folds and a composite ventroapical ciliation. Labial palps with a complete set of papillae and guards. Proximal field with 4 setae, basomedian field with 5 setae. Maxillary palp trifurcate with 4 sublobal hairs. Mandibles normal, strong. Maxilla with unmodified short lamellae. Head with 5–7 postlabial setae on each side of ventral line. Body hairs strong, on head and thorax clearly differentiated in macrochaetae and mesochaetae. Abdominal tergites with alternating short and long setae in the p-row. Macrochaetae strong, on abd.4–6 clearly serrated. Median macrochaetae on abd.5 more than 3 times as long as inner length of last claw. Ventral setae absent on thorax. Ventral tube with 2–3 frontal setae on each side, up to 8 lateroapical and 10 posterior setae. Retinaculum with 4 + 4 teeth and up to 10 setae. Manubrium with relatively few ventral setae, ventroapical groups with 3 + 3 shorter setae. Manubrial spines sharp, sometimes with split tips. Dens with numerous ventral setae and up to 15 dorsal setae in proximal half. Tibiotarsi with 2-3-3 equally strong clavate apical hairs (Fig. 62A). Claws with small lateral and inner teeth, inner tooth set in apical 1/3. Unguiculus with small corner tooth. Mucro with 3 teeth, asymmetric, apical tooth large (Fig. 62C). Males present, not epitokous.

*Discussion.* – Large specimens with well-developed tenent hairs are easily identified. Due to some variation in the differentiation of the

clavate tenent hairs, specimens are not always separable from *monochaeta*. On the European level probably more than one species are involved, differing in ecology and diffuse morphological characters (Potapov, 2001). *P. sensibilis* was originally described from Novaya Zemlya.

*Distribution and ecology.* – Common in a variety of habitats, usually in forest litter and in moss on tree trunks and rocks. Also in the alpine. In the Arctic only from Jan Mayen. General distribution: Palaearctic, possibly wider.

## 261. ***Pseudisotoma monochaeta*** (Kos, 1942)

Fig. 62B

*Isotoma sensibilis* var. *monochaeta* Kos, 1942, Razpr. mat.-prir. Razr. Akad. Znan. Umet. Ljubl. 2: 125.

*Description.* – Body size up to 1.5 mm. Colour greyish blue, often very pale. Median clavate tenent hair ($A_1$) on tibiotarsi strongly knobbed (Fig. 62B), other tenent hairs pointed ($A_2$) or blunt ($A_7$). Apart from weaker tenent hairs and usually paler colour, inseparable from *sensibilis*. Like previous species probably a complex of several European forms of unclear status (Potapov, 2001).

*Distribution and ecology.* – Appears to have a western distribution in our area, being present in samples from Faroe Islands (common) and the west coast of Norway from Rogaland to N. Trøndelag. Usually in humid coastal heath land (*Calluna*/*Erica*/*Empetrum*), meadows (pastures) and in coniferous forest plantations. General distribution: Palaearctic.

# Genus *Marisotoma* Fjellberg, 1997

*Marisotoma* Fjellberg, 1997, Pedobiologia 41: 26. Type species: *Marisotoma canaliculata* Fjellberg, 1997, by original designation.

The two Nordic species in this genus resemble a *Parisotoma notabilis* but are recognised by the presence of an integumentary channel system on head (Fig. 3I) and presence of feathered macrochaetae on tibiotarsus of second pair of legs (Fig. 3J). Ocelli present, but numbers reduced. Maxillary palp trifurcate, 4 sublobal hairs. The integumentary channel system branches off from the ventral line, covering lateral and dorsal side of the head. Tib.2 with 2–3 feathered macrochaetae. Ventroapical setae of manubrium slender, not spine-like. Tibiotarsi with 8 setae in the apical whorl ($A_{1-7}$, $T_1$). Mucro with 3 teeth.

## Key to species

1 Ocelli 1 + 1, abdominal macrochaetae not very long . . . . . 262. *canaliculata* Fjellberg

– Ocelli 6 + 6, abdominal macrochaetae exceptionally long, strongly ciliate . . . . . 263. *tenuicornis* (Axelson)

## 262. ***Marisotoma canaliculata*** Fjellberg, 1997

Figs 3I, J, 63A–H

*Marisotoma canaliculata* Fjellberg, 1997, Pedobiologia 41: 26.

*Description.* – Body size up to 1.1 mm. Pigmentation weak, uniformly greyish brown/black with paler spots. Eye-spot small, dark. Body shape much like *Parisotoma notabilis*, but mouth more conically protruding (Fig. 63A). Ocelli 1 + 1. PAO large, oval (Fig. 63H). Antenna slender, last segment slightly upturned (Fig. 63A). Ant.1 with 3–4 short spine-like ventral sensilla. Ant.2 with two lateroapical hair-like sensilla. Ant.3 organ with two blunt sensilla and a ventroapical spine-like sensillum in addition to about 10 hair-like sensilla dispersed over dorsal side of the segment. Ant.4 with 3 moderately thickened lateral sensilla in apical half in addition to many hair-like sensilla (Fig. 63G). Subapical pin-seta and organite absent. Labrum with 554 unmodified setae, 4 prelabrals. Apical edge of labrum with two median finger-like papillae and one lateral fold on each side. Ventroapical ciliation brush-like. Labial palps with a complete set of papillae and guards ($e_7$ present). Proximal setae 4. Basomedian field with 5 setae. Head with 4–5 postlabial setae on each side along ventral line. Mandibles normal, strong. Maxilla with ciliate/denticulate lamellae. Lam.1 not apically expanded. Lam.6 with apical 1/3

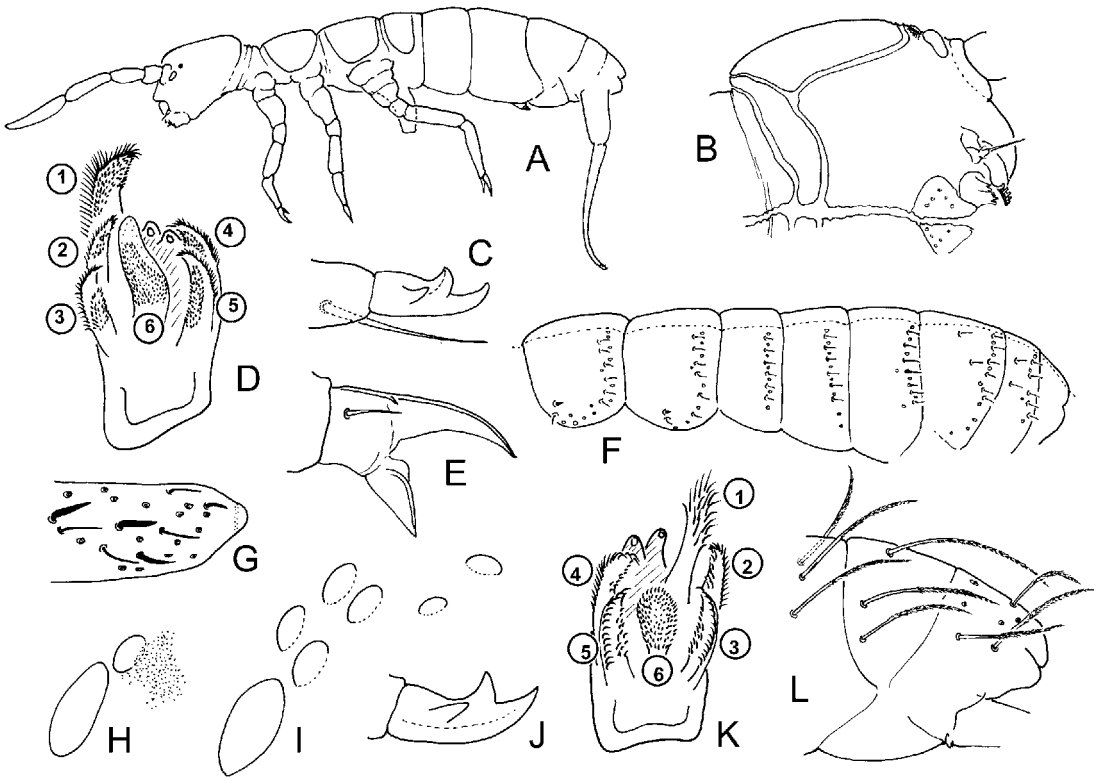


Fig. 63. *Marisotoma canaliculata* (A–H) and *M. tenuicornis* (I–L): (A) Habitus; (B) integumentary channels on head connecting on ventral side; (C) mucro; (D) maxilla; (E) claw; (F) sensillary distribution on th.2–abd.5; (G) sensilla in apical part of ant.4; (H) PAO and eye; (I) ditto; (J) mucro; (K) maxilla; (L) long ciliate macrochaetae on abd.3–6.

smooth (Fig. 63D). Integumentary channels on head as Figs 3I and 63B. Body hairs acuminate, longest abdominal macrochaetae distinctly ciliated. Median macrochaeta on abd.5 as long as tergite. Th.2–abd.5 with slender macrosensilla, distributed as 77/666 on th.2–abd.3. On abd.4–5 more variable, 7–10 on each side. Spine-like microsensilla as 11/001. No ventral setae on thorax. Ventral tube with 4–5 frontal setae on each side, 3 + 3 lateral and 5–6 caudal setae. Retinaculum with 4 + 4 teeth and 2–4 setae. Furca long and slender. Dens with 7–8 dorsal setae in basal half, ventral setae numerous (>60). Mucro with 3 teeth, apical tooth long (Fig. 63C). Tib.2 with 3 feathered setae ($B_1$,$C_1$, $D_1$), the upper one only distinct in large specimens (Fig. 3J). Claws with a pair of small lateral teeth near base, inner tooth absent. Unguiculus triangular, no corner tooth (Fig. 63E). Only females are observed.

*Discussion.* – Easily identified by the 1 + 1 ocelli, the channel system on the surface of the head and the feathered setae on tib.2. No other species of Isotomidae has this combination of characters. In mixed samples easily mistaken for a *Parisotoma notabilis* which has a similar size, body shape and pigmentation. However, *canaliculata* has a smaller and more distinct eyespot, more prominent mouth cone (like an *Isotomurus*), more slender ant.4 and body pigmentation more black than brown.

*Distribution and ecology.* – The species has a marked western distribution, with records from Iceland, Faroe Islands and the outer part of the Norwegian west coast from Bergen to Nordland. In damp habitats, usually in *Sphagnum* along small ponds in coastal rocks and sea cliffs. Sometime around springs and in wet forest habitats.

## 263. *Marisotoma tenuicornis* (Axelson, 1903)

Fig. 63I–L

*Isotoma tenuicornis* Axelson, 1903, Acta. Soc. Fauna Flora fenn. 25: 10.

*Description.* – Body size 1.1 mm. Colour spotted greyish. Body shape like previous species, with protruding mouth cone. Head with an integumentary channel system like previous species. Ocelli 6 + 6, PAO large, elongate, about twice as long as diameter of nearest ocellus (Fig. 63I). Antennae slender, tip of ant.4 upturned. Ant.1 with 1–2 slender, hair-like sensilla in ventroapical position. Ant.2 with 4–5 long, hair-like dorsoapical sensilla. Ant.3 with two large, slender apical sensilla and many hair-like sensilla dispersed over the surface. Ant.4 with many hair-like sensilla. Subapical organite and pin-seta absent. Labrum with 554 setae, 4 sharp apical folds and a brush-like ventroapical ciliation. Prelabral setae 4. Labium with a full set of apical papillae and guards ($e_7$ present). Proximal and basomedian fields with 4 setae. Mandibles normal, strong. Maxilla with 3-toothed capitulum and 6 lamellae (Fig. 63K). Lam.1 reaching beyond tip of capitulum, with a uniform cover of long denticles/serrations (no differentiated marginal ciliation). Lam.2–5 with marginal ciliations and some coarse denticles along the inner edge. Lam.6 covered with fine denticles. Body hairs strongly differentiated. Abdominal macrochaetae and lateral macrochaetae on thorax very long, heavily ciliated/serrated (Fig. 63L). Ground cover of setae particularly strongly differentiated on head and thorax, with curved, sharp dagger-like mesochaetae and short microchaetae. The mesochaetae on head and thorax mostly with serrations in basal part. Sensillary set on th.2–abd.5 as 97/66686 according to Potapov (2001). Abd.5–6 dorsally fused, no clear demarcation line between the segments. Ventral side of thorax without setae. Ventral tube with 3–4 frontal setae on each side, with 3 + 3 lateral and 6–7 caudal setae. Retinaculum with 4 + 4 teeth and 5–7 setae. Manubrium with blunt ventroapical teeth and 3 + 3 ventroapical short setae. Dens with 15–20 dorsal setae in proximal half. Ventral side with numerous setae (>100 in large specimens). Mucro 3-toothed, slender, no lateral seta (Fig. 63J). An inner lamella runs from base to the apical tooth. Tib.2 with two enlarged, apically feathered macrochaetae. Claws with a pair of weak lateral teeth, unguiculus with broad basal lamella. Tibiotarsi without differentiated tenent hairs.

*Discussion.* – Easily identified by the 6 + 6 ocelli, presence of integumentary channels on head, feathered tibiotarsal setae and exceptionally long and ciliated abdominal macrochaetae. The species had usually been assigned to the genus *Isotoma* s.l., until Potapov (2001) found that it actually possessed the essential characters of the genus *Marisotoma*. A third species of the genus – *M. irmeli* (Potapov, 1991) – occurs in the Ural mountains.

*Distribution and ecology.* – A boreal species reported from Finland and easternmost districts of Norway. Most records from *Sphagnum* bogs. World distribution: Palaearctic.

## Genus *Parisotoma* Bagnall, 1940

*Parisotoma* Bagnall, 1940, Entomologist's mon. Mag. 76: 171. Type species: *Isotoma notabilis* Schäffer, 1896, by original designation.

Our *Parisotoma* species are small (at most 1.0 mm), with few ocelli (4 + 4 or less) and 3 teeth on mucro (4 in one rare species). Pigmentation is usually weak. Maxillary palp is trifurcate with 4 sublobal hairs. Maxilla specialised, with broad lamellae bearing rows of long cilia. Four Nordic species are present.

### Key to species

1 Mucro with 3 teeth . . . . . 2
– Mucro with 4 teeth . . . . . 267. *trichaetosa* (Martynova)

2 Eye-spot large, square, with 3–4 ocelli on each side. Body greyish brown. Maxilla as Fig. 64I . . . . . 264. *notabilis* (Schäffer)
– Eye-spot small, roundish, only 1 + 1 ocelli. Body paler . . . . . 3

3 Basal part of first leg with 3 outer setae (Fig. 64F). Ventral tube with 3 + 3 lateral setae. Maxilla as Fig. 64J . . . . . 265. *agrelli* (Delamare Deboutteville)

– Basal part of first leg with 2 outer setae (as Fig. 64E). Ventral tube with 4 + 4 lateral setae. Maxilla as Fig. 64K
. . . . . 266. *ekmani* Fjellberg

## 264. ***Parisotoma notabilis*** (Schäffer, 1896)

Fig. 64A–E, I

*Isotoma notabilis* Schäffer, 1896, Mitt. naturh. Mus. Hamb. 13: 187.

*Description.* – Body size up to 1.0 mm. Colour diffusely brownish grey. Body shape slender, abdomen widening towards tip, furca long (Fig. 64A). Eye-spot square with 3–4 ocelli which are often hard to detect. PAO large, oval, about 3 times as long as diameter of nearest ocellus (Fig. 64C). Ant.1 with two short ventroapical sensilla. Ant.2 with a dorsolateral slender sensillum near apex. Ant.3 with two thick dorsoapical sensilla, 3 slender guards and one spine-like ventrolateral sensillum with an associated guard. Males with some additional hair-like sensilla on ant.2–3. Ant.4 with many hair-like sensilla and 3–4 slightly thickened dorsal sensilla in apical part. Tip of ant.4 with a subapical organite and a simple pin-seta. Labrum with 554 setae, 4 prelabrals. Labral edge with 4 small apical folds, median pair shorter than lateral ones. Ventroapical ciliation simple. Labial palp with a complete set of papillae and guards. Proximal field with 4 setae, basomedian field with 5 setae. Head with 4 + 4 postlabial setae. Maxillary palp trifurcate, 4 sublobals. Mandibles normal. Maxilla (Fig. 64I) with 3-toothed capitulum and 6 lamellae. Max. lam.1 much longer than capitulum, apex fan-shaped expanded, with delicate marginal ciliation and several rows of coarse, long denticles on the inner side. Lam.2–3 with marginal ciliation and a few coarse denticles on the inner face. Lam.4–5 small, with few or none ciliation/denticles. Lam.6 prominent, apically expanded, with long ciliation along anterior edge and 4–5 regular transverse rows of denticles. Body with a sparse cover of relatively long pointed setae. Longest macrochaetae on coxae and abdomen distinctly serrated. Median macrochaeta on abd.5 about as long as the tergite. Sensillary set of th.2–abd.5 usually as 87/66677, microsensilla 11/111. Ventral tube with 3 + 3 frontal, 3 + 3 lateral and 3–5 caudal setae. Retinaculum with 4 + 4 teeth and two setae. Manubrium with blunt ventroapical teeth and usually 2 + 2 short ventroapical setae. Dens with 7 dorsal setae in basal half and numerous ventral setae (Fig. 64B). Mucro with 3 teeth. Apical and outer basal tooth large (Fig. 64D). Base of first pair of legs with two external setae (Fig. 64E). Tibiotarsi with 7 apical setae ($A_{1-7}$), seta $T_1$ absent. Claws short, without teeth. Unguiculus with broad basal lamella. Juveniles (1.instar) without ventral setae on manubrium. Males generally absent in Nordic samples, but present in compost heaps.

*Discussion.* – Normally easy to identify by the key characters, but care should be taken in seashore habitats where the similar species *agrelli* may occur together with *notabilis*. The two species differ sharply in details of the maxilla and *notabilis* only has two outer setae at base of the first leg (3 in *agrelli*, Fig. 64F).

*Distribution and ecology.* – One of the most common and widely distributed species of Collembola in our area, including the arctic islands. General distribution: Cosmopolitan.

## 265. ***Parisotoma agrelli*** (Delamare Deboutteville, 1950)

Fig. 64F, J

*Isotoma agrelli* Delamare Deboutteville, 1950, Revue fr. Ent. 17: 43.

*Description.* – Body size up to 1.0 mm. Colour pale, small spots of black pigment scattered over the body, eye-spots darker. Body shape as in *notabilis*. Ocelli 1 + 1. PAO oval, about 4 times as long as diameter of ocellus. Antennal sensilla, labrum, labium and maxillary palp as in *notabilis*. Head with 3 + 3 postlabial setae. Mandibles normal. Maxilla (Fig. 64J) similar to that of *notabilis*, but lam.1 with only two clear rows of cilia and lam.6 with only 2–3 irregular rows of denticles in addition to the marginal ciliation. Longest body hairs distinctly serrated, median macrochaeta on abd.5 about as long as tergite. First three abdominal segments with 6 macrosensilla on each side. Th.2–3 and abd.4–5 with a variable number of sensilla in adults (7–9). Microsensilla 11/111. Ventral tube

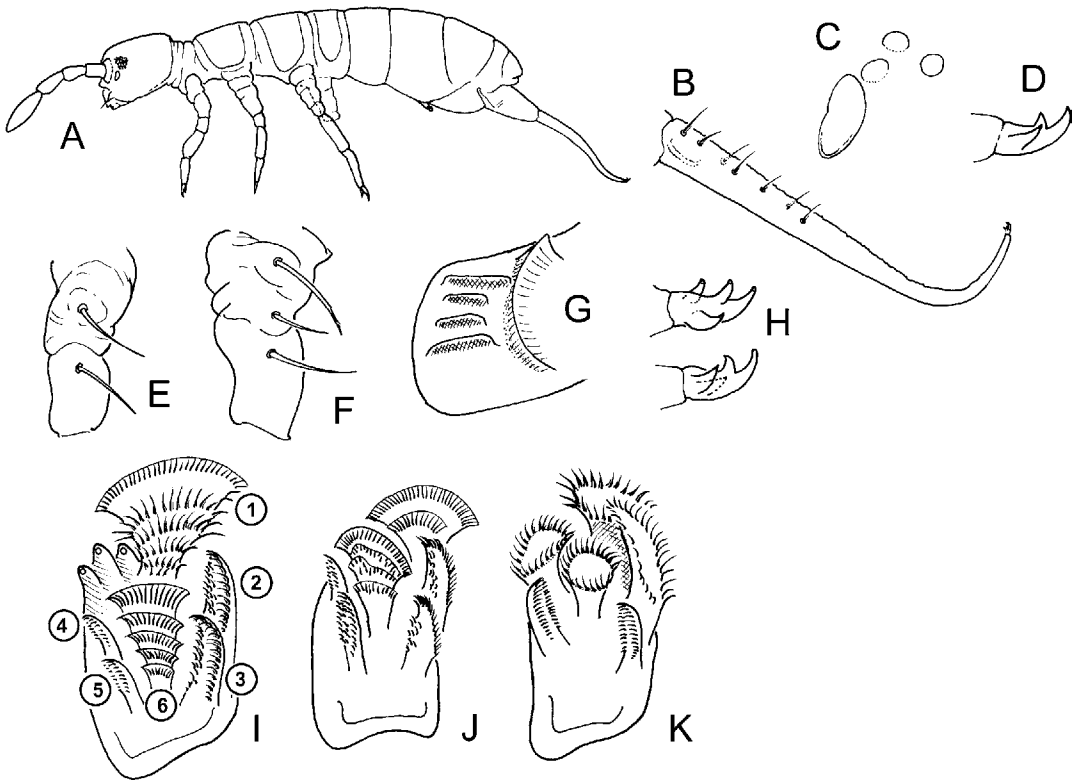


Fig. 64. *Parisotma* spp.: (A–E) *notabilis*, (A) habitus, (B) dorsal setae on dens; (C) PAO and eyes, (D) mucro, (E) base of left foreleg; (F) *agrelli*, ditto; (G–H) *trichaetosa*, (G) labral edge, (H) mucro; (I–K) maxilla in *notabilis* (I), *agrelli* (J) and *ekmani* (K).

with 3–5 frontal setae on each side, 3 + 3 lateral and 5–6 caudal setae. Retinaculum with 4 + 4 teeth and 3–6 setae. Furca as in *notabilis*. Base of first pair of legs with 3 external setae (Fig. 64F). Tibiotarsi with 7 apical setae ($A_{1-7}$). Claws with small lateral teeth. Males present.

*Discussion.* – Easily identified by the 1 + 1 ocelli and the characteristic maxilla. Clearly differentiated from *notabilis* by the extra subcoxal seta on the first pair of legs.

*Distribution and ecology.* – A characteristic species in the marine supralittoral, in rotten seaweeds, under rocks and wrack and in salt wet meadows. Probably widely distributed, but overlooked. General distribution: Palaearctic.

## 266. ***Parisotoma ekmani*** (Fjellberg, 1977)

Fig. 64K

*Isotoma ekmani* Fjellberg, 1977, Ent. scand. 8: 9.

*Isotoma notabilis* f. *pallida* Agrell, 1939 (nec Nicolet, 1842, nec Moniez, 1894).

? *Isotoma sphagneticola* Linnaniemi, 1912.

*Note.* – The original description of *Isotoma sphagneticola* Linnaniemi, 1912 was based on 3 specimens from alpine regions in northern Finland. The specimens had first been misidentified as *Isotoma bipunctata* (now *Cryptopygus*), but then described as a new *Isotoma*. Linnaiemi (1912: 171) stressed the similarity to *notabilis*, but noted that *sphagneticola* had no pigment and no ocelli. The 3-toothed mucro, 2 setae on retinaculum and great similarity with *notabilis*, makes one believe that *sphagneticola* is a senior synonym of *ekmani*. The small eye and the weak pigment is easily overlooked in pale *ekmani*. The type locality of *sphagneticola*, Pallastunturi, is certainly inhabited by *ekmani* which is widespread in similar habitats in the north. Un-

fortunately no material of *sphagneticola* can be traced in Finnish museums so the taxon remains a 'species inquirenda' and the synonymy cannot be asserted.

*Description.* – Body size 0.7 mm. White, or with very scattered dark pigment on head and body. The small eye-spot dark. Ocelli 1 + 1. PAO oval, about 3 times as long as diameter of the ocellus. Ant.1 with 2–3 ventral thickened sensilla. Ant.3 organ normal, ant.4 with 4 sensilla which are clearly thicker than others, subapical organite projecting. Details of the mouth region as previous species, but labial palp with only 3 proximal setae and basomedian field with 4 setae. The large lamellae of the maxilla (lam.1, 2, 4, 6) only with two rows of cilia, no denticles (Fig. 64K). Characteristic is the strong lam.4 which is as long as lam.2. Head with 4 + 4 postlabial setae. Longest body macrochaetae slightly serrated. Median macrochaeta on abd.5 shorter than tergite. Macrosensilla of th.2–abd.5 as 65/33466, spine-like microsensilla 10/101. Ventral tube with 3 + 3 frontal setae, 4 + 4 lateral and 3 caudal setae. Retinaculum with 4 + 4 teeth and two setae. Furca as in previous species, but dens with 8 dorsal setae. First pair of legs with two outer setae at base (as in *notabilis*). Tibiotarsi with 7 apical setae ($A_{1-7}$). Claws without teeth. Males not seen.

*Discussion.* – Similar to *agrelli* by the 1 + 1 ocelli, but differs by having only two outer setae at base of first leg, 4 + 4 lateral setae on the ventral tube and 8 dorsal setae on dens. The maxilla is unique.

*Distribution and ecology.* – A boreomontane species usually present in moist habitats in the northern forests and above tree line. Often recorded in *Sphagnum*. General distribution: Northern Holarctic.

## 267. ***Parisotoma trichaetosa*** (Martynova, 1977)

Fig. 64G–H

*Isotoma trichaetosa* Martynova, 1977, Komponenty Biocenozov Severnogo Okhotomor'ya: 124.

*Description.* – Body size 1.0 mm. White, with diffuse pigment on head and body, eye-spots darker. Ocelli 1 + 1. Body shape as normal for the genus. Labrum with 554 setae, 4 prelabrals, with a subapical transverse ridge and 4 longitudinal apical ridges (two median ones shorter) (Fig. 64G). Labial palps with a complete seta of papillae and guards ($e_7$ present). Basal fields with 5 median and 5 lateral setae. Maxilla as in *notabilis* (Fig. 64I), lam.1 and 6 with 5–6 rows of cilia. Head with 4–5 postlabial setae. Macrochaetae of the body moderately long, distinctly serrated. Sensilla on th.2–abd.5 distributed as 65/44467, microsensilla 11/111. Ventral tube with 3–4 frontal setae on each side, 3 + 3 lateral and 3–6 caudal setae. Retinaculum with 4 + 4 teeth and two setae. Base of first pair of legs with two outer setae. Tibiotarsi with 7 apical setae. Claws without teeth. Manubrium with 2 + 2 ventroapical setae. Dens with 7 dorsal setae, all in basal half. Mucro with 4 teeth. Both basal teeth large, subequal (Fig. 64H).

*Discussion.* – The 4-toothed mucro readily identifies this species which looks like a pale *notabilis*. It also differs from *notabilis* by having only 4 macrosensilla on each side of abd.1–2 (6 in *notabilis*).

*Distribution and ecology.* – Originally described from litter in pine forest in far eastern Russia (Magadan). Later recorded from southern Siberia (Potapov, 2001). The first Nordic records are from several compost heaps in the Oulu district in Finland (October 2004, V. Huhta leg.). Possibly an expansive species which should be looked for in compost in other Nordic sites.

# Genus *Halisotoma* Bagnall, 1949

*Halisotoma* Bagnall, 1949, Ann. Mag. nat. Hist. (12) 2: 85. Type species: *Isotoma maritima* Tullberg, 1871, by original designation.

Our two *Halisotoma* species are living in the marine littoral and are characterised by a full set of eyes, apically broadened and feathered macrochaetae on tib.2, three mucronal teeth and 2 + 2 lateral (apical) setae on the ventral tube. Maxillary palp is trifurcate and the maxillae are specialised with broad, ciliate lamellae.

## Key to species

1 Tib.3 with seta $A_7$ thicker than $A_1$ (Fig. 65B). Claws slender, with small lateral teeth set in basal part. (Fig. 65B, G). Labral edge with 4 finger-like projections (Fig. 65J). Maxillary lam.1 with 5–6 rows of cilia (Fig. 65D). Hypostomal seta H reduced to a small papilla, guards $b_3$–$b_4$ set on a common stem (Fig. 65H, I)
. . . . . 268. *maritima* (Tullberg)

– Tib.3 with $A_7$ slender, not thicker than $A_1$ (Fig. 66A). Claws stout, large lateral teeth set beyond middle of dorsal edge (Fig. 66A, D). Labrum with 4 keel-like projections (Fig. 66B). Max. lam.1 with 2 rows of cilia (Fig. 66E). Hypostomal seta H long, guards $b_3$–$b_4$ separate (Fig. 66G, H)
. . . . . 269. *poseidonis* (Bagnall)

## 268. ***Halisotoma maritima*** (Tullberg, 1871)

Fig. 65A–L

*Isotoma maritima* Tullberg, 1871, Öfvers. K. VetenskAkad. Förh. 28: 151.

*Description.* – Body size up to 1.7 mm. Colour greyish brown, including extremities. Dens and last antennal segment usually paler. Large specimens darker. Body shape slender, *Isotoma*-like, with long extremities. Ocelli 8 + 8, G and H smaller. PAO large, oval, 2–3 times as long as diameter of nearest ocellus (Fig. 65L). Ant.1 with 3–4 short, setaceous sensilla in ventroapical position and a few more in ventrobasal part. Similar sensilla also in lateroapical part of ant.2 and ventroapically on ant.3. Ant.3 in addition with several short setaceous sensilla in dorsal and lateral parts. Ant.4 with 3–4 thickened dorsoapical sensilla in addition to numerous short setaceous sensilla. Apical pin-seta and subapical organite not developed. Ant.1–2 with or without sharp outer corners (not related to sex, Fig. 65K). Labral chaetotaxy as 4/554, labral setae undifferentiated. Apical edge of labrum with 4 slender, finger-like projections (Fig. 65J). Ventroapical ciliation long, consisting of 2–3 irregular rows. Frontoclypeal field with more than 25 setae. Labial palp with full set of papillae and guards, 4 proximal setae. Labial papilla B modified, with a roundish lobe on the inner side and guards $b_3$ and $b_4$ running from a common stem set on the dorsal side of the papilla (Fig. 65H). Hypostomal seta H reduced to a small knob, $h_1$ and $h_2$ enlarged, curved, longer than the terminal sensillum on the papillae (Fig. 65I). Basomedian field with 5 setae. Head with 4–5 postlabial setae. Maxillary palp trifurcate, 4 sublobal hairs. Mandibles normal, strong. Maxilla with 3-toothed capitulum and strongly modified lamellae. In particular lam.1 and 6 are apically expanded, bearing 5–6 regular rows of fine ciliations (Fig. 65D). Lam.2 has long ciliations along ventral edge and some serrations on the inner face. Lam.3 and 5 with marginal ciliations only. Lam.4 densely packed with serrations, with a thin membranous outer flap which is apically serrated, projecting into the space behind the maxillary teeth ("toothbrush", Fig. 65E). Dorsal side of body with a dense cover of short setae. Macrochaetae short but distinct. Sensilla of tergites abundant. A second instar juvenile had 67/776 and 78/677 sensilla on the two sides of th.2–abd.3, and 11–12 and 11–14 on the two sides of abd.4–5. Spine-like microsensilla 11/111 (Fig. 65A). No ventral setae on thorax. Lateral tube with 4–5 frontal setae, 2 + 2 lateral and 5–6 caudal setae. Retinaculum with 4 + 4 teeth and 4–5 setae. Manubrium with sharp ventroapical teeth. Dens with 8–10 setae in the dorsal half. Mucro with 3 teeth, apical tooth long. Inner lateral lamella reaching base of apical tooth. No lateral seta. Apical seta of dens long (Fig. 65F). Tibiotarsi with 8 apical setae ($T_1$ present). Tenent hairs acuminate. Tib.2 with two (sometimes one) apically expanded and serrated macrochaetae (Fig. 65C). On tib.3 $A_7$ much thicker than $A_1$ (Fig. 65B). Claws short, lateral teeth set in basal half of unguis. Unguiculus acuminate (Fig. 65G). Males present.

*Discussion.* – There is a considerable variation in size of ocelli and length of abdominal macrochaetae. Specimens with corner tooth on ant.1–2 tend to have larger ocelli (PAO 2.0–2.5 as long as diameter of ocellus) and shorter macrochaetae (abd.5 median macro less than twice as long as inner claw 3), while those without corner tooth have smaller ocelli (PAO almost three times as long as ocellus) and longer macrochaetae (abd.5 median macro almost three

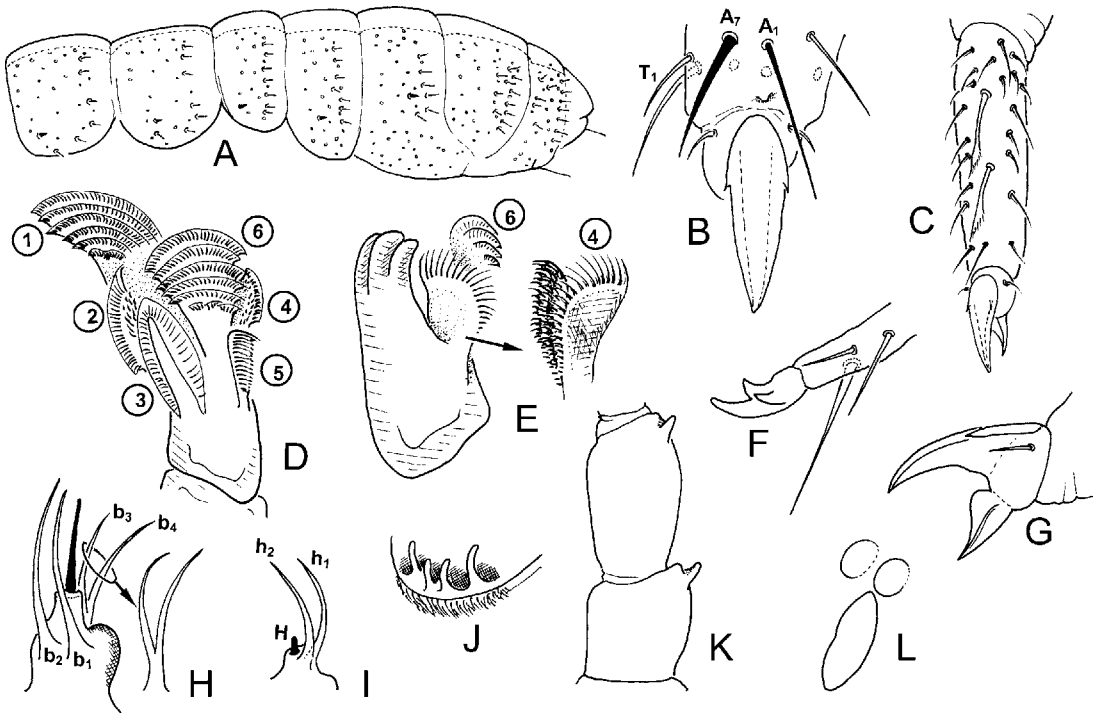


Fig. 65. *Halisotoma maritima*: (A) Sensillary distribution on th.2–abd.5 in a 2.instar juvenile; (B) apical setae on right tib.3; (C) outer side of tib.2 with two feathered setae; (D) maxilla; (E) dorsal view of maxilla with details of lam.4; (F) mucro and long apical seta on dens; (G) claw; (H) labial papilla B showing guards $b_3$–$b_4$ rising from a common stem; (I) hypostomal papilla with reduced H; (J) apical edge of labrum; (K) left ant.1–2; (L) PAO and nearest ocelli.

times as long as inner claw 3). Other characters, including details of the mouth apparatus, are the same.

*Distribution and ecology.* – A common marine littoral species along our seashores, being present also in Iceland. General distribution: Cosmopolitan, but more than one species may be involved.

## 269. ***Halisotoma poseidonis*** (Bagnall, 1939)

Fig. 66A–H

*Isotoma poseidonis* Bagnall, 1939, Entomologist's mon. Mag. 75: 96.

*Description.* – Body size up to 2.5 mm. Colour greyish, usually rather pale. Ocelli large. PAO oval, about 1.5 as long as diameter of ocellus (Fig. 66C). Antennal sensilla as in previous species. Labrum with 4 small, keel-like apical folds (Fig. 66B). Ventroapical ciliation dense, brush-like. Labial palps with a complete set of papillae and guards. Papilla B with a small lobe on the inner side, dorsal guards $b_{3-4}$ separate (Fig. 66H). Hypostomal group normal, H long (Fig. 66G). Basomedian field of labium in large specimens with up to 9 setae. Head with up to 10 postlabial setae on each side of ventral line. Maxilla modified (Fig. 66E, F). Lam.1 apically expanded, with two fringes of cilia and some coarser serration on the inner side. Lam.2 with ciliation along dorsal edge only, no inner serrations. Lam.3–4 with ciliation along dorsal and ventral edge, inner side densely packed with serrations. Lam.4 in addition with a small ciliated flap, a "tooth brush". Lam.5 with long, thin ciliations along dorsal and ventral edges, no serrations on inner face. Lam.6 with an apical fringe of fine cilia and several irregular rows of coarse serrations. Body macrochaetae moderately developed, those in median part of abd.5 about twice as long as inner length of last claw. Num-

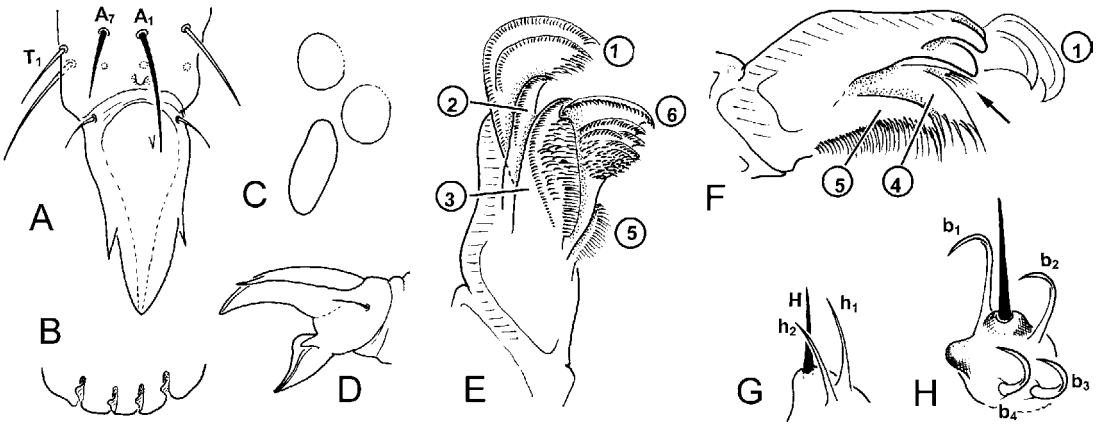


Fig. 66. *Halisotoma poseidonis*: (A) Apical setae on right tib.3; (B) apical edge of labrum; (C) PAO and nearest ocelli; (D) claw; (E) maxilla; (F) dorsal view of maxilla showing lam.4–5, arrow points to the "toothbrush"; (G) hypostomal papilla; (H) labial papilla B with separate $b_3$–$b_4$.

ber of dorsal sensilla on tergites abundant, even more than in *maritima*. Dens in large specimens with up to 20 dorsal setae. Tib.3 with apical setae $A_7$ and $A_1$ both thin (Fig. 66A). Claws short and thick with large lateral teeth set beyond middle of unguis. Teeth often asymmetric and dissimilar, with the posterior one largest (Fig. 66A). Other body marks as in *maritima*.

*Discussion.* – Usually separated from *maritima* by larger body size, paler colour, the stout claws with lateral teeth in apical part, and the slender $A_7$ seta on tib.3. Decisive characters are the maxillary lam.1 which has only two fringes of cilia and the details of the labial/hypostomal papillae.

*Distribution and ecology.* – The species, originally described from Britain, has been confused with *maritima* and the distribution is not well known. Samples are seen from Norway, Denmark and Iceland. The species lives in the marine intertidal zone and has been collected by flotation after turning up rocks lying embedded in rotten seaweeds. The big, pale specimens of *poseidonis* appear much more sluggish than the dark and agile *maritima* which may live in the same site. General distribution: Palaearctic.

## Genus *Isotoma* Bourlet, 1839

*Isotoma* Bourlet, 1839, Mém. Soc. Sci. Agric. Lille 1839 (1): 399. Type species: *Isotoma viridis* Bourlet, 1839, by subsequent designation by Börner, 1903.

By a quick glance individuals belonging to this genus may be confused with *Isotomurus* species, which, however, have a more strongly protruding mouth cone. Also the positions of macrochaetae on abd.4 is different, being triangular in *Isotomurus* and linear in *Isotoma* (Fig. 59C, D). The long abdominal macrochaetae of *Isotomurus* easily fall off in specimens preserved in alcohol, while they are retained in *Isotoma*.

General characters: Large Isotomidae with long, serrated macrochaetae. Ocelli 8 + 8. PAO small, roundish, shorter than diameter of nearest ocellus (Fig. 67B). Maxillary palp bifurcate, 4 sublobal hairs. Labrum with 554 setae, 4 prelabrals. Apical edge of labrum with 4 folds of variable size. Ventroapical ciliation brush-like. Mandibles strong, unmodified. Maxilla with short lamellae, densely covered with denticles. Labium with a full set of papillae and guards, proximal setae 4. Basomedian field with increased number of setae. Sensillary chaetotaxy of th.2–abd.3 in Nordic species as 66/555, including 11/111 spine-like sensilla (most easily observed in small juveniles). Number of sensilla on abd.4–5 usually 6 in small specimens, more in large individuals. No ventral setae on thorax. Ventral tube with numerous setae in anterior, lateral and caudal positions. Retinaculum with 4 + 4 teeth and numerous setae. Inner edge

of claws with two teeth (Fig. 67G). Tibiotarsi with 8 primary apical setae ($T_1$ present), tenent hairs pointed. Body hairs with glandular basis. Manubrium with thickened, spine-like ventroapical setae (Fig. 67F). Mucro with 3 teeth, no lateral seta (Fig. 67E). Abd.5–6 separated. Males generally present in all species, epitoky not observed. Members of this genus are among our largest Collembola. Full-grown adults may reach 3–4 mm length. The Nordic species were recently revised by Fjellberg (2003). Molecular evidences for species separations were presented by Burkhardt & Filser (2005).

## Key to species

1 Ventroapical manubrial teeth simple (Fig. 67F) . . . . . 3
– Ventroapical manubrial teeth bispinose (Fig. 68B) . . . . . 2
2 Manubrial seta A > B. Dens with 3 dorsobasal macrochaetae (Fig. 68C). 1.instar juv. without manubrial setae . . . . . 273. *anglicana* Lubbock
– Manubrial seta A < B. Dens with two dorsobasal macrochaetae (as Fig. 67C). 1.instar juv. with 1 + 1 ventroapical setae on manubrium (as Fig. 59L) . . . . . 272. *caerulea* Bourlet
3 Body with 3-striped pattern (Pl. 4) . . . . . 271. *riparia* (Nicolet)
– Body uniformly coloured, not with 3 longitudinal lines . . . . . 270. *viridis* Bourlet

## 270. ***Isotoma viridis*** Bourlet, 1839

Fig. 67A–G

*Isotoma viridis* Bourlet, 1839, Mém. Soc. Sci. Agric. Lille 1839 (1): 401.

*Description.* – Colour variable, usually greenish. Small individuals pale, weakly pigmented. Large individuals often darker, brown or reddish. Posterior edges of tergites often darkened.

Antennae with a normal sensillary equipment. All segments with many hair-like sensilla. Erect sensilla present in both males and females. Ant.4 with subapical pin-seta bifurcate. Subapical organite small, in a pit. Edge of labrum as Fig. 67D, lateral folds larger than median pair. Basomedian field of labium with more than 10 setae in large individuals. Maxilla as Fig. 67A. Lam.4–5 similar to lam.2–3. Ground pilosity on dorsal side of head and tergites notably "double" with long and short setae. Longest setae and macrochaetae serrated. Median macrochaetae on abd.5 more than twice as long as tergite. Ventroapical spines on manubrium simple (Fig. 67F). Dorsal manubrial macrochaeta A shorter than B (Fig. 67C). Basal part of dens with 2 dorsal macrochaetae. Mucro usually with a minute fourth tooth on the ventral edge (Fig. 67E). The 1.instar juvenile with 1 + 1 ventroapical manubrial setae (as Fig. 59L).

*Discussion.* – Identified by the simple manubrial spines, differentiation of dorsal manubrial macrochaetae and uniform coloration.

*Distribution and ecology.* – Common and widely distributed in a variety of habitats both in forest, meadows, seashores and alpine tundra. May possibly tolerate some drier conditions than *anglicana* (Filser, 1999). General distribution: Holarctic.

## 271. ***Isotoma riparia*** (Nicolet, 1842)

Pl. 4

*Desoria riparia* Nicolet, 1842, Neue Denkschr. Allg. schweiz. Ges. ges. Naturw. 6 (3): 62.

*Description.* – Body pattern as Pl. 4, with mid-dorsal dark line and dorsolateral patches which give the impression of three longitudinal bands. The degree of coloration variable, in small juveniles only traces of the mid-dorsal line left. In very large individuals the dark elements often become confluent. Lateral apical folds of labrum much larger than median ones. Unguiculus sometimes without corner tooth. The first instar juveniles with 1 + 1 manubrial setae.

*Discussion.* – Apart from colour pattern, almost identical to *viridis*. The claws are more expanded at base and dens is thicker in the apical part, but these characters vary and are difficult to quantify. Burkhardt & Filser (2005) found that *riparia* and *viridis* were more closely related to each other than to any of the other two Nordic

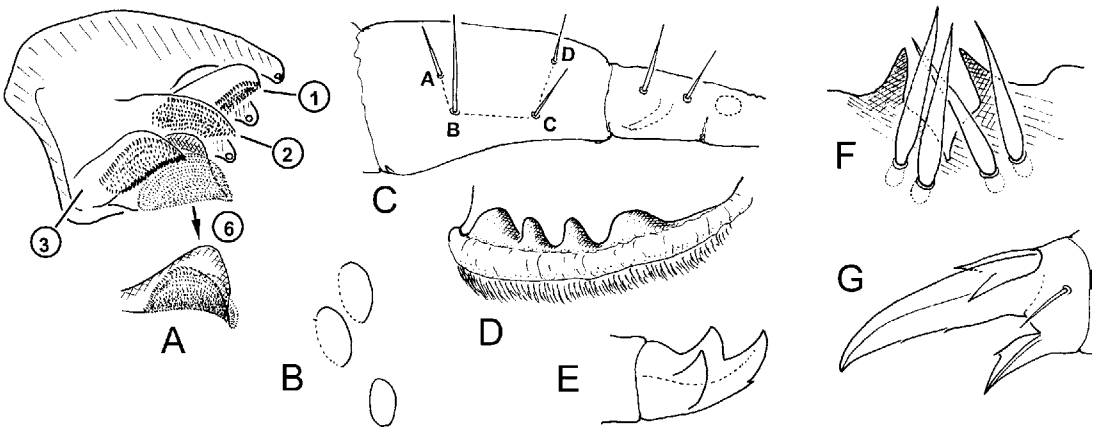


Fig. 67. *Isotoma viridis*: (A) Left maxilla, ventral view; (B) PAO and two nearest ocelli; (C) principal macrochaetae on manubrium and proximal part of dens; (D) apical papillae of labrum; (E) mucro; (F) spine-like setae with glandular bases in ventroapical part of manubrium; (G) claw.

species. By a quick glance the species may be confused with *Isotomurus plumosus* which has a similar 3-striped pattern and may live in the same habitats. They are easily separated by the pigmentation on the head: In *riparia* there is a dark stripe between the eyes while *plumosus* only has a dark occipital spot but no pigment between the eyes (Pl. 2: 5).

*Distribution and ecology.* – A hygrophilous species, often abundant in wetlands near marine seashores, but also in bogs and along ponds and lakes. Never in dry habitats. Probably widely distributed, but some records are unreliable due to confusion with other species. General distribution: Palaearctic.

## 272. ***Isotoma caerulea*** Bourlet, 1839

*Isotoma caerulea* Bourlet, 1839, Mém. Soc. Sci. Agric. Lille 1839 (1): 401.

*Description.* – Colour in full grown specimens bluish or brownish red. Smaller specimens (less than 1.0 mm) usually greyish green, pale. Labral apical folds variable, often almost subequal in size. Manubrial teeth bispinose (as Fig. 68B). 1.instar juveniles with 1 + 1 manubrial setae.

*Discussion.* – Apart from the bispinose manubrial teeth, almost identical to *viridis* including the macrochaetal characters of manubrium and dens. Until recently the species had been confused with *anglicana*.

*Distribution and ecology.* – In various habitats, but most frequent in dry, sandy soils. Probably widely distributed but old records are unreliable. General distribution: Holarctic.

## 273. ***Isotoma anglicana*** Lubbock, 1862

Fig. 68A–C

*Isotoma anglicana* Lubbock, 1862, Trans. Linn. Soc. Lond. 23: 596.

*Description.* – Colour variable, usually uniformly violet or blue of variable intensity. Unlike *caerulea*, also small individuals have a distinct bluish coloration. Labral folds variable, often almost subequal. Manubrial teeth bispinose (Fig. 68B). Manubrial dorsal macrochaetae A > B, A moved forward in relation to B. Dens with three dorsobasal macrochaetae (Fig. 68C). 1.instar juveniles with thick, strongly serrated spike-like macrochaetae on abd.5–6 and no ventroapical setae on manubrium.

*Discussion.* – The above chaetotaxy characters of manubrium and dens isolate *anglicana* from the three other Nordic species, in accordance with the molecular evidence reported by Burkhardt & Filser (2005).

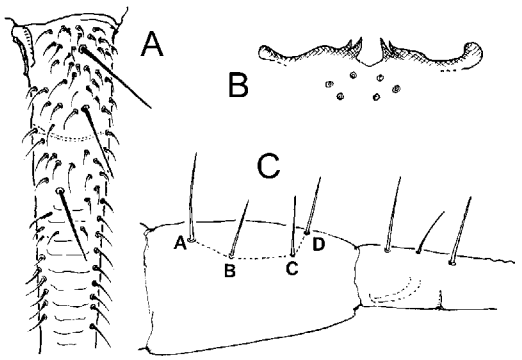


Fig. 68. *Isotoma anglicana*: (A) Dorsal setae at base of dens, note three macrochaetae; (B) bispinose manubrial teeth; (C) principal macrochaetae on manubrium and proximal part of dens.

*Distribution and ecology.* – Both in forest and open fields, usually in humid soils with high organic content. Often in farmlands and gardens. Apparently it avoids the dry sandy habitats where *caerulea* may be found. It is the only *Isotoma* species present in the arctic islands. Widely distributed, but few verified records due to confusion with *caerulea* until 2003. General distribution: Holarctic.

## Genus *Desoria* Nicolet, 1841

*Desoria* Nicolet, 1841, Bibltque Univ. Genève 32: 126. Type species: *Desoria saltans* Nicolet, 1841.

A large genus with a heterogeneous assemblage of species, of which some will probably be allocated to other genera in future. General characters: Ocelli 8 + 8, G and H often smaller. Labrum with 554 unmodified setae, prelabral setae 4. Mandibles normal, strong, unmodified. Maxilla modified in some species. Ventral setae absent on thorax (except in *hiemalis*). Setal bases non-glandular (except *trispinata*). Manubrium with slender ventroapical setae (not spine-like). Tibiotarsi with 11 apical setae ($T_{1-4}$ present), except in *trispinata* and *multisetis* (reduced). Tenent hairs acuminate, unmodified (except in winter form of *nivea*). Males normally present, not epitokous. In the first instar juvenile the ventral manubrial setae are absent and the inner basal tooth of mucro is absent in species where adults have a 4-toothed mucro. Several species are cyclomorphic with distinct winter and summer forms.

### Key to species and species groups

1 Mucro with 4 teeth . . . . . 2
– Mucro with 3 teeth . . . . . 4
2 Mucro without lateral seta . . . . . 3
– Lateral seta present on mucro (Fig. 69G) . . . . . *olivacea* group (p. 117).
3 Maxillary palp simple . . . . . *tigrina* group (p. 125).
– Maxillary palp bi- or tri-furcated (Fig. 69A) . . . . . *hiemalis* group (p. 120).
4 Maxillary palp trifurcate. Abd.5 macrochaetae smooth, shorter than tergite. Ventral tube with 3 + 3 lateroapical setae. Maxilla modified . . . . . 290. *trispinata* (MacGillivray)
– Maxillary palp bifurcate. Abd.5 macrochaetae densely ciliate, much longer than tergite. Ventral tube with about 10 + 10 lateroapical setae. Maxilla simple . . . . . 291. *multisetis* (Carpenter & Phillips)

### *olivacea* group

Maxilla unmodified, with short lamella densely packed with fine denticles, no long marginal ciliation. Labial palp with 4 proximal setae, basomedian field with 4 setae. Maxillary palp simple, bi- or tri-furcated. Body hairs generally short, macrochaetae smooth. Ventral tube with two setae in the caudal transverse apical row. Microsensilla of th.2–abd.3 as 10/001. Manubrium with 1 + 1 short ventroapical setae, ventroapical teeth blunt (Fig. 69C). Mucro with 4 teeth, asymmetric, with outer basal tooth laterally displaced, lateral seta present. Males present.

### Key to species of the *olivacea* group

1 Labrum with 4 sharp apical lobes (Fig. 69E). Maxillary palp bi- or tri-furcated (Fig. 69A) . . . . . 2

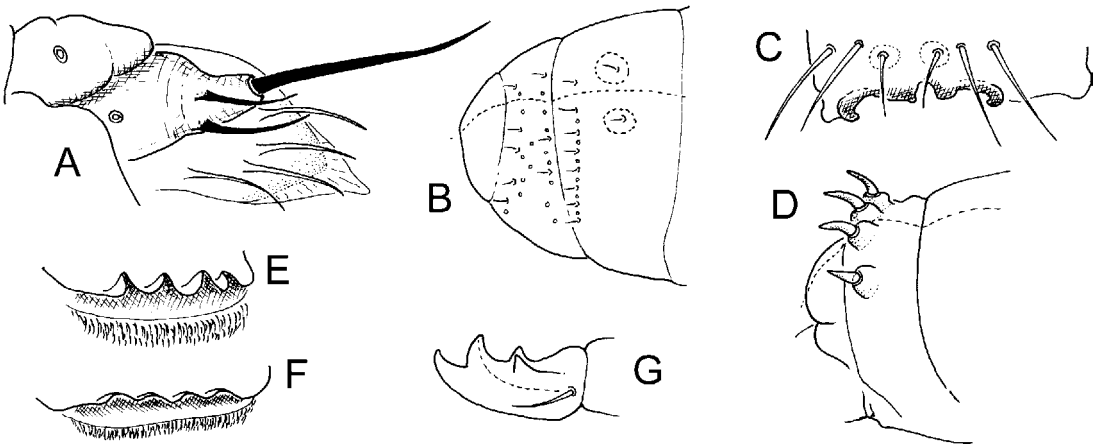


Fig. 69. *Desoria olivacea* group: *olivacea* (A–C, E, G), *fennica* (D, F): (A) maxillary outer lobe with a trifurcate palp (black); (B) sensilla on abd.4–6 in a juvenile specimen, anterior pair on abd.4 encircled; (C) ventroapical setae on manubrium, the 1 + 1 short setae encircled; (D) spines on abd.5 in an ecomorphic juvenile; (E–F) apical edge of labrum; (G) mucro.

– Labrum with roundish apical lobes (Fig. 69F). Maxillary palp simple ..... 277. *fennica* (Reuter)

2 Maxillary palp trifurcate. Abd.4 with a pair of anterior sensilla (Fig. 69B) ..... 3

– Maxillary palp bifurcate. Anterior sensilla absent on abd.4 .. 275. *infuscata* (Murphy)

3 Abdominal macrochaetae shorter, median pair on abd.5 0.5–0.6 as long as tergite. Ant.4 pin-seta simple ..... 274. *olivacea* (Tullberg)

– Abdominal macrochaetae longer, median pair on abd.5 0.7–1.0 as long as tergite. Ant.4 pin-seta bifurcate. Arctic species only ..... 276. *tshernovi* (Martynova)

## 274. ***Desoria olivacea*** (Tullberg, 1871)

Fig. 69A–C, E, G

*Isotoma olivacea* Tullberg, 1871, Öfvers. K. VetenskAkad. Förh. 28: 151.

*Description.* – Body size up to 2.1 mm. Colour uniform olive green, varying from pale to dark brownish. Body slender, integument smooth. Ocelli 8 + 8. PAO oval, about twice as long as nearest ocellus (1.7–2.3). Ant.1 with a few slightly thickened ventral sensilla. Ant.2–3 in full grown adults with many slender hair-like sensilla on dorsal side. Ant.3 organ normal. Ant.4 with numerous hair-like sensilla, simple subapical pin-seta and globular subapical organite. Labrum with 4 sharp apical folds and composite ventroapical ciliation. Maxillary palp trifurcate (Fig. 69A). Labial palp complete (guard $e_7$ present). Head with 4 + 4 postlabial setae along ventral line. Body hairs short and smooth, ground cover on tergites of uniform length. Median macrochaetae on abd.5 are 0.5–0.6 as long as tergite, 1.1–1.2 as long as inner length of last claw. Macrosensilla of tergites set in the p-row, in small juveniles as 66/56785, but variable. A pair of sensilla always present in mid-section of abd.4 (Fig. 69B). Abd.5 with 2 + 2 anterior sensilla. Ventral tube with a variable number of frontal setae (1–3), usually 4 + 4 lateral and up to 6 caudal setae. Retinaculum usually with less than 10 setae (6–14). Dens with up to 40 dorsal setae. Apical tooth of mucro strong (Fig. 69G). Claws with small inner and lateral teeth. Unguiculus without corner tooth. Males present. Cyclomorphosis not observed.

*Discussion.* – Usually identified by the key characters, but may be difficult to separate from *tshernovi* in mixed Arctic populations (Bear Island).

*Distribution and ecology.* – Widely distributed, also in the alpine. More rare in southern districts. Abundant in wet habitats, in particular along

ponds and bogs in coniferous forests. General distribution: Holarctic.

## 275. *Desoria infuscata* (Murphy, 1959)

*Sensiterga infuscata* Murphy, 1959, Proc. R. ent. Soc. Lond. (B) 28: 118.

*Description.* – Body size up to 1.5 mm. Colour dark olive or brownish green. Very similar to *olivacea*, but differing in having bifurcate maxillary palp, bifurcate subapical pin-seta on ant.4, few or no hair-like sensilla in dorsal part of ant.2 (except in apical part), head usually with only 3 + 3 postlabial setae, ventral tube usually with only 1 + 1 frontal and 3 + 3 lateral setae, retinaculum with fewer setae (3–6), and abd.4 with sensilla only in the p-row (anterior pair absent, compare Fig. 69B). In addition specimens are generally smaller and darker with more swollen antennal segments and shorter body hairs. Median macrochaetae on abd.5 only 0.3–0.4 as long as the tergite, 0.8–0.9 as long as inner length of last claw. Abdominal segments 5–6 appear more fused than in *olivacea*, without distinct dorsal constriction between them. The loss of anterior sensilla on abd.4 (easily observed in juvenile specimens) and the bifurcate maxillary palp are sharp diagnostic characters. Cyclomorphosis is not observed.

*Distribution and ecology.* – In Scandinavia a western species which is common in montane/alpine wet meadows, in particular on and along snowfields in the mountains. General distribution: Palaearctic.

## 276. *Desoria tshernovi* (Martynova, 1974)

*Isotoma tshernovi* Martynova, 1974, Ent. Obozr. 53: 796.
*Isotoma nanseni* Fjellberg, 1978.

*Description.* – Body size up to 1.5 mm. Colour variable, usually paler or darker yellowish green to olive green. Antennae bluish red towards tip. Maxillary palp trifurcate, anterior pair of sensilla present on abd.4 (as Fig. 69B). Ant.4 with bifurcate apical pin-seta. Median macrochaetae on abd.5 are 0.7–1.0 as long as tergite, 1.7–2.5 as long as inner length of last claw. Ventral tube usually with 1 + 1 frontal setae. Retinaculum with 3–6 setae. On ant.2 there are no dorsal hair-like sensilla apart from the apical ones. Unguiculus sometimes with a small corner tooth. The species is cyclomorphic with distinct summer an winter form (Fjellberg, 1995). The summer form was originally described as *nanseni*. The cyclomorphosis affects the subapical ant.4 organite (spherical in summer, rod-shaped in winter), the size of PAO (about twice as long as diameter of nearest ocellus in summer, only 1.5 as long in winter), apical tooth of mucro (large in summer, small in winter), and length of macrosensilla on thorax and abdomen (long in summer, short in winter).

*Discussion.* – Very similar to *olivacea*, differing principally by longer abdominal macrochaetae, bifurcate apical pin-seta on ant.4 and presence of distinct summer and winter forms.

*Distribution and ecology.* – An arctic species, in our area only from Spitsbergen. Usually in damp, cold sites. Records from outside the Arctic need verification. General distribution: Holarctic.

## 277. *Desoria fennica* (Reuter, 1895)

Fig. 69D, F

*Isotoma hiemalis* var. *fennica* Reuter, 1895, Acta Soc. Fauna Flora fenn. 11: 27.
*Isotoma ruseki* Fjellberg, 1979; syn. nov.
*Isotoma (Desoria) gersi* Najt, 1981.
*Isotoma (Desoria) huetheri* Dunger, 1982.

*Description.* – Body size up to 1.9 mm. Colour greyish to yellowish green, sometimes slightly violet. Antenna darker towards tip. PAO oval, 1.5–1.7 as long as diameter of nearest ocellus. Sensillary set on antennae normal, ant.2 with several hair-like sensilla on dorsal side in full grown adults. Ant.4 with bifurcate pin-seta and peg-like subapical organite. Labrum with 4 roundish, blunt apical folds (Fig. 69F). Ventroapical ciliation composite. Maxillary palp simple. Labial palp without guard $e_7$. Head with 5–9 postlabial setae on each side of ventral line. Median macrochaetae on abd.5 are 0.4–0.6 as long as tergite, 1.0–1.4 as long as inner length of last claw. Small specimens with 4 macrosensilla on each side on abd.1–3 tergites. Abd.4

with anterior pair of macrosensilla present (as Fig. 69B). Ventral tube with 1–4 frontal setae on each side, with 5–6 lateral and 3–5 caudal setae. Retinaculum with up to 12 setae. Mucro with apical tooth smaller than subapical. Claws with small inner and lateral teeth, unguiculus usually with distinct corner tooth. Small juveniles may be ecomorphic with 4 curved spines on abd.5 and modified primary granules of the cuticle (Fig. 69D).

*Discussion.* – Numerous syntypes (Zool. Mus., Helsinki) in alcohol from Reuter's original sample from Halikko (Finland) were checked in 2005 and found to be identical to *Isotoma ruseki* Fjellberg, 1979, which thus falls as a junior synonym. A lectotype (slide) labelled 'Finland. Ab.: Halikko, Toppjoki. 1880. U. Collan leg.' has been designed. The species is superficially similar to *olivacea* but differs sharply by the simple maxillary palp and the blunt apical lobes of labrum. Also the number of macrosensilla on abd.1–3 appears to be lower in *fennica* than in other members of the group.

*Distribution and ecology.* – A rare species, but probably with wide distribution. Most older records need verification (Wahlgren, 1906; Linnaniemi, 1912). Usually found in damp habitats in forests or meadows, also above tree line. Often on snow in winter. General distribution: Palaearctic.

## *hiemalis* group

Labial palp complete, guard $e_7$ present, proximal setae 4. Maxillary palp bi- or tri-furcated. Basomedian field of labium with 5 setae (4 in *blekeni*). Maxillary lamellae short, unmodified (except *nivea*). Ventral tube with 4 setae in the apical transverse row on posterior side. Dens dorsally crenulated. Mucro with 4 teeth, lateral seta absent.

### Key to species of the *hiemalis* group

1 Manubrium with free ventroapical teeth (Fig. 70O) . . . . . 2
– Manubrial teeth not free (as Fig. 69C) . . . 3
2 Abd.5–6 fused, often darker than rest of body. Ant.4 pin-seta bifurcate . . . . . 281. *blufusata* (Fjellberg)
– Abd.5–6 not fused, not darker than rest of body. Ant.4 pin-seta simple . . . . . 280. *neglecta* (Schäffer)
3 Body well pigmented, bluish or reddish . . 4
– Body white or diffusely brownish grey, only eye-spots dark . . 283. *nivea* (Schäffer)
4 Maxillary palp bifurcated. Abd.1–2 with more than two sensilla on each side. Spine-like microsensilla 11/111 . . . . . 5
– Maxillary palp trifurcated. Abd.1–2 with only two sensilla on each side (Fig. 70A). Spine-like microsensilla 10/001 . . . . . 282. *blekeni* (Leinaas)
5 Median macrochaeta on abd.5 are 1.5 as long as tergite or less. First leg with only two outer setae at base (Fig. 70J). Ventroapical ciliation of labrum as a single row (Fig. 70B). Th.3 without ventral setae. Sensilla of abdomen set within the p-row (Fig. 70H) . . . . . 278. *tolya* sp. nov.
– Median macrochaeta on abd.5 at least twice as long as tergite. First leg with more than two outer setae at base (Fig. 70K). Ventroapical ciliation of labrum brush-like (Fig. 70C). Th.3 with 1–2 setae on each side of ventral line (Fig. 70L). Sensilla of abdomen set in front of the p-row (Fig. 70I) . . . . . 279. *hiemalis* (Schött)

### 278. ***Desoria tolya*** sp. nov.

Fig. 70B, D–E, H, J

*Isotoma violacea* auct., nec Tullberg, 1876.

*Type material.* – Holotype (alc.): Sex not determined, from 'Norway. TEi: Tinn. Gaustadtoppen, 17.VII.1994. Moss cushions, 1.800 m. A. Fjellberg 94.265.'. Paratypes (alc.), 8 specimens from the same sample. All deposited in Tromsø Museum, Dept. of Zoology.

*Description.* – Body size up to 2.4 mm. Colour violet blue, sometimes very dark in large specimens. Posterior part of head (lateral and ventral) is unpigmented like distal parts of feet and furca. Antennae reddish blue, tip darker. PAO oval,

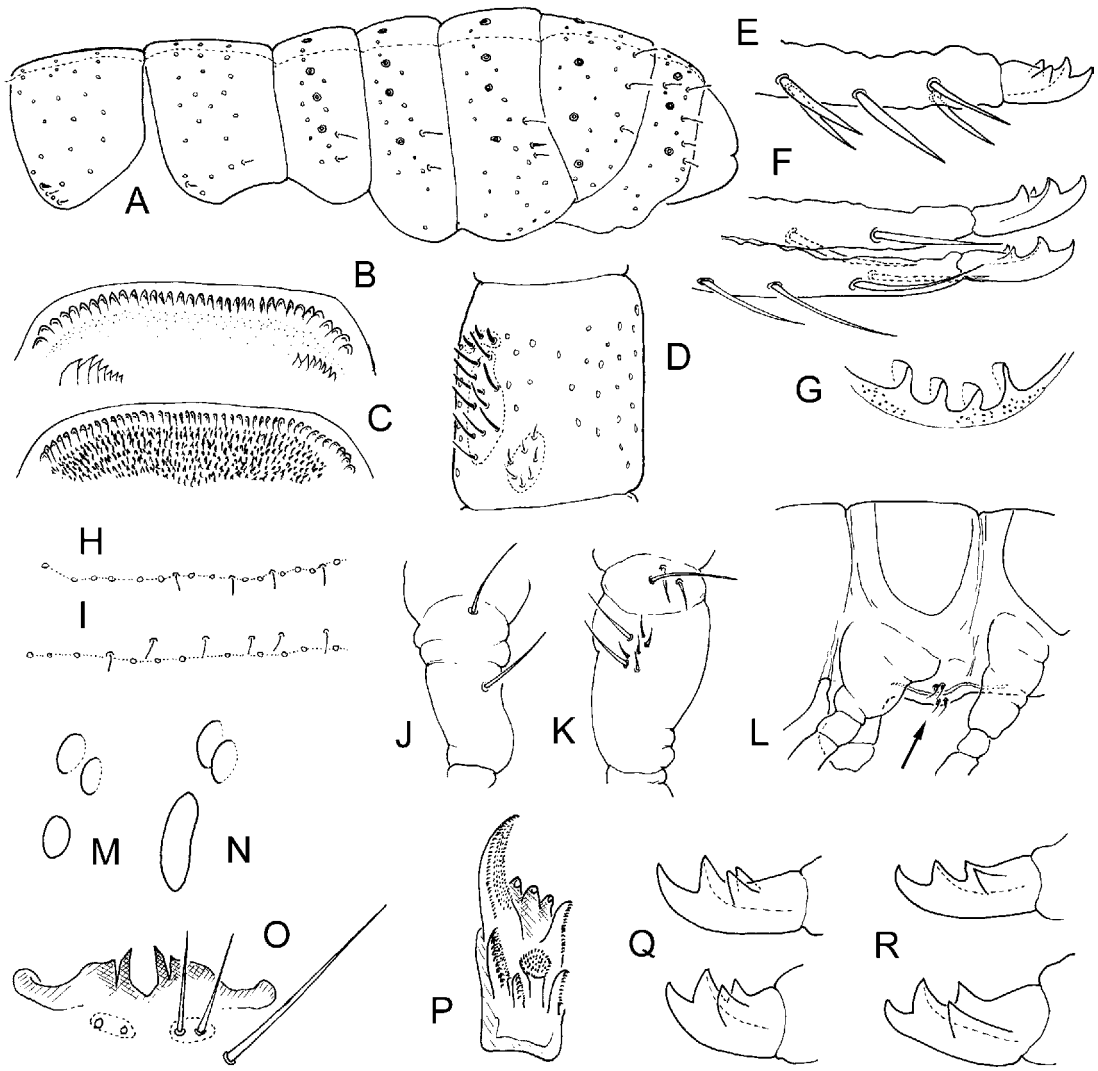


Fig. 70. *Desoria hiemalis* group: (A) *blekeni*, distribution of sensilla, ordinary setae and macrochaetae on th.2–abd.5 in a 1.instar juvenile specimen; (B) *tolya* sp. nov., ventroapical ciliation of labrum; (C) *hiemalis*, ditto; (D) *tolya* sp. nov., ventral sensilla on ant.1; (E) *tolya* sp. nov., apical part of dens with mucro; (F–G) lectotype *violacea* with mucro and apical part of dens (F) and labral edge (G); (H–I) position of sensilla and p-setae on left side of abd.1 in *tolya* sp. nov. (H) and *hiemalis* (I); (J–K) setae at base of left foreleg in *tolya* sp. nov. (J) and *hiemalis* (K); (L) *hiemalis*, ventral setae on th.3 (arrow); (M–N) PAO and two nearest ocelli in *hiemalis* (M) and *neglecta* (N); (O) *neglecta*, ventroapical teeth of manubrium and 2 + 2 short setae; (P) *nivea*, maxilla; (Q–R) mucro, summer form (above) and winter form (below) of *hiemalis* (Q) and *neglecta* (R).

1.2–1.5 as long as diameter of nearest ocellus. Ventral side of ant.1 with a group of short basal microsensilla, 2–3 apical short spine-like sensilla and a group of slender hair-like sensilla. In large adults as Fig. 70D, in smaller specimens the number of sensilla is reduced. Ant.2–3 with many hair-like sensilla in dorsal part (large specimens). Ant.3 organ normal. Ant.4 with bifurcate pin-seta and peg-like subapical organite. Labrum with 4 sharp apical folds, ventroapical ciliation as a simple row (Fig. 70B). Head with 6–12 postlabial setae on each side of ventral line. Maxillary palp bifurcate. Body hairs smooth, abdominal macrochaetae long.

Median macrochaetae on abd.5 are 1.2–1.5 as long as tergite, 2.3–3.1 as long as inner length of last claw. Macrosensilla somewhat variable, but juveniles appear to have a basic number of 66/566 on th.2–abd.3. Abd.4 without sensilla in the mid-section (all set in p-row). Spine-like microsensilla as 11/111. Abd.5–6 separated. Ventral tube with many frontal (3–10), lateral (7–22) and caudal (4–10) setae. Retinaculum with up to 13 setae. Manubrium with 2 + 2 (rarely 3 + 3) ventroapical short setae, apical teeth blunt. Dens with many dorsal crenulations and up to 20 dorsal setae. Ventral subapical setae short, not reaching middle of mucro (Fig. 70E). Mucro almost symmetric, with basal teeth set on each side of the midline. Apical and subapical teeth large, subequal. Claws with strong lateral and inner teeth, unguiculus with sharp corner tooth. First leg with two outer setae at base (Fig. 70J).

*Discussion.* – Babenko & Bulavintsev (1993) discussed the position of the species *Desoria violacea* (Tullberg, 1876), originally described from W. Siberia (Swedish Jenisey Exp. 1875), and restricted the name to populations from this area. The form present in Scandinavia, redescribed by Fjellberg as *violacea* in 1979, represents another species for which no definite name is available. It is therefore formally described as a new species based on the populations which inhabit the high Norwegian mountains. Populations from the forested lowlands vary considerably and more than one species may be involved. Our *tolya* differs from Siberian *violacea* by simple ventroapical labral ciliation (composite in *violacea*, Fig. 70G), shorter ventroapical setae on dens (Fig. 70E, F), two setae at base of first leg (3 in violacea) and probably lower number of macrosensilla on thorax (7 in *violacea*). When one of the two syntypes (designed as paralectotype) of *violacea* was examined in 1979, no definite conclusion about its status could be made. The remaining specimen, the lectotype, was mounted in slide in 2006 and carefully examined. The ventroapical ciliation of labrum was clearly seen and found to be composite (Fig. 70G). Also dens had long apical setae, different from the Scandinavian specimens (Fig. 70F). For a matter of convenience (to avoid changing the name of the Scandinavian *violacea* s. Fjellberg, 1979) Potapov (2001: 157) and Babenko & Fjellberg (2006: 86) proposed to restrict the name *violacea* for the Skandinavian/W. European populations, while the Siberian form would be *inupikella* Fjellberg, 1978, originally described from Alaska. However, the lectotype of *violacea* is clearly the same as *inupikella* (which then falls as a junior synonym), and the Scandinavian '*violacea*' must be renamed.

*Etymology.* – The new species is dedicated to Dr Anatoly Babenko in memory of our splendid joint field work in Taimyr in the summer of 1990 when so many new Collembola species were discovered.

*Distribution and ecology.* – Apparently common and widespread, but older records need verification. Most abundant in the high mountains in moss and grass cushions on exposed ridges, but also in wet habitats up to 2.200 m. Lowland records mostly from moss on logs, rocks and tree stems, but also under bark on dead trees and in seashore meadows. General distribution: Holarctic (present in Greenland).

## 279. ***Desoria hiemalis*** (Schött, 1893)

Fig. 70C, I, K–M, Q

*Isotoma hiemalis* Schött, 1893, K. svenska VetenskAkad. Handl. 25: 70.
*Isotoma violacea* var. *mucronata* Axelson, 1900.

*Description.* – Body size up to 2.9 mm. Colour dark bluish or violet grey, extremities and posterior and ventral sides of head paler. PAO small, oval, 0.9–1.2 as long as diameter of nearest ocellus (Fig. 70M). Ant.1 with many hair-like ventral sensilla. Ant.2–3 with many hair-like sensilla in dorsal and lateral parts. A few erect, thin and blunt-tipped sensilla are found ventrally on ant.1–3. Ant.3 organ normal. Ant.4 with bifurcate pin-seta and a small, rod-shaped subapical organite. Labrum with 4 sharp apical folds and a composite ventroapical ciliation. Maxillary palp bifurcated. Head with many (8–12) postlabial setae on each side of the ventral line. Body with long macrochaetae which may be finely serrated on tip of abdomen. Median macrochaetae on abd.5 are 2.0–2.3 as long as tergite, 3–4 times as long as inner length of last claw. Abd.5–6 separated. Macrosensilla of tergites situated slightly in front of the p-row (Fig. 70I), numbers variable (8–9 on th.2–3, 6–8 on abd.1–3, more than 10 on abd.4–5). Spine-like microsensilla 11/111.

Th.3 usually with 1 + 1 or 2 + 2 ventral setae (Fig. 70L). Ventral tube with up to 20 setae in frontal, lateral and caudal positions. Retinaculum with more than 10 setae in large specimens. Manubrium with 2–3 short ventroapical setae on each side and sharp apical teeth. Mucro affected by cyclomorphosis. In winter it has short apical tooth, in summer slender (Fig. 70Q). Claws with strong lateral and inner teeth. Unguiculus with large corner tooth. First leg with several outer setae at base (Fig. 70K).

*Discussion.* – Identified by large body size, long abdominal macrochaetae, small PAO and the mucro shape. The summer form, with long mucro, was described as *mucronata* by Axelson (1900).

*Distribution and ecology.* – Common in humid forest habitats, mostly in forest floor under conifers. Avoids open, dry sites. Often on snow in winter. General distribution: Holarctic. Typical specimens are seen from Canada (Alberta and British Columbia).

## 280. ***Desoria neglecta*** (Schäffer, 1900)

Fig. 70N, O, R

*Isotoma neglecta* Schäffer, 1900, Jh. Ver. vaterl. Naturk. Württ. 56: 258.
*Isotoma affinis* Axelson, 1900.

*Description.* – Body size up to 1.8 mm. Colour uniformly distributed over the body, greyish brown/red of variable intensity. Tip of abdomen sometimes paler than rest of body. PAO elongated, 2.0–2.4 as long as diameter of nearest ocellus (Fig. 70N). Sensillary equipment of antennae normal. Ant.4 with simple apical pin-seta. Subapical organite large and globular in summer, small and rod-shaped in winter (cyclomorphic). Labrum with 4 sharp apical folds and composite ventroapical ciliation. Head with 6–9 postlabial setae. Maxillary palp bifurcated. Body hairs smooth. Median macrochaetae on abd.5 are 0.8–1.2 as long as tergite, 2.2–2.7 as long as inner length of last claw. Abd.5–6 separated. Macrosensilla on tergites set in front of the p-row, 7–8 on each side of th.2–abd.3, more on abd.4–5. Abd.4 with 3–4 sensilla set in middle part of the tergite. Spine-like microsensilla 11/111. Ventral tube in large specimens with more than 10 setae in frontal, lateral and caudal positions. Retinaculum with up to 15 setae. Manubrium with 2–3 ventroapical short setae on each side. Apical teeth of manubrial thickening sharp, free (Fig. 70O). Apical tooth of mucro large in summer, smaller in winter (Fig. 70R). Claws with distinct lateral, inner and unguicular teeth. First leg with more than two outer setae in basal part.

*Discussion.* – Easily identified by the free manubrial teeth in combination with separate abd.5–6. In the similar species *blufusata* abdominal segments 5–6 are dorsally fused.

*Distribution and ecology.* – Widely distributed, mostly in northern and eastern parts of our area. Usually in damp habitats (bogs, shores of lakes and rivers). Also in the alpine and in the arctic. General distribution: Holarctic.

## 281. ***Desoria blufusata*** (Fjellberg, 1978)

*Isotoma blufusata* Fjellberg, 1978, Ent. scand. 9: 97.

*Description.* – Body size up to 1.9 mm. Colour bluish green, dorsal parts of abd.3–6 usually darkest. PAO oval, 1.4–1.8 as long as diameter of nearest ocellus. Sensillary equipment of antennae normal, as in *hiemalis* (see above). Ant.4 with bifurcate pin-seta and a projecting blunt subapical organite which is reduced in size in winter animals. Labral edge with 4 sharp apical folds, ventroapical ciliation composite. Basomedian fields of labium with 5–6 setae. Head with 5–7 postlabial setae on each side of ventral line. Maxillary palp bifurcate. Body hairs smooth, rather short. Abd.5–6 completely fused. Median macrochaetae on abd.5 are 2.0–2.8 as long as inner length of last claw. Macrosensilla of tergites set in front of the p-row, their numbers vary (5–7 on each side of abd.1–5). Abd.4 in addition has several sensilla in mid-tergal position. Spine-like microsensilla 11/111. Ventral tube with 5–9 anterior setae and more than 10 lateral and caudal setae in large specimens. Retinaculum with up to 16 setae. Manubrial teeth free (as Fig. 70O), short ventroapical setae 1–2 on each side. Mucro cyclomorphic, with large apical tooth in summer, small in winter. Claws with distinct teeth. First leg with more than two outer setae in basal part.

*Discussion.* – Easily identified by the fused abd.5–6, the colour and the free manubrial teeth.

*Distribution and ecology.* – Common in wet debris along shores of lakes and rivers. General distribution: Holarctic.

## 282. ***Desoria blekeni*** (Leinaas, 1980)

Fig. 70A

*Isotoma blekeni* Leinaas, 1980, Revue Ecol. Biol. Sol 17: 281.

*Description.* – Body size up to 1.3 mm. Colour violet blue. Posterior and lateral parts of head almost unpigmented, like dens and apical parts of the legs. Antennae reddish. PAO oval, small, 0.9–1.1 as long as diameter of nearest ocellus. Sensillary equipment of antennae reduced. Ant.1 with 2–3 short spine-like ventroapical sensilla and 2–3 long hair-like sensilla, in addition to 2–3 ventrobasal short sensilla. Ant.2 only with a single hair-like lateroapical sensillum and two basal microsensilla. Ant.3 only with the 6 primary apical (dorsal/lateral) sensilla. In full grown adults ant.2–3 may have 2–3 ventral erect blunt-tipped sensilla. Ant.4 with few hair-like sensilla. Apical pin-seta shortly bifurcate. Subapical organite projecting, globular (smaller in winter). Labrum with 4 sharp apical folds and a composite ventroapical ciliation. Basomedian field of labium with 4 setae. Head with 5–6 postlabial setae on each side of ventral line. Maxillary palp trifurcate. Body tergites with a remarkably open/sparse cover of setae. Macrochaetae moderately long and finely serrated. Median pair on abd.5 are 1.1–1.5 as long as tergite, 2.5–3.0 as long as inner length of last claw. Abd.5–6 separated. Number of macrosensilla on tergites of th.2–abd.5 reduced: 32/22235, spine-like microsensilla 10/001 (Fig. 70A). Lateral sensilla shorter than medial ones on abd.1–5. Only lateral sensilla present on thorax. In adults the macrosensilla are set in the p-row of abd.1–4. Ventral tube with 2–4 anterior setae, 5–6 lateral and 6–7 caudal setae. Retinaculum with 2–4 setae. Manubrium with 1 + 1 short ventroapical setae and blunt apical teeth. Dens with 9–11 dorsal setae. Mucro with apical tooth a little larger than subapical tooth, in winter animals slightly smaller (cyclomorphosis). Claws with distinct teeth. First leg with two outer setae in basal part.

*Discussion.* – Identified by the trifurcate maxillary palp and the uniquely reduced sensillary set on the tergites. No other *Desoria* has only two macrosensilla on each side of abd.1–3.

*Distribution and ecology.* – An uncommon boreal species. Most records from mesic habitats in coniferous forest, often in moss on tree trunks and fallen logs. General distribution: Palaearctic.

## 283. ***Desoria nivea*** (Schäffer, 1896)

Fig. 70P

*Isotoma nivea* Schäffer, 1896, Mitt. naturh. Mus. Hamb. 13: 184.
*Isotoma albella* auct., nec Packard, 1873.

*Description.* – Body size up to 1.4 mm. Colour white, eye-spots black. Large specimens usually with scattered brownish pigment dispersed over the body. PAO oval, 1.5 (winter)–2.0 (summer) as long as diameter of nearest ocellus. Ant.1 on ventral side with a group of 3–4 thickened long sensilla in addition to the short apical and basal ones. Ant.2–3 with several additional hair-like sensilla in addition to the standard set. Ant.4 with simple apical pin-seta. Subapical organite globular and prominent (summer), or small and rod-shaped (winter). Labrum with weakly undulating apical edge and simple ventroapical ciliation. Head with 6–9 postlabial setae. Maxillary palp bifurcate. Maxilla with modified lamellae. Lam.1 prolonged well beyond capitulum, with ciliated ventral edge. Lam.2 with coarse serrations along ventral edge (Fig. 70P). Body with moderately-developed macrochaetae, slightly serrated towards tip of abdomen. Median pair on abd.5 are 0.8–1.0 as long as tergite, 2.1–2.4 as long as inner length of last claw. Number of tergal macrosensilla variable, typically 76/56688. On th.2–3 sensilla are set in front of the p-row, on abd.1–5 within the p-row. Abd.4 with one sensillum in front of the p-row, abd.5 with 2–3 in anterior part of the tergite. Spine-lik microsensilla 10/001. Ventral tube with 4–7 frontal setae, 7–13 lateral and 4–6 caudal setae of which there are 4 in the apical transverse row. Retinaculum with 10–18 setae. Manubrium with sharp ventroapical teeth and

usually 2 + 2 short ventroapical setae. Dens usually with 10 (7–11) dorsal setae. Apical tooth of mucro larger (summer) or smaller (winter) than subapical tooth. Tibiotarsi with prolonged apical setae $A_1$, $A_2$ and $A_7$. These are pointed in summer, clavate in winter. Cyclomorphosis affects size of the eyes (larger in winter), shape of the antennal subapical organite, mucro and tibiotarsal tenent hairs.

*Discussion.* – The modified maxillary lamellae, enlarged ventral sensilla on ant.1 and weak undulations of labral edge resembles that of *tigrina/grisea*, but *nivea* is distinguished by the bifurcate maxillary palp. The winter morph with clavate tenent hairs could be mistaken for a *Vertagopus*.

*Distribution and ecology.* – Common under bark on dead trees, both conifers and hardwood. General distribution: Palaearctic.

## *tigrina* group

Mucro with 4 teeth, no lateral seta. Maxillary palp simple.

### Key to species of the *tigrina* group

1 Abd.5–6 not fused. Median macrochaetae on abd.5 in most species shorter than tergite . . . . . 2
– Abd.5–6 fused. Abd.5 macrochaetae longer than tergite . . . . . 284. *intermedia* (Schött)
2 Apical tooth of mucro much larger than subapical (Fig. 71F) . . . . . 3
– Apical tooth of mucro smaller than subapical (Fig. 71D, E) . . . . . 4
3 Maxillary head short, compact. Max. lam.2 and 4 not beyond tip of capitulum. Max. lam.6 broad, with many denticles (Fig. 72E). Labial palp with normal lateral guards, not strongly curved ($e_{5-6}$, Fig. 72L). Labial guard $b_4$ long, curved (Fig. 72H) . . . . . 288. *tigrina* Nicolet
– Maxillary head long, elongate. Max. lam.2 and 4 reaching beyond tip of capitulum. Max. lam.6 narrow, with few denticles (Fig. 72F). Labial palp with lateral guards strongly curved (Fig. 72K). Labial guard $b_4$ short, straight (Fig. 72I) . . . . . 289. *grisea* (Lubbock)
4 Abd.5 macrochaetae shorter than tergite . . . . . 5
– Abd.5 macrochaetae longer than tergite . . . . . 287. *divergens* (Axelson)
5 Dorsal side of dens with a few (11–16) large humps (Fig. 71H) . . . . . 285. *potapovi* sp. nov.
– Dorsal side of dens with many (>25) small crenules . . . . . 286. *propinqua* (Axelson)

### 284. ***Desoria intermedia*** (Schött, 1902)

Fig. 71B, C

*Isotoma intermedia* Schött, 1902, Bih. K. svenska VetenskAkad. Handl. 28: 25.
*Isotoma germanica* Hüther & Winter, 1961; syn. nov.

*Description.* – Body size up to 2.1 mm. Colour dark violet blue. Mouth region, posterior, lateral and ventral parts of head paler, reddish. Dens and distal parts of legs whitish. A dark arrow-shaped figure present between the eyes. PAO oval, 1.3–1.5 as long as diameter of nearest ocellus. Ant.1 with a few hair-like ventral sensilla, apical ones thickened. Ant.2 with a curved, thickened lateroapical sensillum and several thin hair-like sensilla in lateral and dorsal part near apex. Ant.3 organ normal, surrounded by several thin hair-like sensilla. Ant.4 with bifurcate pin-seta and a small, rod-shaped subapical organite. Labrum with distinct apical folds, but not as sharp as in the *hiemalis*-complex. Ventroapical ciliation composite. Labial palps with 4 proximal setae, guard $e_7$ absent. Basomedian field with 4 setae. Head with 6–10 postlabial setae. Maxillary palp simple. Maxilla with short unmodified lamellae. Body hairs smooth, macrochaetae moderately long. Median pair of macrochaetae on abd.5 are 1.3–1.4 as long as tergite, about 3 times as long as inner length of last claw. Abd.5–6 fused, but a weak incision line is visible. Number of macrosensilla on the tergites vary around 76/55656. On thorax sensilla are set in front of the p-row, on abd.1–4 within the p-row. Abd.4 without sensilla in median part of the tergite, abd.5 with 1–2

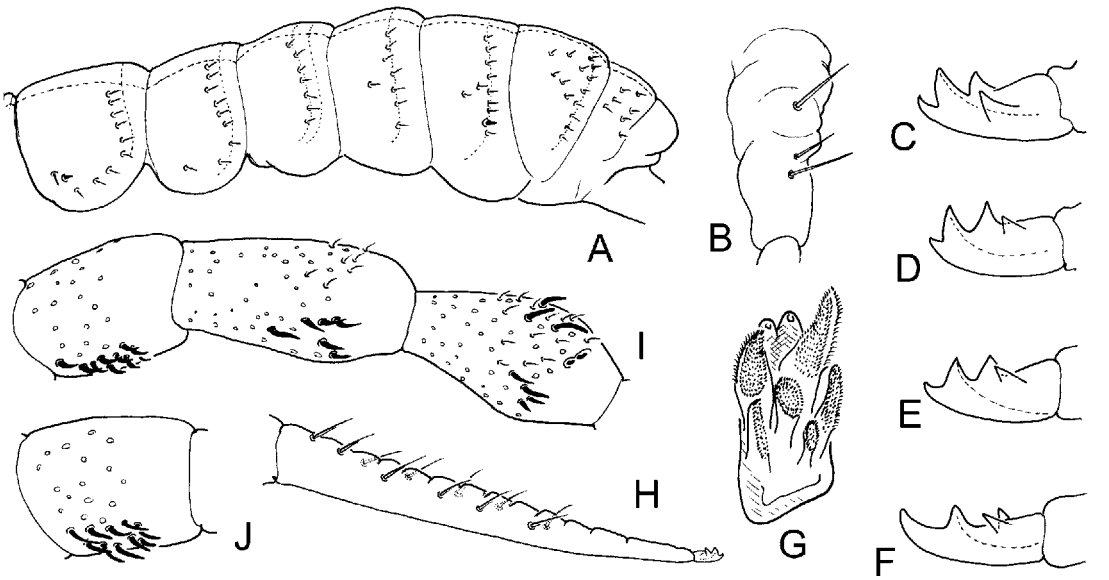


Fig. 71. *Desoria tigrina* group: (A) *propinqua*, sensillary distribution on th.2–abd.5 in a 2.instar juvenile specimen; (B) *intermedia*, setae at base of left foreleg; (C–F) mucro in *intermedia* (C), *propinqua* (D), *potapovi* sp. nov. (E) and *tigrina* (F); (G) *propinqua*, maxilla; (H) *potapovi* sp. nov., dens and mucro; (I) ditto, sensilla on ant.1–3; (J) *propinqua*, ventral sensilla on ant.1.

anterior sensilla. Microsensilla 10/001. Ventral tube with 2–5 anterior setae, 8–14 lateral and 5–8 posterior setae of which there are 4 in the apical transverse row. Retinaculum with 6–10 setae. Manubrium with blunt apical teeth and 1–2 short ventroapical setae on each side. Dens with up to 21 dorsal setae. Mucro with short apical tooth (Fig. 71C). Claws with large inner and lateral teeth, unguiculus with a small corner tooth. Basal part of first leg with 3 outer setae (Fig. 71B).

*Discussion.* – One of two syntypes in alcohol with the original handwritten label '*Isotoma intermedia* Schött, Suecia Schött typ!' was examined in 2005 (Zool. Mus., Helsinki). It has the typical colour as described above, a fused abd.5–6, blunt manubrial teeth, mucro with apical tooth much smaller than subapical, simple maxillary palp, labral edge with 4 moderately sharp folds. There is hardly any doubt that *intermedia* is identical with the common winter species which until now has been known as *germanica*. The original specimen were '... trouvée par Professeur G. Lindström en grand nombre en Gotland sur de la neige nouvellement tombée, ...' (Schött, 1902: 25). *D. intermedia* is the only Nordic species of the genus which has fused abd.5–6, apart from *blufusata*. The simple labial palp and normal (not free) manubrial teeth separate the two species.

*Distribution and ecology.* – The species is often found in great numbers on snow in winter, both in forests and in open country (meadows, parks in cities), also at shore of lakes. It is possibly cyclomorphic, but so far no specimens have been collected in summer. Specimens collected in mid-April in southern Sweden still have mucro with small apical tooth. General distribution: Palaearctic.

## 285. ***Desoria potapovi*** sp. nov.

Fig. 71E, H, I

*Isotoma fennica* auct., nec Reuter, 1895.

*Type material.* – Holotype: Female (slide) from 'Norway. ON: Skjåk. Marlo, 7 Jan. 1978. On snow, conifers. A. Fjellberg 78.001'. Paratypes: 2 (alc.) from the holotype sample, 15 (alc.) from same locality, collected 'Jan.–March, pitfall traps, conif. forest. A. Fjellberg leg.'. All deposited at Tromsø Museum, Dept. of Zoology.

*Description.* – Body size up to 1.2 mm. Dark bluish or brownish grey, sometimes slightly red or violet. Head and anterior part of body darkest. Feet and antennae paler. A slender animal with narrow head which is clearly longer than broad when viewed from above. Tip of ant.4 with a dark spot. PAO oval, 1.6–2.0 as long as diameter of nearest ocellus. Ant.1 on ventral side with a group of thick and curved short sensilla. Similar spine-like sensilla are also found on ant.2–3 which also have additional thin hair-like sensilla (Fig. 71I). Ant.4 with many hair-like and thickened sensilla. Ant.4 with bifurcate pin-seta and a small peg-like subapical organite. Labrum with 4 roundish apical folds, flanked by a smaller fold on each side. Ventroapical ciliation composite. Labial palps with guard $e_7$ absent, proximal setae 4. Basomedian field of labium with 4 setae. Head with 6–8 postlabial setae. Maxilla with unmodified lamellae, lam.1 slightly longer than capitulum. Abd.5–6 separated, macrochaetae smooth or finely serrated. Median pair on abd.5 are 0.6–0.8 as long as tergite, 1.3–1.7 as long as inner length of last claw. Body hairs in general short, almost spine-like. Number of sensilla on the tergites variable in adults, up to 9 on th.2–3. On abd.1–5 a typical number is 66777, but sometimes up to 8–9 on each tergite. Spine-like sensilla 10/001. Sensilla on th.2–3 set in front of the p-row, on abdomen within the p-row with some also in more anterior position. Ventral tube with 1–2 frontal setae on each side of ventral line, 4–7 lateral and 5–6 caudal setae of which there are 4 in the apical transverse row. Retinaculum with 3–7 setae. Manubrium with blunt ventroapical teeth and 2 + 2 short ventroapical setae. Dens with 11–16 large dorsal humps and 10–14 dorsal setae (Fig. 71H). Mucro with small apical tooth (Fig. 71E). Claws slender, with distinct teeth. Upper subcoxa on first pair of legs with one outer macrochaeta, lower subcoxa on outer side with one macrochaeta and 2–3 additional short setae (absent in smaller specimens).

*Discussion.* – This is the species which has usually been called *Isotoma fennica* since the revision of Fjellberg (1979). However, recent examination of the types of *fennica* proves that it is identical with *Isotoma ruseki* Fjellberg, 1979, and a new name has to be established for *fennica* auct. nec Reuter. A unique character for this species, now named *potapovi* sp. nov., is the presence of less than 17 dorsal crenulations on dens which is seen in no other European *Desoria*. Otherwise it is quite similar to *propinqua*, but the latter has a more abundant set of sensilla on the tergites. Ecomorophosis is not reported in *potapovi.*

*Etymology.* – It is a pleasure to dedicate the species to our eminent Russian colleague Mikhail Potapov.

*Distribution and ecology.* – Due to confusion with other species, the distribution of *potapovi* is not well known. Verified specimens are seen from Norway, Finland, Poland and USA (Illinois, J. Hart leg.), all collected in winter time. Sometimes active on snow. General distribution: Holarctic.

## 286. ***Desoria propinqua*** (Axelson, 1902)

Fig. 71A, D, G, J

*Isotoma propinqua* Axelson, 1902, Meddn Soc. Fauna Flora fenn. 28: 107.

*Description.* – Body size up to 2.1 mm. Colour uniformly greyish (darker or paler), including feet, furca and antennae. Head often darkest. Pigmentation rather "grainy". PAO elongate, 2–3 times as long as diameter of nearest ocellus. Ant.1 ventrally with many hair-like sensilla which may be more or less thickened (Fig. 71J). Ant.2–3 in full grown individuals with many thin hair-like sensilla on dorsal and lateral sides in addition to the standard set of primary sensilla. Ventrally on ant.3–4 there are in addition a few short, erect blunt-tipped sensilla. Ant.4 with bifurcate pin-seta and a small rod-shaped subapical organite. Labrum with 4 roundish apical folds, often flanked by one smaller on each side. Ventroapical ciliation composite (2–3 rows). Labial palps with 4 proximal setae, guard $e_7$ absent. Basomedian field with 4 setae. Head with 6–7 postlabial setae. Maxillary palp simple. Maxillary head with unmodified lamellae, densely packed with fine denticles. Lam.1 reaching beyond tip of capitulum, with short ciliation along the edges (Fig. 71G). Body hairs short and smooth. Macrochaetae hardly differentiated on the anterior tergites, on abd.5 they are 0.7–0.9 as long as tergite, 1.6–2.1 as long as inner length of last claw. Abd.5–6 separated. Macrosensilla on

tergites variable in numbers, up to 14 on each side of abd.4 (Fig. 71A). Juveniles (1.instar) with at least 10 sensilla on each side of abd.3–4. The macrosensilla are set in front of the p-row on th.2–3, within the p-row on abd.1–4. Spine-like microsensilla 10/001. Ventral tube with 2–3 frontal setae, 5–8 lateral and 5–6 caudal setae with 4 in the apical transverse row. Retinaculum with 4–7 setae. Manubrium with blunt or somewhat pointed ventroapical teeth and 2–3 short ventroapical setae on each side. Dens with many dorsal crenulations and 10–12 dorsal setae. Mucro with short apical tooth (Fig. 71D). Claws with distinct lateral teeth, inner tooth and unguicular tooth sometimes absent. Basal part of first leg with 2 outer setae (sometimes 3 in large specimens). Young specimens may become ecomorphic showing a transverse row of 6 spines on abd.5. Such specimens were given the names *pectinata* Stach, 1926 and *hexaspina* Agrell, 1936.

*Discussion.* – Similar to *fennica* by the short abdominal macrochaetae and the small apical tooth of mucro, but differing by the numerous dorsal crenulations on dens (in *fennica* not more than 16).

*Distribution and ecology.* – Probably widely distributed, but not often collected due to its special habitat requirements. Normally found in nests of small rodents on the ground (moss/grass), in particular after overwintering under snow when there is a lot of organic debris in the nest. Some records also from litter and under bark in broadleaf forest and in seashore wrack. Once from a roe deer carcass. – World distribution: Holarctic.

## 287. ***Desoria divergens*** (Axelson, 1900)

*Isotoma violacea* var. *divergens* Axelson, 1900, Meddn Soc. Fauna Flora fenn. 26: 118.

*Description.* – Body size up to 1.8 mm. Colour bluish or reddish with paler extremities. PAO narrow, elongate, 1.5–2.0 as long as diameter of nearest ocellus. Ant.1 with several slender hair-like ventral sensilla. Ant.4 with bifurcate pin-seta and a small rod-shaped subapical organite. Labrum with 4 roundish apical folds, ventroapical ciliation composite. Labial palp with guard $e_7$ absent. Head with 8–15 postlabial setae. Maxillary palp simple. Maxilla with short, unmodified lamellae. Body hairs smooth. Median pair of macrochaetae on abd.5 are 1.3–1.5 as long as tergite, 2.5–3.3 as long as inner length of last claw. Abd.1–3 with 7–8 sensilla set in the p-row. Abd.5–6 separate. Ventral tube with 4–7 frontal setae, 10–12 lateral and 5–7 caudal setae of which there are 4 in the apical transverse row. Retinaculum with 7–11 setae. Manubrium with pointed ventroapical teeth and 3–5 short ventroapical setae on each side. Dens with 14–16 dorsal setae. Mucro with apical tooth smaller than subapical. Inner basal tooth on line with apical/subapical teeth, outer basal tooth laterally displaced. Claws with distinct lateral, inner and unguicular teeth.

*Discussion.* – Recognised by the elongate PAO, simple maxillary palp, long abdominal macrochaetae and small apical tooth of mucro.

*Distribution and ecology.* – Among our *Desoria* species this is the least known with very few records from forest litter in Sweden and Finland only. General distribution: Palaearctic.

## 288. ***Desoria tigrina*** Nicolet, 1842

Figs 71F, 72A–E, G, H, L

*Desoria tigrina* Nicolet, 1842, Neue Denkschr. Allg. schweiz. Ges. ges. Naturw. 6 (3): 59.

*Description.* – Body size up to 2.1 mm. Colour uniform, darker or paler grey or brownish grey, never blue or reddish. PAO elongate, narrow, more than 3 times as long as broad, 2–3 times as long as diameter of nearest ocellus (Fig. 72B). Ant.1 with a variable number of ventrolateral thickened, pointed sensilla in addition to several thin hair-like sensilla (Fig. 71D). Similar sensilla are found also in lateral and dorsal part of ant.2. Ant.3 with many hair-like sensilla and 1–2 thickened lateral sensilla in addition to the standard set in ant.3 organ. Apical pin-seta of ant.4 shortly bifurcate. Subapical organite small, rod-shaped. Ant.4 with many moderately thickened sensilla and thin hair-like sensilla. Labrum with simple ventroapical ciliation (Fig. 72C). Apical edge membranous, sometimes weakly folded. Labial palp unmodified, guard $e_7$ absent. Guards $e_{5-6}$ normal, inserted on each side of the lateral process (Fig. 72L). Guards $b_{3-4}$ long, curved,

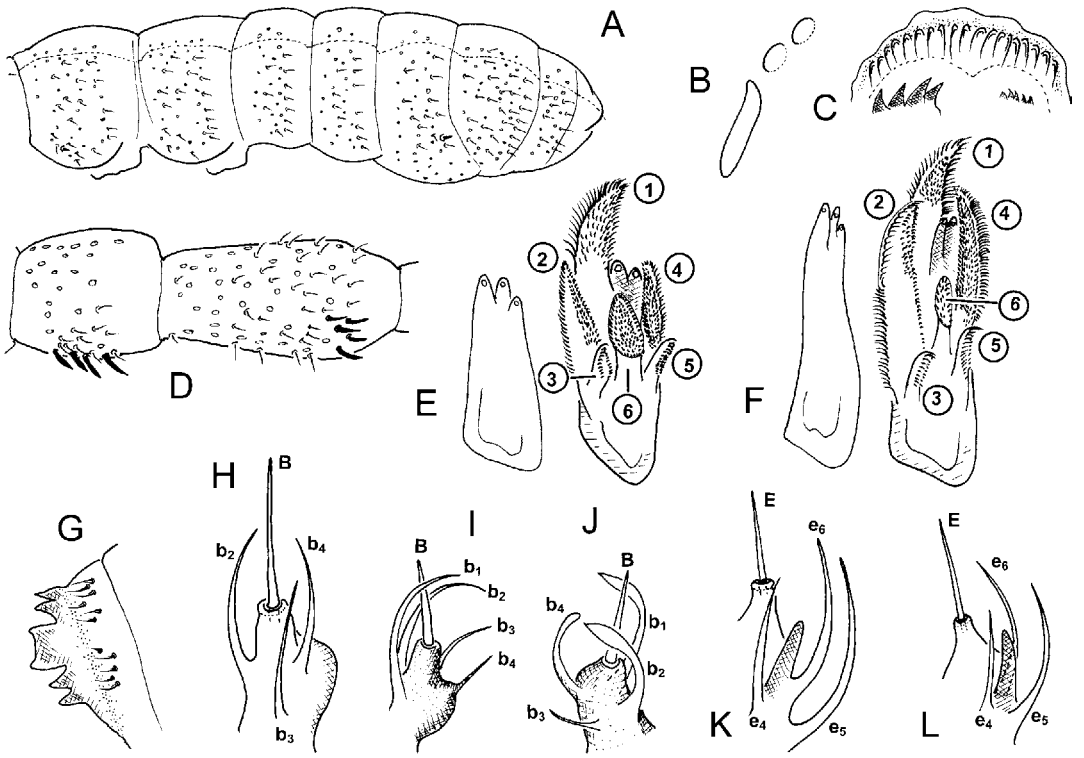


Fig. 72. *Desoria tigrina* group: (A–E) *tigrina*, (A) distribution of sensilla and ordinary setae on th.2–abd.5 in a 2.instar juvenile specimen, (B) PAO and two nearest ocelli, (C) ventroapical ciliation of labrum, (D) sensilla on right ant.1–2, (E) maxilla; (F) *grisea*, maxilla; (G) *tigrina*, abd.5 "crown" in an ecomorphic juvenile specimen; (H–J) labial papilla B and guards in *tigrina* (H), *grisea* (I) and a possibly undescribed species related to *grisea* from the Faroe Islands (J); (K–L) labial papilla E and guards surrounding the lateral process (hatched) in *grisea* (K) and *tigrina* (L).

subequal (Fig. 72H). Proximal setae 4, basomedian field with 4 setae. Maxilla as Fig. 72E. Maxillary head compact, with three strong teeth. Lam.1 long and broad, with long ciliation along ventral edge. Inner face with a dense cover of coarse, curved denticles, not clearly arranged in rows. Lam.2 and 4 not passing beyond tip of capitulum, with fine denticles and marginal ciliation. Lam.3 and 5 short, with few denticles. Lam.6 broad, with many denticles. Head with 6–8 postlabial setae. Body with a dense and uniform cover of smooth setae, macrochaetae only differentiated on abd.5–6. Median pair of abd.5 are 0.6–0.8 as long as tergite, about twice as long as inner length of last claw. Macrosensilla of the tergites abundant, accessorial p-sensilla (accp) 5–8 on th.2–abd.5, situated in front of the p-row on thorax, within the p-row on abdomen. In addition all tergites of th.2–abd.5 have several sensilla dispersed over the middle parts. Spine-like microsensilla 10/001. Ventral tube with 3–8 frontal setae, 4–5 lateral and 5–8 caudal setae with 4 in the apical transverse row. Retinaculum with 6–10 setae. Manubrium with pointed ventroapical teeth and 2–3 short ventroapical setae on each side. Dens with many dorsal crenulations and 14–17 dorsal setae. Apical tooth of mucro much larger than subapical (Fig. 71F). Claws with variable lateral, inner and unguicular teeth. Basal part of first leg with two outer setae. Ecomorphic juveniles have a dorsal "crown" of modified setae and chitinous ridges on abd.5 (Fig. 72G).

*Discussion.* – For separation from *grisea*, see below.

*Distribution and ecology.* – A common species in compost and other organic debris. General distribution: Palaearctic.

## 289. ***Desoria grisea*** (Lubbock, 1869)

Fig. 72F, I, K

*Isotoma grisea* Lubbock, 1869, Trans. Linn. Soc. Lond. 27: 278.

*Description.* – Body size up to 2.0 mm. Colour uniformly grey, as in previous species. Labial palps modified, guard $e_7$ absent. On labial papilla B the upper guard $b_4$ is shorter than $b_3$, thin and straight, set on a roundish swell on the trunk of the papilla (Fig. 72I). The lateral guards of papilla E, guards $e_5$ and $e_6$, are strongly curved and inserted one after the other on the trunk of the lateral process (Fig. 72K). Maxillary head narrow, elongate. Maxillary lamellae long, with fine denticles and long marginal ciliations. Lam.2 and 4 elongated, reaching beyond tip of capitulum. Lam.6 narrow, with few denticles (Fig. 72F). Sensillary equipment of tergites abundant. In small juveniles 15–20 sensilla on each side of th.2–3, 10–12 on abd.1–3, 20–25 on abd.4 and 8–10 on abd.5 (Fig. 72A). Microsensilla 10/001. In small juveniles mucro has only three teeth (inner basal tooth not developed) and ventral manubrial setae are absent.

*Discussion.* – *D. grisea* is almost impossible to distinguish from *tigrina* by external characters (labial palp) without a trained eye. However, the small differences in labium and the maxilla are sharp and reliable and the two species are not difficult to tell apart in good slides. The differences in the mouthparts between *tigrina* and *grisea* probably reflects differences in the food and feeding habits. Thus the species may coexist in the same habitat without excluding each other. The presence of two European species covered by the taxon *tigrina* has been known for several years, but their formal status were not fixed until now. Both species are widely distributed and may occur together, so it is not evident if Nicolet/Lubbock had the one or the other when they described their respective species. However, in May 2005 Stephen P. Hopkin organised a search for *grisea* in Lubbock's old collecting sites at High Elms south of London where he had 'watched them in their native haunts, and kept them for some time in confinement' (Lubbock, 1869: 278). In samples from compost and other organic debris in Lubbock's garden we found the species here defined as *grisea*.

*Distribution and ecology.* – Common and widely distributed (Norway, Denmark, Iceland, Faroe Islands, England, Poland). Old records of *tigrina* must be re-checked. Often found together with *tigrina* in garden compost, but also in rich forest soil and in various deposits of organic litter (seashore wrack beds). All specimens from Faroe Islands (several samples) have slender maxilla like *grisea*, but differ by reversed conditions on the labial papilla B: Guard $b_4$ is curved and longer than the short, erect $b_3$ (Fig. 72J). This may indicate a geographic differentiation among populations, but more likely it is a different species.

## 290. ***Desoria trispinata*** (MacGillivray, 1896)

Fig. 73A–E

*Isotoma trispinata* MacGillivray, 1896, Can. Ent. 28: 51.

*Description.* – Body size up to 1.3 mm. Colour bluish grey, posterior edges of tergites often darkened. Body shape much like *Parisotoma notabilis*. Ocelli 8 + 8, large, subequal. PAO roundish, only slightly larger than nearest ocellus (Fig. 73D). Ant.1 with a ventral group of 5–6 sensilla, of which three apical ones are short (Fig. 73A). Ant.3 organ normal. Ant.4 without differentiated (thick) sensilla, with many hair-like sensilla. Subapical organite indistinct, pin-seta simple. Ant.2 and 3 with many slender, hair-like sensilla dispersed over the surface. Labral chaetotaxy 4/554. Two apical rows of labral setae set on distinct sockets, proximal setae without sockets. Apical edge with 4 small, upright spines followed by a transverse bulge (Fig. 73E). Ventroapical ciliation absent. Labial palp trifurcate, 4 sublobal hairs. Labial papilla E without guard $e_7$. Guards $b_3$ and $b_4$ detached from the trunk of papilla B, pointed upwards, into the mouth. Proximal field of labium with 4 setae. Basomedian field with 4 setae. Head with 4–5 postlabial setae. Maxilary palp trifurcate, 4 sublobal hairs. Mandibles normal. Maxilla strongly modified, lam.1 much longer than the 3-toothed capitulum, apically expanded, with two rows on long filaments (Fig. 73B). Lam.2 with ciliation along the edges only, lam.3–5 almost smooth or with fine denticles (3). Lam.6 broad, with many regular rows

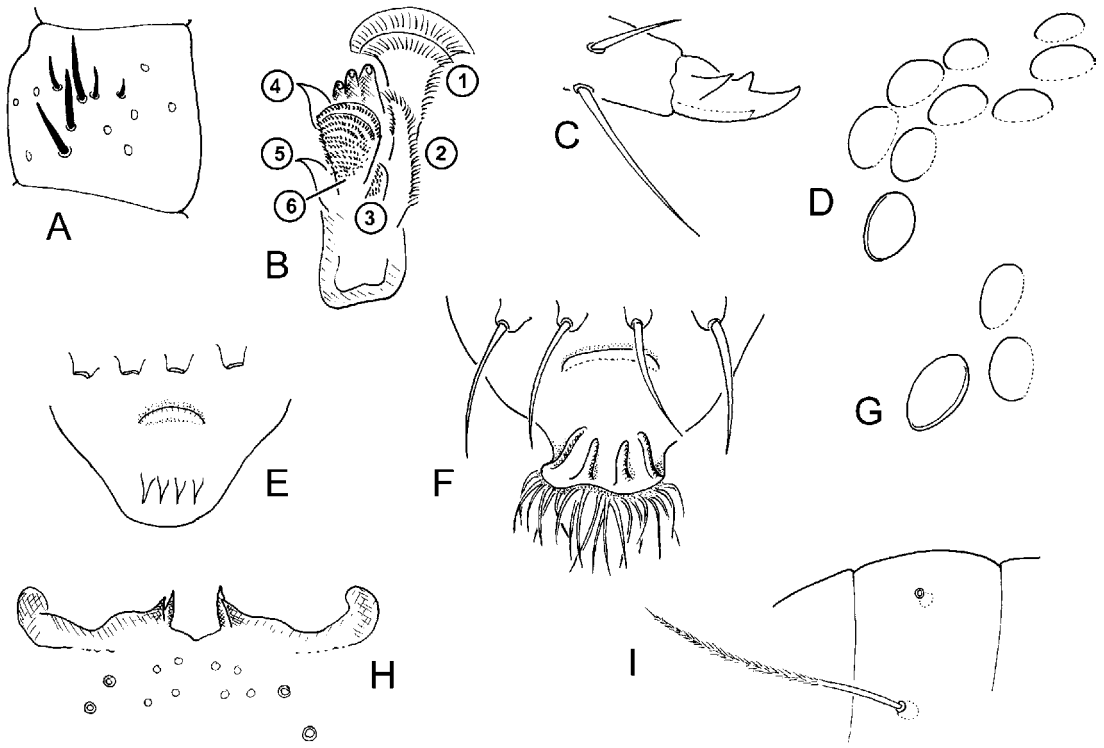


Fig. 73. *Desoria trispinata* (A–E), *D*. sp. related to *trispinata* (F) and *multisetis* (G–I): (A) ventral sensilla on ant.1; (B) maxilla; (C) mucro and apical part of dens; (D) PAO and eyes; (E–F) apical part of labrum; (G) PAO and two nearest ocelli; (H) ventroapical manubrial spines; (I) ciliate macrochaeta on abd.5.

of small denticles. Body hairs short, fine and smooth, macrochaetae of abd.5 shorter than the tergite. Sensillary chaetotaxy abundant, more than 10 sensilla on each side of abdominal segments 3–5. All tergites with sensilla also in midsections of the segments (ac-sensilla). Spine-like microsensilla 11/111. No ventral setae on thorax. Ventral tube with 4–5 frontal setae on each side, 3 + 3 lateral and 5–6 caudal setae. Retinaculum with 4 + 4 teeth and 5–7 setae. Manubrium with sharp apical teeth and usually 2 + 2 ventroapical short setae. Dens strongly crenulated, with 15–20 dorsal setae in basal half. Mucro with 3 teeth. An inner lamella stops with a small tooth about 1/3 from apex (Fig. 73C). No mucronal seta. Tibiotarsi with 8 apical setae ($T_1$ present). Claws with a pair of small basal teeth. Unguiculus pointed. Basal part of first leg with three outer setae. Males not observed.

*Discussion.* – This probably introduced species, originally described from Ohio, USA, is recorded twice in our area from a garden at Brønderslev (Denmark) and from compost in Vigelandsparken, Oslo. It has no clear affinity to Nordic species groups. The maxilla looks like that of the *Parisotoma*-species, but the labral edge with four spines and loss of ventroapical ciliation is unique. Another synanthropic species, with a most unusual labrum, was found in two German samples (Bremen and Munich) from indoor flower pots and a mass occurrence on an outdoor house wall. The only notable difference to Danish and Norwegian *trispinata* is the labrum which has four apically diverging ridges and an apical bundle of exceptionally long, curved ventral cilia projecting forwards (Fig. 73F). This species probably originated from warmer parts of the world and appears to be undescribed.

*Distribution and ecology.* – In Nordic countries only in compost and other organic debris. Probably introduced. General distribution: Cosmopolitan.

## 291. *Desoria multisetis* (Carpenter & Phillips, 1922)

Fig. 73G–I

*Isotoma multisetis* Carpenter & Phillips, 1922, Proc. R. Ir. Acad. (B) 36: 16.

*Description.* – Body size up to 1.6 mm. Dark blue, head paler on dorsal (lateral and posterior) and ventral sides. PAO oval, about 1.5 as long as diameter of nearest ocellus (Fig. 73G). Ant.4 with a small spherical subapical organite, pin-seta shortly bifurcate. Maxilla with strong teeth, lamellae short and unmodified. Maxillary outer lobe bifurcated, 4 sublobal hairs. Labrum with 4 sharp apical folds and a simple ventroapical ciliation. Labium with 3 proximal setae, lateral guard $e_7$ present, basomedian field with 6–7 setae. Abdominal macrochaetae long, densely ciliate all around (Fig. 73I). Median macrochaetae on abd.5 about 3 times as long as inner edge of last claw. Setal bases glandular. Ventral tube with many frontal setae, about 10 + 10 lateral and posterior setae, with 4 setae in the apical transverse row. Retinaculum with 4 + 4 teeth and 9–11 setae. Manubrium with split ventroapical teeth (Fig. 73H). Mucro with three subequal teeth. Claws with two small teeth on the inner edge. Tib.1–3 with 8-8-9 apical setae ($T_1$ present on tib.1–2, $T_1$ and $T_4$ present on tib.3).

*Discussion.* – The species was originally described from Bjørnøya in the Norwegian Arctic and later reported from Svalbard by Valpas (1967). None of these specimens were available for study and recent samples from the east coast of Greenland were used instead. The 3-toothed mucro and the multiciliate macrochaetae is a unique character combination and the species shows no clear affinity to other species groups among our *Desoria*. Glandular setal bases, reduced tibiotarsal chaetotaxy, 3-toothed mucro and two inner teeth on the claws point to the genus *Isotoma* s. str. Potapov (2001) puts the species in the *Desoria pjasinae* group which has several Asiatic members.

*Distribution and ecology.* – Recorded from arctic tundra in Bjørnøya and Svalbard only. Also from Greenland. Other arctic records must be re-examined as there are probably several related species involved (Potapov, 2001). General distribution: Holarctic (circumpolar).

# Family ENTOMOBRYIDAE

The family is traditionally split in two subfamilies: Entomobryinae and Orchesellinae. Most genera belong to the first subfamily, characterised by undivided ant.1 segment and by having abd.4 much longer than abd.3. The second subfamily has two genera in our area which are recognised by the subdivided ant.1 (or 1 and 2) and subequal abd.3–4.

## Key to genera

1 Abd.4 in dorsal midline more than twice as long as abd.3 (Fig. 74A). Ant.1 not subdivided (subfam. ENTOMOBRYINAE) . . . 3

– Abd.4 in dorsal midline about 1.5 as long as abd.3 (Fig. 74B). Ant.1 with a basal short subsegment (Fig. 74E) (subfam. ORCHESELLINAE) . . . . . 2

2 Body with scales. Ocelli 1 + 1, body pigment absent or very weak . . . . . *Heteromurus* Wankel (p. 160)

– Body with normal hairs only. Ocelli 8 + 8, body with characteristic colour patterns . . . . . *Orchesella* Templeton (p. 157)

3 Body with normal hairs only, no scales . . 4

– Body with hairs and transparent scales (which easily fall off) . . . . . 6

4 Ocelli absent or 2+2, body without distinct colour patterns. Dens abruptly constricted just before tip (Fig. 1D) . . . . . *Sinella* Brook (p. 133)

– Ocelli 8 + 8, most species with distinct colour patterns. Dens more gradually tapering towards tip (as Fig. 1E) . . . . . 5

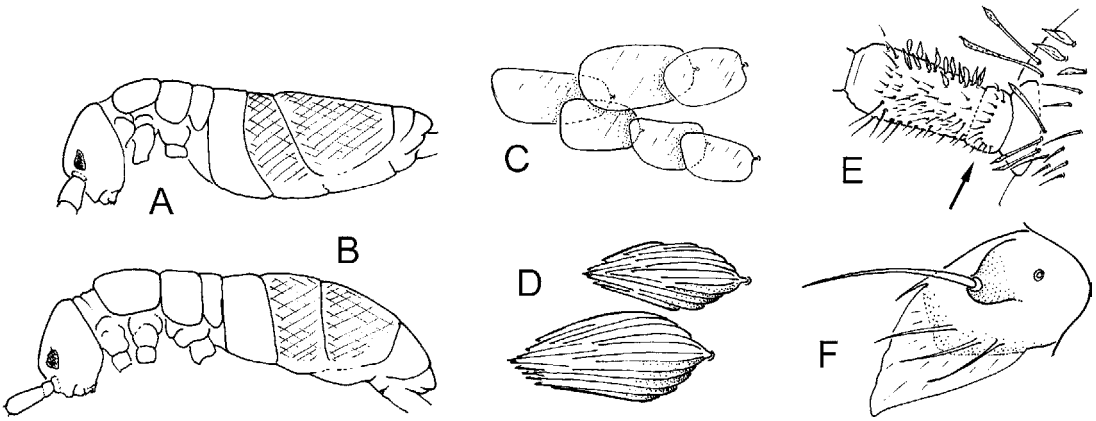


Fig. 74. Morphological structures of Entomobryidae: (A–B) Different proportions of abd.3–4 in *Lepidocyrtus* (A) and *Orchesella* (B); (C–D) scales from dorsal side of abdomen in *Lepidocyrtus* (C) and *Willowsia* (D); (E) *Heteromurus nitidus*, subsegmentation (arrow) of ant.1; (F) *Entomobrya nivalis*, maxillary outer lobe.

5 Tibiotarsus of hind leg with many smooth setae on the inner side (Fig. 78B) ..... *Entomobryoides* Maynard (p. 141)
– Tibiotarsi of hind leg with only a single smooth inner seta near apex ..... *Entomobrya* Rondani (p. 135)
6 Body scales blunt, without sharp striae (Fig. 74C), also present ventrally on dens ..... 7
– Body scales pointed, with sharp striae (Fig. 74D), absent ventrally on dens ..... *Willowsia* Shoebotham (p. 154)
7 Ocelli 8 + 8, on large ocellar spots ..... *Lepidocyrtus* Bourlet (p. 141)
– Ocelli 0–4 on each side, ocellar spots small or absent ..... *Pseudosinella* Schäffer (p. 149)

# Subfamily ENTOMOBRYINAE

## Genus *Sinella* Brook, 1882

*Sinella* Brook, 1882, J. Linn. Soc., Zool. 16: 543. Type species: *Sinella curviseta* Brook, 1882, by monotypy.

Members of this genus are recognised by reduced eye number (0 + 0 or 2 + 2 in Nordic species) and the peculiar structure of dens and mucro (Figs 1D, 75D, E).

### Key to species

1 Ocelli absent. Mucro simply hooked (Fig. 75D) ..... 292. *tenebricosa* Folsom
– Ocelli 2 + 2. Mucro with two teeth (Fig. 75E) ..... 293. *curviseta* Brook

### 292. *Sinella tenebricosa* Folsom, 1902

Figs 1D, 75A–D, G, H

*Sinella tenebricosa* Folsom, 1902, Psyche, Camb. 9: 365.
*Entomobrya caeca* auct., nec Schött, 1896.

*Description.* – Body size up to 1.5 mm. White, sometimes with scattered reddish-brown pigmentation. Eyes absent. Labrum with 554 setae, 4 prelabrals, all smooth. Labium and ven-

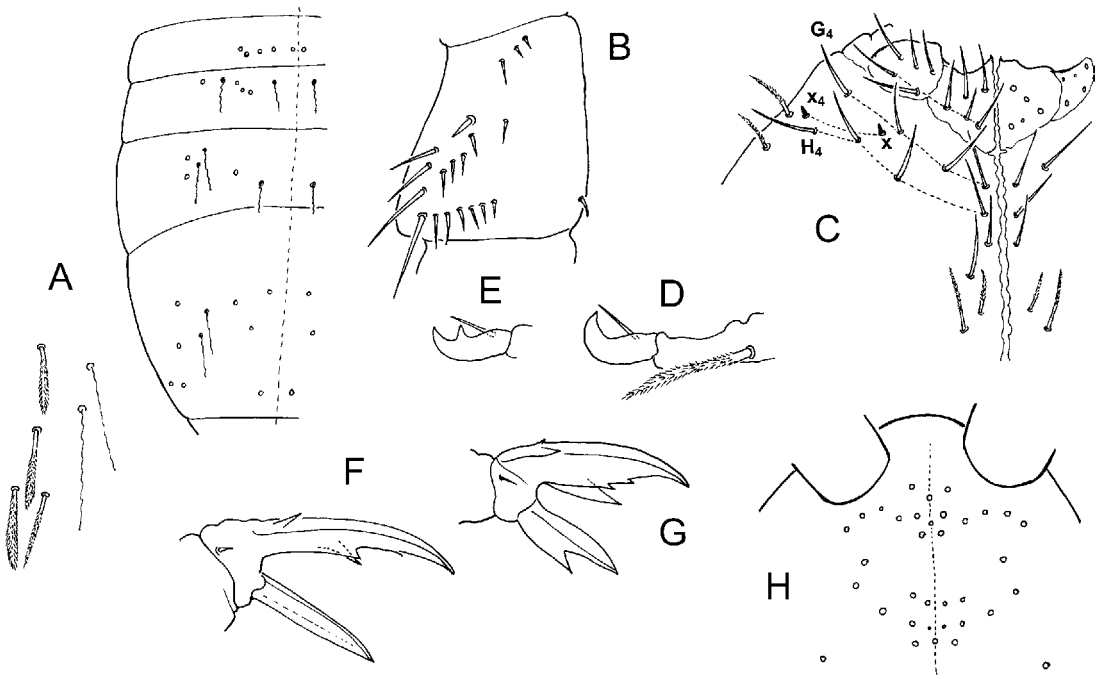


Fig. 75. *Sinella tenebricosa* (A–D, G–H) and *S. curviseta* (E–F): (A) Distribution of trichobothria and macrochaetae on abd.1–4, details of abd.4 to the left; (B) trochanteral organ of hind leg; (C) chaetotaxy of ventral side of head, right anterior part; (D) mucro and apical seta on dens; (E) mucro; (F) claw; (G) ditto; (H) distribution of macrochaetae on dorsal side of head, anterior part.

tral side of head as Fig. 75C, spine-like setae x and $x_4$ present. Maxillary outer lobe with 3 sublobal hairs. Lamellary complex of maxilla fused, with fine denticles and ciliations. Dorsal macrochaetotaxy in median parts of head and abd.1–4 as Fig. 75A, H. Trochanteral organ as Fig. 75B. Inner side of tibiotarsus with several smooth setae. Claws as Fig. 75G, inner edge with a single distal tooth and an unequal pair of teeth in the middle. Lateral teeth set in basal 1/3. Unguiculus with a strong tooth on the ventral edge. Mucro hooked, basal spine reaches tip (Fig. 75D). Dorsal side of manubrium and dorsobasal part of dens with some smooth setae.

Reproductive males with genital field surrounded by inwardly directed papillae and stiff setae.

*Discussion.* – In a study of mainly Chinese *Sinella*, Chen & Christiansen (1997) concluded that Schött's old species *coeca*, originally described from North America, was different from what had usually been called *coeca* in various parts of the world, including Europe. Our species was found to be identical with the almost cosmopolitan *tenebricosa*, also described from North America. *Sinella* species with a falcate mucro, like *tenebricosa*, are usually assigned to a separate subgenus, *Coecobrya*, which is sometimes given generic status (Deharveng, 1990).

*Distribution and ecology.* – Lie-Pettersen (1896) reported some specimens (as *Sinella hoefti* Schäffer, 1896, which may actually be a senior synonym of *tenebricosa*) from a greenhouse at Minde, near Bergen. Also a recent record (1981) from compost in Vigelandsparken in Oslo. Linnaniemi (1912) lists eleven Finnish records from hothouses and indoor flowerpots in various parts of the country. Recently also from compost heaps in southern Finland and Sweden. General distribution: Cosmopolitan.

## 293. ***Sinella curviseta*** Brook, 1882

Fig. 75E, F

*Sinella curviseta* Brook, 1882, J. Linn. Soc., Zool. 16: 543.

*Description.* – Body size up to 2.0 mm. White with diffuse brownish red pigmentation. Ocelli 2 + 2, on individual eye-spots. Mucro with two teeth and a spine (Fig. 75E). Claws as Fig. 75F, slender, unguiculus without ventral tooth. Chaetotaxy in Nordic specimens not studied.

*Distribution and ecology.* – The only Norwegian record is that of Lie-Pettersen (1896) from Bergen, in a greenhouse together with the previous species. Linnaniemi (1912) reported the species from the hothouse in the Botanical garden in Helsinki. No recent records. General distribution: Cosmopolitan.

## Genus *Entomobrya* Rondani, 1861

*Entomobrya* Rondani, 1861, Dipterologiae italicae Prodromus 4: 40. Type species: *Degeeria muscorum* Nicolet, 1842, by subsequent designation by Börner, 1903.

Most of our *Entomobrya* species have distinct colour patterns which will identify the species. They may be confused with similarly coloured *Willowsia*, but differ by absence of scales on the body. The body has a ground cover of ciliate setae and long macrochaetae which are set in fixed patterns which often give diagnostic characters on species level. Head has a full set of eyes (8 + 8), ocelli G and H usually much smaller than others. Mandibles strong, maxilla with lamellar complex fused without apparent differentiation among our species. Maxillary outer lobe with 3 sublobal hairs and one spine. Labial palps with a full set of papillae (A–E). Papilla E with 4 guards. Labrum with 554 smooth setae and 4 ciliate prelabral setae. Anterior edge of labrum with 4 roundish papillae which may either be smooth or beset with a few small spinules. Antennal tip with an apical bulb which may be either simply rounded, bi- or tri-lobed. Furca strong, mucro with two teeth and a basal spine. Tibiotarsi with an apically expanded tenent hair. Inner side of tib.3 with a single smooth seta near apex. Claws with strong teeth, without significant differentiation among species except in position of the basolateral teeth and shape of the ventral edge of unguiculus (serrate or smooth).

### Key to species

1 Body with distinct dark colour pattern. If not (pale specimens of *nivalis*), then median fields of abd.3 with two macrochaetae only (Fig. 76) . . . . . 2
– Body pale, without dark patterns. Abd.3 with 4 macrochaetae in the median fields (Fig. 76) . . . . . 294. *lanuginosa* (Nicolet)
2 Colour pattern as Pl. 6: 1, th.3–abd.3 completely dark . . . . . 296. *albocincta* (Templeton)
– Colour pattern different, th.3–abd.3 not completely dark . . . . . 3
3 Colour pattern as Pl. 5: 4, th.2–abd.3 with narrow, unbroken bands along posterior edges . . . . . 295. *marginata* (Tullberg)
– Colour pattern different . . . . . 4
4 Mesonotum conically protruding, antennae and last femur distinctly "ringed". Colour pattern characteristic (Pl. 6: 3) . . . . . 302. *superba* (Reuter)
– Mesonotum not protruding, colour pattern different . . . . . 5
5 Abd.3 either completely dark (Pl. 6: 2) or with a rectangular transverse spot . . . . . 6
– Abd.3 marks different, not filling the segment, not rectangular . . . . . 7
6 Colour pattern as Pl. 6: 2. Th.2 dark all around the edges, unpigmented on disc. Abd.3 entirely dark . . . . . 297. *corticalis* (Nicolet)
– Th.2 not darkened along posterior edge. Abd. less dark . . . . . 303. *spectabilis* Reuter
7 Colour pattern as Pl. 5: 3. Th.2–abd.3 with broad lateral patches which become narrow and diffuse towards midline, leaving discs mostly unpigmented. Abd.2–3 with 4 and two macrochaetae in median fields (Fig. 76) . . . . . 300. *nicoleti* (Lubbock)
– Colour pattern different. Th.2–abd.3 mostly with dark median spots which are disconnected to lateral elements. Abd.2–3 chaetotaxy different . . . . . 8
8 Colour pattern as Pl. 5: 2. Th.2–3 with sharp bands along posterior edges, un-

broken in the middle. Transverse median zigzag band on abd.4 mostly disconnected with posterior patches. Abd.2–3 with 4 and 4 macrochaetae in median fields (Fig. 76) . . . . . 301. *multifasciata* (Tullberg)

– Colour pattern and chaetotaxy different . . . . . 9

9 Colour pattern as Pl. 5: 1. Median part of abd.4 without dark pigment. Sometimes all body uniformly greenish grey. Abd.2 with 5 macrochaetae in median fields (Fig. 76) . . . . . 299. *nivalis* (Linnaeus)

– Colour pattern as Pl. 8. Abd.4 with dark pigment in median part. Abd.2 with 7 macrochaetae in median fields (Fig. 76) . . . . . 304. *muscorum* (Nicolet)

– Colour pattern as Pl. 7. Abd.2 with 3 setae in median fields . . . 298. *arborea* (Tullberg)

## 294. ***Entomobrya lanuginosa*** (Nicolet, 1842)

Fig. 76

*Degeeria lanuginosa* Nicolet, 1842, Neue Denkschr. Allg. schweiz. Ges. ges. Naturw. 6 (3): 74.

*Description.* – Body size up to 2.0 mm. Unpigmented or with a diffuse greyish green pigmentation which is darkened along sides of thorax and along posterior edges of tergites. Eye-fields and a small spot between bases of antennae dark. Antennae slightly darker towards tip. Labral papillae smooth or with small projections. Apical bulb of antennae simple or slightly bilobed. Lateral teeth of claws set at base. Chaetotaxy of abd.2–3 as in *multifasciata* (Fig. 76).

*Discussion.* – Absence of a distinct colour pattern may lead to a confusion with pale *nivalis*, but the different numbers of macrochaetae in median fields on abd.3 will identify them (two in *nivalis*, 4 in *lanuginosa*).

*Distribution and ecology.* – Widely distributed in southern districts. Most records from seashore habitats, in rock vegetation and dry sandy meadows. General distribution: Palaearctic.

## 295. ***Entomobrya marginata*** (Tullberg, 1871)

Fig. 76; Pl. 5: 4

*Degeeria marginata* Tullberg, 1871, Öfvers. K. VetenskAkad. Förh. 28: 148.

*Description.* – Size up to 2.0 mm. Colour pattern as Pl. 5: 4, pigmentation violet blue, rather pale. Characteristic are the narrow, sharp bands along posterior edges of th.2–abd.3. These bands are uniform, without triangular projections in the lateral parts. Most of abd.4–6 and the lateral parts of other tergites with greyish blue pigmentation. Antennae and legs (in particular last pair) also darkened. Labral papillae smooth. Apical vesicle on ant.4 bilobed. Lateral teeth of claws set at base. Chaetotaxy in median parts of abd.2–3 as Fig. 76.

*Discussion.* – Well-pigmented specimens are easily identified by pattern. The abd.2–3 chaetotaxy is only matched by *albocincta*.

*Distribution and ecology.* – Common and widely distributed. Usually found under bark scales, moss and lichens on tree trunks, also under bark on dead trees and in dry habitats on the ground. General distribution: Cosmopolitan, but systematics unclear. Originally described from southern Sweden.

## 296. ***Entomobrya albocincta*** (Templeton, 1835)

Fig. 76; Pl. 6: 1

*Podura albocincta* Templeton, 1835 Trans. ent. Soc. London 1 (2): 95.

*Description.* – Size up to 2.0 mm. Colour pattern characteristic (Pl. 6: 1), with head having reddish brown pigment in the anterior half and on the sides, mesothorax whitish with violet blue pigment along anterior edge, th.3–abd.3 entirely violet blue, abd.4 violet blue in posterior half and yellowish white in anterior part, abd.5–6 yellowish white. The dark pigment of the body extends to the ventral side, in particular ventrally on abd.4. Three last antennal segments brownish red. Coxal parts of two first pair of legs darkened, last leg darkened beyond femur. Ventral tube darkened. Labral papillae smooth. Apical bulb of ant.4 simple. Lateral teeth of claws set

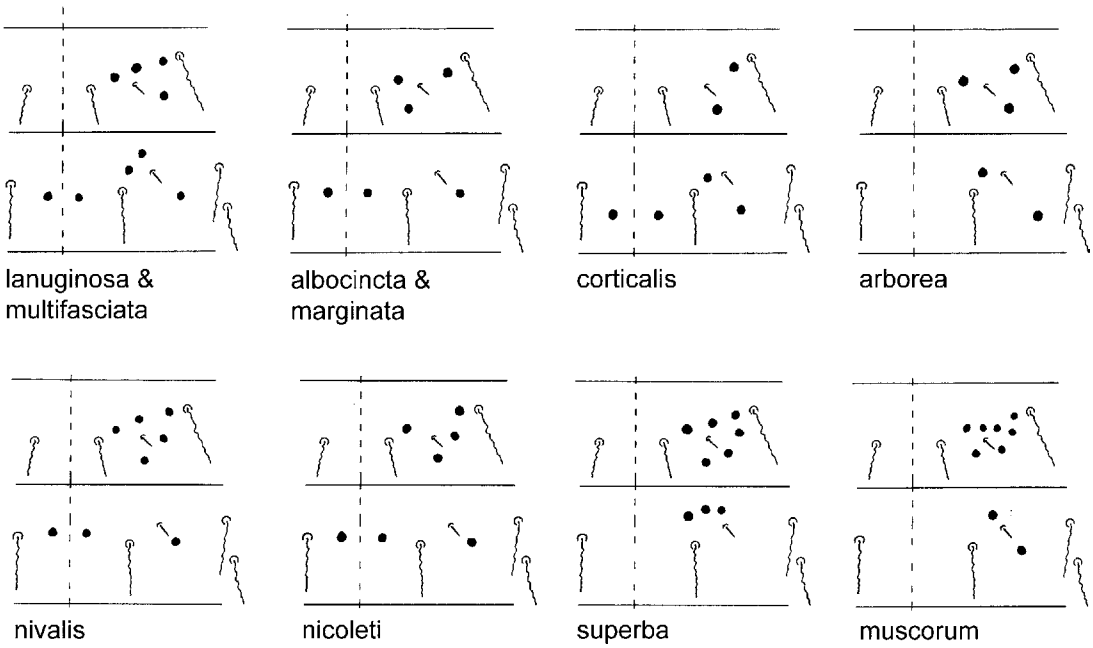


Fig. 76. *Entomobrya* spp. Distribution of macrochaetae (black dots) near midline of abd.2–3.

in the middle, posterior ventral edge of unguiculus distinctly serrate. Chaetotaxy of abd.2–3 as in *marginata* (Fig. 76).

*Discussion.* – Easily identified in field by the extensive dark colour pattern.

*Distribution and ecology.* – Common in southern districts, usually in moss on tree stems, sometimes under bark and in forest litter. Huldén (1984) lists the species from Finland, but no locality is given. General distribution: Palaearctic.

## 297. ***Entomobrya corticalis*** (Nicolet, 1842)

Fig. 76; Pl. 6: 2

*Degeeria corticalis* Nicolet, 1842, Neue Denkschr. Allg. schweiz. Ges. ges. Naturw. 6 (3): 72.

*Description.* – Body size up to 1.5 mm. A small species with a characteristic colour pattern (Pl. 6: 2). Ground colour in fresh specimens creamy white, dark pigment bluish black. Head dark in front of eyes, including antennal sockets. Also with a large dark spot on the sides behind the eyes, leaving hind corners of head unpigmented. Antennae darkened towards tip, last segment completely dark. Thoracic tergites dark along the edges, posterior band often diffuse towards the sides. Coxae unpigmented. Femora and tibiotarsi usually with some diffuse pigmentation. Abd.1–2 dark along the sides, abd.3 all dark. Abd.4 with a broad transverse zigzag band in the middle. Abd.5–6 dark. Furca and ventral side of body and head unpigmented. Labral papillae with small projections. Apical papilla on antennae bilobed. Lateral teeth of the claws set in the middle, posterior ventral edge of unguiculus serrate. Chaetotaxy of abd.2–3 as Fig. 76, with two macrochaetae on abd.2 and 3 on abd.3.

*Discussion.* – The colour pattern readily identify this species. The chaetotaxy of abd.2–3 is also unique among our species.

*Distribution and ecology.* – A corticole species particularly common under bark on dead trees, both hardwood and conifers. Widely distributed. General distribution: Palaearctic.

## 298. *Entomobrya arborea* (Tullberg, 1871)

Fig. 76; Pl. 7

*Degeeria arborea* Tullberg, 1871, Öfvers. K. VetenskAkad. Förh. 28: 148.

*Description.* – Body size up to 1.5 mm. Body shape rather broad. Colour pattern characteristic (Pl. 7). Tergites of th.2–abd.3 usually with some patches which are free, not connected with the transverse posterior bands. Abd.4 with a prominent transverse zigzag band which is not connected with the posterior elements. Intensity of pigmentation varies considerably. In the palest specimens only traces of the patterns are left. In the darkest specimens most of the body is dark, leaving unpigmented only posterior part of head and some spots on abd.4. The macrochaetal patterns on abd.2–3 are unique among our species (Fig. 76).

*Discussion.* – The broad body shape and the colour pattern is characteristic for this species and the macrochaetal pattern on abd.2–3 also identify it.

*Distribution and ecology.* – Scattered records in Sweden and Finland only. On bark on live trees, mainly hardwood. Originally described from Uppsala, Sweden. General distribution: Palaearctic.

## 299. *Entomobrya nivalis* (Linnaeus, 1758)

Fig. 76; Pl. 5: 1

*Podura nivalis* Linnaeus, 1758, Systema naturae, 10th ed.: 609.

*Entomobrya subarctica* Stach, 1962: 14; syn. nov.

*Description.* – Body size up to 2.0 mm. Ground colour pale yellowish green in freshly collected specimens. Colour pattern characteristic, pigmentation violet blue (Pl. 5: 1). Head dark in front of eyes, including antennal sockets. A dark band runs along the sides of the animal from eye-field to anterior part of abd.3, including subcoxal parts of the legs. A characteristic transverse band is present along posterior edges of abd.2–3, having a triangular extension in its lateral parts. The band is narrowly interrupted in the median line and is disconnected to the lateral spots of the segments. Weak shades of similar bands are also seen on th.2–3, while abd.1 is unpatterned on the dorsal disc. On abd.3 the lateral band is disconnected in the middle, continuing backwards along the sides of abd.4. A characteristic V-shaped figure is present on abd.4. Parts of it consists of the transverse zigzag band which is broadly disconnected in the middle (not continuous like in *multifasciata*, cf. Pl. 5: 2). Abd.5–6 dark, paler in the middle. Furcal subcoxae with a dark spot. Femora of last two pairs of legs often darkened. Furca and ventral side of body and head unpigmented. Intensity of the dark coloration varies, but traces of the basic pattern is usually visible. There is however a distinct form in the Scandinavian mountains and at coast level in northernmost Norway where the bluish pigment of the body is restricted to small spots at the hind corners of abd.4–5. A diffuse "grainy" greyish green pigmentation may cover more or less of the dorsal and ventral side including head and extremities. Chaetotaxy of abd.2–3 is the same in these forms. Posterior ventral edge of unguiculus serrate. Labral papillae with small projections or smooth. Apical bulb of ant.4 bilobed. Chaetotaxy of abd.2–3 as Fig. 76, abd.2 with 5, abd.3 with 2 macrochaetae in the median fields.

*Discussion.* – Typically coloured specimens are easily identified. Very pale specimens – like the Scandinavian mountain form – may be mistaken for *lanuginosa*, but the different chaetotaxy of abd.2–3 will separate the species. The mountain form possibly corresponds to *enormis* Stach, 1963 which was described as a variety of *nivalis* from the Carpathian mountains. Stach's name is invalid according to Article 45 c, e in the International Code of Zoological Nomenclature. An alternative name is *maculata* Schäffer, 1896. The status of the mountain form should be checked by molecular methods. The species *subarctica* Stach, 1962 was described from a single specimen collected at Hornsund in Spitsbergen by a Polish expedition in 1960. The described colour pattern matches that of specimens from northern Finnmark. As the single diagnostic character Stach (1962: 15) referred to the labral apical papillae having the lateral pair twice as large as the median pair. However, these characters are variable and *subarctica* is considered a junior synonym of *nivalis* until there is evidence for the contrary.

*Distribution and ecology.* – One of our most common species of Collembola, with a preference for dry habitats. Very common under bark scales and in moss/lichens on live trees, both conifers and hardwood. Also in rocky alpine habitats. General distribution: Cosmopolitan, although systematics on a world scale is uncertain.

## 300. *Entomobrya nicoleti* (Lubbock, 1868)

Fig. 76; Pl. 5: 3

*Degeeria nicoleti* Lubbock, 1868, Trans. Linn. Soc. Lond. 26: 299.

*Description.* – Size up to 1.5 mm. Colour pattern as Pl. 5: 3. Pigmentation violet blue, background colour whitish. Characteristic is the almost unpigmented mid-section of thorax and anterior part of abdomen and the broad lateral spots which narrows and disappears towards the midline of the segments. In dark individuals the lateral spots form an almost continuous longitudinal band along the sides. Abd.4 has a V-shaped figure like in *nivalis*, but the posterior end of the "arms" are broadly connected to the lateral spots, not narrow and detached as in *nivalis*. The dorsal discs of abd.2–3 never have distinct transverse bands which are detached from the lateral marks as is found in *nivalis* (Pl. 5: 1). Chaetotaxy on abd.2 differs from that of *nivalis* in having only 4 macrochaetae in the median fields, not 5 (Fig. 76).

*Discussion.* – Separated from *nivalis* by the above characters.

*Distribution and ecology.* – Widely distributed, but often confused with similar species. Usually found in dry meadow vegetation, often in sandy seashore habitats. Less common in forests. General distribution: Palaearctic or more extensive, but systematics on a world scale is unclear.

## 301. *Entomobrya multifasciata* (Tullberg, 1871)

Figs 76, 77A–G; Pl. 5: 2

*Degeeria multifasciata* Tullberg, 1871, Öfvers. K. VetenskAkad. Förh. 28: 148.

*Description.* – Size up to 1.5 mm. Colour pattern as Pl. 5: 2, pigmentation bluish, ground colour white. Characteristic is the narrow sharp posterior bands on th.2–abd.1 which are not or only diffusely connected with the lateral bands, the two triangular side spots on the posterior band of abd.2–3, the sharp posterior band of abd.3 which laterally connects with the side band of abd.4, the broad transverse zigzag band of abd.4 which is only diffusely connected with the posterior spots of the segment. Rarely the median elements may fuse and form a V-shaped figure as in *nivalis*. The three distal antennal segments and tip of ant.1 darkened. Legs pal, except subcoxae and tip of femur on last two pairs of legs. Ocelli G and H only slightly smaller than E and F (Fig. 77C). Labral papillae with small projections (Fig. 77E). Maxilla as Fig. 77F, G. Apical bulb of antenna variable, bilobed or simple (Fig. 77D). Lateral teeth of claws almost at level with inner pair of teeth (Fig. 77A, B). Ventral edge of unguiculus smooth. Abd.3 with two macrochaetae in front of the median trichobothrium (Fig. 76).

*Discussion.* – Normally identified by colour pattern alone. In mixed samples of freshly collected specimens *multifasciata* usually differs from *nivalis* by a pure whitish ground colour, while *nivalis* has a greyish green ground colour. The chaetotaxy pattern on abd.3 is shared only with *lanuginosa*.

*Distribution and ecology.* – Common and widely distributed, usually in dry meadows and seashores, more rare in forests. General distribution: Palaearctic, possibly wider. Originally described from southern Sweden. On a world scale more than one species may be involved.

## 302. *Entomobrya superba* (Reuter, 1876)

Fig. 76; Pl. 6: 3

*Degeeria superba* Reuter, 1876, Meddn Soc. Fauna Flora fenn. 1: 85.

*Description.* – Body size up to 3.0 mm. A characteristic animal with conically protruding mesonotum, long antennae and distinct pattern of violet blue coloration (Pl. 6: 3). Head dark, including antennal sockets. Mouth region pale. Antennae white, except distal spots on segments

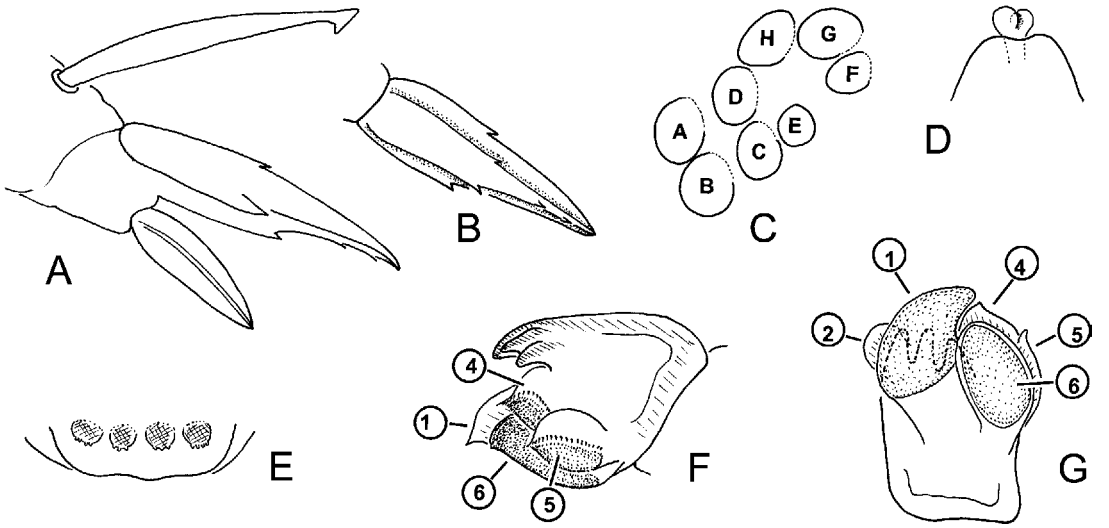


Fig. 77. *Entomobrya multifasciata*: (A) Claw with spatulate apical seta on tibiotarsus; (B) unguis, ventral view; (C) ocelli of left eye; (D) apical papilla of ant.4; (E) apical papillae of labrum; (F) right maxilla, dorsal view; (G) ditto, axial view.

2 and 3 and. Ant.4 dark, with tip, mid-section and base pale. Mesonotum dark with a broad pale band along posterior edge. Anterior part of metanotum with a dark transverse band, narrowing in the middle. Abd.1 mostly unpigmented. Abd.2 with a broad transverse band, leaving posterior edge unpigmented. Most of abd.3 dark. Abd.4 white in the anterior 1/3 and along posterior edge, otherwise dark blue. Abd.5 dark, abd.6 white. Manubrium with longitudinal dark stripes. The dark colour of the body includes ventrolateral parts and subcoxae of the legs. Legs otherwise unpigmented, apart from the distal 1/3 of the femur of the last pair of legs which is dark. Labral papillae with small projecting spinules. Apical bulb of ant.4 trilobed. Abdominal tergites with increased number of macrochaetae, abd.2–3 at least with 6 and 4 macrochaetae in the median fields.

*Discussion.* – An unmistakable species due to the distinct colour pattern and the protruding mesonotum.

*Distribution and ecology.* – A southern/eastern species with many records from Finland and a single Danish record from Lolland (Bartholin, 1916). Not in Norway and Sweden. In Finland the species has been collected from moist meadows, often in thickets of *Salix* spp. (Linnaniemi, 1912). General distribution: Palaearctic.

## 303. ***Entomobrya spectabilis*** Reuter, 1890

*Entomobrya spectabilis* Reuter, 1890, Meddn Soc. Fauna Flora fenn. 17: 25.

*Description.* – The colour pattern resembles that of *corticalis*, but is less extensive. Notably th.2–3 are not dark along their posterior borders and abd.3 has a transverse band in anterior part of the segment only, usually broken in the midline. The chaetotaxy characters are unknown. No recent specimens were available for description.

*Distribution and ecology.* – Originally described from greenhouses and indoor flower pots in Finland. Linnaniemi (1912) reports only few Finnish records. Listed as Swedish by Agrell (1943), but locality unknown. General distribution: Holarctic.

## 304. ***Entomobrya muscorum*** (Nicolet, 1842)

Fig. 76; Pl. 8

*Degeeria muscorum* Nicolet, 1842, Neue Denkschr. Allg. schweiz. Ges. ges. Naturw. 6 (3): 75.

*Description.* – Size up to 3.0 mm. Antenna very long, in large individuals longer than body. Ground colour whitish, with bluish black pattern as Pl. 8. Th.2–abd.4 with dark lateral patches forming a longitudinal band which continues onto the sides of the head and terminates at the eye-spot. A dark cross-band runs from the anterior edge of the eye-spot over the antennal sockets, leaving a small unpigmented spot between the antennal bases. Mouth region unpigmented. Top of the head with a variable dark V-spot. A pair of sharp dorsolateral bands, sometimes dissolved into patched, runs from posterior edge of abd.3 to anterior edge of th.2. Mid-section of abd.4 crossed by a variable zigzag band having a characteristic arrow-spot in the median line. In dark individuals the cross-band expands and leave only a few unpigmented large spots (one anterodorsal, 3 posterior). Abd.5 dorsally dark, abd.6 white. Antennae and legs yellowish brown, with darker pigmentation forming longitudinal bands in particular on femora and two first antennal segments. Chaetotaxy of abd.2–3 as Fig. 76.

*Discussion.* – The colour pattern and the long antennae easily identify this species. No Nordic specimens were available and the above description is based on material from Netherland.

*Distribution and ecology.* – In our area only reported from Lolland (Bartholin, 1916). The species lives among ground vegetation in lush forests. General distribution: Cosmopolitan.

## Genus *Entomobryoides* Maynard, 1951

*Entomobryoides* Maynard, 1951, Monogr. Collembola NY State: 161. Type species: *Degeeria purpurascens* Packard, 1873, by original designation.

The single Nordic species is similar to *Entomobrya* but differs by having many smooth setae on the inner side of all tibiotarsi (Fig. 78B), while there is only one near apex of tib.3 in *Entomobrya*.

### 305. *Entomobryoides myrmecophilus* (Reuter, 1886)

Fig. 78A–E

*Entomobrya myrmecophila* Reuter, 1886, Meddn Soc. Fauna Flora fenn. 13: 179.

*Description.* – Body size up to 2.5 mm. Pigmentation bluish grey, diffuse, including feet and antennae. The lamellary complex of the maxilla is less fused than in *Entomobrya*, with clearly differentiated lam.1, 4 and 5 (Fig. 78C). Tip of lam.1 well beyond capitulum. Macrochaetotaxy in median part of abd.1–4 as Fig. 78A. Claws with a pair of strong inner teeth, posterior largest. Inner edge of unguis with two single distal teeth. Lateral teeth set in basal 1/3. Unguiculus with serrated ventral edge (Fig. 78D, E).

*Discussion.* – Large size, greyish colour and myrmecophilic behaviour easily identify the species. The only available Nordic specimens (Zool. Mus., Helsinki) were collected in 1899 (Esbo, Finland) and some morphological details were invisible.

*Distribution and ecology.* – A single Danish record (Lolland, Barholin, 1916) and several records from southern Finland (Linnaniemi, 1912). Wahlgren (1906) reports the species from Uppland, but there are no modern Swedish records. Usually collected in ant nests (*Lasius*, *Formica*, *Myrmica*). General distribution: Palaearctic.

## Doubtful record

*Mesentotoma dollfusi* Denis, 1924. Reported from southern Sweden by Bödvarson (1961). Exact locality is not given, but the specimen was collected in pine litter. Normally the species lives in the marine littoral with northernmost records from S. England. Until verified, the Swedish record is considered dubious.

## Genus *Lepidocyrtus* Bourlet, 1839

*Lepidocyrtus* Bourlet, 1839, Mém. Soc. Sci. Agric. Lille 1839 (1): 391. Type species: *Lepidocyrtus curvicollis* Bourlet, 1839, by monotypy.

Our *Lepidocyrtus* species have a full set of eyes (8 + 8) and a silvery or metallic blue colour due to the cover of scales on the body. This makes them easy to spot in field. The scales which are present on head, body and ventral side of

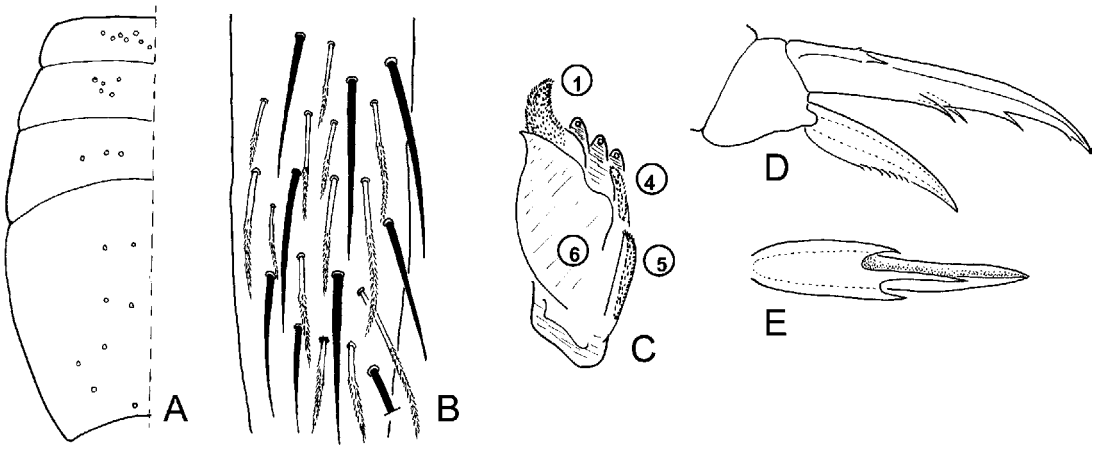


Fig. 78. *Entomobryoides myrmecophilus*: (A) Distribution of macrochaetae on abd.1–4; (B) ciliate and smooth (black) setae on inner side of tib.3, mid-section; (C) maxilla, lam.6 probably a fused complex of lam.2–3 and 6; (D) claw of hind leg; (E) unguis, ventral view.

furca are blunt-tipped and appear smooth (microstriae present) (Fig. 74C). Some species with scales also on legs and antennae. The ground cover consists of ciliate setae. Macrochaetae present but reduced in number. Trichobothria present on abd.2–4 (2-3-2 on each side). The setal arrangement around the trichobothria on abd.2–4 offer diagnostic characters, but carefully mounted specimens are necessary. Maxillary outer lobe with simple palp and 3 sublobal hairs (0 in *fimetarius*). Labrum with 554 smooth setae and 4 ciliate prelabrals (smooth in *curvicollis*). Labral edge with 4 pointed (hooked) papillae. Labial palps with a normal set of papillae and guards, proximal setae 5. Lateral papillae (D and E) with 4 guards (3 in *fimetarius*) and a variable lateral process. Basomedian field of labium with a variable chaetotaxy, often species specific. Basolateral field always with 5 setae, usually 3 smooth and 2 ciliate (all smooth in *curvicollis*). Ocelli 8 + 8, PAO absent. Maxilla with a 3-toothed capitulum, lamellary complex fused to form short pads with a delicate denticulate surface, no long cilia or serrations. Mandibles normal, strong. Retinaculum with 4 + 4 teeth and one macrochaeta. Manubrial ventroapical thickening blunt, without teeth/serrations. Mucro with two teeth and a spine. Tibiotarsi with a spatulate apical tenent hair. Claws with a pair of lateral teeth and a dorsomedian tooth in basal 1/3. Inner edge has a double tooth in the middle and a single tooth more distally. Unguiculus of variable shape, ventral edge sometimes serrated.

There are no recent treatments which give an adequate survey of Nordic species. There are certain forms found in greenhouses and compost and one outdoor form for which species identification have failed. They probably belong to described taxa, but revisionary work on the European *Lepidocyrtus* is necessary (see Unidentified taxa at end of chapter).

## Key to species

1 Two first segments of antennae and legs beyond coxae with scales . . . . . 2
– Antennae and legs beyond coxae without scales . . . . . 5
2 Mesonotum hood-like projecting above head (Fig. 79B, C). Body size up to 3.0 mm . . . . . 4
– Mesonotum normal (Fig. 79A). Smaller species . . . . . 3
3 Pale species, blue pigment at most at base of legs, on head and in posterior part of abd.4 . . . . . 307. *lignorum* (Fabricius)
– Blue pigment usually covering most of the body . . . . . 309. *violaceus* (Geoffroy)
4 Pale species, blue pigment absent from body apart from base of legs and on an-

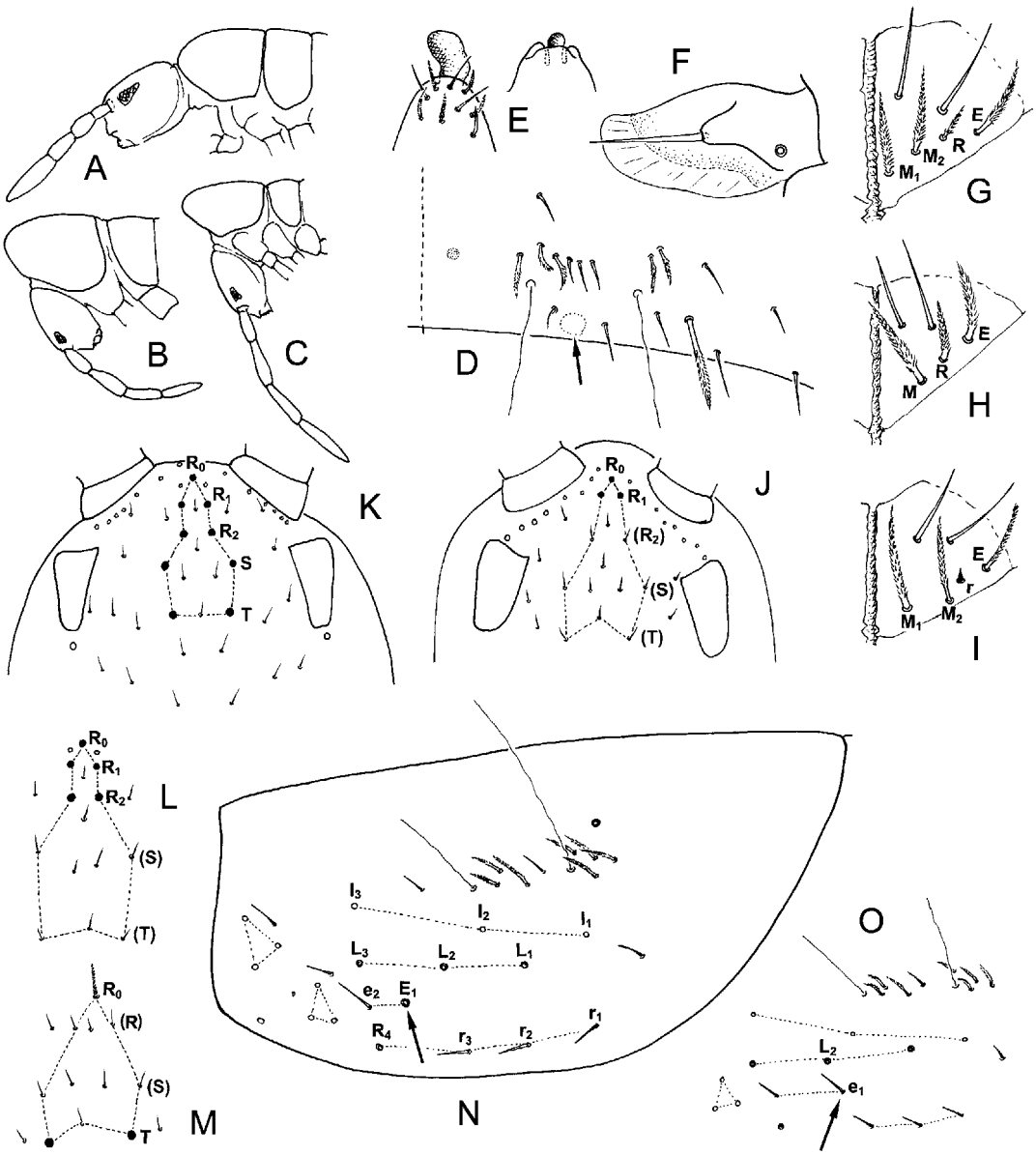


Fig. 79. *Lepidocyrtus* spp.: (A–C) Profile of head and thorax in *lignorum* (A), *curvicollis* (B) and *paradoxus* (C); (D–F) *fimetarius*, (D) setal pattern on right side of abd.2, note absence of macrochaeta (arrow), (E) apical papilla of ant.4, extruded (left) and inverted (right), (F) maxillary outer lobe with absence of sublobal hairs; (G–I) setae of the basomedian field of labium in *lignorum* (G), *lanuginosus* (H), and *pallidus* (I); (J–M) chaetotaxy in anterodorsal part of head in *fimetarius* (J), *lanuginosus* (K), *violaceus* (L), and *pallidus* (M); (N–O) chaetotaxy on right side of abd.4 in *pallidus* (N) and *weidneri* (O).

terior side of mesonotum. The 4 prelabral setae smooth ..... 311. *curvicollis* Bourlet

– Blue species, prelabral setae ciliated ..... 312. *paradoxus* Uzel

5 Ant.4 without apical bulb. Macrochaeta present between trichobothria on abd.2 (Fig. 82A). Sublobal hairs present on maxillary outer lobe ..... 6

– Apical bulb present on antenna (Fig. 79E). No macrochaetae between abd.2 trichobothria (Fig. 79D). Maxillary outer lobe without sublobal hairs (Fig. 79F) . . . . . 306. *fimetarius* Gisin

6 Head with macrochaetae S and T present between the eyes (Fig. 79K). Basomedian field of labium with only one M-seta (Fig. 79H) . . . . . 7

– Head with T present, S absent (Fig. 79M). Basomedian field of labium normally with 2 M-setae (Fig. 79I) . . . . . 8

7 Pale species, pigment absent from body . . . . . 308. *lanuginosus* (Gmelin)

– Blue species . . . . . 310. *cyaneus* Tullberg

8 Abd.4 with macrochaetae $E_1$ inserted behind $L_2$ (Fig. 79N) . . . 313. *pallidus* Reuter

– Macrochaeta $E_1$ on abd.4 transformed to a short seta ($e_1$), set in front of $L_2$ (Fig. 79O) . . . . . 314. *weidneri* Hüther

## 306. ***Lepidocyrtus fimetarius*** Gisin, 1964

Figs 79D–F, J, 80A–C

*Lepidocyrtus fimetarius* Gisin, 1964, Revue suisse Zool. 71(20): 390.

*Description.* – Body size up to 2.2 mm. Unpigmented apart from eye-spots, or large individuals with a faint violet blue colour over head and most of body including base of legs. Scales absent from legs and antennae. Tip of antennae with a retractile apical bulb (Fig. 79E). Labial base with setae M and E ciliated, r vestigial (Fig. 80B). Papillae D and E of the labial palp with 3 guard setae only. Maxillary outer lobe without sublobal hairs (Fig. 79F). Head without dorsal macrochaetae behind the antennal group (R, S and T short, Fig. 79J). Chaetotaxy of abd.2 as Fig. 79D. Setae associated with the trichobothria ciliate, but not clearly expanded towards tip. Trichobothria on abd.2 set close together, no macrochetae between them. Lateral chaetotaxy of abd.4 as Fig. 79O, seta $e_1$ in front of $L_2$. Central field of abd.4 with $2 + 2$ macrochaetae (Fig. 80A). Inner edge of unguis with a paired tooth in the middle and two small distal teeth, of which the inner one show a tendency of becoming split (paired). Unguiculus pointed, lanceolate (Fig. 80C).

*Discussion.* – A small species, very characteristic by the presence of an antennal apical bulb, loss of all sublobal hairs on the maxillary outer lobe and no macrochetae between the trichobothria on abd.2 (all unique characters among our *Lepidocyrtus*). The species was redescribed in detail by Hüther (1971).

*Distribution and ecology.* – Only collected in S. Sweden (Sk: Lund, Örtofta, 18 June 2006) in enormous numbers in fermenting dry deposits of seeds and debris from grain and sugar beet production.

## 307. ***Lepidocyrtus lignorum*** (Fabricius, 1793)

Figs 79A, G, 81A–D

*Podura lignorum* Fabricius, 1793, Entomologica systematica, 2: 67.

*Description.* – Body size up to 1.6 mm. Colour whitish, often blue at base of legs, on dorsal side of head and in posterior part of abd.4. Antennae bluish in distal part. Live specimens silvery metallic. Scales present on the two first segments of antennae and on legs beyond coxae. Base of labium with 4 ciliate setae in the median field (Fig. 79G). Head macrochaetae S and T not developed (short setae only, as Fig. 79L). Chaetotaxy in median parts of abd.2 as Fig. 81A. Seta associated with the trichobothria distinctly ciliate. Abd.4 with $4 + 4$ macrochaetae in the median field (Fig. 81B). On abd.4 lateral macrochaeta $E_1$ set between $L_2$ and $L_3$ (as in *pallidus*, Fig. 79N). Chaetotaxy of the trichobothrial fields of abd.4 as Fig. 81D, anterior and posterior groups set wide apart. Inner edge of unguis with a double tooth in the middle and a single tooth in distal 1/3. Unguiculus lanceolate, without teeth (Fig. 81C).

*Discussion.* – Usually easy to identify by the key characters. Individuals in which the body scales have been rubbed off, are recognised by absence of blue colour on dorsal side of thorax and anterior abdomen in combination with loss of macrochaetae S and T on head.

*Distribution and ecology.* – Common in many types of habitats, preferably in humus rich soil in

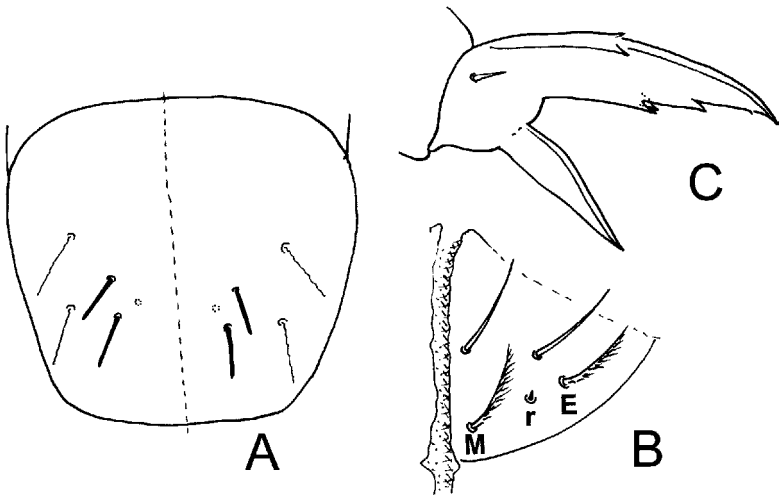


Fig. 80. *Lepidocyrtus fimetarius*: (A) Macrochaetae (black) and trichobothria on abd.4; (B) claw; (C) labium, basomedian field.

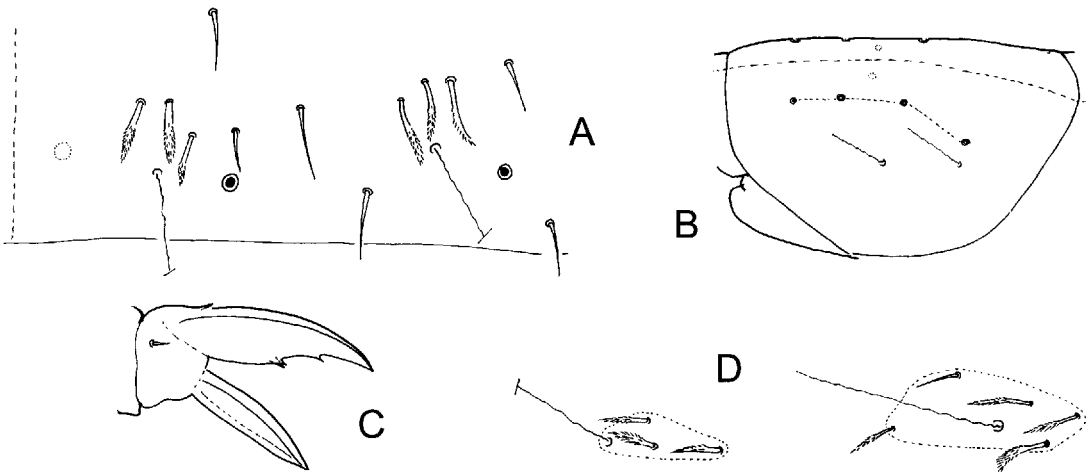


Fig. 81. *Lepidocyrtus lignorum*: (A) Chaetotaxy on right side of abd.2, macrochaetae as black dots; (B) macrochaetae (black dots) and trichobothria on abd.4, right side; (C) claw; (D) trichobothria and associated setae on abd.4, right side.

meadow vegetation. Our most common *Lepidocyrtus*, being present also in the Arctic islands. General distribution: Holarctic.

## 308. ***Lepidocyrtus lanuginosus*** (Gmelin, 1790)

Figs 79H, K, 82A–C

*Podura lanuginosa* Gmelin, 1790, Systema naturae, 13th ed.: 2911.

*Description.* – Body size up to 2.0 mm. Colour white, blue pigment absent on body. Scales absent from antennae and legs beyond coxae. Base of labium with 3 ciliate setae in median field (Fig. 79H). Head macrochaetae S and T present between the eyes (Fig. 79K). Chaetotaxy of median fields of abd.2 as Fig. 82A. Microchaetae associated with the trichobothria finely ciliated. Abd.4 with 3 + 3 macrochaetae in the median field (Fig. 82B). Distribution of lateral macrochaetae on abd.4 as in *pallidus* ($E_1$ set behind $L_2$, Fig. 79N). Chaetotaxy of the

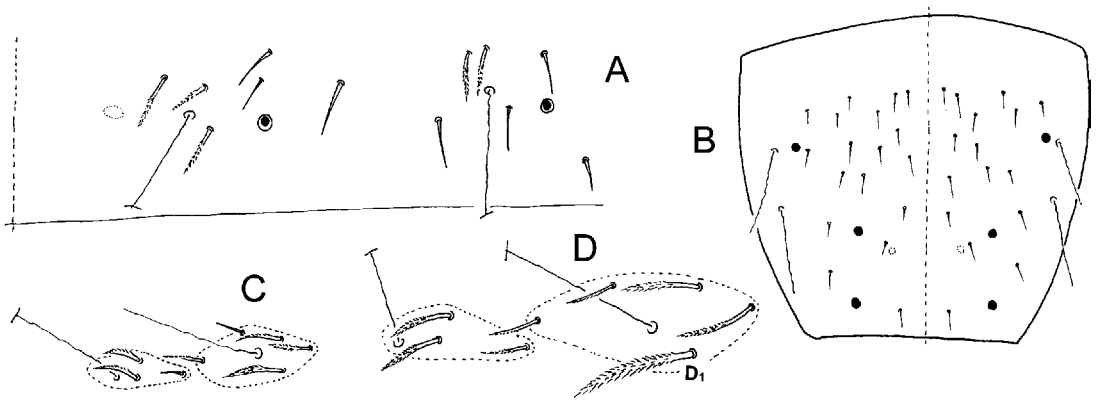


Fig. 82. *Lepidocyrtus lanuginosus* (A–C) and *L. cyaneus* (D): (A) Chaetotaxy on right side of abd.2, macrochaetae as black dots; (B) macrochaetae (black dots), trichobothria and microsetae on abd.4; (C–D) trichobothria and associated setae on abd.4, right side.

trichobothrial fields as Fig. 82C, anterior and posterior groups set close to each other. Unguiculus lanceolate.

*Discussion.* – Easily separated from *lignorum* by the key characters. The head macrochaetae (S, T) are often rubbed off, but their round large sockets are clearly distinguished.

*Distribution and ecology.* – As most older records of '*lanuginosus*' probably were misidentified *lignorum*, the distribution is not well know. But apparently the species is less common with a southern distribution. Most records from rich organic soils in lush hardwood forests, but also from dry sites in open land.

## 309. ***Lepidocyrtus violaceus*** (Geoffroy, 1762)

Fig. 79L

*Podura violaceus* Geoffroy, 1762, Histoire abrégée des insectes 2: 611.

*Description.* – Body size up to 1.5 mm. Colour blue of variable intensity. Head paler, at least ventrally. Legs beyond coxae pale, like basal part of antennae and distal part of dens. Scales present on the two first segments of antennae and on legs beyond coxae. Basomedian field of labium with 4 ciliate setae. Head without macrochaetae S and T (Fig. 79L). Chaetotaxy in median fields of abd.2 as in *lanuginosus* (Fig. 82A), microchaetae around the trichobothria almost smooth. Abd.4 with 3 + 3 macrochaetae in the median field (as *lanuginosus*, Fig. 82B). Trichobothrial field and lateral macrochaetae on abd.4 as in *lignorum* ($E_1$ behind $L_2$), but trichobothrial microsetae less ciliated. Unguiculus lanceolate, ventral edge finely serrated.

*Discussion.* – Easy to identify by the key characters. If scales are rubbed off from legs and antenna, the absence of macrochaetae S and T on head and the different labial chaetotaxy will separate the species from *cyaneus*.

*Distribution and ecology.* – Common in forests, in moss, litter and rotten wood. Sometimes in beach deposits and meadow vegetation. Ascends into the mountains, but not in the Arctic. Old records may be misidentified *cyaneus*. General distribution: Holarctic.

## 310. ***Lepidocyrtus cyaneus*** Tullberg, 1871

Fig. 82D

*Lepidocyrtus cyaneus* Tullberg, 1871, Öfvers. K. VetenskAkad. Förh. 28: 150.

*Description.* – Body size up to 1.5 mm. Colour dark violet blue, with paler parts as in *violaceus*. Scales absent from antennae and legs beyond coxae. Basomedian field of labium with 3 ciliate setae. Macrochaetae S and T present

on head (as in *lanuginosus*, Fig. 79K). Microchaetae around trichobothria strongly ciliated and slightly expanded towards apex. Abd.4 with 3 + 3 macrochaetae in the median field. Setae of the trichobothrial field set close together, seta $D_1$ much stronger than others (Fig. 82D). Distribution of lateral macrochaetae as in *lignorum* ($E_1$ behind $L_2$). Claws normal, unguiculus lanceolate.

*Discussion.* – The key characters will identify the species.

*Distribution and ecology.* – Less common than *violaceus*, but often recorded in humid habitats along lakes and in bogs (*Sphagnum*, *Salix*). Also in compost and in forest habitats. Old records may be mixed with *violaceus* and are not reliable, like the many records from Finland (Linnaniemi, 1912) which must be revised. General distribution: Holarctic.

## 311. ***Lepidocyrtus curvicollis*** Bourlet, 1839

Figs 79B, 83A–C

*Lepidocyrtus curvicollis* Bourlet, 1839, Mém. Soc. Sci. Agric. Lille 1839 (1): 392.

*Description.* – Body size up to 3.0 mm. Violet blue or reddish pigment present at base of the two first pair of legs, in ventral and lateral sides of the head, on frontal side of mesonotum and in distal parts of the antennae. Body shape as Fig. 79B, mesonotum hood-like projecting, blunt at tip. Antennae and legs with scales. The 4 prelabral setae all smooth. Basomedian field of labium with 6 setae, of which only the two short ones are ciliated (Fig. 83C). Head without macrochaetae between eyes. Chaetotaxy in median fields of abd.2 as Fig. 83A. Microsetae surrounding the trichobothria distinctly ciliate, slightly expanded. Abd.4 with 4 + 4 macrochaetae. Trichobothrial field with anterior and posterior groups set at a distance (as in *lignorum*, Fig. 81D). Lateral macrochaeta $E_1$ set behind $L_2$. Claws with very strong basal teeth (Fig. 83B). Inner edge with a paired tooth in the middle and a single tooth in distal position. Unguiculus lanceolate, ventral edge finely serrated.

*Discussion.* – Easily identified by colour, body shape and the unique characters of labial base.

*Distribution and ecology.* – Few Nordic records. In Bergen observed on moist house walls grazing *Pleurococcus*. General distribution: Holarctic.

## 312. ***Lepidocyrtus paradoxus*** Uzel, 1890

Figs 79C, 83D

*Lepidocyrtus paradoxus* Uzel, 1890, Rozpr. math.-přir. K. ceské. Spol. Náuk 2: 50.

*Description.* – Body size up to 3.0 mm. Colour dark blue. Legs beyond coxae, dens, two basal antennal segments and dorsal side of head paler. Body shape as Fig. 79C. Growth of mesonotum is allometric, conically pointed in large specimens. Small individuals are more similar to *curvicollis* (Fig. 79B). Legs and antennae with scales. Basomedian field of labium with 4 ciliate setae in the M-R-E row. Basolateral field with 2 ciliate and 3 smooth setae. The 4 prelabral setae ciliated. Head without macrochaetae between the eyes. Claws as in *curvicollis*.

*Discussion.* – The dark blue colour and the unusual body shape easily identify the species. Pale specimens may be confused with *curvicollis*, but *paradoxus* has ciliate prelabral setae and more ciliate setae at base of labium (compare Fig. 83C, D).

*Distribution and ecology.* – The species was recorded by Linnaniemi (1911) from Gudbrandsdalen in Norway (one specimen under a piece of wood), but this has not been verified by further records. Probably it was one of the other two blue species. Found once in Finland, in an open liquor bottle in a Helsinki cellar (Linnaniemi, 1912). The natural European distribution goes north to S. England and Poland and the outdoor occurrence in the Nordic countries has yet to be demonstrated. General distribution: Holarctic.

## 313. ***Lepidocyrtus pallidus*** Reuter, 1890

Figs 79I, M, N, 83E–G

*Lepidocyrtus pallidus* Reuter, 1890, Meddn Soc. Fauna Flora fenn. 17: 24.

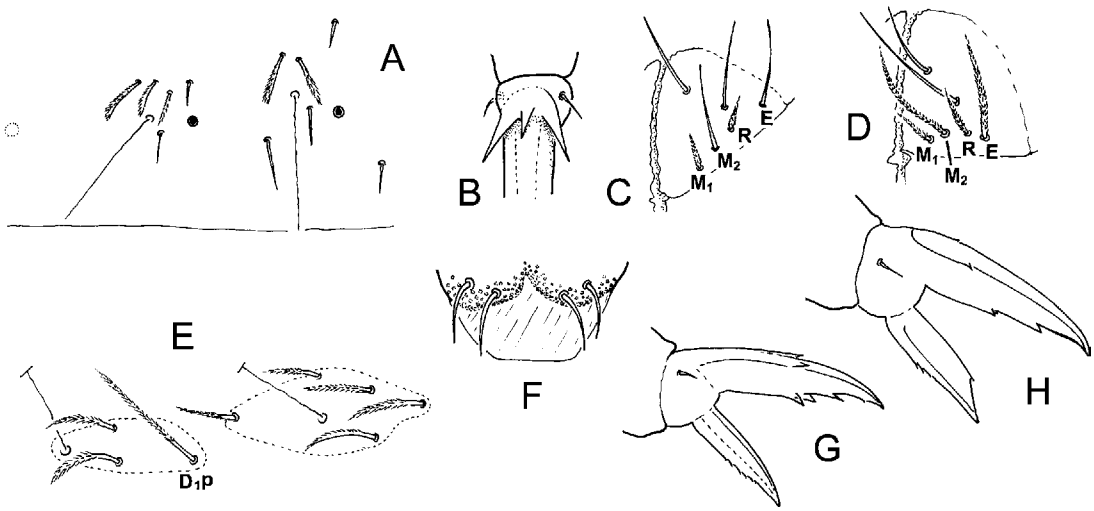


Fig. 83. *Lepidocyrtus* spp.: (A–C) *curvicollis*, (A) chaetotaxy on right side of abd.2, macrochaetae as black dots, (B) strong teeth at base of last claw, (C) labium, basomedian field; (D) *paradoxus*, basomedian field of labium; (E–G) *pallidus*, (E) trichobothria and associated setae on abd.4, right side, (F) apical edge of labrum, (G) claw; (H) sp "*ruber*", claw.

*Description.* – Largest specimens 1.2 mm. Colour diffuse bluish grey, with tendency to "banding" as mesothorax, abd.2–3 and posterior part of abd.4 are darker than other segments. Scales absent from antennae and legs beyond coxae. Basomedian field of labium as Fig. 79I, with $M_1$, $M_2$ and E long and ciliated, r like a minute spine. Anterior edge of labrum smooth, without papillae (Fig. 83F). Head with macrochaeta T present, S absent (Fig. 79M). Setae surrounding trichobothria on abd.2–3 slender, distinctly ciliate. Abd.4 with $3 + 3$ macrochaetae in median field, seta $D_1p$ longer than surrounding setae (Fig. 83E). Lateral macrochaeta $E_1$ set behind $L_2$ (Fig. 79N). Claws with distinct teeth, unguiculus lanceolated, ventral edge serrated (Fig. 83G).

*Discussion.* – The species is recognised by pale bluish grey colour, slender (not fan-shaped) ciliate microchaetae around the trichobothria, absence of macrochaetae S on head and presence of macrochaetae $E_1$ on abd.4.

*Distribution and ecology.* – Originally described from Finland, collected in a greenhouse in Helsinki (Reuter, 1890). Linaniemi (1912: 228) also reported a Finnish record from under bark on a rotten pine log. Lie-Pettersen (1896) found numerous specimens in soil in a greenhouse near Bergen. Recent records of this species come from compost and indoor flowerpots in Norway. Some of these were reported as *L. ruber* by Fjellberg (1980) which was a misidentification. General distribution: Cosmopolitan.

## 314. *Lepidocyrtus weidneri* Hüther, 1971

Fig. 79O

*Lepidocyrtus weidneri* Hüther, 1971, Ent. Mitt. zool. Mus. Hamburg 72: 159.

*Description.* – Very similar to *pallidus*, but on abd.4 the macrochaeta $E_1$ is transformed to a short seta ($e_1$) and moved forward, in front on $L_2$ (Fig. 79O).

*Distribution and ecology.* – Two specimens collected from an indoor flower pot at Årø near Molde (MRy) in 1975 are probably *weidneri*. The specimens were earlier misidentified as *ruber* by Fjellberg (1980). General distribution: Palaearctic.

## Unidentified taxa

*Lepidocyrtus ruber* Schött, 1902. Described from Sweden ('...dans un serre de Rosendal...'). Apart from colour (brownish

red), body shape (mesonotum not strongly projecting), and unguiculus (obliquely cut at the end), the author gives few significant characters. The identity of the species remains obscure. Fjellberg (1980) reported the species from compost and flower pots in Norway which proved to be misidentified *pallidus* and *weidneri*. Samples from wetlands and lake shores in southern Sweden and Norway have specimens with unguiculus as described for *ruber* (Fig. 83H), labium and chaetotaxy characters (head, abd.2–4) like *lignorum*, antennae and legs with scales. Blue pigment is absent, apart from distal segments of antennae. Head and body with a diffuse reddish brown pigmentation. Hopkin (www.stevehopkin.co.uk) has several British records of a similar form from wet sites, but says there are no scales on legs and antennae, and blue pigments is present on head, thorax and legs. This form complex obviously waits for taxonomic treatment.

*Lepidocyrtus* sp. From two compost heaps in S. Norway (VE) I have a blue *Lepidocyrtus* which is similar to *cyaneus* by absence of scales on antennae and legs, differing by absence of macrochaeta S on head and by having the trichobothrial microchaetae on abd.2–4 more strongly expanded, wing-shaped. So far the species has not been successfully identified.

## Genus *Pseudosinella* Schäffer, 1897

*Pseudosinella* Schäffer, 1897, Hamburger magalhaensische Sammelreise, Apterygoten: 38. Type species: *Tullbergia immaculata* Lie Pettersen, 1897, by subsequent designation by Gisin, 1960.

Species of *Pseudosinella* are essentially like *Lepidocyrtus* with reduced number of eyes (in Nordic species 4 + 4 or less). Body pigment is absent or poorly developed. Details of claws and the chaetotaxy of abd.2–4 provide good diagnostic characters.

### Key to species

1 Ocelli present (2–4 on each side), eye-spots dark . . . . . 2
– Ocelli absent, no dark eye-spots . . . . . 4
2 Ocelli 2 or 4, set on a single eye-spot (Fig. 84A). Abd.2 with macrochaeta A developed (Figs 84B, 85A) . . . . . 3
– Ocelli 3 + 3, set in two spots with 2 and 1 ocellus respectively (Fig. 86A). Abd.2 with macrochaeta A not developed (small only, Fig. 86B) . . . . . 317. *sexoculata* Schött
3 Ocelli 2 + 2, on a small eye-spot. Abd.2 chaetotaxy as pABqq (Fig. 84B). Head with macrochaeta S reduced (Fig. 84A) . . . . . 315. *alba* (Packard)
– Ocelli 4 + 4 on a large eye-spot. Abd.2 chaetotaxy as pABQq (Fig. 85A). Head with macrochaeta S developed . . . . . 316. *octopunctata* Börner
4 Unguiculus with a strong tooth on ventral edge (Fig. 87D) . . . . . 5
– Unguiculus without ventral tooth (Fig. 88D, E) . . . . . 6
5 Unguis without unpaired distal tooth (Fig. 87D). Tibiotarsal tenent hair pointed. Antennae about twice as long as head diagonal . . . . . 318. *halophila* Bagnall
– Inner edge of unguis with an unpaired distal tooth. Tenent hair clavate. Antennae less than two times head diagonal . . . . . 321. *petterseni* Börner
6 Unpaired distal tooth of unguis set between the paired teeth. Tenent hair short, pointed (Fig. 88D) . . . . . 319. *immaculata* (Lie-Pettersen)
– Unpaired distal tooth set beyond the paired teeth. Tenent hair long, clavate (Fig. 88E) . . . . . 320. *decipiens* Denis

### 315. *Pseudosinella alba* (Packard, 1873)

Fig. 84A–E

*Lepidocyrtus albus* Packard, 1873, Rep. Peabody Acad. Sci. 5: 37.

*Description.* – Body size up to 1.1 mm. Colour white, apart from the small dark eye-spot. Ocelli 2 + 2. Basomedian field of labium as in *Lepidocyrtus pallidus* (Fig. 79I), $M_{1-2}$ and E cili-

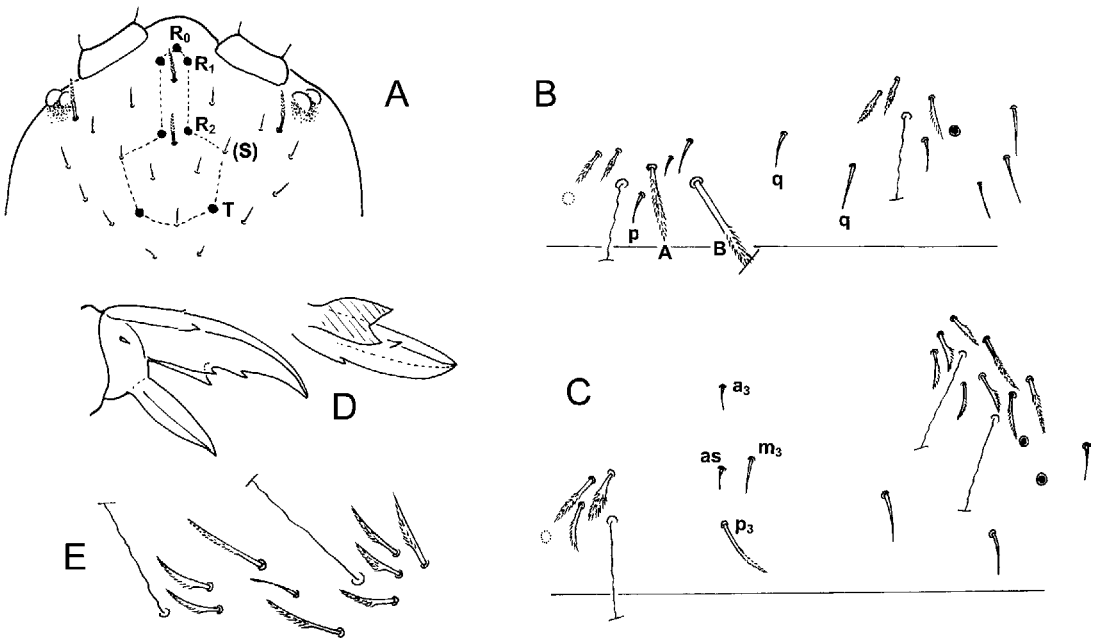


Fig. 84. *Pseudosinella alba*: (A) Chaetotaxy in central field of head; (B) chaetotaxy on right side of abd.2; (C) ditto, abd.3; (D) claw, ventral edge of unguis above; (E) trichobothrial field on abd.4, right side.

ate, r reduced, spine-like. The 4 prelabral setae ciliate. Macrochaeta T present on head, S not developed (present as microchaeta, Fig. 84A). Chaetotaxy of abd.2–4 as Fig. 84B, C, E. Abd.2 formula as pABqq. Abd.4 with 3 + 3 macrochaetae in the median field, lateral macrochaeta $E_1$ absent. Claws as Fig. 84D. Unguiculus with the paired inner teeth unequal, posterior tooth larger than anterior. Lateral teeth small, in basal 1/3. Ventral edge of unguiculus untoothed.

*Discussion.* – The presence of 2 + 2 ocelli is unique among our Nordic *Pseudosinella*, which makes the species easy to identify.

*Distribution and ecology.* – Our most common *Pseudosinella*, widely distributed to north of the arctic circle in Norway. Found in many different habitats, both in moss and forest litter, meadows and seashores. General distribution: Cosmopolitan.

## 316. ***Pseudosinella octopunctata*** Börner, 1901

Fig. 85A–D

*Pseudosinella octopunctata* Börner, 1901, Zool. Anz. 24: 705.

*Description.* – Body size up to 1.1 mm. Colour white, with diffuse bluish grey pigment on antennae and dorsal and ventral side of head. Body with scattered brownish red pigment. Ocelli 4 + 4, set on a square eye-spot. Labium with one ciliate M-seta, r vestigial (Fig. 85B). Maxillary outer lobe with 3 sublobal hairs and a small spine. Head with both macrochaeta S and T present (as in *Lepidocyrtus lanuginosus*, Fig. 79K). Chaetotaxy of abd.2 as Fig. 85A. Abd.2 formula as pABQq. Trichobothrial microsetae all slim and smooth, also on abd.3 (otherwise abd.3 like *alba*). Abd.4 with 3 + 3 macrochaetae in the median field. Setae of the trichobothrial fields smooth, except one (Fig. 85D). Claws narrow, with small paired inner teeth, posterior slightly larger and more distal than anterior. Lateral teeth small, set beyond middle of unguis. Unguiculus narrow lanceolate, without distinct teeth (Fig. 85C).

*Discussion.* – Normally identified by the 4 + 4 ocelli which are set on large eye-spots and the presence of some dark pigment on head and

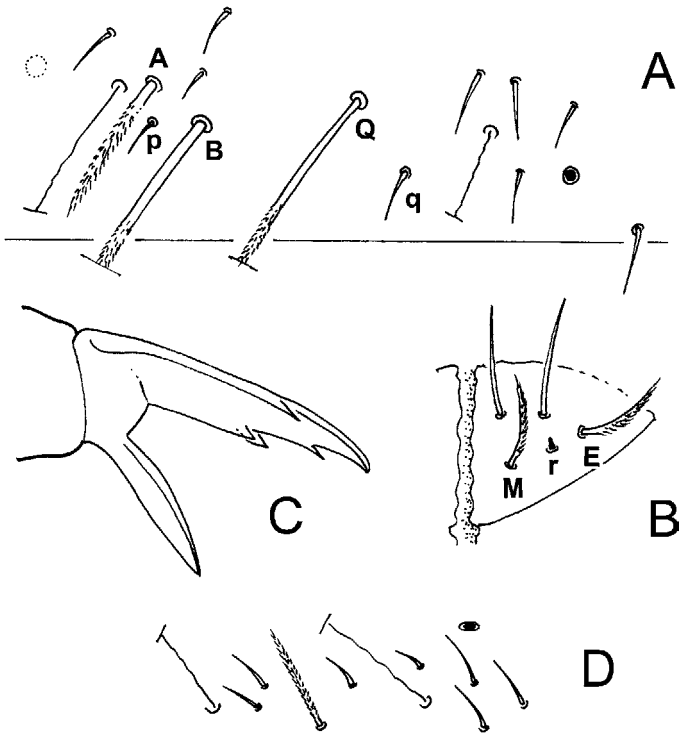


Fig. 85. *Pseudosinella octopunctata*: (A) Chaetotaxy on right side of abd.2; (B) basomedian field of labium; (C) claw; (D) trichobothrial field on abd.4, right side.

body. Specimens with indistinct eyes may be confused with *alba*, but that species differs by broader, heavily ciliate trichobothrial microsetae. A sharp difference is the presence of the macrochaeta Q on abd.2 in *octopunctata*, while the corresponding seta in *alba* is a microchaeta. Also the details of labium, head dorsal chaetotaxy and claw structures differ between the species.

*Distribution and ecology.* – Few records in southern districts only. Agrell (1939) reported the species from Swedish Lapland (Lu, To), which needs verification. A characteristic species in dry, warm habitats like patchy vegetation in scree and gravel/sand slopes. General distribution: Cosmopolitan.

## 317. *Pseudosinella sexoculata* Schött, 1902

Fig. 86A–F

*Pseudosinella sexoculata* Schött, 1902, Bih. K. svenska VetenskAkad. Handl. 28: 34.

*Description.* – Size up to 1.3 mm. Colour white. Ocelli 3 + 3, on two separate eye-spots (Fig. 86A). Labium with $M_1$ strongly ciliate while $M_2$, E and $L_{1-2}$ are almost smooth. Seta r vestigial (Fig. 86C). Prelabral setae almost smooth. Head with macrochaeta S absent, T present. Chaetotaxy of abd.2–4 as Fig. 86B, E, F. Abd.2 formula as paBQq. Abd.3 with $m_3$ developed as a small marochaeta while corresponding seta in *alba*/*octopunctata* is a smooth microchaeta (Fig. 84C). Trichobothrial microsetae distinctly ciliate, some of them clearly expanded distally. Abd.4 with 3 + 3 macrochaetae in the median field. Claws with moderately strong inner teeth, lateral teeth set at middle. Unguiculus with minute ventral serrations (Fig. 86D).

*Discussion.* – Normally easy to identify by the 3 + 3 ocelli. Other distinctive characters are

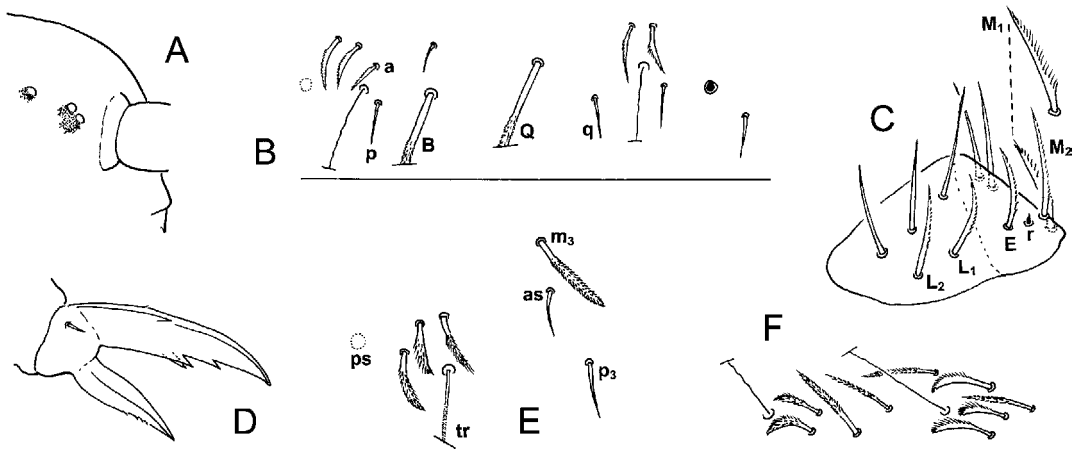


Fig. 86. *Pseudosinella sexoculata*: (A) Head with eye-spots; (B) chaetotaxy on right side of abd.2; (C) chaetotaxy of basal fields of labium, right side; (D) claw; (E) abd.3 right side, microsetae around median trichobothrium (tr: trichobothrium, ps: pseudopore); (F) trichobothrial field on abd.4, left side.

labial chaetotaxy, enlarged $m_3$ on abd.3 and short a-seta on abd.2.

*Distribution and ecology.* – Only a few records from southern districts in compost and other organic deposits. General distribution: Cosmopolitan.

## 318. ***Pseudosinella halophila*** Bagnall, 1939

Fig. 87A–F

*Pseudosinella halophila* Bagnall, 1939, Entomologist's mon. Mag. 75: 200.

*Description.* – Size up to 1.5 mm. Colour white, eyes absent. Antennae long, about twice as long as head diagonal (profile). Labial complex with all seta smooth, seta r vestigial (Fig. 87B). All ventral setae on head and prelabral setae smooth. Dorsal macrochaetae of head strongly reduced ($R_0$ present, $R_1$, $R_2$, S and T absent, Fig. 87A). Chaetotaxy of abd.2–4 as Fig. 87C, E, F. Abd.2 formula as pABQq. On abd.3 the macro $P_6$ moved to posterior end of the tergite. Abd.4 with $2 + 2$ macrochaetae in the median field, the macrochaetae on the inner side of anterior trichobothrium reduced in size (Fig. 87E). Tibiotarsal tenent hair ($A_1$) thin, pointed. Claws with very unequal inner pair of teeth, posterior tooth very large. Lateral teeth set near base. No distal tooth on inner edge. Unguiculus with a large tooth on the ventral edge (Fig. 87D).

*Discussion.* – Absence of eyes and the very characteristic claws readily identify the species.

*Distribution and ecology.* – A marine littoral species, also found in salt marshes at some distance from the sea. Under stones and in debris. Only a few records from the east coast of Norway (VE) and southern Sweden (SK). General distribution: Palaearctic.

## 319. ***Pseudosinella immaculata*** (Lie-Pettersen, 1896)

Fig. 88A–D, F

*Tullbergia immaculata* Lie-Pettersen, 1896, Bergens Mus. Aarb. 8: 16.
*Pseudosinella martelii* (Carpenter, 1897).

*Description.* – Size up to 1.9 mm. White, eyes absent. Labial formula $M_1M_2rEL_1L_2$. Seta $M_1$ ciliate, others smooth. Seta r vestigial. Some of the postlabial setae on ventral side of head – which normally are ciliate – are also smooth (encircled on Fig. 88B). Head with a complete set of dorsal macrochaetae (Fig. 88A). Chaetotaxy of abd.2 as in *alba* (pABqq, Fig. 84B), macrochaeta A much shorter than B (Fig. 88F). Abd.4 with an extra microseta in the anterior trichobothrial group (Fig. 88C). Trichobothrial

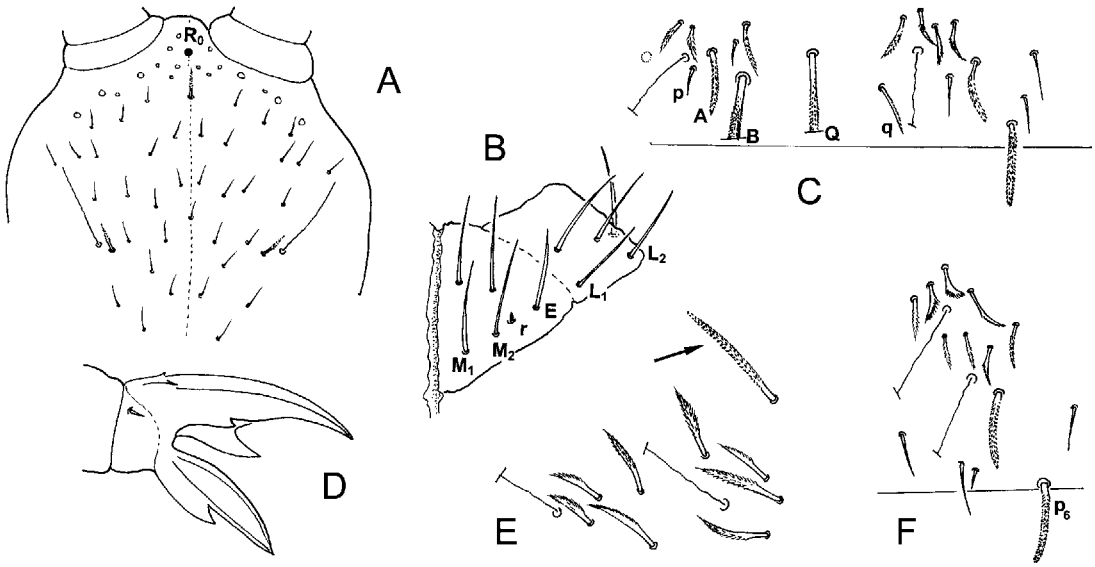


Fig. 87. *Pseudosinella halophila*: (A) Setae on dorsal side of head; (B) chaetotaxy of basal fields of labium, left side; (C) chaetotaxy on right side of abd.2; (D) claw; (E) trichobothrial field on abd.4, right side, with small macrochaeta (arrow); (F) abd.3, setae around lateral trichobothria, right side. Note posterior position of $p_6$.

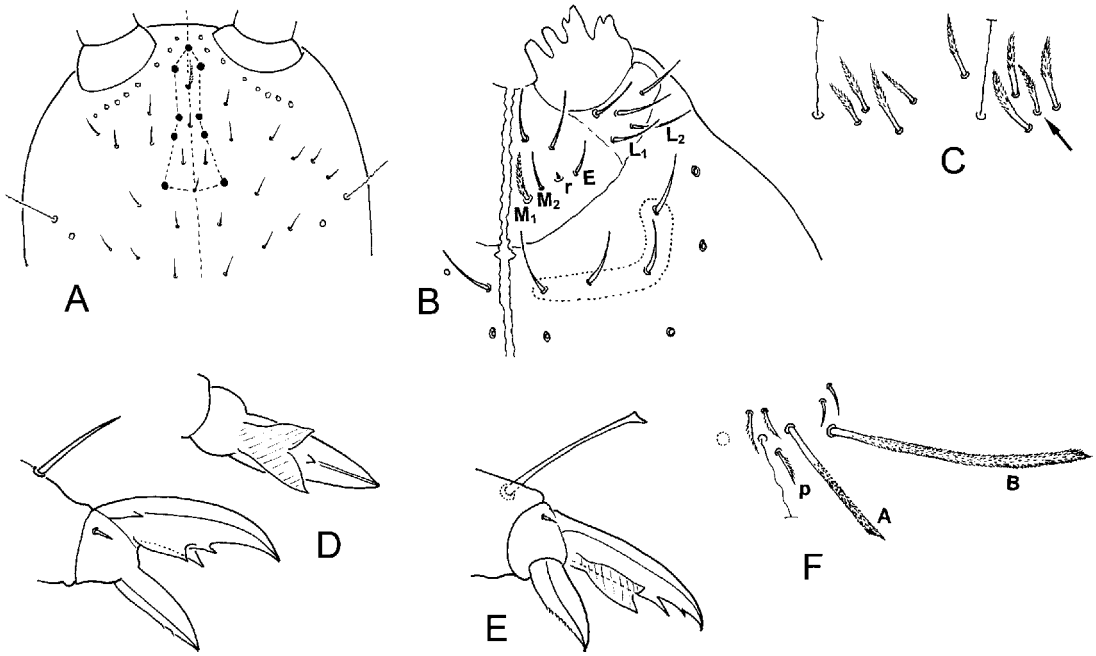


Fig. 88. *Pseudosinella immaculata* (A–D, F) and *P. decipiens* (E): (A) Setae on dorsal side of head; (B) labium and smooth postlabial setae (encircled); (C) trichobothrial field on abd.4, right side, arrow marks additional seta; (D) claw, ventral edge of unguis above; (E) claw (ventrolateral) with clavate apical seta on tibiotarsus; (F) abd.2 right side, setae around median trichobothrium.

microsetae slender, only moderately expanded apically. Claws as Fig. 88D. Inner pair of teeth large, unequal. One distal tooth set in the middle of the inner edge, between the paired teeth. Lateral teeth set near base. Unguiculus at most with 2–3 delicate serrations on ventral edge. Dorsal tenent hair ($A_1$) of tibiotarsus thin and pointed, shorter than unguiculus.

*Discussion.* – The claw resembles that of *decipiens*, but that species has two distal teeth on the inner edge, the inner one set clearly beyond tips of the paired teeth. Also *decipiens* has a much longer tenent hair which is distinctly clavate (Fig. 88E).

*Distribution and ecology.* – Few records in southern Sweden and Norway. In rich broad-leaved forest soil. General distribution: Palaearctic.

## 320. *Pseudosinella decipiens* Denis, 1924

Fig. 88E

*Pseudosinella decipiens* Denis, 1924, Bull. Soc. zool. Fr. 49: 198.

*Description.* – Size up to 1.5 mm. White, no eyes. Labial formula $M_1M_2rEL_1L_2$. Seta $M_2$ may be absent. Seta r vestigial, other labial setae serrate/ciliate. No smooth postlabial setae, all ciliate/serrate. Labral formula 4/554, all setae smooth. Labrum with two small spinules in the middle of the anterior edge. Head with complete macrochaetotaxy (as *immaculata*, Fig. 88A). Chaetotaxy of abd.2 as in *immaculata*, but seta p is smooth (compare Fig. 88F). Claws as Fig. 88E, inner edge with two unpaired distal teeth. The inner one set beyond the middle of the inner edge, clearly outside the paired teeth. Dorsal tenent hair ($A_1$) of tibiotarsus strong, bent and clavated at tip, longer than unguiculus.

*Discussion.* – The claw structures readily separate this species from *immaculata.*

*Distribution and ecology.* – A few records from southern Sweden in forest soil. General distribution: Palaearctic.

## 321. *Pseudosinella petterseni* Börner, 1901

*Pseudosinella petterseni* Börner, 1901, Zool. Anz. 24: 707.

*Description.* – Size up to 1.0 mm. White, no eyes. Antennae about 1.5 as long as head diagonal. No specimens were available for study, but the species is easily recognised by having a strong ventral tooth on unguiculus (like *halophila* Fig. 87D) and an unpaired distal tooth set beyond the paired teeth on the inner edge of unguis. This distal tooth is absent in *halophila*. Tibiotarsal tenent hair ($A_1$) is described as weakly expanded at apex.

*Distribution and ecology.* – Only two Danish records. Deep forest soil. General distribution: Palaearctic.

## Unidentified taxa and doubtful record

*Pseudosinella martelli* var. *talpae* Agrell, 1939. Described from 12 specimens collected in nests of *Talpa europaea* in southern Sweden (SK: Bara, N.A. Kemner leg.). Agrell's figure of the claw shows a clavate tenent hair and the teeth of unguis and unguiculus resembling those of *P. petterseni* which is a likely synonym. However, no type specimens have been seen to verify this.

*Pseudosinella martelli* var. *religiosa* Agrell, 1939. Described from 3 specimens collected under stones in the crypt of the Lund cathedral, southern Sweden (B. Hanström leg.). The original figure shows a clavate tenent hair and a claw with teeth resembling *P. decipiens* which is a likely synonym.

*Pseudosinella cavernarum* (Moniez, 1893). Wahlgren (1907) reports the species from Sweden (Ög), but Agrell (1943) doubts that the identification is correct.

# Genus *Willowsia* Shoebotham, 1917

*Willowsia* Shoebotham, 1917, Ann. Mag. nat. Hist. (8) 19: 432. Type species: *Seira nigro-*

*maculata* Lubbock, 1873, by original designation.

Members of *Willowsia* are recognised by the pointed, striate scales on the body (Fig. 74D). Scales are absent from manubrium while they are present in the other scaled genera.

## Key to species

1 Body uniformly violet brown, antennae less than twice as long as head diagonal (profile) . . . . . 322. *buskii* (Lubbock)
– Body with bluish patterns forming spots and bands. Antennae longer . . . . . 2
2 The dark pigment on th.3, abd.2 and abd.4 does not form entire transverse bands . . . . . 323. *nigromaculata* (Lubbock)
– Complete transverse bands present on th.2, abd.2 and abd.4 . . . . . 324. *platani* (Nicolet)

## 322. ***Willowsia buskii*** (Lubbock, 1870)

Fig. 89A, B, D, G; Pl. 9

*Seira buskii* Lubbock, 1870, Trans. Linn. Soc. Lond. 27: 280.
*Sira flava* Ågren, 1903.

*Description.* – Body size up to 1.5 mm. Ocelli 8 + 8, two smaller hardly visible. Head broad, antennae relatively short, less than two times head diagonal. Body violet brown, with lighter patches (Pl. 9). Small specimens less pigmented, with dark colour at lateral sides of tergites and as transverse bands. Base of abd.5 unpigmented. Head yellowish white apart from the dark eyespots and the area between eyes and antennal base. Antennae dark with ant.1 and base of ant.2 paler. Legs pale with some dark pigment on subcoxae, femora and in mid-sections of tibiotarsi. Furca pale. Central part of head with many macrochaetae. In the T-group an unpaired $T_0$ macrochaeta present (Fig. 89A, B). Labrum with 4/554 setae. The four prelabrals finely ciliate, others smooth. Labral edge with 4 papillae bearing a spinule. Labial formula $M_1rEL_1L_2$, all ciliate, with r about 2/3 as long as others. Other labial setae smooth. All postlabial setae on head ciliate. Maxillary outer lobe with 3 sublobal hairs and one spinule. Lamellary complex of maxilla fused, short, covered with fine denticles. Mesothorax with 9 macrochaetae in the posterior field in adults (Fig. 89D), less in juveniles. Abd.3 with only two macrochaetae inside the lateral trichobothria (compare Fig. 89F). Inner side of tibiotarsi with ciliate setae only, except a single smooth setae on inner side of tib.3 near apex. Tibiotarsi with a strong clavate tenent hair. Claws with small paired inner teeth and two single distal teeth. Lateral teeth set in the middle. Unguiculus with serrated ventral edge (Fig. 89G). Mucro with two teeth and a basal spine.

*Discussion.* – An unmistakable species due to the pointed and striate body scales, the yellowish white broad head and the violet brown body. Less pigmented specimens were named *flava* by Ågren (1903).

*Distribution and ecology.* – A characteristic animal in hot, dry places like exposed tree trunks. Sometimes also on house walls and inside buildings. Widely distributed. General distribution: Cosmopolitan.

## 323. ***Willowsia nigromaculata*** (Lubbock, 1873)

Fig. 89C, E, F

*Seira nigromaculata* Lubbock, 1873, Monograph Collembola Thysanura: 146.

*Description.* – Size up to 2.5 mm. A slender species with antennae more than 2.5 as long as head diagonal. Head with diffuse bluish pigment ventrally and laterally below eyes. Eyespots, antennal sockets and area between antennal bases dark blue. Dorsal side behind eyes unpigmented. Body whitish, with a continuous blue band along the outer edges of th.2–abd.1. Abd.2 with lateral spots which continue along its posterior edge, forming a narrow transverse band which is broken in the middle. Abd.3 with a broad transverse band, narrowed in the middle, disconnected to the lateral pigmentation. Abd.4 blue along posterior edge and the sides, also with diffuse pigmentation in the middle, forming a broken transverse band. Abd.5 blue with unpigmented base, abd.6 entirely blue or with

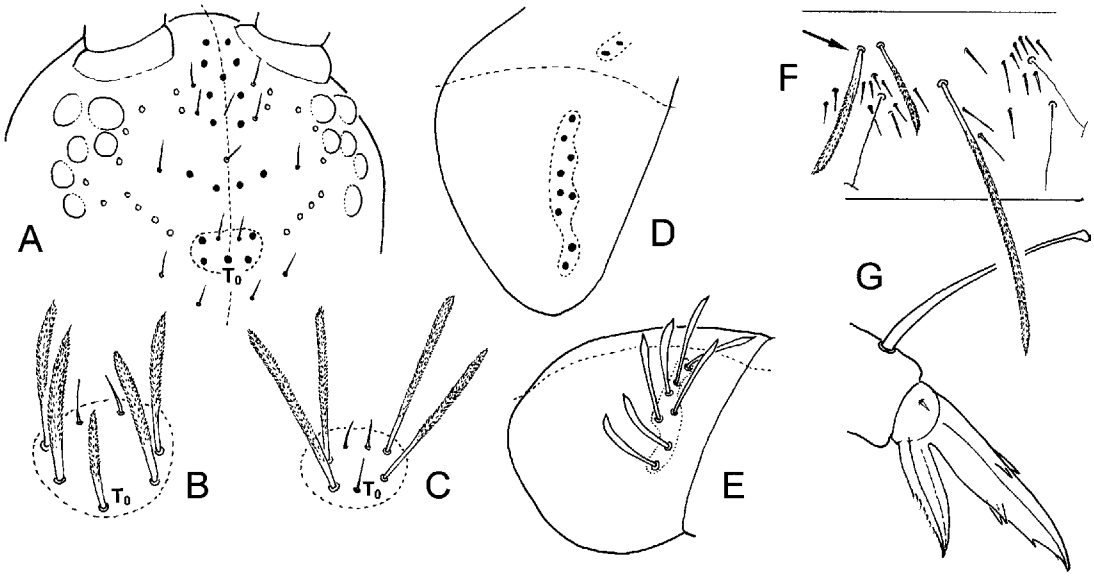


Fig. 89. *Willowsia buskii* (A, B, D, G) and *W. migromaculata* (C, E–G): (A) macrochaetae on dorsal side of head; (B) ditto, enlargement of the T-group; (C) ditto, (D) mesothorax with 9 macrochaetae in the posterior group; (E) ditto, showing 7 macrochaetae; (F) abd.3 right side, trichobothrial field showing 3 macrochaetae. Arrow points to macrochaetae which is absent in *W. buski*; (G) claw.

a small unpigmented spot at base. Legs mostly bluish, furca unpigmented. Chaetotaxy of head as in previous species, but seta $T_0$ is a microchaeta (Fig. 89C). On the tergite of mesothorax there are no more than 7 macrochaetae in the posterior group (Fig. 89E). Abd.3 with 3 macrochaetae inside the lateral trichobothria (Fig. 89F). Claws as in previous species (Fig. 89G).

*Discussion.* – A characteristic species by colour and details of chaetotaxy. Pale specimens of *buskii* differ from *nigromaculata* by shorter antennae and details of chaetotaxy. Specimens with the same basic patterns as *nigromaculata*, but with continuous transverse bands on th.2 and abd.3–4, have been assigned to the species *platani* (Nicolet, 1842). The chaetotaxy of *platani* is unknown as no specimens were available for study. If there is only one variable species, as indicated by Gisin (1960), Nicolet's name takes priority.

*Distribution and ecology.* – A typical indoor species which may sometimes bee seen running outside on the house walls, usually in warm summer evenings after sunset. Sometimes it drops into samples which are being extracted in open funnels, which may be very confusing! Also some records from warm outdoor habitats (tree trunks). Widely distributed, but less common than *buskii*. General distribution: Cosmopolitan.

## 324. ***Willowsia platani*** (Nicolet, 1842)

*Degeeria platani* Nicolet, 1842, Neue Denkschr. Allg. schweiz. Ges. ges. Naturw. 6 (3): 72.

*Description.* – Similar to previous species, but dark colour more extensive, forming transverse bands on th.3 and abd.2–4. Possibly a dark form of *nigromaculata* and a senior synonym of the same (see above).

*Distribution and ecology.* – Only indoor records in our area. General distribution: Cosmopolitan.

# Subfamily ORCHESELLINAE

## Genus *Orchesella* Templeton, 1835

*Orchesella* Templeton, 1835, Trans. ent. Soc. London 1 (2): 92. Type species: *Podura cincta* Linnaeus, 1758, by subsequent designation by Börner, 1903.

Our *Orchesella* are large colourful species which are usually recognised by their distinctive colour patterns. Generic characters are the absence of scales on body, subdivided ant.1 and subequal abd.3–4. Body with a dense ground cover of ciliate setae and long macrochaetae. Ocelli 8 + 8, G and H smaller than others. PAO absent. Antennae long, ant.1–2 each with a short basal subsegment (Fig. 90A). Labrum with 554 undifferentiated smooth setae, prelabral setae 4, smooth. Frontal edge of labrum with 4 papillae, each with an apical filament. Maxillary outer lobe with a simple palp and 4 undifferentiated sublobal hairs. Labial palps typical for the family, with 5 papillae. Papilla E with 4 guards and a short lateral process. Basomedian field of labium with increased number of setae (8–12), two of them are smooth, the rest are ciliate. Basolateral field always with 5 setae (3 smooth, 2 ciliate) (Fig. 90F). Mandibles normal, strong. Maxilla with a strong 3-toothed capitulum, lamellary complex partly fused (Fig. 90D, E). Retinaculum with 4 + 4 teeth and one seta. Claws slender, inner edge of unguis with a double tooth in the middle and two single distal teeth. Lateral teeth set in basal 1/3. Unguiculus with a single ventral tooth. Last leg with one ventral subapical smooth setae, other setae ciliated. Apical tenent hair spatulated (Fig. 90I). Furca long and slender, manubrial thickening with some teeth (Fig. 90H). Mucro with two teeth and a spine. Reproductive males have on dorsal side of manubrium a small group of what looks like deeply embedded spine-like setae sitting in a circular field (Fig. 90G). Characteristic colour patterns will usually identify adult specimens, while juveniles may only show weak indications of the patterns. At least in one species males and females are differently coloured. Chaetotaxy of the tergites is not studied in the Nordic species, but may provide diagnostic characters.

### Key to species

1 Dorsal disc of abd.3 entirely dark (Pl. 10: 1, 4) . . . . . 2
– Abd.3 at most with dorsolateral dark spots as part of longitudinal bands of the body (Pl. 10: 2) or dark pattern broken into spots (Pl. 3: 3) . . . . . 3
2 Abd.2–3 with large square spots (Pl. 10: 4) . . . . . 326. *bifasciata* Bourlet
– Only abd.3 dark, abd.2 pale (Pl. 10: 1) . . . . . 325. *cincta* (Linnaeus)
3 Colour pattern as Pl. 10: 5. Fully coloured males with a dark transverse band on abd.2. Antennae in both sexes pale beyond basal subsegment of ant.1. Macrochaetae on outer side of tib.3 short (Fig. 90C) . . . . . 328. *spectabilis* Tullberg
– Colour pattern as Pl. 10: 2. Body with dorsolateral continuous longitudinal bands running from th.2 to abd.2 or longer. Abd.2 never with a dark transverse band. Antennae darkened until tip of ant.2. Tib.3 macrochaetae long (Fig. 90B) . . . . . 327. *flavescens* (Bourlet)
– Colour pattern as Pl. 10: 3, with irregular patches. Dorsolateral band on thorax broken into oblique patches. Abd.3 with a characteristic arched patch, opening forward. Basal subsegment of ant.1 pale . . . . . 329. *villosa* (Geoffroy)

### 325. *Orchesella cincta* (Linnaeus, 1758)

Fig. 90A, D–F, H, I; Pl. 10: 1, 6

*Podura cincta* Linnaeus, 1758, Systemae naturae, 10th ed.: 609.

*Description.* – Body size up to 3.0 mm. Colour pattern as Pl. 10: 1. Characteristic is the dark dorsal disc of abd.3 and the contrasting white part of abd.2. In younger specimens the dark pattern is less developed, while very large individuals become almost black, leaving only ant.3–4,

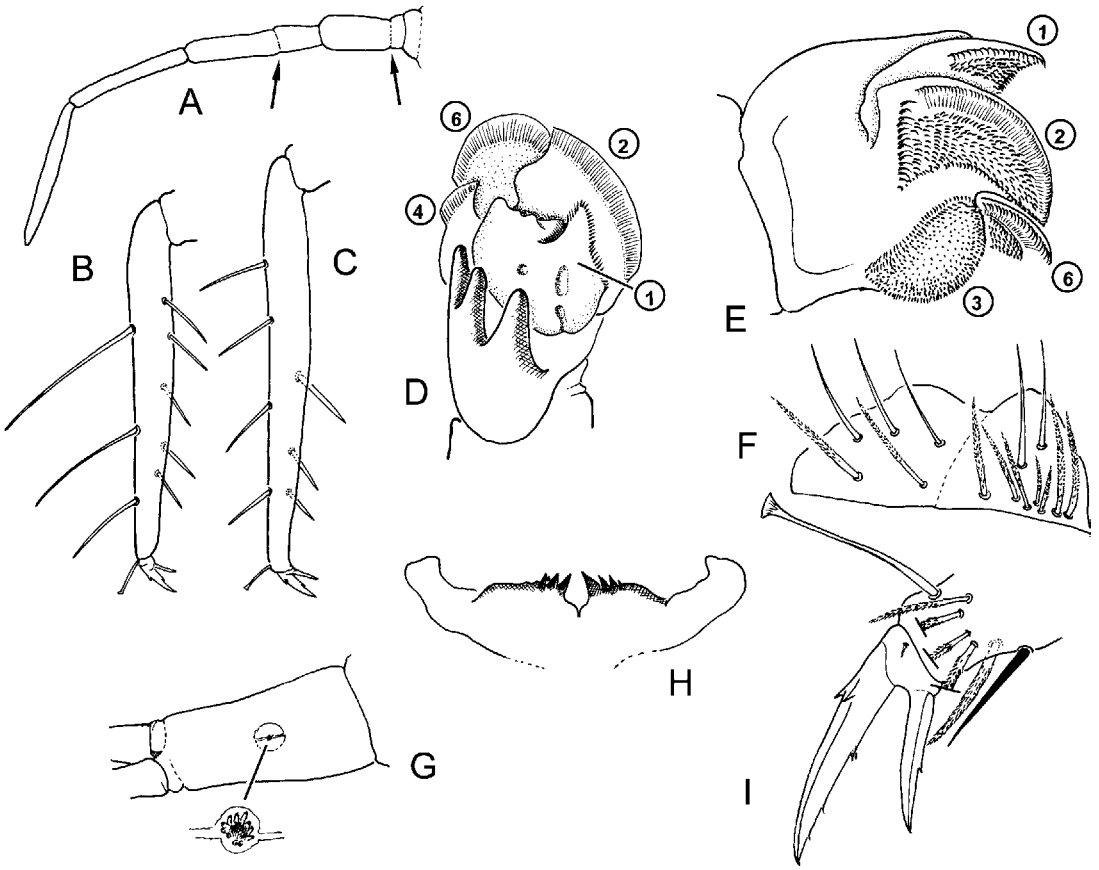


Fig. 90. *Orchesella* spp.: (A) *cincta*, antenna with subsegmentation of ant.1–2 indicated (arrow); (B–C) macrochaetae (only the longest ones) on tib.3 in *flavescens* (B) and *spectabilis* (C); (D, E) *cincta*, maxilla, different views; (F) *cincta*, basal fields of right labium; (G) *bifasciata*, dorsal organ on manubrium in reproductive male; (H–I) *cincta*, manubrial spines (H) and tip of tibiotarsus with claw (I).

distal part of ant.1, distal parts of legs and furca and posterior part of abd.2 unpigmented. Ventroapical manubrial thickening with 3–4 large teeth (Fig. 90H).

*Discussion.* – The colour pattern will normally identify this species, in particular the dark abd.3 contrasting the pale median part of abd.2. The almost "glowing" white distal part of ant.1 is typical in large dark specimens (Pl. 10: 6).

*Distribution and ecology.* – Common in southern districts in dry forest habitats. Usually found in litter around foot of trees, in moss on tree trunks and rocks, sometimes in meadows. Lie-Pettersen (1907) reports the species from Vega (NSy) and Alta (Fv) in Norway. These northern records need verification. General distribution: Holarctic.

## 326. *Orchesella bifasciata* Bourlet, 1839

Fig. 90G; Pl. 10: 4

*Orcesella bifasciata* Bourlet, 1839, Mém. Soc. Sci. Agric. Lille 1839 (1): 401.

*Description.* – Body size up to 2.5 mm. Colour pattern as Pl. 10: 4. Characteristic are the broad transverse bands on abd.2–3 and absence of longitudinal lines in anterior part of the body (apart from dark sides of th.2–3). Usually also posterior edge of abd.4 and most of abd.5 are

dark, with a sharp unpigmented band separating the segments. Distal parts of feet and antennae bluish. Mid-ventral side of the body diffusely blue. Ventroapical thickening of manubrium with 3–4 small teeth. Macrochaetae at base of outer side of tib.3 much longer than on inner side.

*Discussion.* – The two transverse bands on abd.2–3 and otherwise rather pale body will normally identify this species.

*Distribution and ecology.* – Common in southern districts in moss on rocks and tree trunks and in forest litter. Often in rather humid conditions. The northern records from Vega (NSy) and Tromsdal (TRy) by Lie-Pettersen (1907) need verification. General distribution: Holarctic.

## 327. ***Orchesella flavescens*** (Bourlet, 1839)

Fig. 90B; Pl. 10: 2, 7

*Heterotoma flavescens* Bourlet, 1839, Mém. Soc. Sci. Agric. Lille 1839 (1): 395.

*Description.* – Body size up to 4.0 mm. Colour pattern as Pl. 10: 2. Small individuals mainly with 4 longitudinal lines. Larger specimens with more extensive dark patterns. In the darkest ones the head is completely black and abd.4–6 more or less dark. Often there are also patches of dark pigment in the median part of the tergites of th.2–abd.3, leaving a very narrow unpigmented midline. In freshly collected specimens the paler parts of the body has an intense reddish brown ground colour, extending to the two basal antennal segments. In dark specimens the black colour of the head extends to basal part of the second subsegment of ant.1 (Pl. 10: 7). Last two antennal segments pale, ant.1–2 dark. Inner side of femur and trochanter with a characteristic dark line. Legs with some very long macrochaetae. Outer side of tib.3 with longest macrochaeta almost half as long as tibiotarsus, much longer than setae on the inner side (Fig. 90B). Ventroapical thickening of manubrium with many (7–8) small teeth. Males are generally darker than females.

*Discussion.* – Large size, presence of longitudinal bands and absence of large transverse spot abd.2–3 will identify this species. For separation from *spectabilis*, see below.

*Distribution and ecology.* – Widely distributed in forested areas, often in moss and litter in damp habitats. General distribution: Holarctic.

## 328. ***Orchesella spectabilis*** Tullberg, 1871

Fig. 90C; Pl. 10: 5

*Orchesella spectabilis* Tullberg, 1871, Öfvers. K. VetenskAkad. Förh. 28: 147.

*Description.* – Body size up to 4.0 mm. Fully coloured specimens (males) as Pl. 10: 5. Males with bluish black head including basal subsegment of ant.1. Beyond that the antennae are unpigmented. Th.2 and abd.2 with broad transverse dark bands, abd.4 entirely dark. Abd.5 with square lateral spots. Inner side of last femur with a dark line. In females the dark pigment is restricted to dorsolateral lines running from th.2.–abd.3 and dark spots on abd.4–6. Antennae all pale, including base of ant.1. Longest macrochaeta on the outer side of tib.3 about 1/6 as long as tibiotarsus, not longer than setae on the inner side (Fig. 90C). Ventroapical thickening of manubrium with many small teeth.

*Discussion.* – May be confused with *flavescens* which has darker antennae and never a broad transverse band on abd.2. The much longer tib.3 macrochaetae in *flavescens* is a distinct character (Fig. 90B, C).

*Distribution and ecology.* – An eastern species, in our area only from Sweden and Finland. Usually in moss and vegetation in forests. General distribution: Palaearctic.

## 329. ***Orchesella villosa*** (Geoffroy, 1762)

Pl. 10: 3

*Podura villosa* Geoffroy, 1762, Histoire abrégée des insectes 2: 608.

*Description.* – Body size up to 4.0 mm or larger. The disrupted and patchy colour pattern without conspicuous transverse or longitudinal bands will serve to identify this species (Pl. 10: 3).

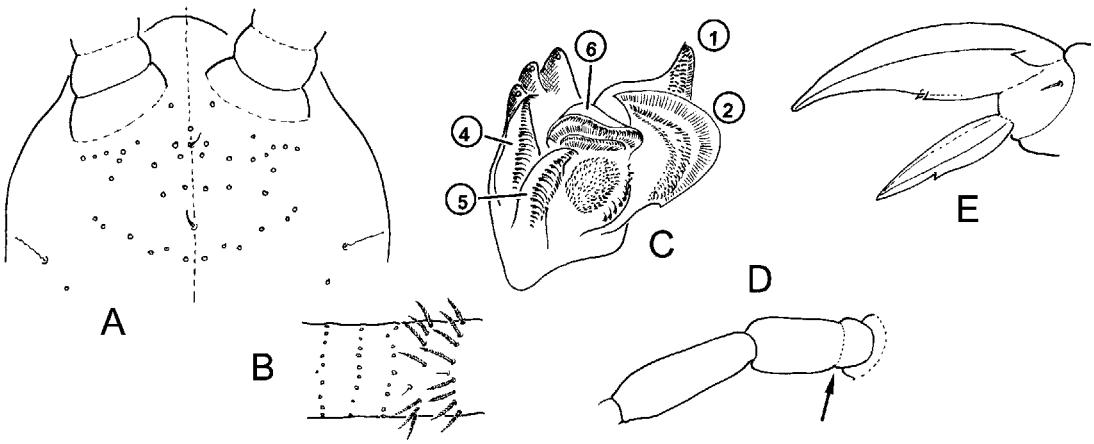


Fig. 91. *Heteromurus nitidus*: (A) Macrochaetal pattern on dorsal side of head; (B) distribution of setae in mid-section of ant.4; (C) maxilla, slightly squeezed; (D) ant.1–2 with subsegmentation of ant.1 (arrow); (E) claw.

*Distribution and ecology.* – A southern species recently found in Denmark (Petersen et al., 2001) and S. Sweden (SK, HA). In meadows and lush forests. At one site (Halmstad) abundant in alder forest near seashore. General distribution: Holarctic.

## Genus *Heteromurus* Wankel, 1860

*Heteromurus* Wankel, 1860, Lotos 10: 203. Type species: *Heteromurus margaritarius* Wankel, 1860, by monotypy.

A characteristic genus with subsegmented first antennal segment (Fig. 91D), "ringed" setal patterns on last antennal segment (Fig. 91B) and scaled body. Our single species has 1 + 1 ocelli. Abd.4 is only slightly longer than abd.3. Mucro with two teeth and a basal spine.

### 330. *Heteromurus nitidus* (Templeton, 1835)

Fig. 91A–E

*Podura nitida* Templeton, 1835, Trans. ent. Soc. London 1 (2): 94.

*Description.* – Body size up to 2.0 mm. White or with diffuse reddish pigment on body and under the 1 + 1 ocelli. Head and body with blunt finely striate scales which are also present on antennae, legs and furca. Maxillary lamellae not fused, individual lamellae distinct (Fig. 91C). Maxillary lam.3 appears to be lost. Maxillary outer lobe with simple palp, 3 sublobal hairs and a spinule. Distribution of macrochaetae on dorsal side of head as Fig. 91A. All setae of the mouth region, frontoclypeal field and ventral side of head smooth. Manubrium with about 10 + 10 smooth dorsal setae, dens with one dorsal smooth seta near base. Lower anal flaps with two smooth macrochaetae. Ventromanubrial thickening with 2–3 small teeth. Tibiotarsi with a double row of smooth setae on the inner side. Apical tenent hair short, pointed. Claws with a pair of small subequal inner teeth set in the middle of unguis ventral edge, sometimes with a weak distal tooth in distal 1/3. Lateral teeth small, set near base. Unguiculus with a ventral tooth (Fig. 91E).

*Discussion.* – Easily identified by the characteristic antennae, but small individuals with indistinct ocelli may be mistaken for a *Pseudosinella*. However, no *Pseudosinella* has so many macrochaetae in the central field on head (Fig. 91A). The maxilla resembles that found in *Orchesella*.

*Distribution and ecology.* – Common in southern districts, under rocks and pieces of wood in deep forest soil. Less common in meadows. General distribution: Cosmopolitan.

# Family CYPHODERIDAE

## Genus *Cyphoderus* Nicolet, 1842

*Cyphoderus* Nicolet, 1842, Neue Denkschr. Allg. schweiz. Ges. ges. Naturw. 6 (3): 63. Type species: *Cyphodeirus albinus* Nicolet, 1842, by subsequent designation by Börner, 1903.

The single Nordic genus, with one species, is strictly myrmecophilous and the animals are usually spotted when they run with jerky movements among ants (*Lasius*, *Formica*) under stones. The white, blind species differs from other Nordic Entomobryomorpha by having a very long mucro and peculiar scale-like setae on dens (Fig. 1B).

### 331. *Cyphoderus albinus* Nicolet, 1842

Figs 1B, 92A–I

*Cyphodeirus albinus* Nicolet, 1842, Neue Denkschr. Allg. schweiz. Ges. ges. Naturw. 6 (3): 67.

*Description.* – Body size 1.6 mm. White, eyes absent. Body shape flattened, broad. Sides of th.2–3 roof like flattened, hiding bases of legs. Thin transparent scales are present on dorsal side of head and body, including legs, two basal segments of antennae and ventral side of dens. Antennae about 2.5 as long as head diagonal. Ant.1 with 7–8 ventral and 3 dorsal (at base) microsensilla. Ant.2–4 with many setaceous short sensilla on dorsal and ventral sides. Ant.3 organ inconspicuous, with small apical sensilla and guards (Fig. 92E). Ant.2–3 with a short, triangular spine-like sensillum in mid-ventral (ventrolateral) position. Ant.4 with a short club-shaped subapical organ. Labrum with 4/554 smooth setae, two setae of the mid-row stronger than others (Fig. 92C). Labral edge unmodified. Frontoclypeal field with 4 + 5 setae, of which the posterior 5 are ciliated (Fig. 92D). Labial palps with a normal papillary complex, with 4 proximal setae. Papilla E with 4 guards. Basal fields with 4 median and 5 lateral setae. Maxillary palp simple, sublobal hairs absent. Maxilla with 3-toothed capitulum and a fused pad-shaped lamellary complex which is not easily interpreted. Tip of longest lamella reaches beyond capitular teeth (Fig. 92G). Top of head with 1 + 1 long trichobothria (Fig. 92A). Head with 3 + 3 postlabial setae. Abd.2–4 with 233 trichobothria (Fig. 92A). Thorax and abdomen with macrochaetae and ciliated setae only along sides, not on dorsal disc. Mesothorax with a row of short, spine-like setae along anterior edge. Ventral tube with 2 + 2 long anterior setae, 2 + 2 short distal and 6–7 posterior setae of which three are longer than others (Fig. 92H). Retinaculum with 4 + 4 teeth and one seta. Coxal parts of mid-legs with 2–3 particularly strong macrochaetae (Fig. 92B). Claws slender, apically expanded, unguis with a long needle-like basal tooth on the back side, inner edge with a small subapical tooth. Unguiculus with a strong, wing-like ventral tooth (Fig. 92I). Trochanteral organ of last leg as Fig. 92F, V-shaped, with about 10 setae. Manubrium with a differentiated cover of dorsal ciliate setae, in particular the 3 + 3 lateral macrochaetae in distal half are distinct (Fig. 92A). Dens dorsally with a double row of about 6 outer and 5 inner blade-like setae, the inner apical as long as mucro. Between the dorsal double rows is a single row of 4 ciliate macrochaetae. Proximal part with 3 setae, of which one is smooth (Fig. 1B). Ventral side of dens with many hyaline scales. Mucro elongate, almost half as long as dens, with two apical teeth.

*Discussion.* – Easily identified by the long mucro and the peculiar dorsal setae on dens. The absence of sublobal hairs on the maxillary outer lobe is an unusual character.

*Distribution and ecology.* – Probably widespread with ants. Usually found under stones with *Lasius* and black *Formica* species. Linnaniemi (1912) also recorded specimens among *Camponotus*, *Myrmica* and *Tetramorium*. General distribution: Palaearctic.

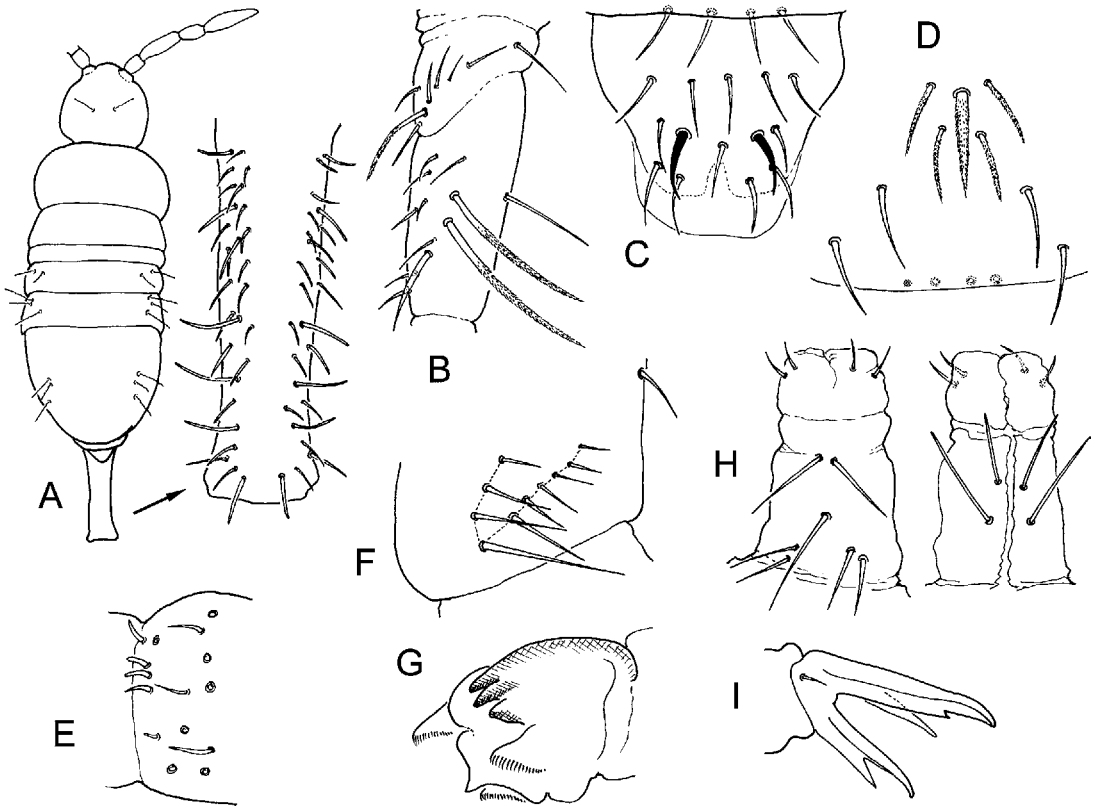


Fig. 92. *Cyphoderus albinus*: (A) Body shape and distribution of dorsal trichobothria, detail of manubrium to the right; (B) setae on outer side of left coxa; (C) labrum; (D) setae of the frontoclypeal field; (E) ant.3 organ; (F) trochanteral organ of left hind leg; (G) maxilla; (H) ventral tube, anterior (left) and posterior (right); (I) claw.

# Family TOMOCERIDAE

The few species of the three Nordic genera of this family are all easily spotted in the field. They are among our largest collembola, reaching 4–5 mm, and are common in moss and litter of the forest floor. They are very active and strong jumpers which quickly disappear when being disturbed. To the naked eye they appear shiny greyish black due to a dense cover of striate scales on the body. In alcohol most species have a pale ground colour with varying amounts of blue, brown or grey pigmentation. The long antennae – in some species longer than the body – have a characteristic secondary annulation of the two last segments. Antennal segment 3 usually much longer than ant.4. Parts of the antennae are often lost, probably due to attacks of spiders or beetles. The mucro is long and slender, covered with setae. All our species have 6 + 6 ocelli, a trifurcate maxillary palp with 4 sublobal hairs, increased number of setae in the proximal and basomedian fields of labium (Fig. 93B, C), labral chaetotaxy as 4/554 with the four anterior setae stronger than others, apical edge of labrum with 4 back-curved spines (Fig. 94I). Mandibles normal, maxillary head strongly developed with rake-like lamellae. Body covered with striate scales of various shapes and size. Scales are found on dorsal and ventral side of head and body, but not on the two distal antennal segments and on dorsal side of dens. Ventral tube with many setae in anterior, posterior and distal position. Retinaculum

with 4 + 4 teeth and a variable number of setae. Macrochaetae of tergites reduced in number. Trichobothria on th.2–abd.4 distributed as 21/0012 (Fig. 93J). Tibiotarsi with a strongly enlarged and clavate tenent hair. Claws with strong lateral teeth set near base of unguis, inner teeth variable in number. Unguiculus with a dorsal tooth. Males present.

## Key to genera

1 Inner side of dens with a broad pointed scale near base (Fig. 93A). Basolateral field of labium with more than five setae (Fig. 93B). Mucro with one dorsal lamella (Fig. 93D). Maxilla with a proximal ciliate lobe attached to lam.5 (Fig. 94A) . . . . . *Pogonognathellus* Paclt (p. 163)

– Inner side of dens without broad scale. Basolateral field of labium with 5 setae (Fig. 93C). Mucro with two dorsal lamellae, the outer one with small teeth (Fig. 93E). Maxillary lam.5 without proximal lobe (Fig. 94F) . . . . . 2

2 All tibiotarsi with several differentiated macrochaetae on inner side (Fig. 93F). Mid-section of mucro with more than 3 teeth, outer basal tooth with a small secondary tooth (Fig. 93E) . . . . . *Tomocerus* Nicolet (p. 164)

– Tib.1–2 without, tib.3 with one inner macrochaeta (Fig. 93I). Mid-section of mucro at most with 3 teeth, outer basal tooth simple (Fig. 94J) . . . . . *Tomocerina* Yosii (p. 166)

# Genus *Pogonognathellus* Paclt, 1944

*Pogonognathellus* Paclt, 1944, Ent. Listy 7: 92. Type species: *Podura plumbea* Linnaeus, 1758, by original designation.

## Key to species

1 Tib.1–3 with 0-0-2 differentiated macrochaetae on inner side (Fig. 93H). Retinaculum with 1–2 setae. Dorsal side of manubrium with acuminate macrochaetae (Fig. 94E). Unguiculus simply pointed (Fig. 94C) . . . . . 332. *flavescens* (Tullberg)

– Tib.1–3 with up to 6-6-10 inner macrochaetae (Fig. 93G). Retinaculum with up to 8 setae. Dorsal macrochaetae of manubrium blunt-tipped (Figs 93A, 94D). Unguiculus needle-like prolonged (Fig. 94B) . . . . . 333. *longicornis* (Müller)

## 332. *Pogonognathellus flavescens* (Tullberg, 1871)

Figs 93B, D, H, 94A, C, E; Pl. 11: 2

*Macrotoma flavescens* Tullberg, 1871, Öfvers. K. VetenskAkad. Förh. 28: 149.

*Description.* – Body size up to 4–5 mm. Ground colour pale yellow with brownish red pigment between eyes and antennal base. Frontoclypeal field unpigmented or not darker than surrounding area. Legs (including subcoxae) often quite dark, but tibiotarsi not darker than femora (Pl. 11: 2). Antennae longer than body in fully developed specimens. Distribution of setae on labium as Fig. 93B. Basolateral field with more than 30 setae in large specimens. Maxilla (Fig. 94A) with a broad lam.1 bearing many rows of strong curved rake-like denticles behind the apical border of fine cilia. Lam.2 with two regular rows of curved coarse rakes followed by a proximal field of finer denticles. Lam.5 with a proximal ciliate projection. Lam.6 reduced, with a few denticles only. Differentiated macrochaetae absent on inner side of tib.1–2, two such macrochaetae present on tib.3 (Fig. 93H). Claws usually with two inner teeth (Fig. 94C). Mucro with up to 9 dorsal teeth in the mid-section (Fig. 93D).

*Discussion.* – Easily identified by the key characters.

*Distribution and ecology.* – Common and widely distributed in moss and forest litter, both under hardwood and conifers. General distribution: Holarctic.

## 333. *Pogonognathellus longicornis* (Müller, 1776)

Figs 93A, G, 94B, D; Pl. 11: 1

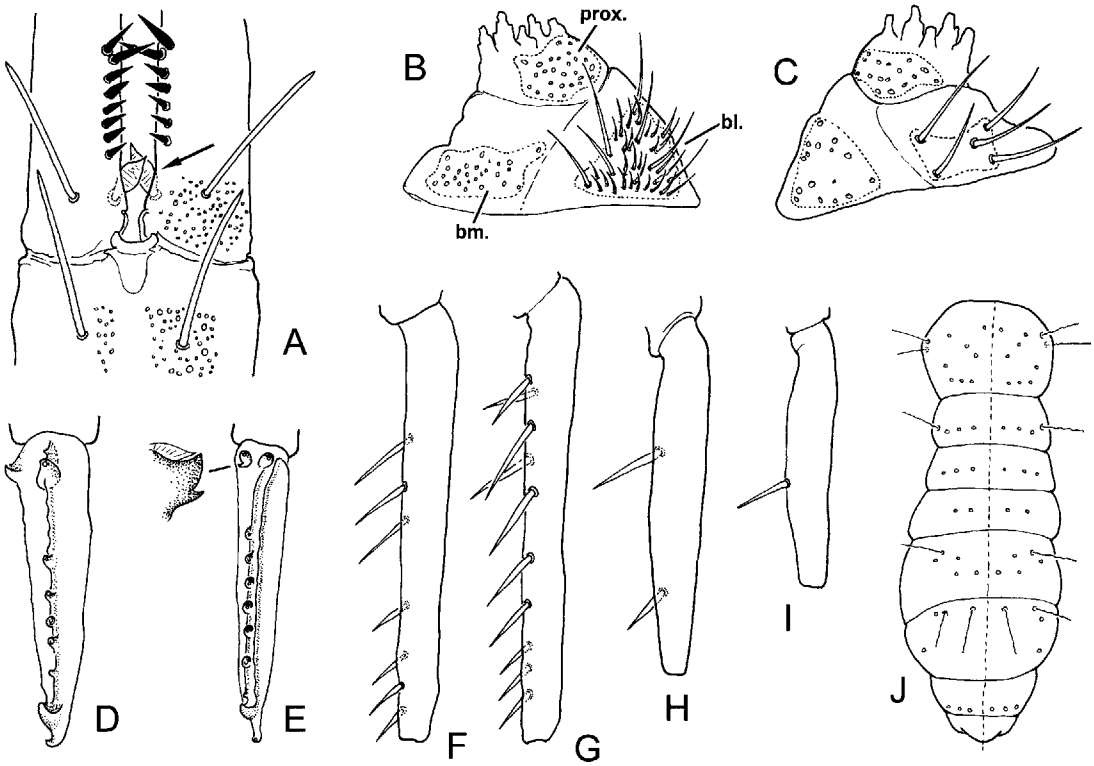


Fig. 93. *Pogonognathellus*, *Tomocerus* and *Tomocerina* spp.: (A) *P. longicornis*, dorsal view of manubrium/dens with dental scales indicated (arrow); (B–C) left labium in *P. flavescens* (B) and *T. minor* (C) (prox.: proximal field, bm.: basomedian field, bl.: basolateral field); (D–E) mucro in *P. flavescens* (D) and *T. minor* (E); (F–I) macrochaetae on inner side of tib.3 in *T. minor* (F), *P. longicornis* (G), *P. flavescens* (H) and *T. minutus* (I); (J) *T. minor*, distribution of macrochaetae and trichobothria, juvenile specimen.

*Podura longicornis* Müller, 1776, Zoologiae Danicae prodromus: 183.

*Description.* – Body size up to 4–5 mm. Ground colour in freshly collected specimens brownish red (Pl. 11: 1). Very similar to previous species, but adults are normally identified by the key characters. Legs normally paler than in previous species. The macrochaetae of the legs are much longer than in *flavescens*. The best character to separate the species are the different shapes of unguiculus in large specimens (Fig. 94B, C). Small specimens may have the apical needle-like filament on unguiculus shortened. When disturbed in field large specimens will often roll up the distal segments of the antennae – probably an adaptation to prevent predators from getting a grip.

*Distribution and ecology.* – In forest litter, mostly in rich hardwood forest. Probably widely distributed, but less known due to confusion with *flavescens*. According to Linnaiemi (1912) the adults of this species appear first in late summer and die away in early winter. Hibernation is in the egg stage. General distribution: Holarctic.

## Genus *Tomocerus* Nicolet, 1842

*Tomocerus* Nicolet, 1842, Neue Denkschr. Allg. schweiz. Ges. ges. Naturw. 6 (3): 31. Type species: *Macrotoma minor* Lubbock, 1862, by designation under the Plenary Powers, Opinion 239.

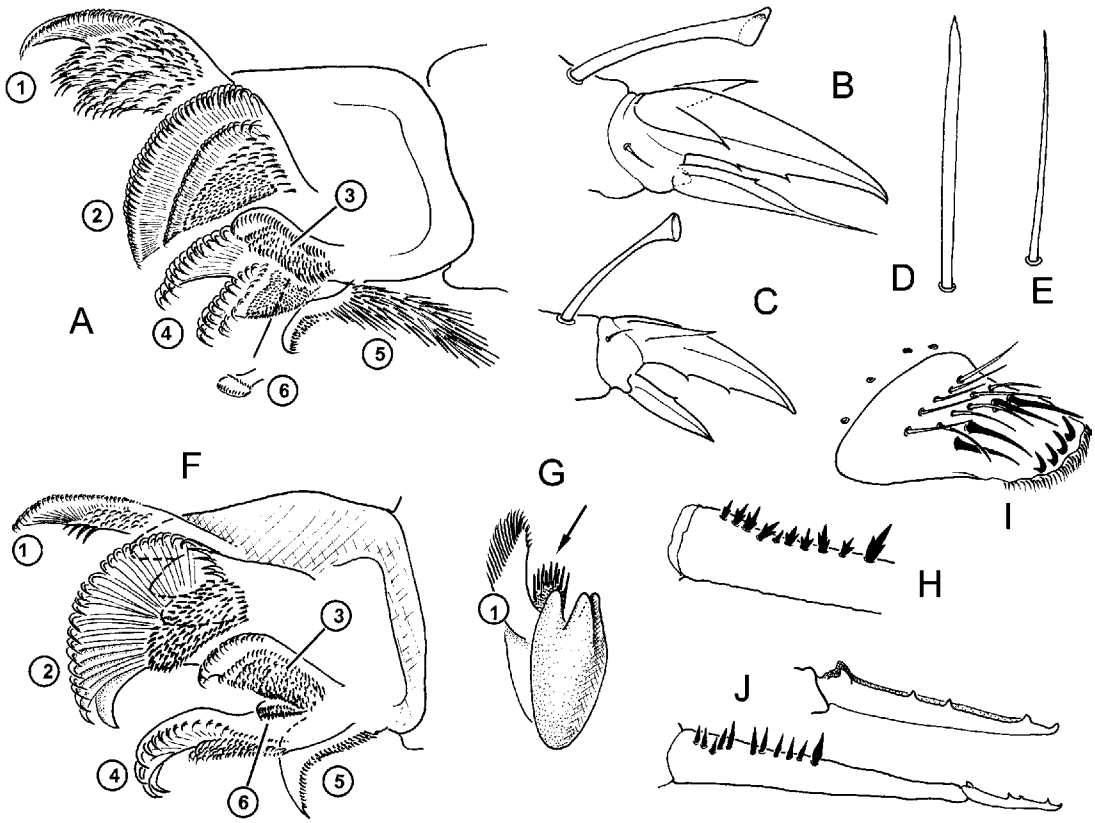


Fig. 94. *Pogonognathellus* (A–E), *Tomocerus* (F–I) and *Tomocerina* (J) spp.: (A) *flavescens*, maxilla; (B–C) claw in *longicornis* (B) and *flavescens* (C); (D–E) dorsoapical macrochaeta of manubrium in *longicornis* (D) and *flavescens* (E); (F–I) *minor*, (F) maxilla, (G) ditto, showing only lam.1 with its "tooth brush" (arrow), (H) dental spines, (I) labrum; (J) *minutus*, dens and mucro with detail of mucro above.

## Key to species

1 Dorsal spines of dens 3-forked (Fig. 94H) . . . . . 334. *minor* (Lubbock)

– Dorsal spines of dens simple . . . . . 335. *vulgaris* (Tullberg)

## 334. ***Tomocerus minor*** (Lubbock, 1862)

Figs 93C, E, F, J, 94F–I; Pl. 11: 3

*Macrotoma minor* Lubbock, 1862, Trans. Linn. Soc. Lond. 23: 598.

*Description.* – Body size up to 4 mm. Ground colour whitish, with a variable greyish pigmentation in anterior part of the body (Pl. 11: 3). Frontoclypeal field distinctly darkened, bluish red. Tibiotarsi darker than femora, bluish red. Antennae shorter than body. Maxilla (Fig. 94F) with narrow lam.1, bearing a small field of denticles behind the apical ciliation. Lam.2 with a single row of long rakes in addition to a proximal field of denticles. Lam.5 without proximal projection. Distribution of setae on labium as Fig. 93C, basolateral field only with the standard set of 5 setae. Dorsal chaetotaxy (juvenile) of thorax and abdomen as Fig. 93J. Trichobothria distributed as 21/00120. Dens with 3-forked spines as Fig. 94H. Mucro with 5–7 teeth on the outer dorsal lamella, outer basal tooth with a small secondary tooth (Fig. 93E). Claws with 4–6 inner teeth.

*Discussion.* – The 3-forked dental spines is an unique character for this species. It often occurs

together with *Pogonognathellus flavescens*. In mixed samples the latter is recognised by more yellow ground colour, frontoclypeal field not contrastingly darkened and tibiotarsi not darker than femora. In *T. minor* the spined part of dens is relatively longer than in *Pogonognathellus*.

*Distribution and ecology.* – Common in forest litter, mostly under hardwoods. General distribution: Cosmopolitan.

### 335. *Tomocerus vulgaris* (Tullberg, 1871)

Pl. 11: 4

*Macrotoma vulgaris* Tullberg, 1871, Öfvers. K. VetenskAkad. Förh. 28: 149.

*Description.* – Body size up to 4 mm. Apart from the simple dark dental spines, very similar to previous species (Pl. 11: 4). Mucro with up to 10 small teeth in the mid-section. Maxilla as in *minor*.

*Distribution and ecology.* – Common and widely distributed in forest litter, often in damp habitats. General distribution: Cosmopolitan.

## Genus *Tomocerina* Yosii, 1955

*Tomocerina* Yosii, 1955, Publs Seto mar. biol. Lab.4: 394. Type species: *Tomocerus minutus* Tullberg, 1876, by original designation.

Our single species differ from *Tomocerus* by the few teeth (0–3) in mid-section of the mucro and by lack of differentiated macrochaetae on inner side of tib.1–2.

### 336. *Tomocerina minuta* (Tullberg, 1876)

Figs 93I, 94J

*Tomocerus minutus* Tullberg, 1876, Öfvers. K. VetenskAkad. Förh. 33: 32.

*Description.* – Body size up to 2.5 mm. Colour bluish grey. Maxilla similar to that of the *Tomocerus* species (Fig. 94F). Unguiculus with a small dorsal tooth. Mucro long and slender, mid-section with 0–3 teeth (Fig. 94J). Outer basal tooth simple. Inner side of tib.3 with a single differentiated macrochaeta (Fig. 93I).

*Distribution and ecology.* – A species of the boreal forest floor with southernmost record in the Jotunheimen mountains in S. Norway. General distribution: Holarctic.

# Family ONCOPODURIDAE

## Genus *Oncopodura* Carl & Lebedinsky, 1905

*Oncopodura* Carl & Lebedinsky, 1905, Zool. Anz. 28: 562. Type species: *Oncopodura hamata* Carl & Lebedinsky, 1905, by original designation.

Only one species present in our area.

### 337. *Oncopodura crassicornis* Shoebotham, 1911

Figs 1A, F, 95A–D

*Oncopodura crassicornis* Shoebotham, 1911, Ann. Mag. nat. Hist. (8) 8: 35.

*Description.* – Body size 0.6–0.8 mm. White, without eyes and pigment. Body shape short and plump, isotomid-like, antennae shorter than head. Body covered with striate scales of irregular swollen shapes. Ant.3 organ with two large sensilla which have a peculiar transverse ring-like structure. A similar sensillum also in apical position on ant.2. Ant.4 with many hair-like curved sensilla and on the outer side with 4 oval sensilla in a line (Fig. 95A). Basomedian field of labium with 5 setae, basolateral with 5.

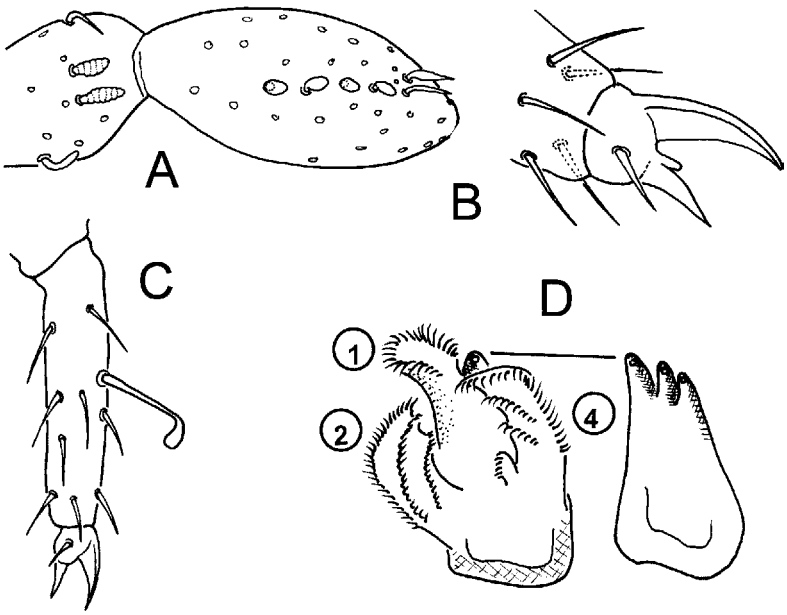


Fig. 95. *Oncopodura crassicornis*: (A) Sensilla on ant.3–4; (B) claw and apical setae of tibiotarsus; (C) tib.2 with clavate macrochaeta; (D) maxilla.

Labial palps with all papillae A–E present, proximal setae 6. Papilla A with one guard, papillae B, D and E with 4 guards. Maxillary palp simple, with 4 sublobal hairs. Labral formula 4/554, setae smooth, undifferentiated. Anterior labral edge with two small papillae in the middle. Mandibles strong, normal. Maxillary head with 3-toothed capitulum and ciliated lamellae (Fig. 95D). The proximal lamellae (lam.3, 5, 6) probably present, but small. PAO large, rosette-like, with 5–6 simple lobes (Fig. 1F). Head with 5 + 5 postlabial setae. Ventral tube with 3 + 3 distal setae only. Retinaculum with 4 + 4 teeth, no seta. Dens with a characteristic set of modified spine-like setae, mucro with 4 teeth and a broad ventral scale (Fig. 1A). Apical whorl of tibiotarsi with only 5 setae which are smooth. Other tibiotarsal setae are ciliated. Tib.2 with an outer enlarged clavate seta in the middle (Fig. 95C). Claws untoothed, the proximal lateral setae prolonged (Fig. 95B). Details of chaetotaxy not studies in Nordic specimens due to lack of adequate material.

*Discussion.* – The many peculiarities in the morphology of this species, in particular the PAO and furca, make it easy to identify.

*Distribution and ecology.* – Only found in two localities at the coast of SE Norway, in warm dry seashore meadows (Hvasser, VE: Tjøme) and under *Dryas octopetala* growing on calcareous rocks. (Langesund, TEY: Bamle). General distribution: Palaearctic.

# Subclass SYMPHYPLEONA

The concept of Symphypleona as used here is in accordance with Bretfeld (1999) and includes the family Neelidae. In the first volume of this series (Fjellberg, 1998a) the Neelidae formed a separate subclass, Neelipleona.

# Family NEELIDAE

The family has three Nordic genera with three species which are eye-less and mostly smaller than 0.5 mm. Antennae shorter than head.

## Key to genera

1 Abdomen with large sensory fields (Fig. 96A). Ant.4 with one particularly strong subapical sensillum (Fig. 96B). Labral edge without cilia (Figs 96H, 98C) . . . 2

– Abdomen without clear sensory fields. Ant.4 without conspicuous sensilla (Fig. 99D). Labrum with ciliate anterior edge (Fig. 99A) . . . *Neelides* Caroli (p. 170)

2 Back side of ventral tube with a small lobe (Fig. 98H). Abdominal sensory field surrounded by two setae (Fig. 98B). Ant.3–4 separated (Fig. 98E). Mucro in our species with serrated edges (Fig. 98L) . . . . . *Neelus* Folsom (p. 169)

– Ventral tube without posterior lobe. Sensory field of abdomen surrounded by 5 setae (Fig. 96A). Ant.3–4 fused (Fig. 96B). Mucro in our species with smooth edges (Fig. 97A, C) . . . . . *Megalothorax* Willem (p. 168)

## Genus *Megalothorax* Willem, 1900

*Megalothorax* Willem, 1900, Annls Soc. ent. Belg. 44: 7. Type species: *Megalothorax minimus* Willem, 1900, by monotypy.

Only one species in our area.

### 338. *Megalothorax minimus* Willem, 1900

Figs 96A–I, 97A–G

*Megalothorax minimus* Willem, 1900, Annls Soc. ent. Belg. 44: 9.

*Description.* – Body size up to 0.4 mm. General morphology as Fig. 96A. Colour whitish, sometimes with a faint reddish pigmentation. Dorsal side of thorax and abdomen with short normal setae. Antennae short. Ant.1 with one seta, ant.2 with 4 setae. Ant.3 organ with two blunt sensilla with rough surface. Ant.4 with one subapical sensillum which is much thicker than others (Fig. 96B). In front of the antennal base and in the area of the PAO and eyes are sensorial fields with spinules in a pit (Fig. 96C, G). Similar sensorial fields are found on dorsal side of thorax and abdomen and at base of two last pairs of legs (Fig. 96A, D, E). Chaetotaxy of face as Fig. 96G. Labrum with 554 setae, 4 prelabrals. The anterior 4 labral setae thick, curved, serrate (Fig. 96H). Distal part of labrum set off like a lip. The inner side of labrum, facing the buccal cavity, with 4 ridges, no ventroapical ciliation (Fig. 96I). Labial palps with all papillae A–E present, with two guards each on papillae B, D and E, proximal setae 4. Basomedian field with 3 setae, basolateral with one. Maxillary outer lobe simple, one sublobal hair (Fig. 96F). Mandibles apically flattened with 6–7 small teeth, molar plate strong (Fig. 97F). Maxillary teeth reduced to two curved stylets, lamellary complex as Fig. 97D, E. Lam.1 split at apex. Lam.6 probably absent. Ventral tube with 2 + 2 distal setae. Retinaculum with 3 + 3 teeth, no seta. Furca as Fig. 97A. Manubrium with 2 + 2 dorsal setae, manubrial base with two elongate setae-like sensilla ("neosminthuroid setae", Fig. 97A). Manubrium/dens articulation with knob-like condyles (Fig. 97B). Dens with two dorsal setae, two subapical dorsal integumental spines and 5 similar apical spines in ventral/ventrolateral part. Mucro constricted at apex, without serrated lamellae, ventral edge keel-like (Fig. 97C). Tibiotarsi with 12-12-10 setae, all pointed, no differentiated apical tenent hair. Unguis with a pair of basal teeth, a long tooth projects from the base on the posterior side. Unguiculus unarmed, with a projecting proximal lobe on the posterior side (Fig. 97G).

*Discussion.* – Easily identified by the generic characters. A few large digestive balls are usually visible in the intestine of cleared specimens.

*Distribution and ecology.* – A common soil form being present in a variety of habitats. General distribution: Cosmopolitan.

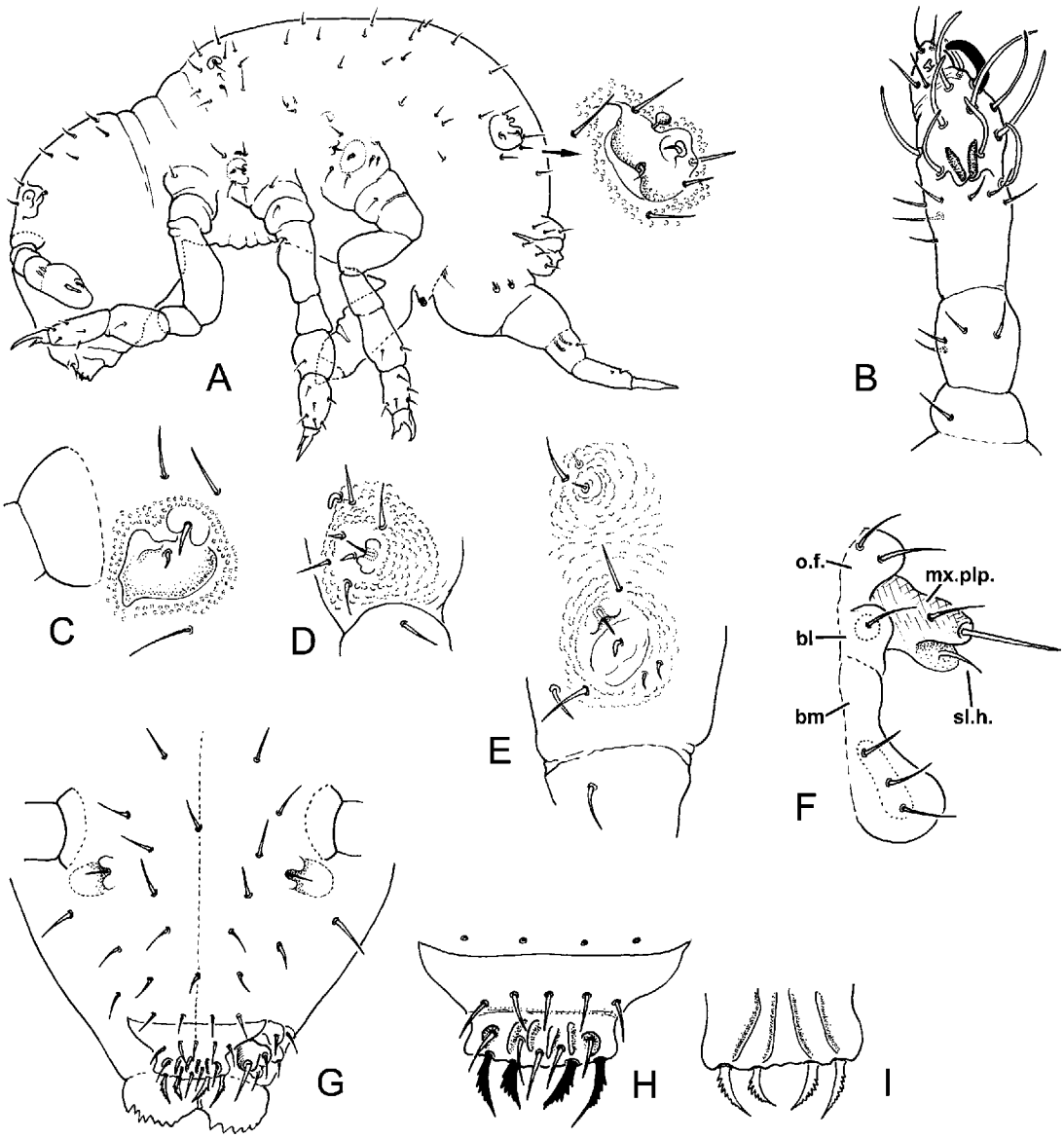


Fig. 96. *Megalothorax minimus*: (A) Habitus with enlargement of abdominal sensorial field; (B) right antenna; (C) sensilla of the PAO/eye field; (D) sensilla at base of middle leg; (E) sensilla at base of hind leg; (F) basolabial fields and maxillary outer lobe (bm: basomedian, bl: basolateral, o.f.: oral folds, mx.plp.: maxillary palp); (G) head, anterior side; (H) labrum, (I) inner side of labrum.

## Genus *Neelus* Folsom, 1896

*Neelus* Folsom, 1896, Psyche, Camb. 7: 391. Type species: *Neelus murinus* Folsom, 1896, by monotypy.

One species in our area.

### 339. *Neelus murinus* Folsom, 1896

Fig. 98A–L

*Neelus murinus* Folsom, 1896, Psyche, Camb. 7: 391.

*Description.* – Body size up to 0.7 mm, but generally smaller. Usually with some weak brown-

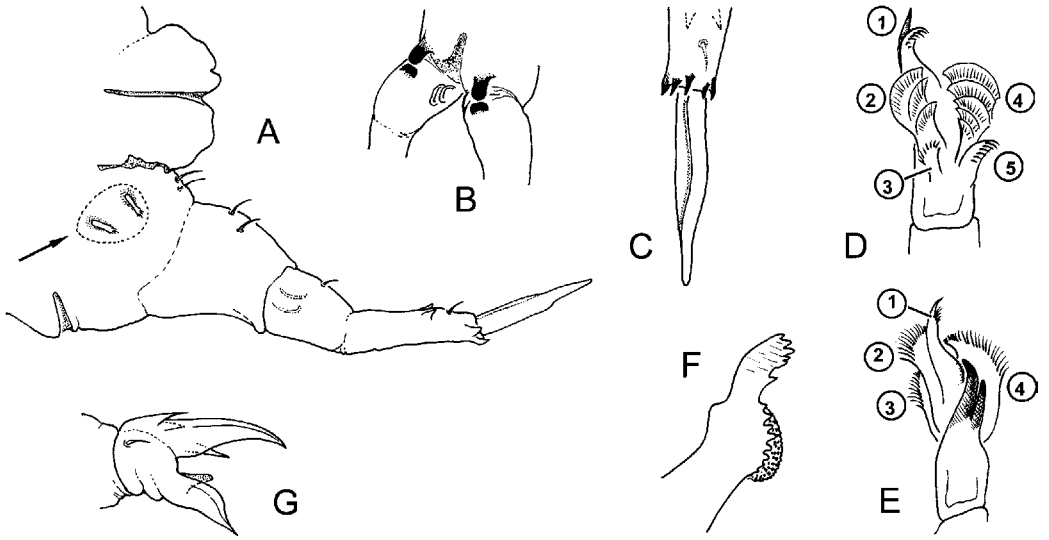


Fig. 97. *Megalothorax minimus*: (A) Tip of abdomen with furca, neosminthuroid setae marked (arrow); (B) manubrium/dens joint; (C) mucro and apical part of dens, ventral view; (D–E) maxilla, different views; (F) mandible; (G) claw.

ish pigment. Body shape as Fig. 98B. Body hairs, apart from the setae surrounding the sensory fields on thorax and abdomen, very short and spine-like. Antennae short. Ant.1 with 3 dorsal setae, ant.2 with 5. Ant.3 organ with a very long ventrolateral guard sensillum. Sensillary equipment of ant.4 as Fig. 98E. Head with sensorial pits in the PAO/ocellar field and in front of the antennal base (Fig. 98A). Similar sensorial fields are found above the base of legs on th.2–3 and on abdomen (Fig. 98B). Labrum with 554 setae, 4 prelabrals. The 5 setae of the basal row thin, apical 5+4 setae enlarged, spine-like. Four ridges separate the median 5 setae (Fig. 98C). The large maxillary palps simple, with one enlarged sublobal hair. Basomedian field of labium with 4 setae, basolateral with two (Fig. 98D). Ventral side of head with 3 + 3 postmedian setae. Labial palps with 4 proximal setae. Labial papillae A–E all present, B and D with two guards, E with one. Mandibles normal, strong, with 4–5 apical teeth. Maxillary capitulum with one hooked tooth and a small stylet (Fig. 98F). Maxillary lamellae strongly ciliate, broad. Lam.1 reaching beyond others, with a dorsal and ventral border of long cilia. Lam.2 and 4 apically flattened, with 5–6 rows of cilia. Lam.3 and 5 membranous, with a single row of long cilia and a proximal filamentous hook. Lam.6 reduced, possibly present as a few small hooks (Fig. 98G). Ventral tube with a blunt posterior lobe and 2 + 2 distal setae (Fig. 98H). Retinaculum with 3 + 3 teeth, no seta. Furca as Fig. 98L. Manubrium with 3 + 3 dorsal setae. A single "neosminthuroid seta" present laterally at base of manubrium. Dens with two dorsal setae at base and one dorsal subapical seta. Middle part of dens with two outer and one inner integumental spine, apex of dens with a mid-ventral sharp spine and two blunt lateral spines (Fig. 98K, L). Mucro with serrated dorsal edges and a mid-ventral keel. Dens/manubrium articulation as Fig. 98I. Claws with a pair of strong lateral teeth and a single strong inner tooth. Unguiculus simple (Fig. 98J).

*Discussion.* – Easy to identify by key characters.

*Distribution and ecology.* – In our area only found in soil in a beech forest near Bergen (Fjellberg, 1980). General distribution: Cosmopolitan.

## Genus *Neelides* Caroli, 1912

*Neelides* Caroli, 1912, Annuar. Mus. zool. Univ. Napoli 3, Suppl.: 2. Type species: *Neelides folsomi* Caroli, 1912, by monotypy.

One species in our area.

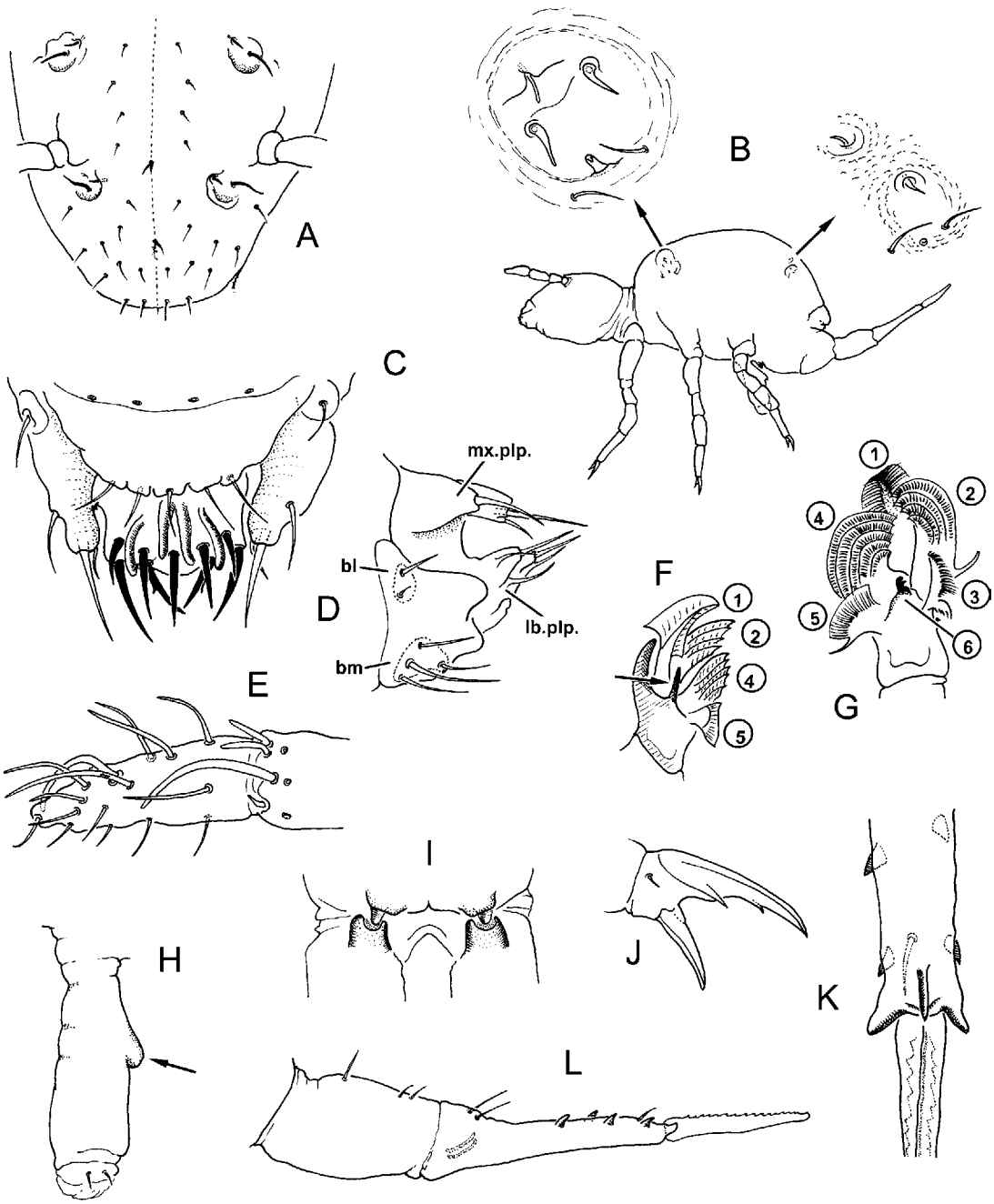


Fig. 98. *Neelus murinus*: (A) Head, anterior side; (B) habitus with enlargement of sensorial fields; (C) labrum and maxillary palps; (D) labium and maxillary outer lobe (lb.plp.: labial palp, other symbols as Fig. 96F); (E) left ant.3–4; (F–G) maxilla, different views, with stylet of the maxillary head marked (arrow); (H) ventral tube with posterior lobe (arrow); (I) manubrium/dens joint; (J) claw; (K) base of mucro and apical part of dens, ventral view; (L) furca.

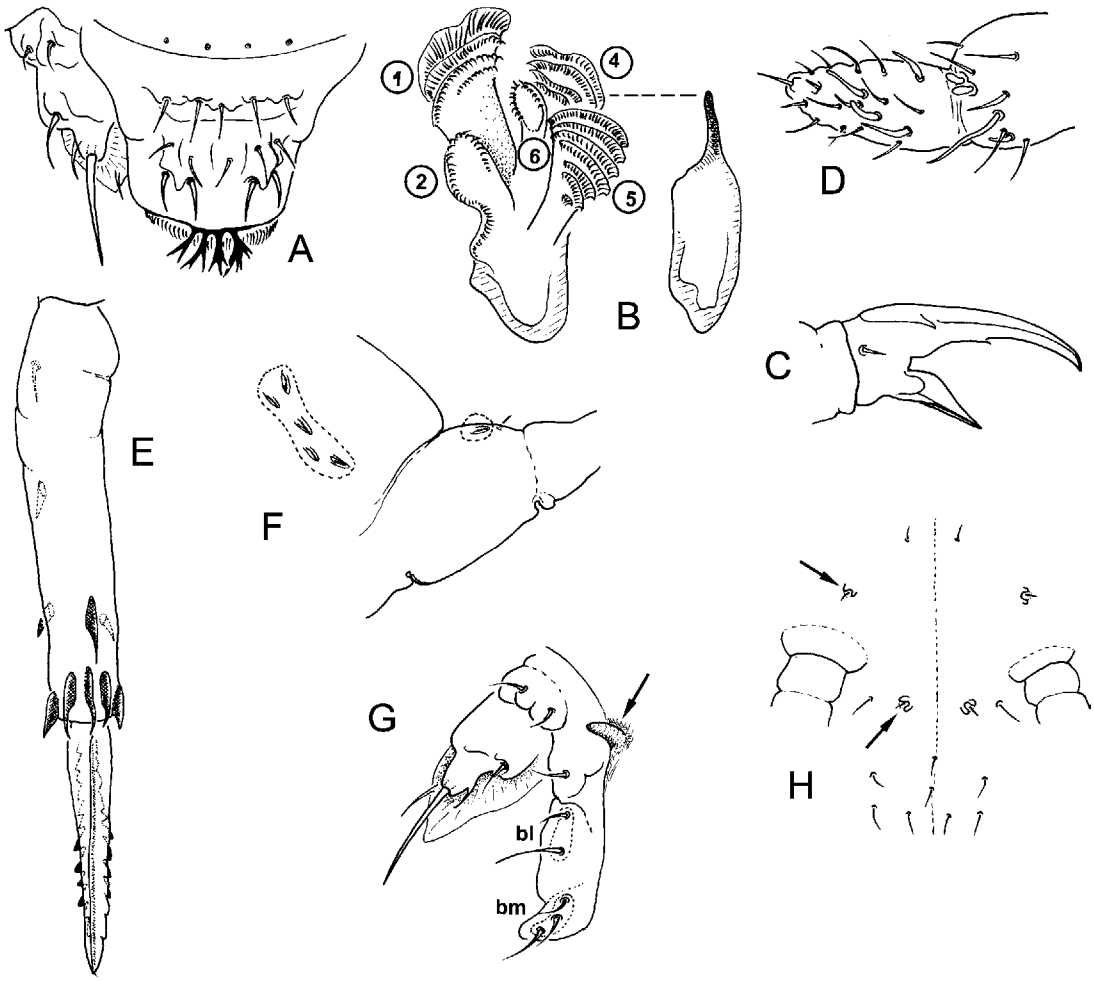


Fig. 99. *Neelides minutus*: (A) Labrum and right maxillary outer lobe; (B) maxilla, (C) claw; (D) left ant.3–4; (E) dens and mucro, ventral view; (F) neosminthuroid setae (encircled) at base of furca; (G) basolabial fields and maxillary outer lobe with finger like projection (arrow), symbols as Fig. 96F; (H) sensilla (arrows) on head near antennal base.

## 340. *Neelides minutus* (Folsom, 1901)

Fig. 99A–H

*Neelus minutus* Folsom, 1901, Psyche, Camb. 9: 221.

*Description.* – Body size up to 0.5 mm. Large specimens with some bluish grey pigmentation. Body shape as in *Neelus* (Fig. 98B). Ant.1 with one seta, ant.4 with 4. Ant.3–4 as Fig. 99D. Ant.3 organ with a long ventrolateral guard. Labrum with 4/554 setae, anterior 4 somewhat enlarged. Labral edge with a double row of cilia. Upper row consists of 4 large apically split cilia, lower row like a simple "comb" (Fig. 99A). Basomedian field of labium with 3 setae, basolateral with two. A finger-like papilla present at base of the oral folds (Fig. 99G). Labial palps with 3 proximal setae and 3 papillae, probably B, D and E, each with 3 guards (Fjellberg, 1998b). Maxillary outer lobe with bifurcate palp and a single short sublobal hair. Head with $1 + 1$ postlabial setae. Two small setaceous sensilla in pits on each side of head, one in front of and one behind antennal base (Fig. 99H). Similar sensilla are found laterally on thorax and above the base of the two last pairs of legs. Other se-

tae on dorsal side of body very short, stub-like. Mandibles normal, strong. Maxillary teeth reduced to a single short blunt stylet, lamellae strongly developed (Fig. 99B). Lam.1, 4 and 5 apically expanded, with several rows of delicate cilia. Lam.2 membranous, with a single marginal row of cilia running almost to base of capitulum. Lam.3 absent. Lam.6 small, with a single marginal row of strong, curved denticles. Ventral tube with 2 + 2 distal setae and a small blunt lobe on posterior side. Retinaculum with 2 + 2 teeth. Dens dorsally with one seta near base and one setaceous spine near apex. Ventral side with 3 + 1 curved spines in apical 1/3. Mid-section with 2 + 1 dorsal spines. In addition apex has one outer and one inner spine (Fig. 99E). Mucro with ventral keel and serrated dorsal edges. Manubrium with 3 dorsal seta on each side. "Neosminthuroid setae" are present at dorsal side of manubrium (1) and laterally on abdomen (5) near base of manubrium (Fig. 99F). Claws with small lateral teeth in basal 1/3 and a small inner tooth in the middle. Unguiculus unarmed, with broad basal lamella (Fig. 99C).

*Discussion.* – The key characters will identify this species. The presence of some dark body pigment and a characteristic body shape will usually distinguish *minutus* from the pale *Megalothorax minimus* when both are present in the same sample.

*Distribution and ecology.* – Scattered records in deep forest soil, sometimes also in mires and *Sphagnum* bogs. General distribution: Cosmopolitan.

# Family MACKENZIELLIDAE

## Genus *Mackenziella* Hammer, 1953

*Mackenziella* Hammer, 1953, Acta arct. 6: 60. Type species: *Mackenziella psocoides* Hammer, 1953, by original designation.

The family is monotypic with only one known species occurring sporadically in various parts of the northern hemisphere.

### 341. *Mackenziella psocoides* Hammer, 1953

Fig. 100A–F

*Mackenziella psocoides* Hammer, 1953, Acta arct. 6: 60.

*Description.* – Body size very small, 0.2–0.3 mm, males smallest. Body shape characteristic (Fig. 100A). Colour pale bluish red. Ocelli 6+6, on dark eye-spots. Adult males with a clasping organ formed by ant.2–3 (Fig. 100E). Mandibles absent, maxilla with untoothed capitulum and 3 weak lamella (Fig. 100D). Maxillary outer lobe absent. Dorsal chaetotaxy as Fig. 100B. Ventral tube with 1 + 1 distal setae. Retinaculum with 3 + 3 teeth, no seta. Furca as Fig. 100C. Mucro simply hooked. Chaetotaxy of tibiotarsus as Fig. 100F.

*Discussion.* – The presence of a male clasping organ, very similar to that found in male *Sphaeridia*, indicate that the family belongs to Symphypleona despite the elongate body shape. Also the chaetotaxy of the legs is of a symphypleone type. The loss of mandibles and the prognathous type of head are possibly a secondary adaptations for feeding on minute organic particles in the narrow spaces between leaves of mosses on which it has repeatedly been collected. However, this particular feeding habit has yet to be demonstrated. A detailed redescription of the species was given by Fjellberg (1989).

*Distribution and ecology.* – In our area so far only known from N. Norway and S. Sweden, extracted from moss on sand (Sandsvika, Grøllefjord) and from vegetation in crevices on dry calcareous rocks (Möckelmosse, Öland). Due to minute size and mite-like appearance the species is probably overlooked. Known world records are from Canada, Canary Islands, Ger-

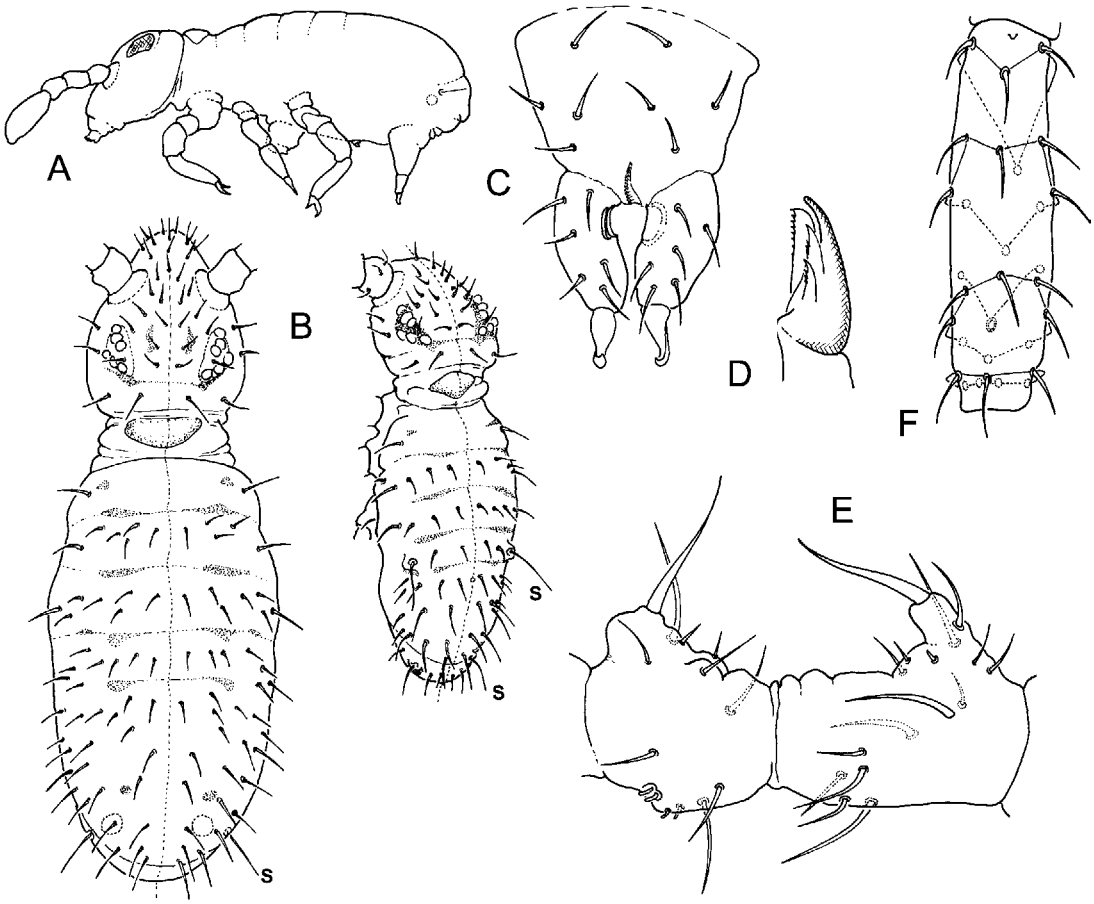


Fig. 100. *Mackenziella psocoides*: (A) Habitus, female; (B) dorsal chaetotaxy of female (left) and male (right); (C) furca, posterior view; (D) maxilla; (E) clasping organ (ant.2–3) in male; (F) chaetotaxy of left foreleg.

many, Poland, Norway and Sweden. Fjellberg (1989) suggested the presence of draught resistant eggs, aiding dispersal and survival in dry habitats. One specimen was extracted from a sample of *Euphorbia* litter from the semi-deserts near Los Christianos, Tenerife, following rewetting of the sample after being kept dry at room temperature in a closed jar for 12 months (Fjellberg, unpubl.). General distribution: Holarctic or wider.

# Family SMINTHURIDIDAE

The members of this family are all small, less than 1.0 mm, and differ from other families by the absence of anal appendages in females and by males having the ant.2–3 modified to clasping organs which are used during courtship.

## Key to genera

1 Inner side of tib.3 with tibiotarsal organ (Fig. 104F) . . . . . 2

– Tibiotarsal organ absent (Fig. 101I) . . . . . *Sphaeridia* Linnaniemi (p. 175)

2 Females . . . . . 3

– Males . . . . . 4

3 Ventral side of ant.3–4 with 2 and 3 long blunt seta (Fig. 110K) . . . . . *Stenacidia* Börner (p. 185)

– Ant.3–4 with normal setae only . . . . . *Sminthurides* Börner (p. 175)

4 The back of the larger abdomen with 6–8 pairs on closely standing long setae (Fig. 110F) . . . . *Stenacidia* Börner (p. 185)

– Back of larger abdomen without normal setae only . . . . . *Sminthurides* Börner (p. 175)

## Genus *Sphaeridia* Linnaniemi, 1912

*Sphaeridia* Linnaniemi, 1912, Acta Soc. Sci. fenn. 40: 248. Type species: *Sminthurus pumilis* Krausbauer, 1898, by monotypy.

Only one species in our area.

### 342. *Sphaeridia pumilis* (Krausbauer, 1898)

Fig. 101A–L

*Sminthurus pumilis* Krausbauer, 1898, Zool. Anz. 21: 495.

*Description.* – Body size up to 0.5 mm, males smaller. Large specimens with weak greyish red pigmentation. Body shape as Fig. 101A. Females with simple antennae, ant.4 not subdivided. Males with clasping organ on ant.2–3 as Fig. 101L. Labrum with 454 setae, the 4 anterior setae slightly thickened. Prelabral setae 6. Anterior labral edge simple. Maxillary outer lobe with simple palp and 4 sublobal hairs. Labial palp with 5 proximal setae, lateral papilla E with 4 guards. Basomedian field of labium with 2 setae, basolateral with 4. Mandibles normal, strong. Maxilla with 3-toothed capitulum. Maxillary lamellae short, not projecting beyond tip of capitulum. Lam.1, 2, 4 and 5 with ciliated edges, lam.3 absent. Lam.6 small, with two apical denticles and a large conical "heel" (Fig. 101F). Head with 1 + 1 postlabial setae along ventral line. Facial chaetotaxy as Fig. 101E. Chaetotaxy of abdomen as Fig. 101D. The sockets of the 3 trichobothria on each side of the greater abdomen form an obtuse angel which opens backwards. Spine-like sensilla present above the bases of two last pair of legs. Ventral tube with 1 + 1 distal setae. Males with a pair of small roundish posterior vesicles apically on ventral tube. Retinaculum with 3 + 3 teeth, two setae and a finger-like papilla on each side (Fig. 101C). Claws with a pair of small lateral teeth in basal 1/3. Unguiculus with subapical filament. Basal lamella of unguiculus narrow on tib.1–2, broad on tib.3 (Fig. 101J, K). Inner side of tib.3 in females with two enlarged serrated setae (Fig. 101I). Dens with a small finger-like papilla on the inner side near base, dorsal and ventral chaetotaxy as Fig. 101G, H. Three of the apical/subapical setae spine-like. Mucro slender with serrated inner edge and a sharp ventral keel (Fig. 101B).

*Discussion.* – This common species has in recent years been split and some other European species may show up in Nordic samples. Actual species may be identified after Bretfeld (1999). So far all checked Nordic specimens belong to *pumilis*.

*Distribution and ecology.* – Unlike members of the next genus, which are mostly present in aquatic or very wet habitats, *pumilis* is frequently found in terrestrial habitats both in forest and outside. Widely distributed, also in the Arctic. General distribution: Cosmopolitan, but old records are unreliable.

## Genus *Sminthurides* Börner, 1900

*Sminthurides* Börner, 1900, Zool. Anz. 23: 616. Type species: *Sminthurus aquaticus* Bourlet, 1842, by subsequent designation by Börner, 1906.

Our members of this genus are dimorphic, with females much larger than males. Males have modified ant.2–3 forming a clasping organ by which they lock up with the female antennae during the "dance" of the courtship. Second antennal segment in males has one trichobothrium on the outer side (two in *penicillifer*, Fig. 103E). Laste antennal segment in females often subdivided. Ocelli 6–8, two of them usually much

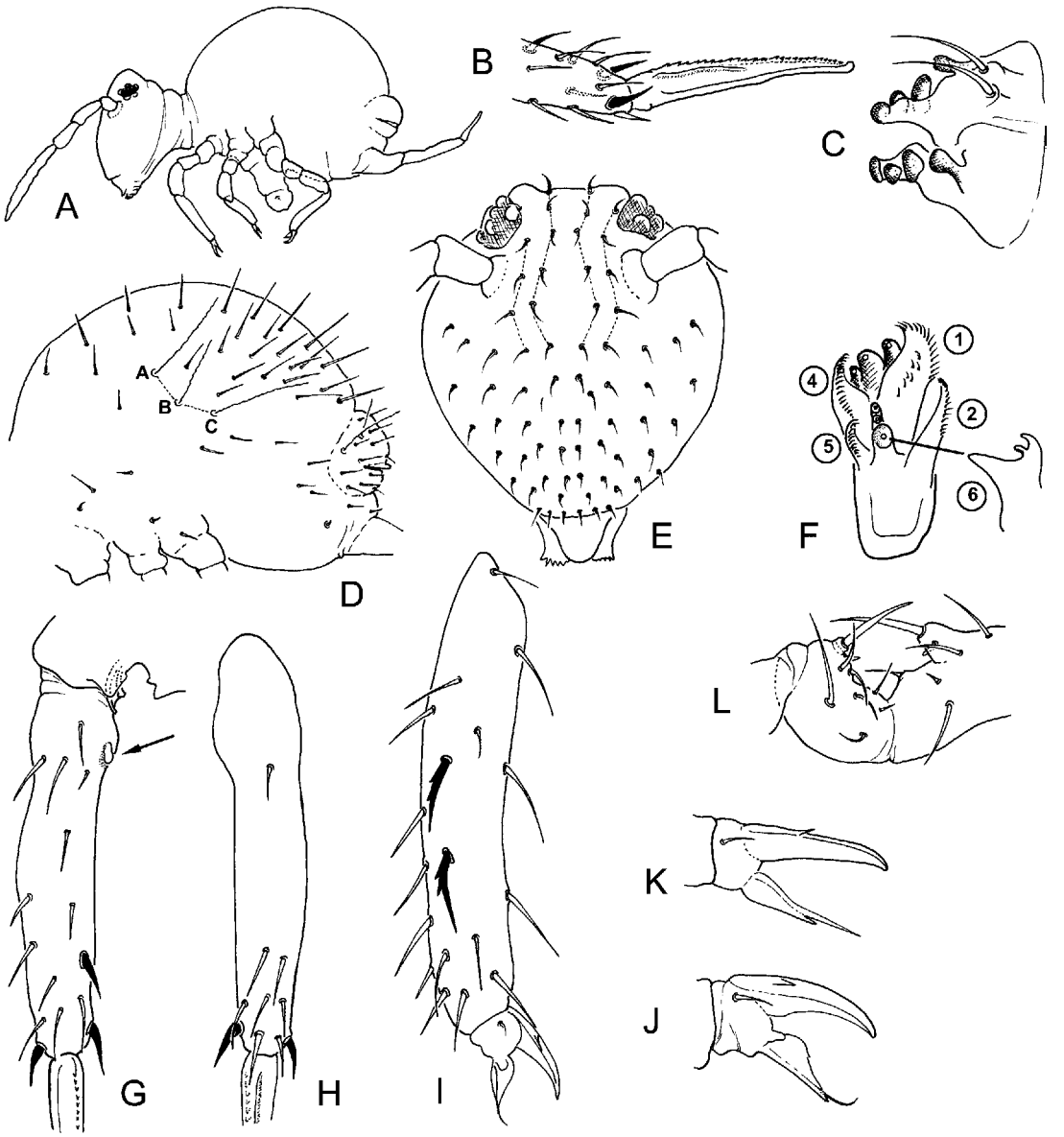


Fig. 101. *Sphaeridia pumilis*: (A) Habitus; (B) mucro and apical part of dens, dorsolateral view; (C) retinaculum; (D) setae of abdomen, with trichobothria marked (A, B, C); (E) anterior side of head; (F) maxilla; (G–H) dens, dorsal (G) and ventral views (H), finger like papilla marked (arrow); (I) inner side of right tib.3, female; (J–K) claws of hind leg (J) and foreleg (K); (L) male clasping organ of ant.2–3.

smaller than others. Labial palps complete, with 5 papillae and 16 guards, proximal setae 8. Basomedian field with 4 setae, basolateral with 4–5. Labrum with 554 setae, 6 prelabrals. Anterior edge membranous and undulating, with 4 spines which are curved anteriorly. One or more of the spines may be branched. Maxillary palp simple, sitting on a short blunt papilla. Sublobal hairs 4, with an additional hair on the inner side at base of the palp. Mandibles large, with strong molar plate. The sockets of the 3 trichobothria on each side of the greater abdomen form an ob-

tuse angel which opens to the anterior (unlike previous genus). Maxilla with 3-toothed capitulum and 6 short lamellae with a sparse cover of denticles/cilia. Ventral tube with 1 + 1 distal setae. Retinaculum with 3 + 3 teeth and 2–4 setae. Claws of two first pair of legs long and narrow, with slender unguiculus. Claw on last legs shorter, with broad basal lamella on unguiculus. Unguiculus with a setaceous apical filament which reach beyond tip of unguis. Mucro with one mid-ventral keel-like lamella and two dorsal (inner, outer) lamellae of which the inner one is usually serrated, the outer undulating. Lateral seta present at base of mucro (absent in *parvulus*). Males with a pair of bladder-like organs dorsolaterally on metathorax.

## Key to species

1 Female . . . . . 2
– Male . . . . . 11
2 Ant.4 subdivided into 4 or 5 clear subsegments (Figs 105A, 109B) . . . . . 3
– Ant.4 undivided or with small annulations (Figs 103G, 106F) . . . . . 6
3 Ant.4 with 4 subsegments, mucronal seta present (Fig. 105A, C) . . . . . 4
– Ant.4 with 5 subsegments, mucronal seta absent (Fig. 109B, C) . . . . . 352. *parvulus* (Krausbauer)
4 Proximal subsegment of ant.4 subequal to distal subsegment (Fig. 105A) . . . . . 5
– Proximal subsegment 2–3 times as long as distal (Fig. 108A) . . . . . 351. *pseudassimilis* Stach
5 Apex of mucro tubular, in profile with subapical constriction (Fig. 107D) . . . . . 350. *schoetti* Axelson
– Apex of mucro not tubular, in profile evenly curved (Fig. 105C) . . . . . 346. *signatus* (Krausbauer)
6 Unguiculus on last leg with branched apical filament (Fig. 103C) . . . . . 344. *penicillifer* (Schäffer)
– Apical filament of unguiculus simple, setaceous (Fig. 104F) . . . . . 7
7 Antenna longer than head diagonal, larger abdomen without cross-like dark figure . . 8
– Antenna shorter than head diagonal, abdomen dorsally with cross-like figure . . . . . 348. *cruciatus* Axelson
8 Ant.4 of normal shape, whole antenna less than 1.5 as long as head diagonal . . . . . 9
– Ant.4 unusually thin, with about 7 annulations. Whole antenna 1.5–2.0 as long as head diagonal . . 349. *annulicornis* Axelson
9 Tib.3 organ with simple seta (Fig. 102C). Mucro about twice as long as wide (Fig. 102B) . . . . . 343. *aquaticus* (Bourlet)
– Seta of tib.3 organ with basal lamella (Fig. 104F). Mucro more narrow, about 3 times longer than wide . . . . . 10
10 Ventral side of ant.4 at base with 3–4 long setae which are about 1/3–1/4 as long as the segment (Fig. 106F). Dens with outer lateral row of seta extending only halfway to proximal bend. Colour uniform violet blue, no patterns . . . . 347. *armatus* Bretfeld
– Ant.4 without particularly long setae on ventral side at base. Longest seta about 1/5 as long as the segment. Dens with outer lateral row of seta extending to proximal bend. Abdomen usually with banded pattern (Pl. 12: 2) . . . . . 345. *malmgreni* (Tullberg)
11 Posterior side of ant.2 with one trichobothrium and one enlarged seta (B1) which is often ciliate (Fig. 104A) . . . . . 12
– Posterior side of ant.2 with 2 trichobothria (Fig. 103E) . . . . 344. *penicillifer* (Schäffer)
12 Ant.4 undivided . . . . . 13
– Ant.4 with 4 more or less complete subsegments . . . . . 351. *pseudassimilis* Stach
13 Mucro in lateral view broad, not pointed (Figs 107D, 109C) . . . . . 14
– Mucro in lateral view pointed (Fig. 104B) . . . . . 15
14 Ventral edge of mucro with subapical constriction (Fig. 107D). Apex tubular. Lateral seta present . . . . . 350. *schoetti* Axelson
– Ventral edge of mucro evenly curved (Fig. 109C). Apex broad, not tubular. Lat-

eral seta absent
. . . . . 352. *parvulus* (Krausbauer)

15 Mucro at least 3 times as long as wide
. . . . . 16

– Mucro about twice as long as wide
. . . . . 343. *aquaticus* (Bourlet)

16 Tib.2 without spine-like seta at base. Ant.3 with small spine-like setae near $c_2$ . . . . . 17

– Tib.2 with an outer spine-like seta near base (Fig. 106C). Ant.3 with two long blunt processes between $c_1$ and $c_2$ (Fig. 106A)
. . . . . 347. *armatus* Bretfeld

17 Ant.2 with elements $b_2$–$b_4$ on a common papilla (as Fig. 107A) . . . . . 19

– Ant.2 with $b_2$ separated from $b_3$–$b_4$ (Fig. 104A) . . . . . 18

18 Ant.4 short, 3–4 times as long as largest diameter. Dorsal side with some proximal back-curved stiff setae
. . . . . 345. *malmgreni* (Tullberg)

– Ant.4 long, at least 6 times longer than diameter. Dorsal base without back-curved setae . . . . . 349. *annulicornis* Axelson

19 Larger abdomen with cross-like dark figure
. . . . . 348. *cruciatus* Axelson

– Larger abdomen unpatterned
. . . . . 346. *signatus* (Krausbauer)

## 343. ***Sminthurides aquaticus*** (Bourlet, 1842)

Fig. 102A–C; Pl. 12: 1

*Smynthurus aquaticus* Bourlet, 1842, Mém. Soc. Centr. Agric. Nord, Douai 1841: 146.

*Description.* – Body size up to 1.0 mm in females, 0.3–0.4 mm in males. Ground colour yellowish grey with diffuse violet pigment, sometimes forming dorsal and lateral patches (Pl. 12: 1). Ant.4 in females more than 1.5 as long as ant.3, with 7–8 weakly marked subsegments. Clasping organ of males as Fig. 102A, with elements $b_2$–$b_4$ on individual papillae. Labrum with all setae slender (not expanded/flattened in apical part). Labial palps with apically flattened proximal setae. Maxilla as in *malmgreni* (Fig. 104C), lam.4–6 with stronger teeth than others. Tibiotarsal organ in females with simple setae (Fig. 102C). Retinaculum with 3–4 setae. Two first pairs of legs with narrow unguiculus having the setaceous apical filament about as long as unguis. Unguis with sharp inner tooth in apical 2/3 and weak lateral teeth. Posterior unguiculus with broad basal lamella. Furca long and slender, dens with numerous setae. Mucro broad, from above about twice as long as wide (Fig. 102B).

*Discussion.* – The large size, broad mucro, undivided ant.4 and simple long seta of the tibiotarsal organ in females readily identify this species.

*Distribution and ecology.* – Common and widely distributed in ponds and along shores of eutrophic lakes. General distribution: Holarctic.

## 344. ***Sminthurides penicillifer*** (Schäffer, 1896)

Fig. 103A–G

*Sminthurus penicillifer* Schäffer, 1896, Mitt. naturh. Mus. Hamb. 13: 211.

*Description.* – Body size up to 1.0 mm in females, 0.3 mm in males. General habitus of males as Fig. 103A. Ground colour pale yellowish with violet lateral band and a dorsal spot which is split in two bands in less pigmented specimens. Ant.4 in females about 1.5 times as long as ant.3, with 7 indistinct subsegments and some secondary annulations (Fig. 103G). Antennal clasping organ in male as Fig. 103D, with elements $b_2$–$b_4$ sitting on a common papilla. Ant.2 on outer side with two trichobothria (Fig. 103E). Anterior two rows of labral setae apically expanded and flattened, spear-shaped (Fig. 103F). Some of the guards and proximal setae of labial palps also more or less flattened, spear-shaped. Maxilla almost identical to that of *malmgreni* (Fig. 104C). Postlabial setae 3 + 3. The seta of the tibiotarsal organ with split basal lamella. Unguiculus with long apical filament which is slightly flattened and expanded in apical 1/3 on the two first pairs of legs while it is strongly branched on last pair of legs (Fig. 103C). Claws on last pair of legs with serrations in apical 1/3 on posterior side. Furca strong, with long curved dens. Mucro broad with serrated wide dorsal lamellae and a distinct midventral lamella (Fig. 103B).

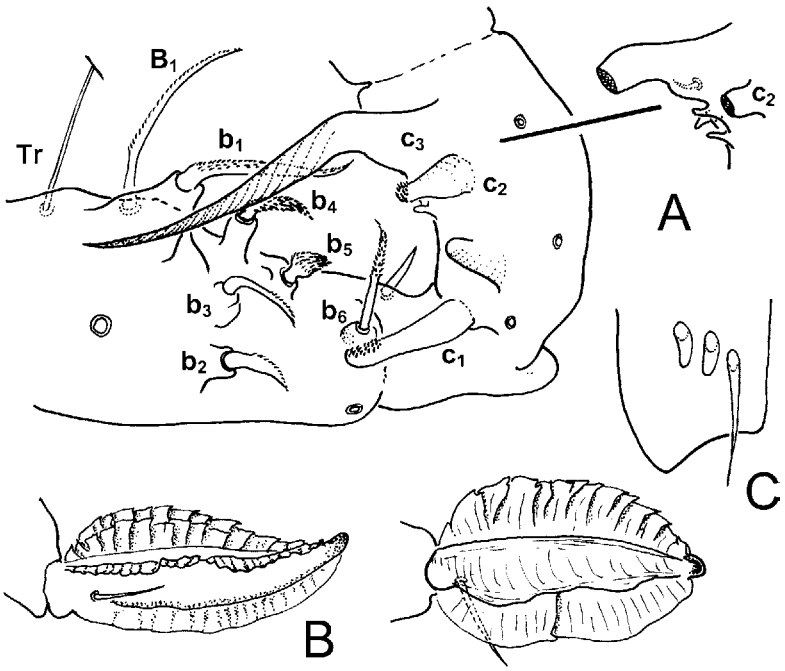


Fig. 102. *Sminthurides aquaticus*: (A) Male clasping organ on left ant.2–3; (B) mucro, lateral (left) and dorsal (right); (C) tib.3 organ.

*Discussion.* – The exceptional unguicular filament of the last claw is an unique character for the species.

*Distribution and ecology.* – In our area only from Sweden and Finland. Uncommon, along shores of lakes with rich vegetation. General distribution: Palaearctic.

## 345. ***Sminthurides malmgreni*** (Tullberg, 1876)

Fig. 104A–F; Pl. 12: 2

*Sminthurus malmgreni* Tullberg, 1876, Öfvers. K. VetenskAkad. Förh. 33: 30.

*Description.* – Body size up to 0.6 mm in females, males 0.3 mm. Ground colour pale yellowish with variable violet pigmentation. In our area usually with a dark lateral band and a dorsal spot (Pl. 12: 2). These elements may expand and fuse to cover most of the larger abdomen, leaving ventral side pale. Head darkened in eye-spots, posterior side, mouthparts, a spot between the antennal bases and cheeks below eyes. Antennae in females with undivided ant.4 which is slightly longer than ant.3. Males with ant.2 as Fig. 104A, elements $b_2$–$b_4$ on separate papillae. Labral setae simple, unmodified. Lateral pair of labral apical spines split at apex (Fig. 104E). Maxilla with 3-toothed capitulum and 6 short, serrated lamellae (Fig. 104C). Head with $4+4$ postlabial setae along ventral line. Ventral tube with smooth apical lobes. Tibiotarsal organ with basically flattened seta (Fig. 104F). Males with a blunt-tipped modified seat on inner side of trochanter on the second pair of legs (Fig. 104D). Dens with many dorsal and ventral setae. Mucro much like that of *penicillife*, but more slender, about 3 times as long as wide (Fig. 104B). Inner dorsal edge with about 10 coarse teeth. Unguiculus with simple setaceous apical filament (Fig. 104F).

*Discussion.* – The colour pattern, mucro shape, undivided ant.4 and broad seta of the tibiotarsal organ normally identify this species.

*Distribution and ecology.* – This is our most common *Sminthurides*, being recorded both in lowlands, mountains and Arctic. May be found

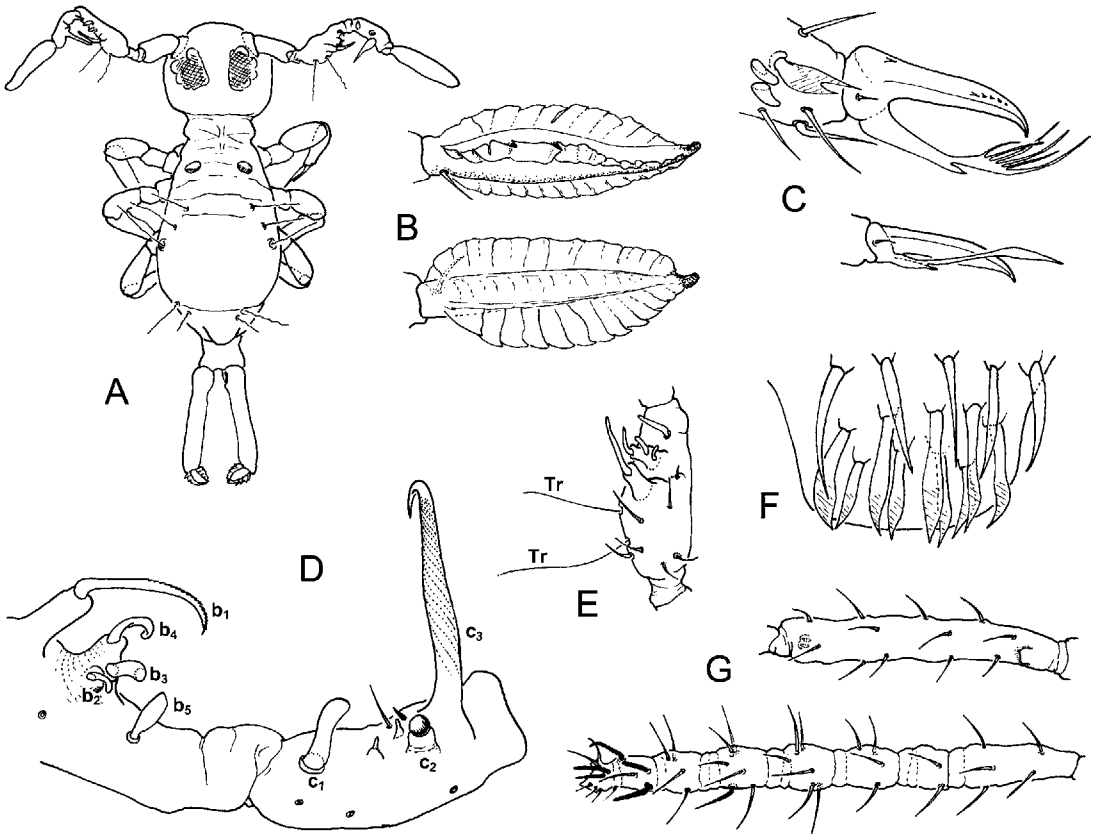


Fig. 103. *Sminthurides penicillifer*: (A) habitus, male; (B) mucro, lateral (above) and dorsal (below); (C) claw of hind leg with tibiotarsal organ (above) and claw on foreleg (below); (D) male clasping organ on left ant.2–3; (E) ditto, ant.2, dorsal view showing two external trichobothria (Tr); (F) labrum; (G) female ant.3 (above) and ant.4 (below).

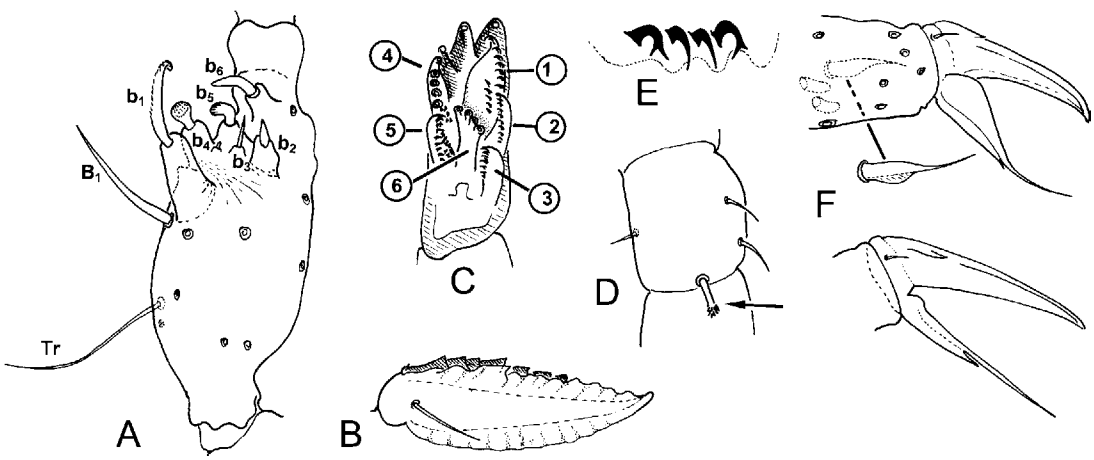


Fig. 104. *Sminthurides malmgreni*: (A) Male clasping organ, left ant.2, dorsal view; (B) mucro; (C) maxilla; (D) specialised seta (arrow) on inner trochanter of middle leg; (E) labrum, apical spines; (F) claw of hind leg with tibiotarsal organ (above) and claw of foreleg (below).

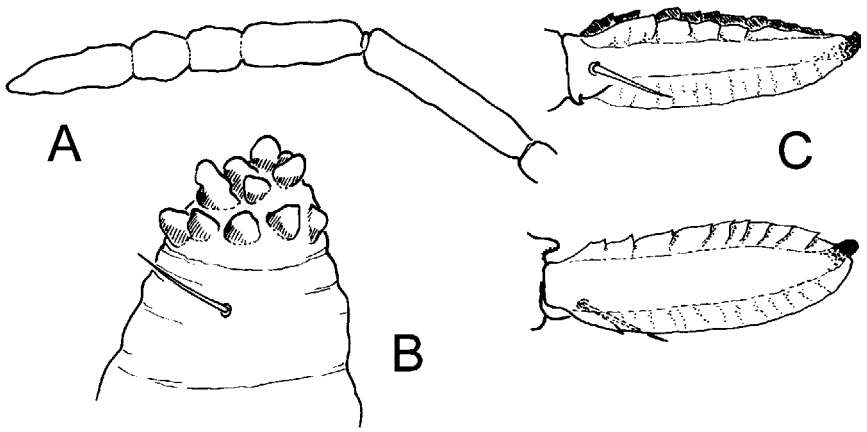


Fig. 105. *Sminthurides signatus*: (A) Female ant.3–4; (B) tip of ventral tube; (C) mucro, lateral (above) and dorsal (below).

in different kinds of water bodies and wetlands. General distribution: Holarctic.

## 346. ***Sminthurides signatus*** (Krausbauer, 1898)

Fig. 105A–C

*Sminthurus signatus* Krausbauer, 1898, Zool. Anz. 21: 496.
*Sminthurides assimilis* (Krausbauer, 1898).

*Description.* – Body size up to 0.5 mm in females, males smaller. Colour pale violet brown, with two darker longitudinal bands on dorsal side of the large abdomen. Ant.4 in female with 4 subsegments, first and last segment subequal (Fig. 105A). Male clasping organ with elements $b_{2-4}$ on a common papilla. Labrum with unmodified setae. Head with 2 + 2 postlabial setae. Ventral tube with 1 + 1 distal setae and about 8 + 8 grape-like papillae on the apical lobes (Fig. 105B). Retinaculum with two setae. Claws normal, unguiculus with setaceous filament reaching beyond tip of unguis. Seta of tibiotarsal organ with basal lamella. Mucro (Fig. 105C) with broad lateral lamellae, the inner one coarsely serrated, the outer undulating. Apex with a blunt tooth.

*Discussion.* – The antennal characteristic of the female is the same as in *schoetti*, but the shape of mucro separate the two species. Linnaniemi's (1912) use of the names *assimilis* and *inequalis* var. *distincta* relates to the species *pseudassimilis*.

*Distribution and ecology.* – Only a single record in our area: Norway, VE: Tjøme (Moutmarka), 28.IX.1998, one female in an eutrophic pond. General distribution: Palaearctic.

## 347. ***Sminthurides armatus*** Bretfeld, 2000

Fig. 106A–H

*Sminthurides inequalis armatus* Bretfeld, 2000, Abh. Ber. NaturkMus. Görlitz 72: 26.

*Description.* – Body size up to 0.5 mm, males smaller. Colour violet blue, unpatterned. Ocelli 7 + 7. Ant.4 in female with weak tendency to subsegmentation (Fig. 106F). Some of the ventral setae in proximal part of ant.4 very long, longer than diameter of the segment (Fig. 106F). Male antennal organ as Fig. 106A, the ant.2 elements sitting on individual papillae. Ant.4 in males with 4–5 back-curved straight spine-like setae on dorsal side in proximal half (Fig. 106B). Anterior setae of labrum heavy, spine-like. Labral edge with forked spines (Fig. 106D). Anterior 4 proximal setae on labial palp heavy, spine-like. Guard $a_1$ particularly thick, blunt (Fig. 106H). Head with 2 + 2 postlabial setae. Maxilla (Fig. 106E) with short lamellae. Lam.1 with short marginal cilia and 2–3 rows of denticles. Lam.2–3 very thin, indistinctly serrated. Lam.4–5 with strong marginal serrations. Lam.6 with fine marginal ciliation followed by 1–2 rows of denticles. Apical sacs of ventral tube smooth. Males with a spine-like seta on the outer

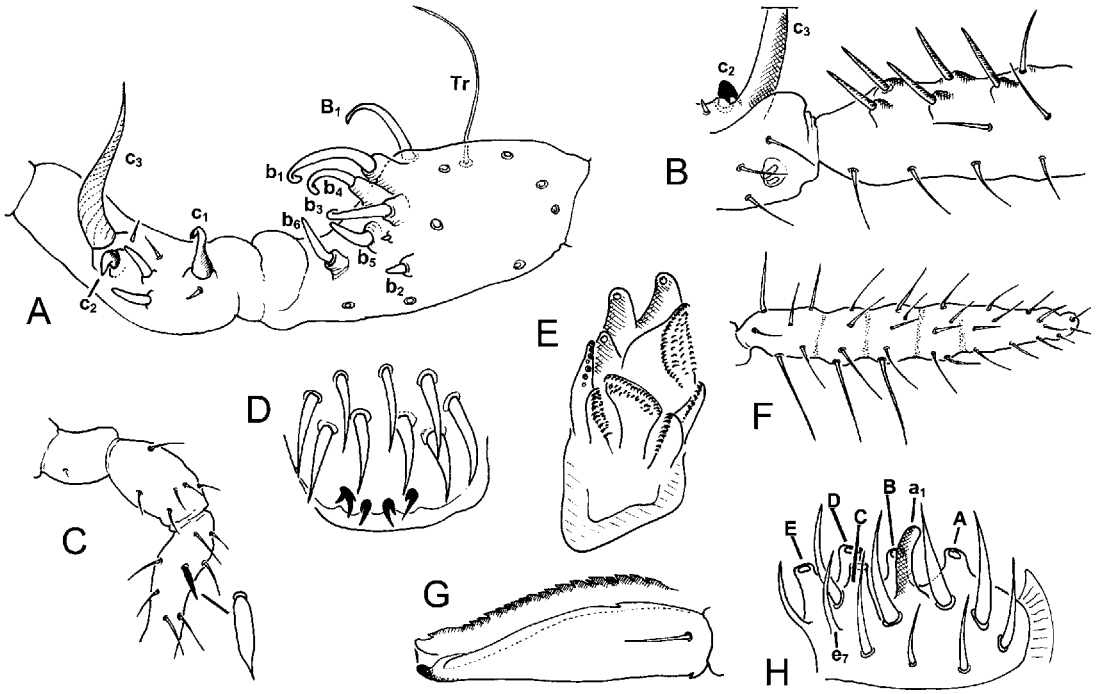


Fig. 106. *Sminthurides armatus*: (A) Male clasping organ, right ant.2–3; (B) transition ant.3–4, showing spiniform setae at base of ant.4, male; (C) spiniform seta (detail) at base of right tib.2, male; (D) labrum with apical spines (black); (E) maxilla; (F) ant.4, female, showing long ventrobasal setae; (G) right mucro (lateral), showing serrated inner edge (above); (H) right labial palp with enlarged guard $a_1$.

side at base of tib.2 (Fig. 106C). Claws normal, apical setaceous filament of unguiculus reaching beyond tip of unguis. The seta of the tibiotarsal organ widened at base. Mucro slender, tapering towards apex which ends in a blunt tooth (Fig. 106G). Inner lamella densely serrated (often more than 15 small teeth), outer lamella at most with a single tooth. Ventral edge keel-like, smooth (devoid of primary granules), ending in the apical tooth.

*Discussion.* – The taxon *armatus* was established by Bretfeld (2000) for specimens from Spitsbergen and N. Siberia (Taimyr, Severnaya Zemlya) which were supposed to be a subspecies of *inequalis* Börner, 1903. The nominate form (France and Italy) has no spine-like seta on tib.2 and ant.4 in females is not clearly subsegmented. The criteria for recognising subspecies in Collembola are diffuse. Just for convenience the taxon is here treated as a distinct species. Only biological observations and/or molecular studies can prove whether *inequalis* and *armatus* are subspecies or full species.

*Distribution and ecology.* – In our area only from Spitsbergen (Ny Ålesund), in dry arctic tundra. General distribution: Palaearctic.

## 348. ***Sminthurides cruciatus*** Axelson, 1905

*Sminthurides cruciatus* Axelson, 1905, Zool. Anz. 28: 792.

*Description.* – Body size up to 0.5 mm in females, males smaller. Ground colour yellowish white. The larger abdomen darker ventrally and with a cross-like violet figure on dorsal side. Antennae short, total length shorter than head diagonal. Ant.4 in females without subsegments or annuli. Male clasping organ with elements $b_{2-4}$ on a common papilla. Details of the mouth parts unknown. The general hair cover of the greater abdomen is unusually short in females. Ventral

tube with papillate apical lobes. Mucro similar to that of *signatus* (Fig. 105C). Males with a spine-like seta on the inner side of femur on the second pair of legs.

*Discussion.* – No specimens were available for study. The above characteristics are extracted from Bretfeld (1999, 2000: 29). The short antennae with the unsegmented ant.4 in female, the mucro shape and the cross-like figure on abdomen should make the species easy to identify. The male spine on femur 2 is not described from other species of the genus.

*Distribution and ecology.* – Very rare on water and stream banks. Only Finland. It is also recorded from Sweden by Stach (1956) and Gisin (1960), but the locality is unknown. General distribution: Palaearctic.

## 349. ***Sminthurides annulicornis*** Axelson, 1905

*Sminthurides annulicornis* Axelson, 1905, Zool. Anz. 28: 793.

*Description.* – Body size up to 0.6 mm. in females, males smaller. Head, body and extremities dark blue. Ant.4 in females unusually slender, with 7 indistinct subsegments/annulations. Total length of antenna about 1.5 as long as head diagonal. Ant.4 in males long and slender with tendency to annulation, at least 6 times longer than longest diameter of the segment. Ventral tube with smooth apical lobes. Trochanter on the second pair of legs with 4 setae, of which one is modified with a rough tip. Mucro about 3 times longer than wide, apex with a dorsal "hollow". The seta of the tibiotarsal organ with broad, serrated basal lamella.

*Discussion.* – Originally described from Finland, based on a single female. Bretfeld & Griegel (1999) redescribed the species based on one female and three males from Poland. The slender antennae with tendency to annulation should identify the species.

*Distribution and ecology.* – Originally described from Russian Karelia from the shore of a small lake together with other *Sminthurides*. Since then only reported from Poland. General distribution: Palaearctic.

## 350. ***Sminthurides schoetti*** Axelson, 1903

Fig. 107A–D; Pl. 12: 3

*Sminthurides schoetti* Axelson, 1903, Acta Soc. Fauna Flora fenn. 25: 12.

*Description.* – Body size up to 0.5 mm in females, males smaller. Ground colour pale yellow with violet pigment covering most of the larger abdomen, leaving anterior midline and parts of the sides unpigmented (Pl. 12: 3). Ant.4 in females with 4 clear subsegments, as in *signatus* (Fig. 105A). Male antennal organ as Fig. 107A, with elements $b_2$–$b_4$ on a common papilla. Maxillary lamellae very short, not reaching tip of capitulum. Lam.6 with many small teeth at anterior edge (Fig. 107B). Labral setae unmodified. Head with 3 + 3 postlabial setae along ventral line. Extruded apical sacks of ventral tube in females with a few irregular lobes (Fig. 107C). Tibiotarsal organ with slender seta. Claws normal, unguiculus with setaceous filament passing tip of unguis. Last claw with a large posterior lateral tooth on unguis. Mucro narrow, inner lateral lamella serrated, outer at most with a single tooth. Ventral edge sharp, apex constricted, more or less tubular (Fig. 107D).

*Discussion.* – Mucro shape and antennal characteristics normally identify this small species.

*Distribution and ecology.* – Common and widely distributed in wetlands and small water bodies. General distribution: Palaearctic.

## 351. ***Sminthurides pseudassimilis*** Stach, 1956

Fig. 108A–C

*Sminthurides pseudassimilis* Stach, 1956, Apteryg. faun. Poland, 6. Fam. Sminthuridae: 43.

*Description.* – Body size up to 0.5 mm in females, males smaller. Colour violet grey, without distinct patterns. Ocelli 8 + 8, one smaller. Ant.4 in female with 4 subsegments, distal subsegment much shorter than proximal (Fig. 108A). Head with 3 + 3 postlabial setae. Maxilla with short lamellae having coarse marginal serrations. Lam.6 with 5–6 apical denticles only. Females with extruded apical sacs show

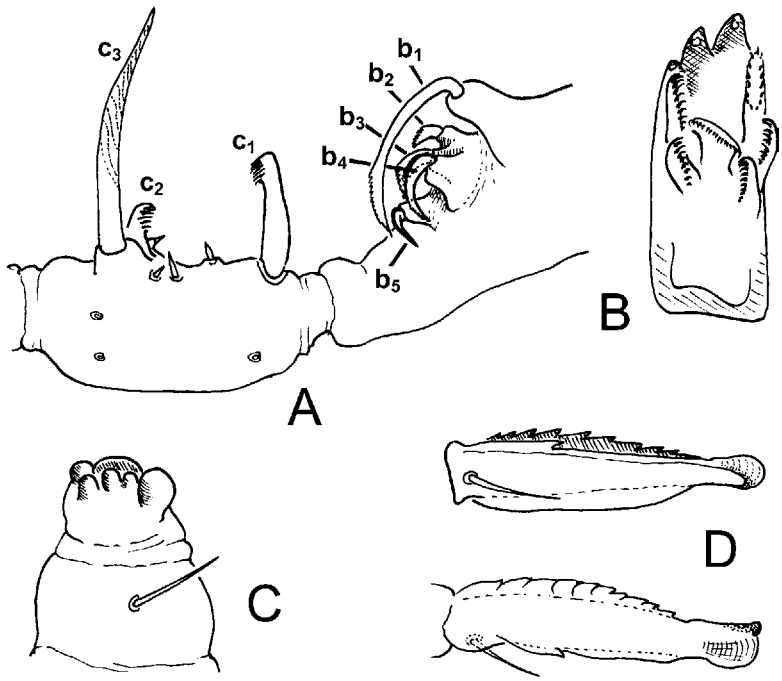


Fig. 107. *Sminthurides schoetti*: (A) Male clasping organ, right ant.2–3; (B) maxilla; (C) tip of ventral tube; (D) mucro, lateral (above) and dorsal (below).

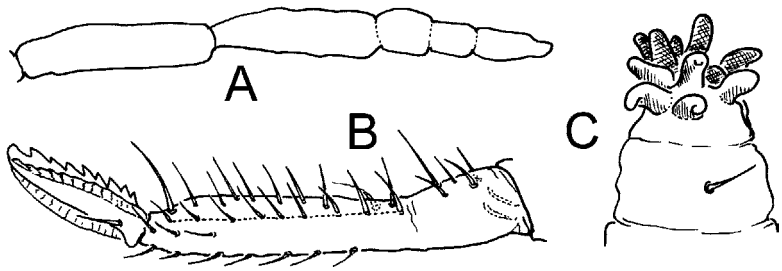


Fig. 108. *Sminthurides pseudassimilis*: (A) Ant.3–4, female; (B) dens and mucro; (C) tip of ventral tube.

5 + 5 regular finger-like papillae (Fig. 108C). Dens with long lateral row of setae (Fig. 108B). Ventral edge of mucro evenly curved. Inner lateral lamella with 8–9 coarse serrations, outer undulating.

*Discussion.* – The antennal characteristics of the female readily identify the species. Also the finger-like apical papillae of the ventral tube are not seen in any other Nordic species. Males were not available for description.

*Distribution and ecology.* – An eastern species recorded from many places in Finland. Apart from that only in easternmost Norway (HEs). In bogs (*Sphagnum*), along shores of lakes and smaller water bodies. General distribution: Palaearctic.

## 352. ***Sminthurides parvulus*** (Krausbauer, 1898)

Fig. 109A–C

*Sminthurus parvulus* Krausbauer, 1898, Zool. Anz. 21: 497.

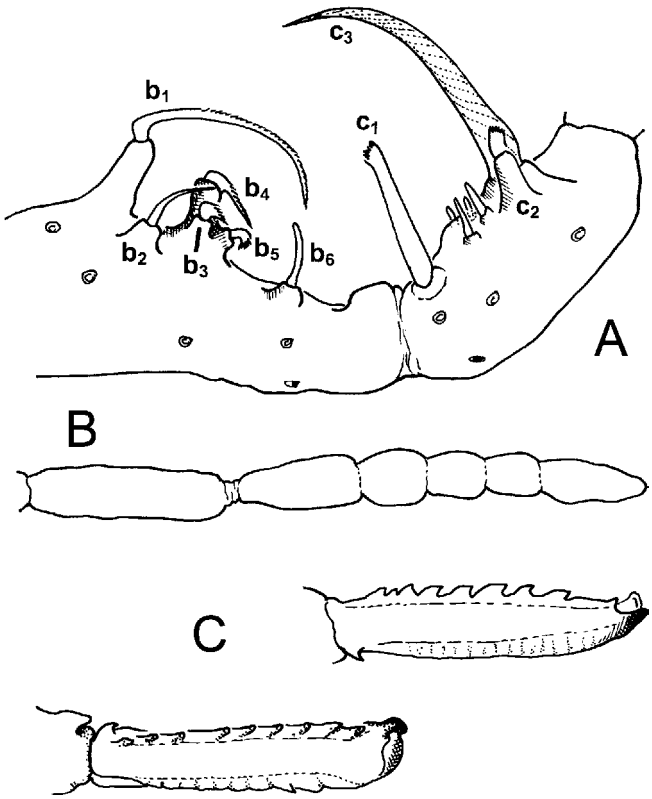


Fig. 109. *Sminthurides parvulus*: (A) Male clasping organ, left ant.2–3; (B) female ant.3–4; (C) mucro, lateral (above) and dorsal (below).

*Description.* – Body size up to 0.5 mm in females, males smaller. Colour pale bluish violet, not forming distinct patterns. Ant. 4 in females with 5 subsegements (Fig. 109B). Male antennal organ as Fig. 109A, $b_3$–$b_5$ sitting on a common papilla. Head with 3 + 3 postlabial setae. Ventral tube with smooth apical sacs. Retinaculum with 3–4 setae. Seta of the tibiotarsal organ with broad basal lamella which is sometimes serrated. Claws normal, apical filament of unguis slender, reaching far beyond tip of unguis. Mucro slender, apex broadly rounded (Fig. 109C). Inner lamella coarsely serrated, ending in a blunt apical tooth. Outer lamella weakly undulating, at most with 1–2 teeth. Ventral lamella membranous, undulating, ending at the apical tooth. Lateral seta absent.

*Discussion.* – The 5-segmented ant.4 in the female and the broad-tipped mucro easily identify this species. The male antennal organ differs from *schoetti* in having a papillate $b_6$. Absence of mucronal seta appears to be unique among our species.

*Distribution and ecology.* – Uncommon species, mainly in damp litter along lakes, wet meadows and *Sphagnum* bogs. Linnaniemi (1912) did not record the species in Finland, but it may have been overlooked. General distribution: Palaearctic.

## Genus *Stenacidia* Börner, 1906

*Stenacidia* Börner, 1906, Mitt. naturh. Mus. Hamb. 23: 182. Type species: *Sminthurus violaceus* Reuter, 1881, by original designation.

The single species of this monotypic genus differs from *Sminthurides* by a very narrow, slender mucro which has both dorsal edges serrated

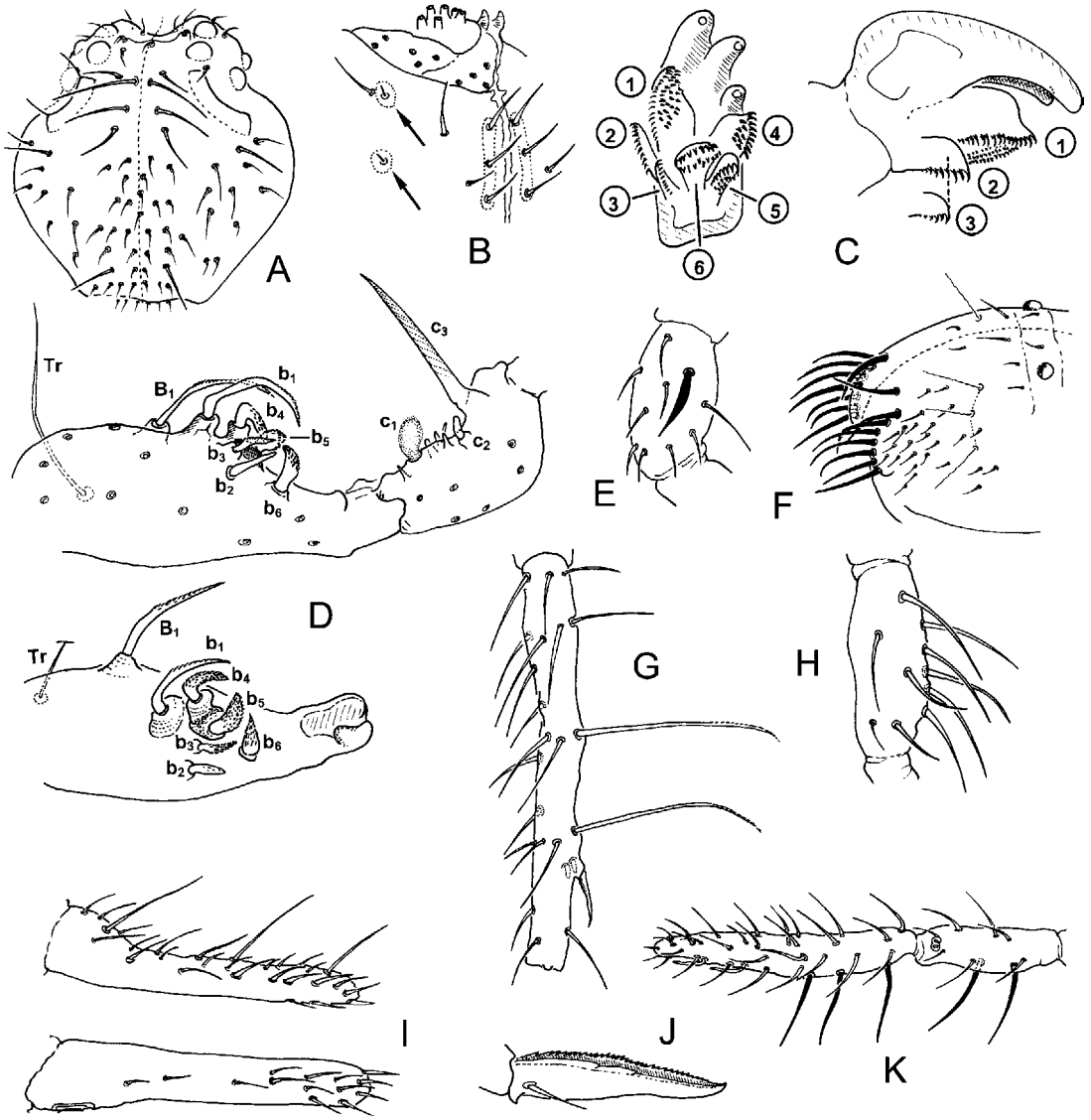


Fig. 110. *Stenacidia violacea*: (A) Frontal view of head, male; (B) ventral side of head showing 3 + 3 postlabial setae and two microchaetae (arrows); (C) right maxilla, inner side (left) and ventral side (right); (D) male clasping organ, left ant.2–3, with dorsal view of ant.2 below; (E) spiniform seta (black) on right femur, middle leg, male; (F) tip of abdomen, male; (G) tib.3, male; (H) femur of last leg, male; (I) dens, lateral (above) and ventral (below); (J) mucro; (K) left ant.3–4, female.

in the males. The most outstanding characters of the genus are the modified setae on abdomen and on last pair of legs in the males (Fig. 110F, G). Females are not clearly distinguished from *Sminthurides*. Bretfeld (1999: 31) uses as a generic diagnostic character the ventral erect setae on ant.3–4 in females, but such setae are also present in *Sminthurides armatus*.

## 353. ***Stenacidia violacea*** (Reuter, 1881)

Fig. 110A–K

*Sminthurus violaceus* Reuter, 1881, Meddn Soc. Fauna Flora fenn. 6: 203.

*Description.* – Body size up to 0.7 mm in females, 0.5 mm in males. Body with violet pigmentation, often almost pale on top of abdomen. Ocelli 8 + 8, two smaller. Ant.4 in female not subsegmented/annulated, ant.3 and 4 with 2 and 3 long, erect setae on ventral side (Fig. 110K). Male clasping organ strongly developed. Ant.2 on the outer side with one trichobothrium and on serrated modified seta ($B_1$). Elements $b_1$–$b_6$ all present, sitting more or less on individual papillae. Ant.3 with a hyaline bladder-like $c_1$ (Fig. 110D). Labrum with 6/554 setae. The labral setae strong and thick, like the 5 sublobal hairs on the maxillary palp flanking labrum. Labral edge with 4 hooks. Labial palps as in *Sminthurides*. Anterior proximal setae strongly thickened, spine-like. Basomedian and basolateral fields of labium with 4 and 5 setae. Head with 3 + 3 postlabial setae and 2 + 2 ventrolateral microsetae (Fig. 110B). Maxilla (Fig. 110C) with short lamellae. Lam.2 and 3 thin, blade-like, with fine serrations along the edge only. Other lamellae with coarse denticles and long marginal serrations. Some of the facial setae of males prolonged (Fig. 110A), in females only moderately so. Ventral tube with 1 + 1 distal setae and smooth apical lobes. Males with a pair of dorsal vesicles on metathorax and 7–8 enlarged setae on each side of the midline in posterior part of the greater abdomen (Fig. 110F). In males the setae on the outer side of last femur as well as two outer setae on tibiotarsus are strongly prolonged (Fig. 110G, H). An enlarged seta also present on the anterior side of femur 2 (Fig. 110E). Tibiotarsal organ present, the long seta widened at base. Claws with two inner teeth, two pairs of lateral teeth and a hyaline membranous tunica on the outer half of unguis. Unguiculus with setaceous apical filament which bypass tip of unguis. Chaetotaxy of dens as Fig. 110I. The outer lateral row of seta reaches the proximal bend of dens. Inner lateral row with 4 enlarged spine-like setae in apical half. Dorsal side with 3 long thin macrochaetae. Mucro narrow, pointed. In males both dorsal edges with fine serrations (30–40 teeth), in females the inner is serrated and the outer undulating with at most two teeth. Ventral edge sharp, without lamella. Lateral seta present (Fig. 110J).

*Discussion.* – The males are readily identified by the peculiar setal cover on the back of abdomen and the double-serrated dorsal edges of the mucro. Females may be confused with females of *Sminthurides armatus* which are smaller, with very indistinct tunica on the claws and fewer teeth (no more than 15) on the inner lamella of mucro. The 2 + 2 microsetae on ventrolateral side of the head in *violacea* are possibly absent in species of *Sminthurides*. Fjellberg (1988) published two records of *violacea* from moist habitats in the high mountains of inner Troms in N. Norway. The specimens may actually have been females of *Sminthurides armatus*, which would be a new record for the Scandinavian mainland. Unfortunately the specimens are lost so new material has to be collected to verify the identity.

*Distribution and ecology.* – Linnaniemi (1912) gives several records from Finland, from various wet habitats. General distribution: Cosmopolitan.

# Family ARRHOPALITIDAE

In our area only one genus with species having 1 + 1 ocelli and reduced pigmentation which is unique among our Symphypleona.

## Genus *Arrhopalites* Börner, 1906

*Arrhopalites* Börner, 1906, Mitt. naturh. Mus. Hamb. 23: 182. Type species, *Sminthurus caecus* Tullberg, 1871, by original designation.

The mouthparts are very similarly built in all examined species. Labrum has 554 setae and 6 prelabrals. The anterior 4 setae are separated by 3 smooth ridges. Anterior edge membranous, without spines or folds (Fig. 111I). Maxillary outer lobe with simple palp and 3 sublobal hairs (two in *principalis*). The labial palp (Fig. 111J) has all papillae A–E present, with 0-5-0-4-3 guards and 5 proximal setae. Basal labial fields with 4 median and 5 lateral

setae. The maxilla of the examined species are all similar (Fig. 111B), having 6 lamellae with short marginal ciliation/serration and large denticulate fields on lam.1 and 6. Head with 2 + 2 postlabial setae along ventral line. The ventral tube has 1 + 1 distal setae and smooth distal sacs. Retinaculum with 4 + 4 teeth and 1–2 setae. Abdomen with 3 + 2 trichobothria on each side. Subanal appendages present in females. Claws in our species with inner tooth and lateral teeth. A variable thin tunica usually present in outer half of the claw. Unguiculus with a small corner tooth and setaceous apical filament. Mucro slender, with serrated dorsal edges and a sharp mid-ventral edge, lateral seta absent. Juveniles with incomplete development of anal appendages and antennal characters may be difficult to identify unless adults are present in the same sample. Most of our species are probably parthenogenetic as males are not seen.

## Key to species

1 Dens with lateroapical spines, no ventroapical spine (Fig. 112D). Abd.6 without integumental spines behind the row of circumanal macrochaetae. Ant.4 with 5 or 6 subsegments . . . . . 2

– Dens with ventroapical spine (Fig. 111H), abd.6 with integumental spines (Fig. 111C). Ant.4 undivided . . . . 354. *caecus* (Tullberg)

2 Ant.4 with 5 subsegments (Fig. 112K) . . . 3

– Ant.4 with 6 subsegments (Fig. 112F) . . . 6

3 Subanal appendages apically expanded and split in long fringes (Fig. 112I) . . . . . 4

– Subanal appendages rod-shaped, with short apical serrations . . . . . 5

4 Setae on top of head normal, not spine-like . . . . . 358. *sericus* Gisin

– Head with 6 + 6 spine-like setae . . . . . 359. *secundarius* Gisin

5 Ant.4 9–10 times as long as ant.1. Dens with 3 inner lateral spines (as Fig. 112D) . . . . . 360. *pygmaeus* (Wankel)

– Ant.4 not more than 7 times as long as ant.1. Dens with 4 inner spines . . . . . 361. *pseudoappendices* Rusek

6 Subanal appendages spoon-like, finely ciliated apex (Fig. 112E). Some of the circumanal setae wing-like expanded and serrated at base . . . . . 7

– Subanal appendages with long apical filaments (Fig. 112I). Circumanal setae not expanded at base . . . . . 357. *principalis* Stach

7 Dens with two external spine-like setae (Fig. 112D) . . . . . 355. *cochlearifer* Gisin

– Dens with 4–6 spine-like external setae . . . . . 356. *spinosus* Rusek

## 354. ***Arrhopalites caecus*** (Tullberg, 1871)

Fig. 111A–J

*Sminthurus caecus* Tullberg, 1871, Öfvers. K. VetenskAkad. Förh. 28: 146.

*Description.* – Body size up to 1.0 mm, general habitus as Fig. 111A. Colour white. Ant.4 undivided or with tendency to 5 subsegments. Ant.3 with a microspine in the middle on the outer side (Fig. 111G). Seta on top of head more or less spiniform, variable (Fig. 111F). Maxilla as Fig. 111B. Capitulum with 3 teeth. Lam.1 and 6 with denticulate fields, other lamellae bladelike with serrated edge. Labrum as Fig. 111I. Labium as Fig. 111J. Dorsal body hairs short, not spiniform. Retinaculum with one seta. Claws with one inner tooth on unguis and two pairs of small lateral teeth. Tunica evident on two last pairs of claws. Unguiculus narrow on first legs, broader on two last pairs (Fig. 111E). A corner tooth present on unguiculus, apical filament short, not beyond tip of unguis. Abd.6 with 2 + 2 integumental spines on each side, behind the row of circumanal setae of which some are serrated/expanded at base (Fig. 111C). Dens and mucro as Fig. 111H. Subanal appendages as Fig. 111D, rod-shaped, apex slightly bent and serrated. Males unseen.

*Discussion.* – The ventrodistal spine on dens and the integumental spines on abd.6 readily identify this species. On the world scale there are probably more than one species covered by the taxon *caecus*. The species was originally described from Sweden.

*Distribution and ecology.* – Widely distributed, but uncommon. In various litter, both in forests

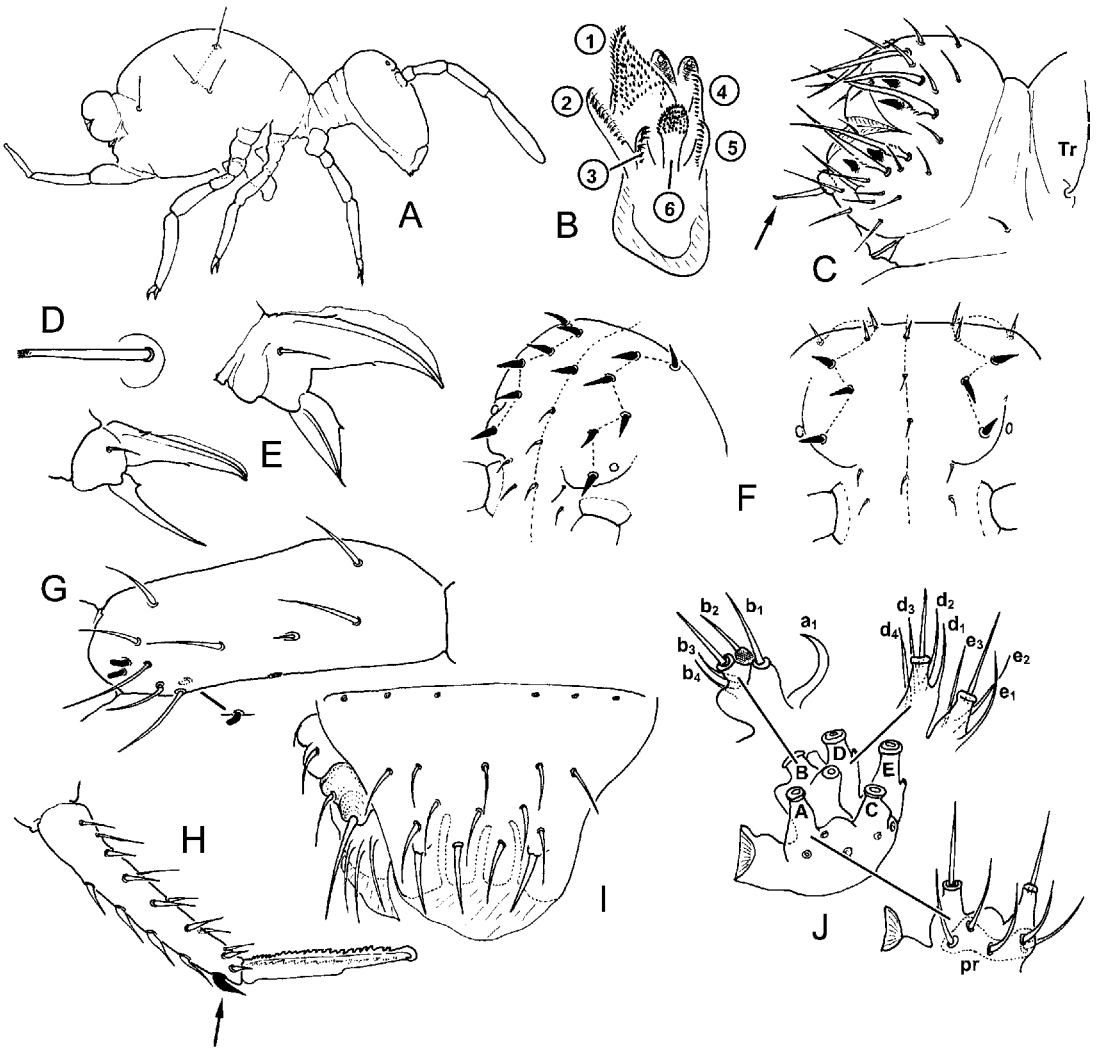


Fig. 111. *Arrhopalites caecus*: (A) Habitus; (B) maxilla; (C) abd.5–6, female, with trichobothrium (Tr), integumental spines (black) and subanal appendage (arrow); (D) subanal appendage; (E) claw of hind leg (above) and foreleg (below); (F) cephalic spines (black) in specimens from south Norway (left) and north Norway (right); (G) left ant.3; (H) dens and mucro; (I) labrum and right maxillary outer lobe; (J) left labial palp, ventral view.

and outside. Sometimes under bark and in rotten wood. General distribution: Palaearctic.

## 355. *Arrhopalites cochlearifer* Gisin, 1947

Fig. 112A–G

*Arrhopalites cochlearifer* Gisin, 1947, Ergebn. wiss. Unters. schweiz. NatnParks 2: 89.

*Description.* – Body size up to 0.7 mm. Colour diffusely grey. Ant.4 with 6 subsegments (Fig. 112F). Head with 4 + 4 heavy spines (Fig. 112A). Th.2–3 with 4+2 heavy spine-like dorsal setae (Fig. 112B). Hairs on back of abdomen long, slender. Retinaculum with two setae (Fig. 112G). Apical filament on unguiculus passing tip of unguis on two first pairs of legs. Subanal appendages spoon-like dilated at apex, finely serrated (Fig. 112E). Some of the circum-

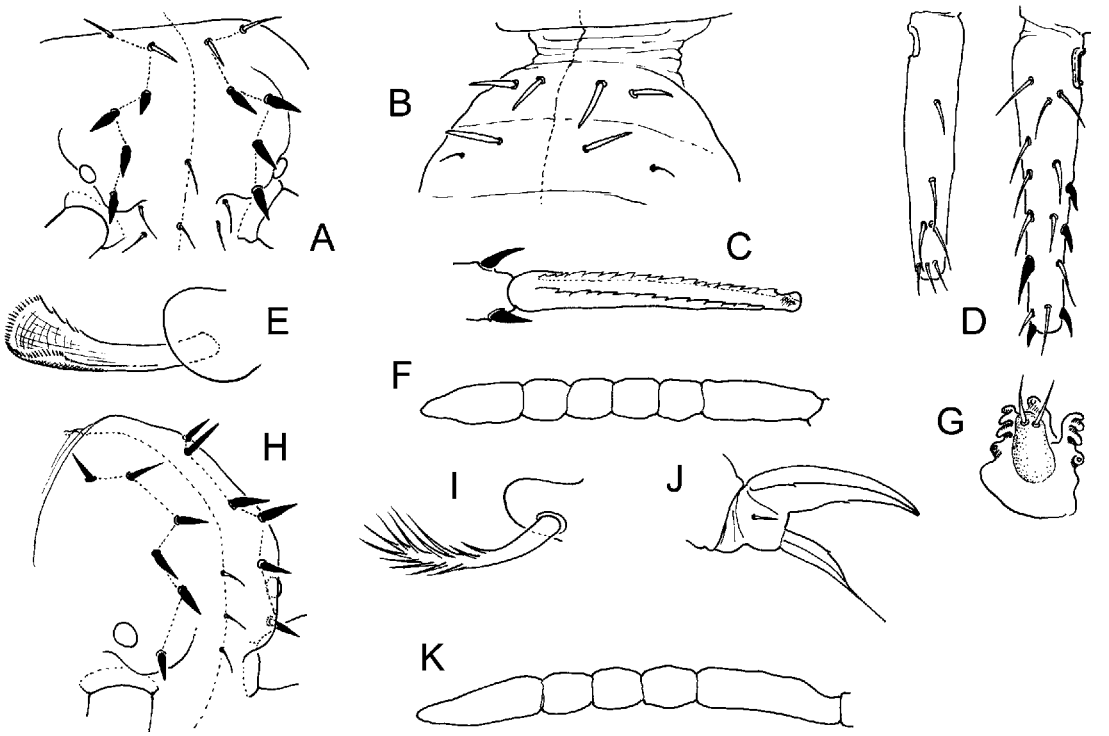


Fig. 112. *Arrhopalites* spp.: (A–G) *cochlearifer*, (A) cephalic spines (black), (B) spine-like setae on th.2–3, (C) mucro, (D) dens, ventral (left) and dorsal (right), (E) subanal appendage, (F) ant.4, (G) retinaculum; (H–J) *principalis*, (H) cephalic spines, (I) subanal appendage, (J) claw of hind leg; (K) *sericus*, ant.4.

anal setae with serrated/expanded bases. Dorsal and ventral side of dens as Fig. 112D. Mucro with serrated inner and outer edges, ventral edge keel-like with a notch in apical 2/3 (Fig. 112C). Males unseen.

*Discussion.* – The spoon-like subanal appendages and 6-segmented ant.4 identify this species.

*Distribution and ecology.* – A few records from bogs and damp forests in Norway and Finland only. General distribution: Palaearctic.

## 356. ***Arrhopalites spinosus*** Rusek, 1967

*Arrhopalites spinosus* Rusek, 1967, Cas. slezsk. Mus. Opave (A): 25.

*Description.* – Apart from the characters given in the key, inseparable from *cochlearifer*. Bretfeld (1999: 94) indicates a possible synonymy of the two taxa.

*Distribution and ecology.* – In our area only from Finland, in pine forests with *Calluna* (Vilkamaa, 1989). General distribution: Palaearctic.

## 357. ***Arrhopalites principalis*** Stach, 1945

Fig. 112H–J

*Arrhopalites principalis* Stach, 1945, Pr. Muz. przyr., Kraków 1: 47.
*Arrhopalites binoculatus* auct., nec Börner, 1901.

*Description.* – Body size up to 1.0 mm. Colour brownish or bluish grey, of variable intensity. Ant.4 with 6 subsegments, first subsegment distinctly longer than last. Maxillary outer lobe with only two sublobal hairs. Head with 6 + 6 moderately thickened spines, the 4 + 4 anterior ones strongest (Fig. 112H). Only median pair of dorsal setae on th.2 enlarged,

spine-like. Circumanal setae slender, not wing-like expanded or serrated at base. Subanal appendages curved, apically split in long filaments (Fig. 112I). Chaetotaxy of dens as in *cochlearifer* (Fig. 112D), with the same spine-like setae. Claws slender, apical filament of all unguiculi reach beyond tip of unguis (Fig. 112J). No males seen.

*Discussion.* – The 6-segmented ant.4 and the fringed subanal appendages identify this species. The presence of only two sublobal hairs is possibly a good diagnostic character, but has to be checked on a larger number of specimens. This is the species which Linnaniemi (1912) referred to as *Arrhopalites binoculatus* (Börn.) f. *principalis*.

*Distribution and ecology.* – Probably our most common *Arrhopalites*, recorded even in high mountains and in the Arctic. Present in moss and forest litter, but also in bogs and alpine meadows and *Salix* thickets. General distribution: Holarctic.

## 358. ***Arrhopalites sericus*** Gisin, 1947

Fig. 112K

*Arrhopalites sericus* Gisin, 1947, Ergebn. wiss. Unters. schweiz. NatnParks 2: 89.

*Description.* – Body size up to 0.8 mm. Body with traces of greyish brown pigment. Ant.4 with 5 subsegments (Fig. 112K). Dorsal setae of head and thorax all slender, not spine-like. Some of the circumanal setae wing-like expanded at base. Subanal appendages as *principalis* (Fig. 112I), with long apical fringes. Chaetotaxy of dens as in *cochlearifer* (Fig. 112D). Claws slender, with long apical filaments on unguis (as in *principalis*, Fig. 112J).

*Discussion.* – The 5-segmented ant.4, fringed subanal appendages and simple cephalic setae identify this species.

*Distribution and ecology.* – A rare species in our area, only collected in moss on tree trunks and rocks in lush forests at one locality in Denmark (Fuglesang Storskov) and one in Norway (Fana, S of Bergen). General distribution: Palaearctic.

## 359. ***Arrhopalites secundarius*** Gisin, 1958

*Arrhopalites secundarius* Gisin, 1958, Revue suisse Zool. 65: 776.

*Description.* – Body size up to 0.6 mm. Ant.4 with 5 subsegments. Head with 6 + 6 cephalic spines. Details of mouthparts not examined. Subanal appendages similar to that of *coclearifer* (Fig. 112I). Circumanal setae winged at base.

*Discussion.* – Apart from presence of cephalic spines, very similar to *sericus*. Linnaniemi (1912: 275) described an *Arrhopalites* with 5-segmented ant.4 and some greyish body pigment which he named *binoculatus* var. *grisea*. It is possibly a senior synonym of *secundarius*.

*Distribution and ecology.* – A few records from caves and forest litter in Norway and Sweden. General distribution: Palaearctic.

## 360. ***Arrhopalites pygmaeus*** (Wankel, 1860)

*Dicyrtoma pygmaea* Wankel, 1860, Lotos 10: 203.

*Description.* – Body size up to 1.2 mm. Colour often reddish. Ant.4 with 5 subsegements. Ant.4 about 9–10 times as long as ant.1 Cephalic spines absent, but some of the setae slightly thickened. Details of mouthparts not studied. Retinaculum with two setae. Circumanal setae slender, not winged at base. Subanal appendages straight, rod-like, apex cut, bearing a few small teeth. Chaetotaxy of dens as *cochleareifer* (Fig. 112D). Claws slender, apical filament of unguiculus reaches beyond tip of unguis.

*Discussion.* – The rod-shaped subanal appendages and 5-segmented ant.4 identify this species. For separation from *pseudoappendices*, see below.

*Distribution and ecology.* – Only reported from Sweden by Agrell (1934, 1943) and Forsslund (1943). There is a possibility that they may have misidentified *A. principalis*. General distribution: Holarctic.

### 361. ***Arrhopalites pseudoappendices*** Rusek, 1967

*Arrhopalites pseudoappendices* Rusek, 1967, Cas. slezsk. Mus. Opave (A): 23.

*Description.* – Body size up to 0.8 mm. Very similar to previous species, differing by having ant.4 only 7 times as long as ant.1 and presence of one more inner lateral spine-like seta on dens (4 instead of 3). Bretfeld (1999: 91) indicates that *pseudoappendices* and *pygmaeus* are possible synonyms.

*Distribution and ecology.* – Reported from Finland, collected by pitfall traps in a cave (Vilkamaa, 1989). General distribution: Palaearctic.

# Family KATIANNIDAE

Members of this family are recognised by one unique character: Tibiotarsi with two extra apical clavate setae just above base of the claw (Fig. 113B). The presence of forwardly directed subanal appendages in females is a character shared only with Arrhopalitidae which differs by having only 1 + 1 ocelli while Katiannidae have a full set of eyes (8 + 8) of which one or two may be reduced in size. Three genera are present in our area.

## Key to genera

1 Seta $a_0$ on abd.6 in females furcated (Fig. 113A). Neosminthuroid seta present on each side at base of furca (Fig. 113A). Maxillary outer lobe with 1 sublobal hair (Fig. 113D)
. . . . . *Sminthurinus* Börner (p. 192)

– Seta $a_0$ simple. Neosminthuroid seta absent. Sublobal hairs either 3 or 0 . . . . . 2

2 Tibiotarsi with 3 clavate apical setae, knees simple. Maxillary outer lobe with 3 sublobal hairs (Fig. 113E)
. . . . . *Gisinianus* Betsch (p. 201)

– Tibiotarsi with 7 clavate apical setae, knees with 5–6 pores (Fig. 113C). Maxillary outer lobe without sublobal hairs
. . . . . *Rusekianna* Betsch (p. 200)

## Genus *Sminthurinus* Börner, 1901

*Sminthurinus* Börner, 1901, Zool. Anz. 24: 344. Type species: *Smynthurus niger* Lubbock, 1868, by subsequent designation by Börner, 1906.

Head and body with normal setae. Greater abdomen with 3 + 3 setaceous trichobothria (A–C), abd.5 with one trichobothrium (D) which may be hair-like (setaceous) or more or less thickened (spiniform). The smooth anterior edge of labrum with 4 conical papillae followed by three elongate ridges. Prelabral setae 6. Labial palps with all 5 papillae (A–E) present and a variable number of proximal setae and guards. Basomedian field of labium with 4 setae, basolateral with 4 or 5. Maxillary outer lobe with simple palp and one sublobal hair (Fig. 113D). Mandibles strong, normal. Maxilla with short lamellae. Lam.1 and 6 with denticulate fields in addition to the marginal short ciliation, other lamellae with marginal ciliation/serration only (Fig. 114C). Head with 1 + 1 or 2 + 2 postlabial setae along ventral line. Ventral tube with smooth apical sacs and 1 + 1 or 2 + 2 distal setae. Retinaculum with 4 + 4 teeth and 1–2 setae. Females with furcated seta $a_0$ on abd.6 (Fig. 113A). Tibiotarsi with 4–5 clavate apical setae. Claws with serrated lateral bases and usually one pair of subapical lateral teeth, inner edge of unguis with 2–3 teeth. A membranous tunica present around distal half of unguis, size variable. Unguiculus with corner tooth and an apical setaceous filament which is longest on first leg. Circumanal setae wing-like expanded at base. Subanal appendages in females curved, apically split in several branches. Mucro without lateral seta. Males generally present, smaller than females.

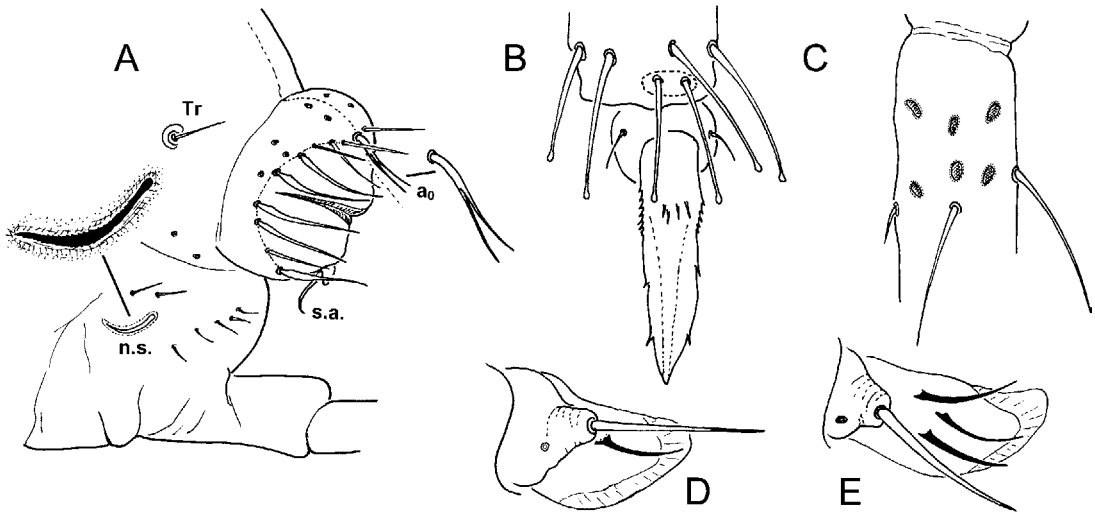


Fig. 113. Katiannidae: (A) *Sminthurinus signatus*, tip of abdomen showing circumanal setae with bifurcate $a_0$, subanal appendage (s.a.), trichobothrium D (Tr) and neosminthuroid setae (n.s.) with detail above; (B) *Sminthurinus aureus*, tip of right foreleg with two extra clavate apical setae (encircled); (C) *Rusekianna albifrons*, upper part of left tib.1 showing 6 pores; (D–E) maxillary outer lobe with sublobal hairs (black) in *Sminthurinus aureus* (D) and *Gisinianus flammeolus* (E).

## Key to species

1 Abd.5 fused to abd.4 (Fig. 114A). Outer side of dens with only 1 subapical seta (Fig. 114E). (*aureus* group) . . . . . 2

– Abd.5 demarcated from abd.4 (Fig. 115D). Outer side of dens with 2–3 subapical setae (Fig. 115H, K) (*niger* group) . . . . . 7

2 Body with distinct bands or stripes/spots . . . . . 3

– Body uniformly coloured, darker or paler . . . . . 362. *aureus* (Lubbock)

3 Abdomen with longitudinal bands and/or cross bands (Pl. 13) . . . . . 4

– Abdomen dark with a roundish white spot (Pl. 13: 3) . . . . . 367. *bimaculatus* Axelson

4 Head with 1 + 1 postlabial setae (Fig. 115A). Trichobothrium D on abd.5 slender, setaceous, not thicker than surrounding setae (Fig. 115B). Pattern as Pl. 13: 4, 6 . . . . . 5

– Head with 2 + 2 postlabial setae (as Fig. 114B). Trichobothrium D thickened, spiniform, thicker than surrounding setae (as Fig. 114H). Pattern as Pl. 13: 2 . . . . . 363. *elegans* (Fitch)

5 Abdomen only with a single lateral band present, no dorsal bands (Pl. 13: 4) . . . . . 366. *signatus* (Krausbauer)

– Abdomen with anterior dorsal zigzags and posterior mid-dorsal band . . . . . 6

6 Head unpigmented in posterior mid-section (Pl. 13: 6) . . . . . 365. *transversalis* Axelson

– Mid-section of head dark back to posterior edge (Pl. 13: 5) . . . . . 364. *reticulatus* Cassagnau

7 Ventral side of dens with 1–2 subapical setae . . . . . 8

– Ventral side of dens without subapical setae . . . . . 368. *alpinus* Gisin

8 Ventral side of dens with 2 subapical setae . . . . . 9

– Ventral side of dens with 1 subapical seta . . . . . 370. *niger* (Lubbock)

9 Dens with 5 proximal and 2 outer setae (Fig. 115M) . . . . . 10

– Dens with 4 proximal and 3 outer setae (as Fig. 115K). Colour pattern as Pl. 13: 1. Indoor species . . . . . 373. *domesticus* Gisin

10 Abdomen uniformly dark . . . . . 11

– Abdomen dark, with a white roundish spot on each side (Pl. 13: 3) . . . . . 371. *trinotatus* Axelson

11 Most of body, including head, bluish black. Outdoor species . . . . . 369. *concolor* (Meinert)

– Head white (apart from back side), contrasting the dark abdomen. Indoor species . . . . . 372. *igniceps* (Reuter)

## *aureus* group

Abd.5 fused to abd.4. Ventral tube with 1 + 1 distal setae. Males with normal (small) guards in ant.3 organ.

### 362. *Sminthurinus aureus* (Lubbock, 1862)

Figs 113B, D, 114A–I

*Smynthurus aureus* Lubbock, 1862, Trans. Linn. Soc. Lond. 23: 589.

*Description.* – Body size up to 1.0 mm. Body uniformly coloured, from pale yellow to brownish or violet black with pale spots between the eyes, no distinct bands or patterns on the body. Abd.5 incorporated into larger abdomen (Fig. 114A). Ant.3 with a weak dorsal papilla in basal part, often split in 4 smaller papillae or almost absent (Fig. 114F). Labrum with 544 setae, sometimes 444 (Fig. 114D). Labial palp with 5 proximal setae, papilla E with 6 guards ($e_7$ missing). Labial base with 4 lateral setae. Head with 2 + 2 postlabial setae (Fig. 114B). Trichobothrium D spine-like, much thicker than surrounding setae (Fig. 114H). Subanal appendages apically split in two serrated branches (Fig. 114I). Dens without subapical ventral setae, proximal group with 3 setae, laterally with one outer seta (Fig. 114E). Mucro with serrated inner edge, outer edge smooth or with a few teeth (Fig. 114G). Ventral edge keel-like, hyaline (devoid of primary granules).

*Discussion.* – The uniform body colour separate this species from the banded *elegans*, *transversalis*, *reticulatus* and *signatus*. The latter taxon (*signatus*) was included in *aureus* in Gisin (1969) and Fjellberg (1980). Other morphological details appear identical in the four species, apart from presence of only 1 + 1 postlabial setae in *signatus*, *transversalis* and *reticulatus* (2 + 2 in *elegans*). Linnaniemi (1912) lists a number of colour forms in addition to the principal form which he describes as yellow or yellowish brown. Probably his var. *alba* Krausb., var. *ochropus* (Reut.) and var. *atrata* Börn. belong to *aureus*.

*Distribution and ecology.* – Common and widely distributed, also in mountains and in the Arctic. Usually found in moss, meadows and litter in forests and thickets. General distribution: Palaearctic.

### 363. *Sminthurinus elegans* (Fitch, 1863)

Pl. 13: 2

*Smynthurus elegans* Fitch, 1863, Trans. N.Y. St. agric. Soc. 22: 657.
*Sminthurus quadrilineatus* Tullberg, 1871.

*Description.* – Body size up to 0.7 mm. Colour characteristic (Pl. 13: 2). Larger abdomen with a narrow mid-dorsal line, usually broken in elongate spots. Sides with two dark reddish brown bands which sometimes fuse more or less, covering the subcoxae of the legs. The lateral band continues to the sides of head below the eyes. Head also with a dark band running across the face below the antennae, leaving mouth region unpigmented, and a mid-dorsal band running from neck to the area between antennal bases. Usually this median band is not connected to the facial transverse band, except in very dark individuals. Area around eye-spots unpigmented. Ventral side, distal parts of the legs and furca unpigmented. Antennae darkened towards tip. Large individuals tend to become increasingly dark with pigment covering most of the abdomen. Ant.3 with weak dorsal papilla, often absent or divided into 4 small papillae. Head with 2 + 2 postlabial setae. Trichobothrium D spine-like.

*Discussion.* – The colour pattern distinguish this species. Medium coloured specimens are very characteristic by the two dark lateral bands and the narrow mid-dorsal stripe. Very dark individuals may be separated from other dark species

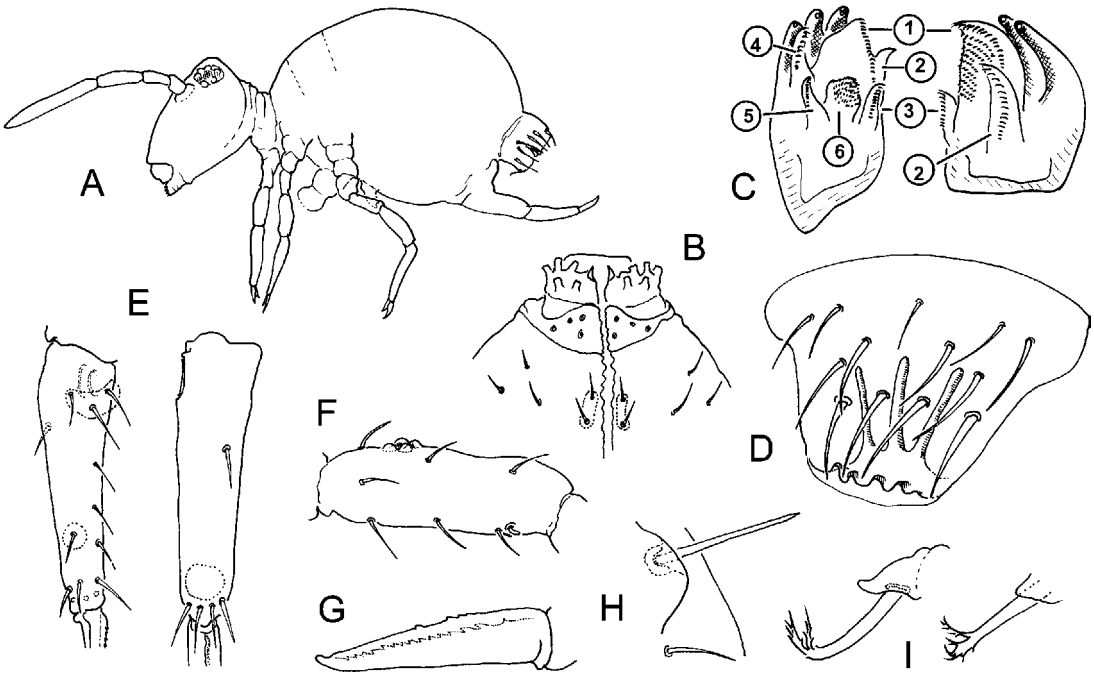


Fig. 114. *Sminthurinus aureus*: (A) habitus; (B) ventral side of head showing 2 + 2 postlabial setae (encircled); (C) maxilla, different views; (D) labrum; (E) dens, dorsolateral (left) and ventral (right); (F) right ant.3, lateral; (G) mucro, (H) spiniform trichobothrium D on abd.5, right side; (I) subanal appendages, different specimens.

of the *aureus* group by the 2 + 2 postlabial setae and the spiniform trichobothrium D (1 + 1 and setaceous in other species, though *bimaculatus* unknown but distinguished by colour). Linnaniemi's (1912: 285) *aureus* var. *ornata* Krausb. is possibly the same as *elegans*.

*Distribution and ecology.* – Probably widely distributed, but mostly scattered records from dry meadows and moss/litter in forests.

## 364. ***Sminthurinus reticulatus*** Cassagnau, 1964

Fig. 115C; Pl. 13: 5

*Sminthurinus reticulatus* Cassagnau, 1964, Bull. Soc. Hist. nat. Toulouse 99: 481.

*Description.* – Body size up to 0.7 mm, males smaller. Colour pattern as Pl. 13: 5, with reddish blue pigment. Characteristic are the 3–4 dorsal transverse bands in the anterior part of the body and the Y-shaped figure along midline in posterior part of the body. The anterior zigzags narrowly disconnected by an unpigmented median line. The broad lateral longitudinal band always distinct, the dorsal elements quite variable, sometimes diffuse. Lateral band widened in posterior part, distinctly set off from and usually not connected with the transverse band on abd.5. Head coloration as in *elegans*, with a transverse facial band (sometimes diffuse) below antennal bases and a mid-dorsal longitudinal band running from neck to antennal bases, leaving area around eye-spots unpigmented. Ant.3 with a low dorsal papilla, usually split in 4 smooth fields. Head with 1 + 1 postlabial setae. Ventral tube with 1 + 1 distal setae. Abd.5 with trichobothrium D thin, setaceous. Dens with 3 proximal dorsal setae, one subapical lateral setae and no subapical ventral setae. Female subanal appendages long, narrow and curved, with a few short apical branches (Fig. 115C).

*Discussion.* – The species may actually be a colour form of *transversalis*, though the above colour pattern is distinct and consistent in the Swedish specimens which have been studied. For separation from *transversalis*, see below.

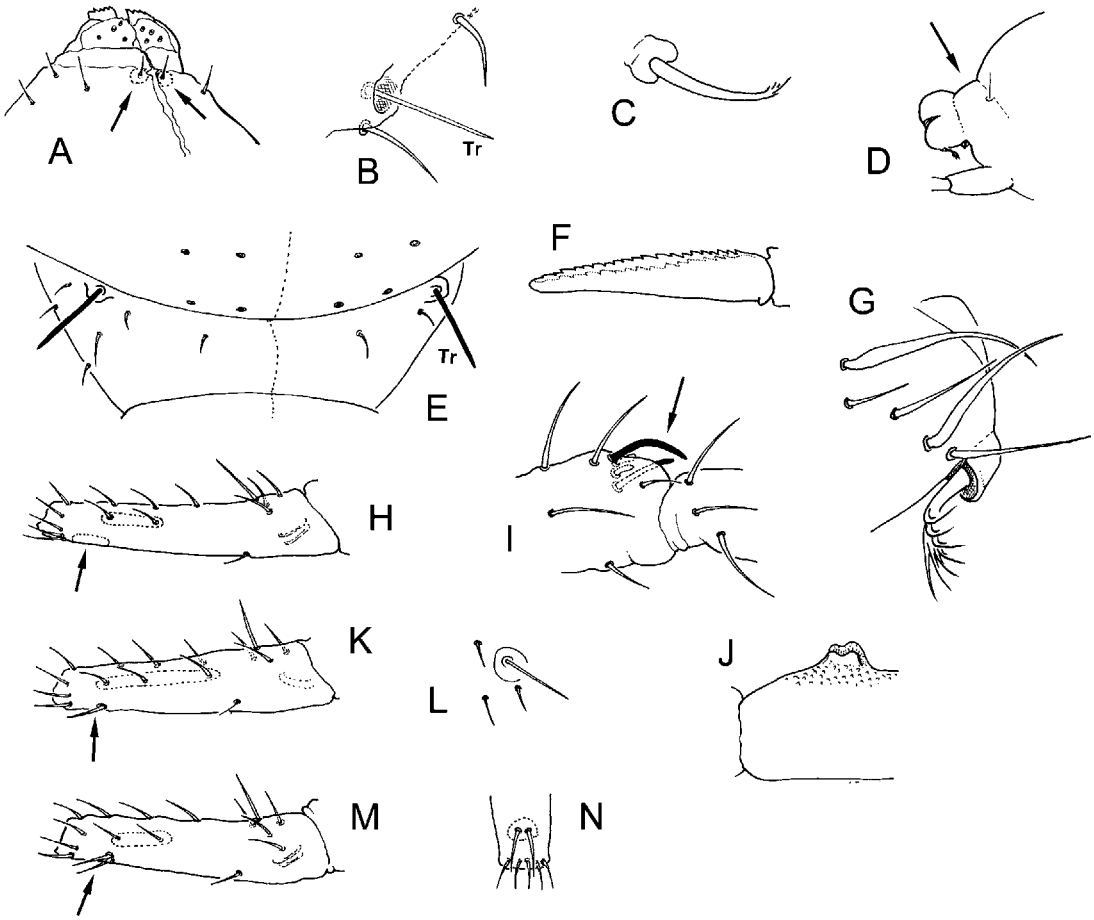


Fig. 115. *Sminthurinus* spp.: (A–B) *signatus*, (A) ventral side of head with 1 + 1 postlabial setae (arrows), (B) trichobothrium (Tr) on abd.5, not thicker than ordinary setae; (C) *reticulatus*, subanal appendage; (D–J) *alpinus*, (D) tip of abdomen, showing abd.5 (arrow) set off from abd.4, (E) spiniform trichobothria (Tr) on abd.5, (F) mucro, (G) abd.6 with fan-shaped subanal appendage and basically expanded circumanal setae, (H) dens, lateral, with two outer setae (encircled) and no ventral subapical setae (arrow), (I) male ant.3 organ with enlarged guards (black), (J) ant.3 papilla; (K–L) *niger*, (K) dens, lateral, with 3 outer setae (encircled) and one ventral subapical seta (arrow), (L) setaceous trichobothrium on abd.5; (M) *trinotatus*, dens, lateral, with two outer setae (encircled) and two ventral subapical setae (arrow); (N) *domesticus*, ventroapical part of dens with two subapical setae (encircled).

*Distribution and ecology.* – One population was discovered in Botaniska Trädgården in Lund, Sweden, in 2006. Juveniles appeared by the end of April and matured during the next few weeks. Specimens were swept from lush meadow vegetation in slopes surrounding the old greenhouse. A few adult specimens were also collected in Rinnebäckravinen and Igelösa outside Lund in October/November 2006. General distribution: Palaearctic.

## 365. *Sminthurinus transversalis* Axelson, 1905

Pl. 13: 6

*Sminthurinus aureus* var. *transversalis* Axelson, 1905, Zool. Anz. 28: 794.

*Description.* – Body size up to 0.7 mm. Colour pattern as Pl. 13: 6. Neck region and posterior part of head unpigmented in the middle. Facial transverse band below the antennae usually

disrupted, with an isolated patch in the middle. Lateral band of abdomen connected to the transverse band on abd.5. Dark markings of body generally heavy, leaving the narrow mid-dorsal line unpigmented. Ventral side of head with 1 + 1 postlabial setae.

*Discussion.* – The species was originally described as a variety of *aureus*. It was not recognised by Gisin (1960) and listed as a synonym of *reticulatus* Cassagnau, 1959 by Bretfeld (1999: 121) who did not give any reason for not using Axelson's name as the senior synonym. Several syntypes from 'Hailuoto, VIII.1902, W.M. Axelson' were examined in 2006, showing a characteristic colour pattern (Pl. 13: 6). They differ from Swedish specimens of *reticulatus* by having a darker, more distinct dorsal pattern. Characteristic are the unpigmented posterior mid-section of the head (in *reticulatus* the dark mid-dorsal band goes back to the neck), the isolated dark spot in the middle of the frontoclypeal field (continuous transverse facial band in *reticulatus*), the broad lateral band which is continuous around the posterior end of abdomen (disconnected in *reticulatus*), and a triangular spot in the posterior mid-section of the great abdomen, rather than an Y-figure with a narrow stem as in *reticulatus*. The latter species may turn out to be a junior synonym of *transversalis*, but the two taxa are here given species status just to give them a better chance of being recognised and studied.

*Distribution and ecology.* – Linnaniemi (1912) reports the species from seashore debris and under rotten wood. No recent Nordic records. General distribution: Palaearctic.

## 366. ***Sminthurinus signatus*** (Krausbauer, 1898)

Fig. 113A; Pl. 13: 4

*Sminthurus aureus* var. *signata* Krausbauer, 1898, Zool. Anz. 21: 495.
*Sminthurus elegans* var. *signatus* Krausbauer, 1902. Bretfeld (1999: 114).

*Description.* – Body size up to 0.8 mm. Colour characteristic (Pl. 13: 4). Background colour whitish with a single sharp violet black band on each side of larger abdomen which continues around the posterior end and on the sides of the head below eyes, crossing the frons between antennal bases and anterior parts of the eye-spots. Anterior part of head below antennal bases unpigmented (facial transverse band absent). Top of head, between the eyes, unpigmented. Mid-dorsal part of greater abdomen and abd.6 unpigmented. Ant.3 usually with 4 small dorsal papillae. Ventral side of head with 1 + 1 postlabial setae (as Fig. 115A). Trichobothrium D setaceous, not thicker than surrounding seta (as Fig. 115L). Subanal appendages with short apical branches.

*Discussion.* – The species has been regarded as a colour variety of *aureus* (Gisin, 1960: 279) or of *elegans* (Bretfeld, 1999: 114). However, the constant presence of no more than 1 + 1 postlabial setae and a setaceous trichobothrium D indicate a clear distance to these species and a closer relationship to *transversalis*/*reticulatus*.

*Distribution and ecology.* – According to Linnaniemi (1912) this characteristic species is widely distributed in Finland, mainly in moss and litter of the forest floor, but also in damp ground. Few records from other Nordic countries. General distribution: Palaearctic.

## 367. ***Sminthurinus bimaculatus*** Axelson, 1902

*Sminthurinus igniceps* (?) var. *bimaculata* Axelson, 1902, Meddn Soc. Fauna Flora fenn. 28: 110.

*Description.* – Body size up to 0.7 mm. Colour characteristic. Greater abdomen laterally with a circular white spot on black background. Mid-dorsal area, ventral side and abd.6 usually pale. A dark zigzag band or spots on face below antennae. Mouth region unpigmented. Females with subanal appendages having only 2–3 short apical branches. Dens and other body marks as in *aureus*, but the mouth apparatus has not been studied.

*Discussion.* – The colour pattern, which is similar to that of *trinotatus* (Pl. 13: 3), probably identify this species, but there are no modern records in our area.

*Distribution and ecology.* – Originally described from forest habitats in northern Finland. No records from other Nordic countries. General distribution: Palaearctic.

Abd.5 free, clearly set off from abd.4 (Fig. 115D). Ventral tube with 2 + 2 distal setae. Males with enlarged guards in ant.3 organ (Fig. 115I) (ant.3 organ not checked in *trinotatus* and *igniceps*, ventral tube not seen in *igniceps*).

## 368. *Sminthurinus alpinus* Gisin, 1953

Figs 1G, 115D–J

*Sminthurinus concolor alpinus* Gisin, 1953, Ann. Mag. nat. Hist. (12) 6: 234.

*Description.* – Body size up to 0.9 mm. Colour bluish black. Ocelli 8 + 8, but one usually reduced. Ant.3 with distinct dorsal papilla which is weakly 4-lobed (Fig. 115J). Males with enlarged lateral guards of ant.3 organ, the upper guard curved, projecting above the base of ant.4 (Fig. 115I). Females with normal small guards. Labrum with 544 setae. Labial palps with 6 proximal setae, lateral papilla E with 5 guards. Basolateral field with 5 setae. Head with 2 + 2 postlabial setae. Ventral tube with 2 + 2 distal setae. Retinaculum with 1–2 setae. Tibiotarsi with 5 clavate apical setae. Unguiculus with apical filament long on first claw (reaching tip of unguis), very short on two last pairs of claws. Abd.5 separated from abd.4 (Fig. 115D). Abd.5 with trichobothrium D spiniform, slightly thicker than surrounding setae. Subanal appendages curved, apically split in long filaments (Fig. 115G). Chaetotaxy of dens as Fig. 115H. Proximal part with 4 setae, outer side with 2 subapical setae, ventral side without subapical setae. Dorsal edges of mucro equally serrated (Fig. 115F).

*Discussion.* – The absence of ventral subapical setae on dens separates this species from other species having free abd.5.

*Distribution and ecology.* – Old records of *niger* (Linnaniemi, 1912; Wahlgren, 1906) certainly includes *alpinus*, and the distribution is not well know. Verified specimens, mostly collected from moss on trees and under bark on rotten wood, are seen from Norway, Sweden and Finland. General distribution: Palaearctic.

## 369. *Sminthurinus concolor* (Meinert, 1896)

*Sminthurus concolor* Meinert, 1896, Vidensk. Meddr Dansk naturh. Foren. 48: 167.

*Description.* – Body size up to 1.5 mm, but usually not above 1.0 mm. Colour bluish black. Ocelli 8 + 8, one usually reduced. Ant.3 with a clear dorsal papillae, sometimes weakly lobed. Ant.3 organ in males with enlarged guards (as *alpinus*, Fig. 115I). Labium with 5 proximal setae, lateral papilla E with 4 guards. Basolateral field of labium with 4 setae. Head with 2 + 2 postlabial setae. Ventral tube with 2 + 2 distal setae. Retinaculum with two setae. Trichobothrium D slightly spiniform. Tibiotarsi with 5 clavate apical setae. Claws as in *alpinus*, but unguiculus with longer apical filament. Dens as in *alpinus*, with the addition of a pair of subapical ventral setae. Mucro with both dorsal edges serrated.

*Discussion.* – Identified by the large size, dark colour and chaetotaxy of dens.

*Distribution and ecology.* – Widely distributed in the north, both in arctic and alpine tundra. Southern records (S. Sweden, Denmark) mainly from damp moss on rocks in shaded forest ravines. Some of Linnaniemi's (1912) records of *niger* may have been *concolor*, but there are no verified records from Finland. General distribution: Holarctic.

## 370. *Sminthurinus niger* (Lubbock, 1868)

Fig. 115K, L

*Smynthurus niger* Lubboock, 1868, Trans. Linn. Soc. Lond. 26: 297.

*Description.* – Body size up to 1.0 mm. Colour dark, bluish black with paler legs and furca and often a white spot inside eyes. Mid-dorsal line of greater abdomen sometimes pale. Ocelli 8 + 8, one smaller. Ant.3 with a weakly lobed dorsal papilla. Males with enlarged guards in ant.3 organ (as Fig. 115I). Labrum with 544 setae. Labial palp with 5 proximal setae. Lateral papilla E with 5 guards. Labial base with 4 lateral setae. Head with 2 + 2 postlabial setae. Ventral tube with 2 + 2 distal setae. Retinaculum

with two setae. Trichobothrium D on abd.5 setaceous, not spiniform (Fig. 115L). Tibiotarsi on all legs with 5 clavate apical setae. Claws with apical filament on unguiculus passing tip of unguis on first pair of legs, shorter in others. Dens in proximal part with 4 dorsal setae. Ventral side with 1 subapical seta, outer side with 3 subapical seta (Fig. 115K). Both dorsal edges of mucro serrated.

*Discussion.* – Due to the confusion with other species, *niger* is not well known. The dark colour and chaetotaxy of dens is characteristic. The single subapical setae on ventral side of dens is unique among our species (Fig. 115K).

*Distribution and ecology.* – Most published records from Nordic countries are probably *alpinus* and *concolor*. Until a revision has been made, nothing can be said about the distribution. Linnaniemi (1912) reported several indoor records (greenhouses, flower pots) from Finland which may have been the true *niger*. Fjellberg (1980) found the species in an indoor flower pot in Bergen. General distribution: Palaearctic.

## 371. ***Sminthurinus trinotatus*** Axelson, 1905

Pl. 13: 3

*Sminthurinus igniceps* var. *trinotatus* Axelson, 1905, Zool. Anz. 28: 794.

*Description.* – Body size up to 0.8 mm. Ground colour pale yellowish brown, with darker pigmentation in anterior and lateral parts of greater abdomen and dorsally on abd.5–6. Sides of abdomen with a large whitish round spot (Pl. 13: 3). The back of greater abdomen more or less pale. Ocelli 8 + 8, one smaller. Ant.3 with a small 4-lobed dorsal papilla. Labrum with 554 unmodified setae. Labial palps with 5 proximal setae, lateral papilla E with 5 guards. Basolateral field of labium with 5 setae. Maxilla and maxillary outer lobe as typical for the genus. Head with 2 + 2 postlabial setae. Ventral tube with 2 + 2 distal setae. Trichobothrium D setaceous. Retinaculum with one seta. All tibiotarsi with 5 clavate apical setae. Apical filament of unguiculus on first claw longer than unguis, on other claws shorter. Dens with two subapical ventral setae, proximal part with 5 dorsal setae, outer side with two lateral setae. Both dorsal edges of mucro serrate. Female subanal appendages apically widened, with long filaments.

*Discussion.* – Easily recognised by the white spots on the sides of abdomen. Only *bimaculatus* has a similar pattern, but that species belongs to the *aureus* group (abd.5 fused to abd.4) and does not occur indoor.

*Distribution and ecology.* – In our area only found indoor in greenhouses and flower pots. General distribution: Palaearctic.

## 372. ***Sminthurinus igniceps*** (Reuter, 1881)

*Sminthurus igniceps* Reuter, 1881, Meddn Soc. Fauna Flora fenn. 6: 203.

*Description.* – Body size up to 0.7 mm. Colour characteristic: Most of body dark, bluish black, including dorsal side of abd.5–6. Head (apart from back side) unpigmented, as well as distal parts of legs and furca. Other body marks as in *trinotatus*, but mouthparts not examined.

*Discussion.* – Recognised by the pale head and dark body.

*Distribution and ecology.* – Only indoor, in greenhouses and flower pots. General distribution: Palaearctic.

## 373. ***Sminthurinus domesticus*** Gisin, 1963

Fig. 115N; Pl. 13: 1

*Sminthurinus domesticus* Gisin, 1963, Revue suisse Zool. 70: 84.

*Description.* – Body size up to 1.0 mm. Colour in freshly collected specimens mottled yellowish brown with sides of abdomen almost black (Pl. 13: 1a). After some time in alcohol the colour turns violet (Pl. 13: 1b). Some individuals paler with dorsal abdomen yellowish. Ant.3 with knob-like undivided papilla. Labrum with 544 setae. Labial palp with 5 proximal setae. Lateral papilla E with 4 guards. Labial base with 4 lateral setae. Head with 2 + 2 postlabial setae. Ventral tube with 2 + 2 distal setae. Dens in the proximal dorsal group with one median, one outer and two inner setae (as *niger*, Fig. 115K). Ventrally with two subapical setae (Fig. 115N). Both dorsal edges of mucro serrated.

*Discussion.* – Characteristic colour and unique chaetotaxy of dens readily identify this species.

*Distribution and ecology.* – Several males and females collected in the greenhouse in Botaniska Trädgården in Lund, Sweden (February 2006). European species with only indoor records in the northern parts. General distribution: Palaearctic.

## Genus *Rusekianna* Betsch, 1977

*Rusekianna* Betsch, 1977, Annls hist.-nat. Mus. natn. hung. 69: 61. Type species: *Rusekianna mongolica* Betsch, 1977 by monotypy.

Our single species is similar to *Gisinianus* by having an unforked seta $a_0$ on abd.6, but differs by having papillate ant.3 (Fig. 116C), more than 3 clavate tibiotarsal apical setae (Fig. 116F, G), presence of pores at base of tibiotarsi (Fig. 113C) and the advanced mouth apparatus.

### 374. *Rusekianna albifrons* (Tullberg, 1871)

Figs 113C, 116A–I; Pl. 14

*Sminthurus albifrons* Tullberg, 1871, Öfvers. K. VetenskAkad. Förh. 28: 145.
? *Rusekianna sibirica* Bretfeld, 2002.

*Description.* – Body size up to 0.8 mm in females, males smaller. Colour dark violet red. Furca, distal part of legs and mouth region pale. Occipital area on top of head whitish (Pl. 14). Ocelli 8+8, one smaller (Fig. 116D). Ant.3 with a large thumb-like papilla (Fig. 116C). Ant.4 are 2.3–2.6 as long as ant.3. Labrum with 554 setae, 6 prelabrals. Apical ridges of labrum short, triangular (Fig. 116A). Labial palp with 5 proximal setae and papillae A–E present. Guard $a_1$ moved to base of papilla C, directed sideways (Fig. 116B). Guards $b_1$ and $b_2$ enlarged, blunt. Papilla E with only two guards and a short lateral process. Basal fields of labium with 4 median and 5 lateral setae. Maxilla (Fig. 116E) with 3 teeth and 6 lamellae of which lam.1 is exceptionally broad and swollen, densely covered with fine denticles. Lam.2 blade-like, wrapped around base of lam.1, with a few denticles only. Lam.3 invisible, possibly appearing as a basal flap of lam.2. Lam.4–6 are small, with a few denticles only. Head with 2 + 2 postlabial setae. Maxillary outer lobe with simple palp and no sublobal hairs. Ventral tube with smooth apical sacs and 2 + 2 distal setae. Retinaculum with 4 + 4 teeth and 1–2 setae. Head and abdomen with short normal setae (not spine-like). Abd.5 separated from the greater abdomen (Fig. 116H). Greater abdomen with 3 + 3 setaceous trichobothria forming an obtuse angel opening forward. Abd.5 with 1 + 1 spine-like D-trichobothria. Abd.6 with slender circumanal setae, $a_0$ unforked (Fig. 116H). Subanal appendages apically curved and split in fine filaments (Fig. 116H). Tibiotarsi with 6–7 clavate apical setae (Fig. 116F, G). Claws with 2 inner teeth and a pair of lateral teeth. Unguiculus with corner tooth and a short apical filament. Inner apical setae of tibiotarsi slightly serrated. Proximal part of tibiotarsi, at the "knee" above the upper setae, with 6 pores (Fig. 113C). Chaetotaxy of dens as Fig. 116I. Proximal part with 5 dorsal setae. Ventral part with 2 subapical seta. Outer side with 2–3 lateral setae. Mucro 3–4 times longer than inner edge of last claw, with serrated dorsal edges, inner edge with more teeth than outer. Males present.

*Discussion.* – The extraordinary conditions of the mouth region (maxilla, labium, labrum, maxillary outer lobe) and the presence of pores at base of tibiotarsi differ from all other Nordic Katiannidae, which easily identify this species. The genus was originally described from Mongolia with the type species *Rusekianna mongolica* Betsch, 1977. Later on Bretfeld (2002) described a second species, *R. sibirica*, from the Krasnoyarsk (Taimyr) region in Russia (one paratype was examined in 2006, but details of mouth region were unseen). The recently described *R. bescidica* Smolis & Skarzynski, 2006 from Poland is possibly the same as *albifrons*, but a larger material is needed to evaluate the variation in chaetotaxy and colour pattern. From Canada (Kananaskis Valley, Alberta) I have two specimens tentatively identified as *Sminthurinus intermedius* Snider, 1978 which clearly are *Rusekianna* (pores at base of tibiotarsi, same type of maxilla, labial palp, maxillary outer lobe, labrum). Possibly also other species associated with *Sminthurinus* s.gen. *Polykatianna* in Christiansen & Bellinger (1980) belong to *Rusekianna*.

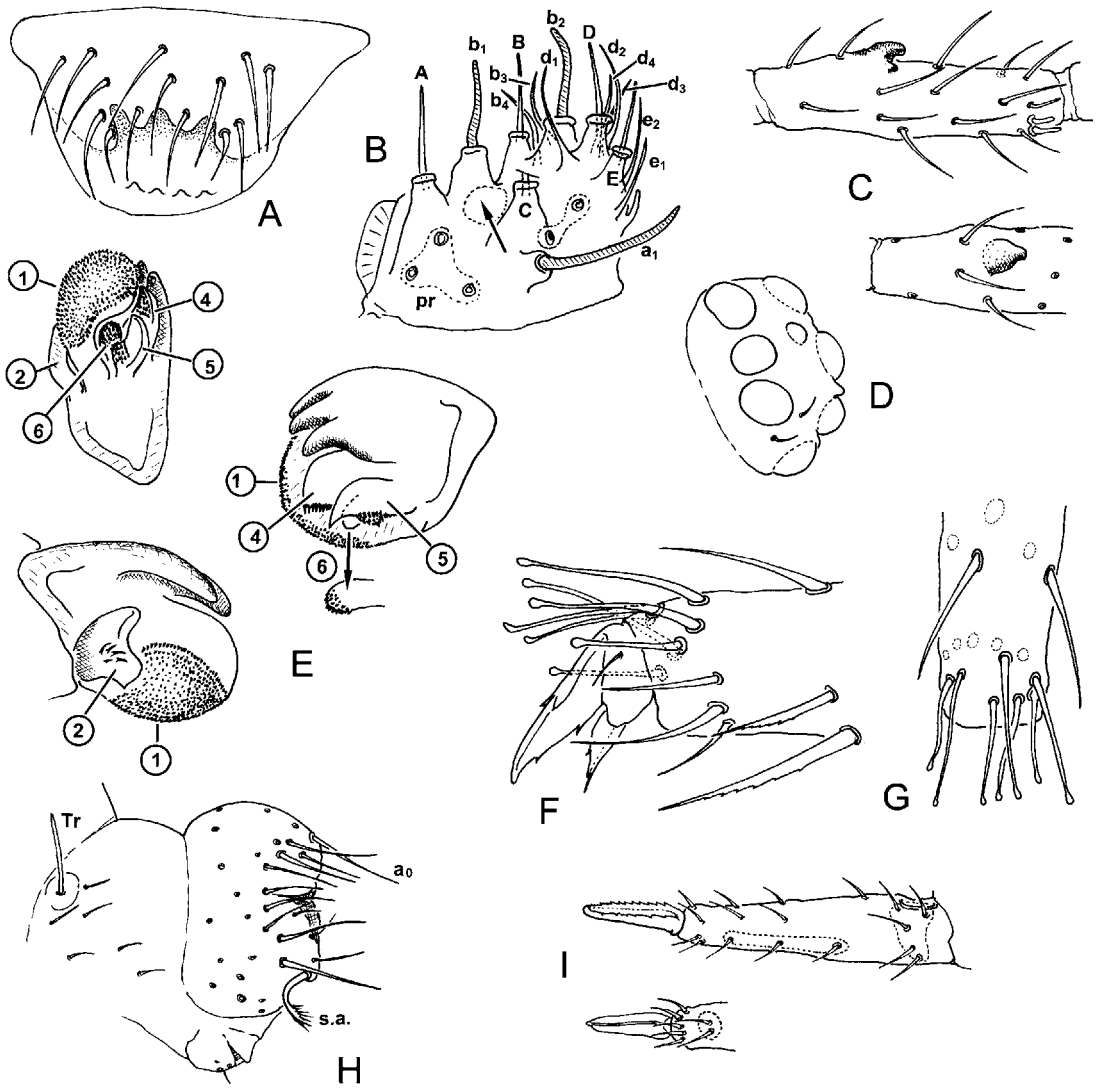


Fig. 116. *Rusekianna albifrons*: (A) Labrum; (B) left labial palp with laterally displaced guard $a_1$ (arrow shows normal position for Katiannidae); (C) dorsal papilla on ant.3, lateral (above) and dorsal (below) views; (D) right eye field; (E) maxilla, different views; (F) claw and apical setae on tibiotarsus on foreleg; (G) clavate apical setae on foreleg; (H) tip of abdomen with spiniform trichobothrium (Tr), simple dorsomedian seta $a_0$ and forked subanal appendage (s.a.); (I) dens with 5 proximal and 3 lateral setae (encircled), ventral side with two subapical setae (below).

*Distribution and ecology.* – Apparently a boreal species associated with forest floor vegetation. Once collected in numbers by fumigation of pine trees (Thunes et al., 2004, identified as *Sminthurinus flammeolus*). These specimens were feeding on pine pollen. General distribution: Palaearctic.

## Genus *Gisinianus* Betsch, 1977

*Gisinianus* Betsch, 1977, Revue Ecol. Biol. Sol 14: 212. Type species: *Sminthurinus flammeolus* Gisin, 1957, by original designation.

Similar to *Sminthurinus*, but the upper circumanal seta ($a_0$) simple (not forked), and the

neosminthuroid seta is absent. The genus is monotypic with a single European species.

## 375. *Gisinianus flammeolus* (Gisin, 1957)

Figs 113E, 117A, B

*Sminthurinus flammeolus* Gisin, 1957, Revue suisse Zool. 54: 488.

*Description.* – Body size up to 0.8 mm. Colour yellowish brown or grey, unpatterned. Ocelli 8 + 8, two smaller. Abd.5 separated from the greater abdomen. Ant.3 without dorsal papilla. Labrum with 554 setae, 6 prelabrals, Anterior part of labrum with 3 elongate smooth ridges and 4 small apical papillae (as Fig. 114D). Labial palps with 6 proximal setae and a full set of guards on papilla E ($e_7$ present). Basal field of labium with 4 median and 5 lateral setae. Maxillary outer lobe with simple palp and 3 sublobal hairs (Fig. 113E). Head with 2 + 2 postlabial setae. Maxilla with unmodified lamellae (as Fig. 114C). Ventral tube with smooth apical sacs and 2 + 2 distal setae. Retinaculum with 4 + 4 teeth and one seta. Body hairs short and fine, circumanal setae slender, not dilated/constricted at base. Subanal appendages curved, apically split in long filaments. Greater abdomen with 3 + 3 long trichobothria, abd.5 with trichobothrium D setaceous, not thicker than surrounding setae. Tibiotarsi each with 3 clavate apical setae. Claws with serrated basal teeth and an inner tooth. Unguiculus with small corner tooth and short apical filament (Fig. 117B). Chaetotaxy of dens as Fig. 117A. Basal part with 4 dorsal setae, outer side with two lateral setae. Ventral side with two subapical setae. Mucro with serrated inner edge, outer edge with a few weak teeth.

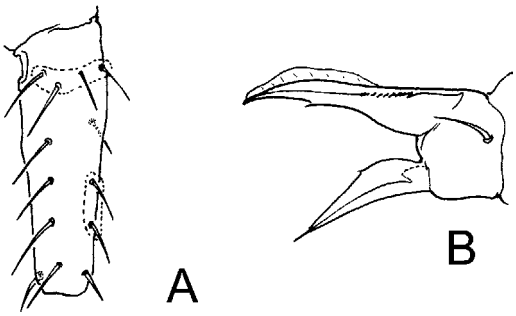


Fig. 117. *Gisinianus flammeolus*: (A) Dens with 4 proximal and two lateral setae (encircled); (B) claw.

*Discussion.* – Easily identified by key characters.

*Distribution and ecology.* – Few Nordic records, mostly from moss/litter in rich deciduous forests (*Alnus* on river banks). General distribution: Palaearctic.

# Family DICYRTOMIDAE

Members of this family are recognised by the exceptionally short ant.4 which is less than half as long as ant.3 (Fig. 118I). Four genera are present in our area.

## Key to genera

1 Top of head and anterior abdomen with large, spine-like macrochaetae (Fig. 118A, J) . . . . . 2

– Top of head and anterior abdomen with short spines or setae only (Fig. 120B) . . . . . *Calvatomina* Yosii (p. 206)

2 Ant.2 with some long setae which are more than twice as long as diameter of the segment (Fig. 122E). Trichobothrium D present on abd.5 (Fig. 122B) . . . . . *Ptenothrix* Börner (p. 209)

– Ant.2 with short setae only. Trichobothrium D absent . . . . . 3

3 Claws with tunica (Fig. 118K). Back side of head with 2 + 2 large spine-like macrochaetae and 1 + 1 normal setae (Fig. 118B) . . . . . *Dicyrtomina* Börner (p. 203)

– Claws without tunica (Fig. 121F). Back side of head with 1 + 1 long spines, other

post ocular setae short (Fig. 121B)
. . . . . *Dicyrtoma* Bourlet (p. 207)

## Genus *Dicyrtomina* Börner, 1903

*Dicyrtomina* Börner, 1903, Sber. Ges. naturf. Freunde Berl.5 1903 (3): 167. Type species: *Podura minuta* O. Fabricius, 1783, by subsequent designation by Börner, 1906.

Members of this genus are recognised by the long spines on head and abdomen in combination with presence of a tunica on the claws. The four Nordic taxa have an unclear status and are only separable by the colour patterns.

### Key to species

1 Back side of larger abdomen with a dark spot, either rectangular or cross-armed (Pl. 15: 3–5) . . . . . 2
– No dark spot of the back side of greater abdomen, only sides of abdomen weakly pigmented (Pl. 15: 6)
. . . . . 379. *flavosignata* (Tullberg)
2 Posterior dark spot rectangular, not cross armed . . . . . 3
– Posterior dark spot cross armed (Pl. 15: 5)
. . . . . 378. *saundersi* (Lubbock)
3 Dorsal part of anterior abdomen with extensive dark patches/cross bands (Pl. 15: 2, 4)
. . . . . 377. *ornata* (Nicolet)
– No dark pigment on dorsal side of anterior abdomen (Pl. 15: 3)
. . . . . 376. *minuta* (O. Fabricius)

### 376. *Dicyrtomina minuta* (O. Fabricius, 1783)

Figs 118A–K, 119A–E; Pl. 15: 3

*Podura minuta* O. Fabricius, 1783, Nye Saml. K. dansk. Vid. Selsk. Skr. 2: 307.

*Description.* – Body size up to 2.5 mm. Typically coloured individuals with a blackish rectangular spot on the back of the greater abdomen, continuing back to dorsal side of abd.6. Lateral sides of abdomen with a variable violet brown pattern, leaving the broad mid-dorsal part of abdomen without pigment (Pl. 15: 3). Larger individuals tend to have more extensive side patterns. Head with some dark spots between the antennae and eyes. Distal part of ant.3 darker than other segments. Legs and furca mostly unpigmented. Antennae long and slender, two distal segments darkened. The joint of ant.1–2 with a ventral articulation consisting of a lobe on ant.1 and a condyle on ant.2 (Fig. 118C). Ant.1 with 3 large dorsal setae, one inner and one outer lateral small seta and two ventral setulae (Fig. 118D). Setae of ant.3 not clearly longer than diameter of the stem. Labrum with 554 unmodified setae, 6 prelabrals. Apical edge with 3 smooth elongate ridges. Labial palp with a complete set of papillae and guards ($e_7$ present). Proximal setae 5. Basal fields with 4 median and 5 lateral setae. Maxillary outer lobe with simple palp (with a short basal spine on the inner side) and 1 sublobal hair. Maxilla as Fig. 118E, with 4-toothed capitulum and strongly developed lam.1 and 4 each bearing two rows of curved cilia/hooks and some proximal denticles. Lam.1 with a serrated edge at base. Lam.2 is a membranous pointed flap without teeth. Lam.3 reduced, invisible. Lam.5 like a small, thin serrated flap. Lam.6 tongue-shaped, with a few fine denticles. Head with $2 + 2$ postlabial setae. Chaetotaxy of head as Fig. 118A. Interocular area with $5 + 5$ spines, ocellar field with 2 shorter spines, back side of head with $2 + 2$ spines and one seta. Frontoclypeal area with 6 unpaired axial spines and $8 + 8$ cup sensilla and $1 + 1$ micropores. Upper part of the face, around the bases of antennae, with $6 + 6$ microspines which differ from the similarly sized cup sensilla by sitting in simple circular sockets (not elongated). Greater abdomen with $5 + 5$ large spines in anterior part, in posterior part only short stub-like spines. Trichobothria ABC as Fig. 118J, trichobothrium D (abd.5) absent. Chaetotaxy of abd.6 as Fig. 119A. Subanal appendages setaceous, curved, directed backwards. Ventral tube with $1 + 1$ distal setae and one seta on each side in middle part of the main trunk (Fig. 118G). Apical sacs, when extruded, long and tubular with warted surface (Fig. 118 H). Retinaculum with $4 + 4$ teeth and 4 setae. Tibiotarsi 1–3 on outer side with 4-5-5 cup-like sensilla and 4-4-4 microspines sitting in smooth depressions (Fig. 119E). Inner side of tibiotarsi with 1-5-5 spine-like macrochaetae with blunt tips bearing

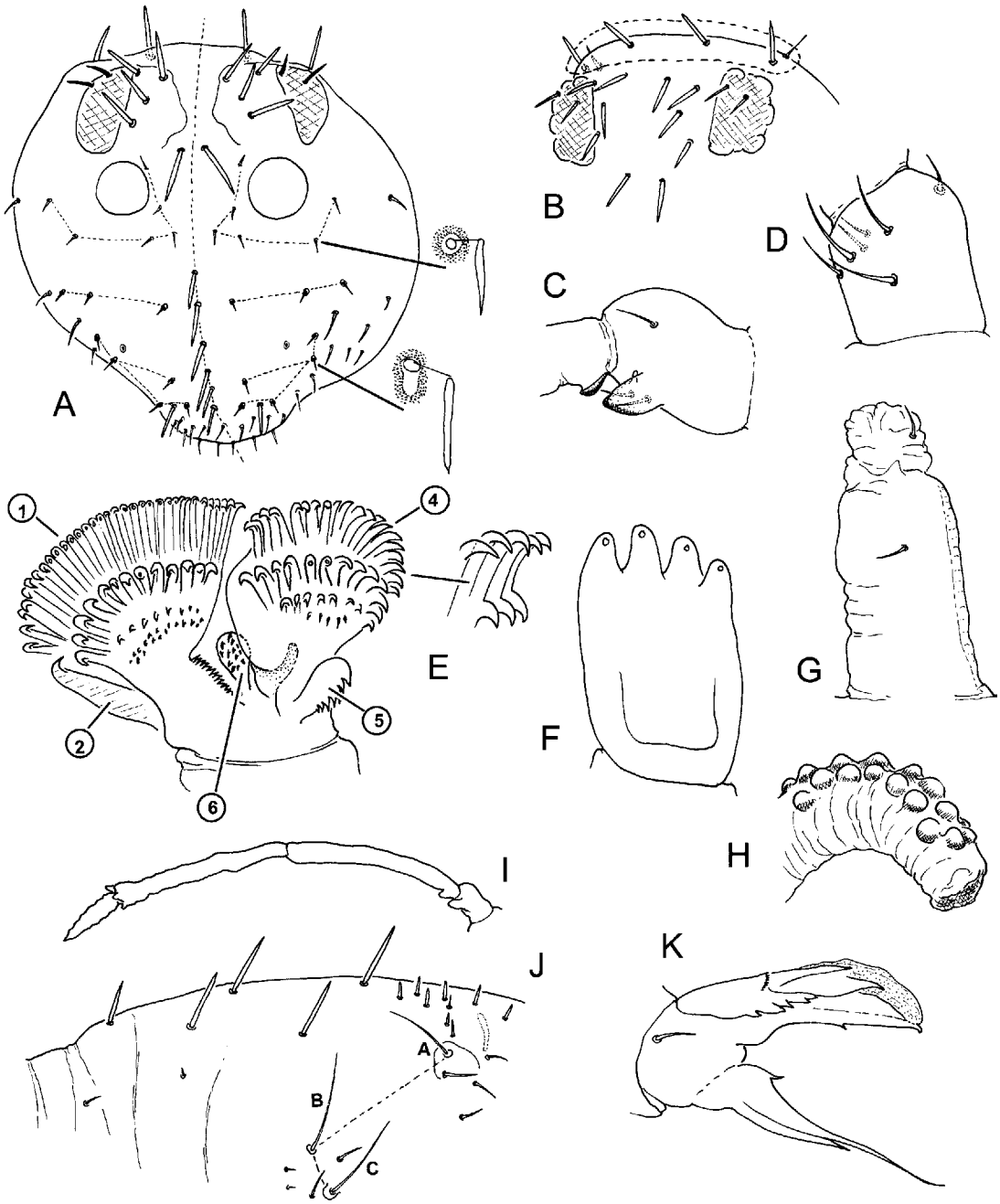


Fig. 118. *Dicyrtomina minuta*: (A) Frontal setae of head with enlargement of microspine (above) and cup sensilla (below); (B) top of head with postocular setae encircled; (C) ant.1–2 articulation; (D) left ant.1, dorsal; (E) lamellary complex of maxilla; (F) 4-toothed maxillary capitulum; (G) ventral tube; (H) extruded apical sac of the ventral tube; (I) antenna; (J) left side of thorax and anterior abdomen with trichobothria A–C; (K) claw of foreleg.

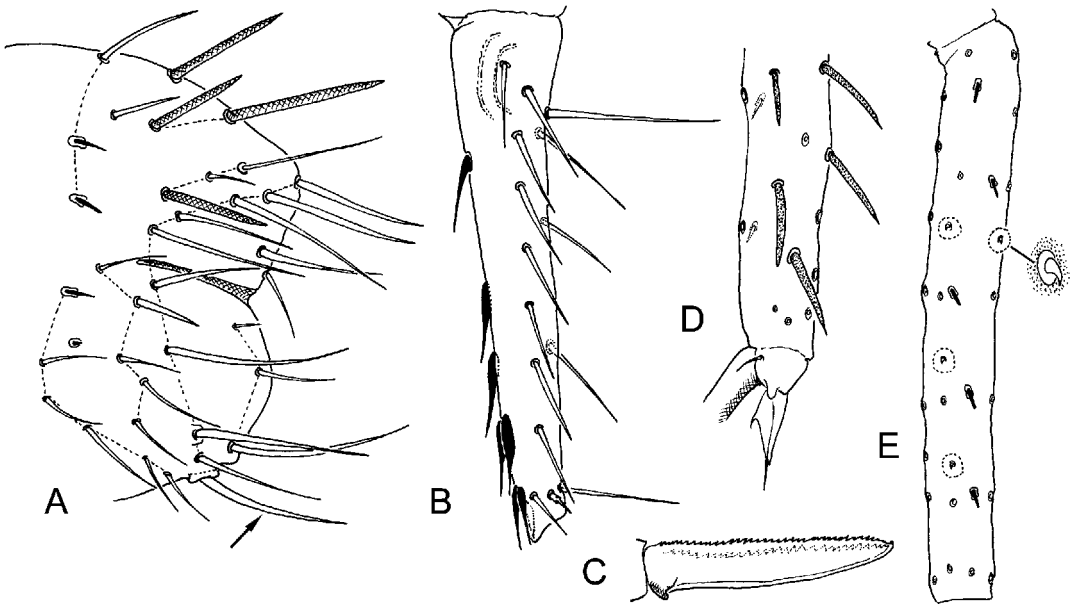


Fig. 119. *Dicyrtomina minuta*: (A) Chaetotaxy of abd.6, left side, with subanal appendage indicated (arrow); (B) dens with 3-2-1-1-1 ventral spines (black); (C) mucro; (D) macrochaetae on inner side of left tib.3; (E) cup sensilla and spine-like sensilla (encircled) on outer side of left tib.2.

a short, thin apical filament which usually break off. The macrochaetae have a rough surface, but not serrated (Fig. 119D). Claws with a variable dentation, usually with one inner tooth, two pairs of lateral teeth, serrated basal edges and a distinct swollen tunica. Unguiculus with corner tooth and thin apical filament reaching tip of claw on first leg, shorter on others (Fig. 118K). Dens with finely serrated dorsal setae. Ventral side with 3-2-1-1-1 setae (Fig. 119B). Mucro about 1/3 as long as dens, with finely serrated dorsal edges (Fig. 119C).

*Discussion.* – The rectangular spot on back of abdomen, only diffuse lateral patterns and unpigmented anterior dorsal abdomen is characteristic for this species.

*Distribution and ecology.* – A common species which is usually found in the litter layer of humid meadows and forests, but also in bogs. General distribution: Holarctic.

## 377. ***Dicyrtomina ornata*** (Nicolet, 1842)

Pl. 15: 2, 4

*Smynthurus ornatus* Nicolet, 1842, Neue Denkschr. Allg. schweiz. Ges. ges. Naturw. 6 (3): 83.

*Description.* – Colour pattern as Pl. 15: 2, 4. Back of greater abdomen with a rectangular blackish spot as in *minuta*. Sides and dorsal anterior part of greater abdomen with violet brown patches and oblique transverse bands, leaving a narrow mid-dorsal line unpigmented. Head with dark markings on the back side and between eyes and antennae. Antennae brownish, distal parts of legs darkened. In very dark individuals most of the sides of abdomen dark with small pale spots only.

*Discussion.* – Apart from colour, inseparable from *minuta*. Body marks, including details of the mouthparts, appear identical. The strong oblique cross bands on anterior dorsal part of abdomen is the most distinctive character separating *ornata* from *minuta*.

*Distribution and ecology.* – Probably less common than *minuta*, with few records apart from in Finland. In Norway common around Bergen in moist habitats. General distribution: Palaearctic.

## 378. *Dicyrtomina saundersi* (Lubbock, 1862)

Pl. 15: 5

*Papirius saundersi* Lubbock, 1862, Trans. Linn. Soc. Lond. 23: 438.

*Description.* – The only distinctive feature, separating *saundersi* from *minuta* and *ornata*, is the cross-armed black spot on the back of abdomen, unlike the rectangular block shape in the two others. The intensity of the other elements of the colour pattern (lateral and anterior dorsal spots, head pigmentation) vary in *saundersi*, but are usually weak or absent on the dorsal side. However, even fully pigmented specimens, like *ornata*, are seen. Details of the mouthparts are the same as in *minuta*.

*Discussion.* – The pale stripes between the dark cross arms on the posterior spot in *saundersi* correspond to the area around and between the bases of two short spines. Such setal areas are generally the last to be filled during a gradual increase in pigmentation, whether the underlying process is ontogeny or polymorphism. Even in typical *minuta/ornata* the setal bases in the dark spot are usually unpigmented. Fanciulli et al. (1995) found evidence for species differentiation between *ornata* and *saundersi* by using allozyme electrophoresis.

*Distribution and ecology.* – Earlier authors may have mixed *saundersi* with *minuta* and the distribution is not well known. Verified specimens are seen from Denmark, Norway and Faroe Islands. General distribution: Palaearctic.

## 379. *Dicyrtomina flavosignata* (Tullberg, 1871)

Pl. 15: 6

*Papirius flavosignatus* Tullberg, 1871, Öfvers. K. VetenskAkad. Förh. 28: 146.
*Dicyrtoma minuta* ab. *pallida* Ågren, 1903.

*Description.* – This form/species differs from the other *Dicyrtomina* by absence of the posterior dark spot on abdomen. (Pl. 15: 6). The only dark pigment which is present, are some grey-violet patches laterally on greater abdomen.

*Discussion.* – The status of *flavosignata* is unclear but it is said to have a more southern/lowland distribution than the other taxa (Linnaniemi, 1912; Bretfeld, 1999).

*Distribution and ecology.* – Few Nordic records, mainly in forests. Recent specimens are collected together with *minuta* from fallen tree trunks in forests and meadows near Lund, S. Sweden (SK). General distribution: Palaearctic.

# Genus *Calvatomina* Yosii, 1966

*Calvatomina* Yosii, 1966, Results Kyoto Univ. scient. Exped. Karakoram Hindukush 8: 400. Type species: *Dicyrtomina* (*Calvatomina*) *cruciata* Yosii, 1966, by original designation.

The single Nordic species differs from all our other Bourletiellidae by absence of spine-like macrochaetae on top of head and in anterior part of abdomen. The corresponding setae are all short (Fig. 120B). Trichobothrium D absent, neosminthuroid setae present on sides of abdomen at base of furca.

## 380. *Calvatomina rufescens* (Reuter, 1892)

Fig. 120A, B

*Papirius rufescens* Reuter, 1892, Meddn Soc. Fauna Flora fenn. 17: 22.

*Description.* – Body size up to 1.5 mm. Ground colour light reddish or yellow, with variable dark patterns. Ant.2 with seta not clearly longer than diameter of the segment. Labrum with 6/554 setae. Labial palp with 5 proximal setae and presence of all A–E papillae. Papilla E with 6 guards ($e_7$ absent). Basal fields of labium with 4 median and 5 lateral setae. Head with 2 + 2 postlabial setae. Maxillary outer lobe with simple palp and one sublobal hair. Maxilla (Fig. 120A) with lam.1 and 4 broad with very strong marginal rakes. Lam.1 with a proximal field of fine denticles, the row of subapical hooks is absent (compare *D. minuta*, Fig. 118E). Lam.4 with a subapical transverse row of curved hooks, no proximal denticles. Ventral tube with 1 + 1 dis-

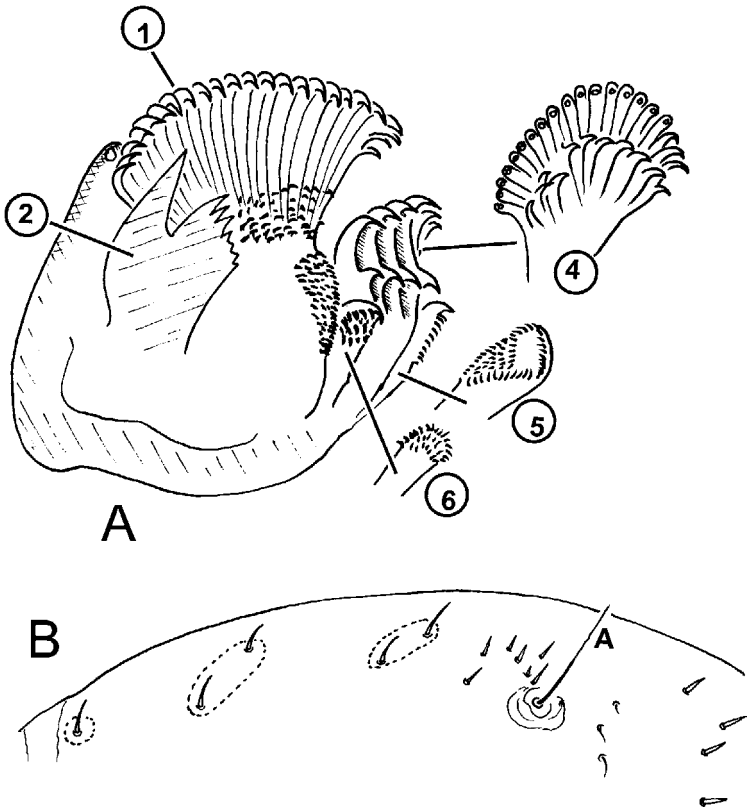


Fig. 120. *Calvatomina rufescens*: (A) Maxilla; (B) anterior part of abdomen, left side, showing trichobothrium A and short setae (encircled) which correspond to macrochaetae in other Dicyrtomidae (cf. Fig. 118J).

tal setae and one seta laterally on the main trunk. Tib.3 on inner side with 3 pointed, short spines. Claws with 2 inner teeth and two pairs of lateral teeth. Unguiculus with corner tooth, apical filament longer than unguis on first leg, very short on other legs. Dens with slender, smooth dorsal setae. Ventral setae distributed as 3-2-1-1-1. Mucro with serrated dorsal edges.

*Discussion.* – Our species is easily differentiated from the other genera of family by the short setae on top of head and abdomen. The details of mouthparts and ventral side of head was extracted from Canarian specimens supposed to be *C. rufescens*.

*Distribution and ecology.* – Reported from greenhouses in Helsinki in 1890–1900, no recent records (Linnaniemi, 1912). General distribution: Holarctic.

## Genus *Dicyrtoma* Bourlet, 1842

*Dicyrtoma* Bourlet, 1842, Annls Soc. ent. Fr 10: 50. Type species: *Papirius fuscus* Lubbock, 1873, by subsequent designation by Ellis & Bellinger, 1972.

Our single species is recognised by absence of tunica on the claws and the short ant.2 setae. Trichobothrium D and neosminthuroid setae absent.

### 381. *Dicyrtoma fusca* (Lubbock, 1873)

Fig. 121A–F; Pl. 15: 1

*Papirius fuscus* Lubbock, 1873, Monograph Collembola Thysanura: 120.

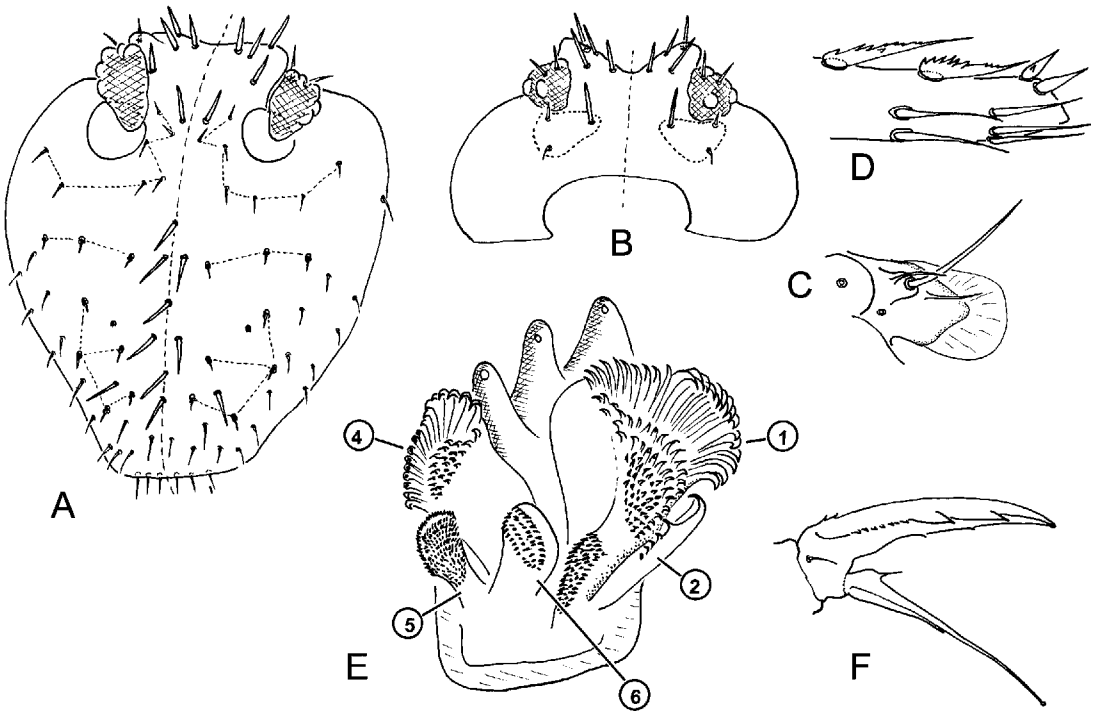


Fig. 121. *Dicyrtoma fusca*: (A) Frontal setae of head; (B) back side of head with 3 + 3 postocular setae (encircled); (C) maxillary outer lobe; (D) apical setae of dens, ventrolateral; (E) maxilla; (F) claw of hind leg.

*Description.* – Body size up to 2.0 mm. Colour uniformly violet brown or red including feet and antenna (Pl. 15: 1). Top of head and top of greater abdomen often paler. Labrum with 6/554 unmodified setae. Apical edge with two papillae and 3 strong, elongate flat-topped ridges. Ventroapical edge with a simple row of cilia. Labial palp with 5 proximal setae and a full set of papillae and guards (guard $e_7$ present). Basal fields with 4 median and 5 lateral setae. Maxillary outer lobe with one sublobal hair and a palp which has a secondary branch above the main stem – almost as long as the sublobal hair (Fig. 121C). Head with 2 + 2 postlabial setae. Mandibles strong, normal. Maxilla as Fig. 121E, with 3-toothed capitulum and strongly developed lam.1 and 4 which have long apical rakes and proximal fields with coarse denticles. Lam.1 with long denticles on a separate basal edge. Lam.2 membranous, with long serrations at the edge. Lam.3 absent. Lam.5 broad, densely packed with fine denticles. Lam.6 with coarse denticles. Chaetotaxy of head as Fig. 121A, B. Anterior part of abdomen with 5 + 5 large spines, posterior part with short spines only. Trichobothria ABC present, D missing. Chaetotaxy of abd.6 principally like that of *Dicyrtomina minuta* (Fig. 119A), but spine-like macrochaetae less differentiated. Ventral tube with 1 + 1 distal setae and one seta on each side of the main trunk. Retinaculum with 4 + 4 teeth and 4 setae. Tibiotarsi with some blunt, rough spine-like macrochaetae on the inner side. Claws with two inner teeth, two pairs of lateral teeth and some serrations at base (Fig. 121F). Unguiculus slender, with corner tooth and long apical filament passing tip of unguis. The filament is weakly knobbed at tip. No tunica on claws. Dens with 3-2-1-1-1 ventral setae. Most of the outer dorsal setae strongly serrated (Fig. 121D). Mucro with finely serrated dorsal edges.

*Discussion.* – Easily identified by the uniform colour, short-haired ant.2 and claws having no tunica. The maxilla is less developed than in *D. minuta*, with shorter and smaller lam.1 and 4 and lam.5 having a denticulate field (only marginal serrations in *minuta*).

*Distribution and ecology.* – Common and widely distributed in forest vegetation, but also in bogs and other wet habitats. – General distribution: Holarctic.

## Genus *Ptenothrix* Börner, 1906

*Ptenothrix* Börner, 1906, Mitt. naturh. Mus. Hamb. 23: 184. Type species: *Podura atra* Linnaeus, 1758, by original designation.

Like in the previous genus, tunica is absent on the claws, but our single species differs by having very long setae on ant.2 (Fig. 122E) and presence of trichobothrium D on abd.5 (Fig. 122B). Neosminthuroid seta absent.

### 382. *Ptenothrix atra* (Linnaeus, 1758)

Fig. 122A–I; Pl. 16: 1

*Podura atra* Linnaeus, 1758, Systema naturae, 10th ed.: 608.

*Description.* – Body size up to 2.5 mm. Brownish or violet black, ant.4 and distal part of ant.3 contrasting white (Pl. 16: 1). Sometimes dorsal side of greater abdomen paler. Ant.2 with some long spine-like macrochaetae which are more than twice as long as diameter of the segment (Fig. 122E). Distal part of ant.3 subsegmented. Ant.3 organ as Fig. 122D. Labrum with 634 setae (the two short setae of the upper row probably translocated from median row). Labial palps with 5 proximal setae and a full set of papillae and guards (papilla E with guard $e_7$ present). Basal fields of labium with 4 median and 5 lateral setae. Head with $2 + 2$ postlabial setae. Chaetotaxy of anterior side of head as Fig. 122A. One of the cup sensilla in the upper transverse row missing. Back side of head with on long macrochaeta and two short setae on each side (Fig. 122F) Maxillary outer lobe without sublobal hairs, the setaceous palp with a short secondary branch on inner side at base. Maxilla with 3-toothed capitulum and 6 lamellae (Fig. 122G). Lam.1 with coarse marginal ciliation and a denticulate field with strong back-curved denticles. Lam.2 thin, membranous, with a few large serrations. Lam.3 small, with a few denticles (alternatively this is a basal part of lam.1). Lam.4 and 5 both covered with very fine denticles. Lam.6 with coarse denticles. Anterior part of greater abdomen, in front of the trichobothria, with $5 + 5$ spine-like macrochaetae (Fig. 122H). Trichobothrium D present on abd.5. Posterior part of greater abdomen with long setae in addition to the small stub-like spines (Fig. 122B). Dorsal chaetotaxy of abd.6 as Fig. 122I. Setae $A_3$, $m_1$, $DL_2$, $P_1$ and sa are spine-like macrochaetae. Subanal appendages setaceous, curved at tip. Ventral tube with $1 + 1$ distal setae and one seta on each side of the main trunk. Apical sacs long and tubular, with warted surface. Retinaculum with 3–4 setae. Inner side of tib.3, in the middle part, with 2 serrated macrochaetae (Fig. 122C). Claws with two inner teeth, two lateral teeth and toothed unguiculus with apical filament passing tip of unguis. Inner and outer side of dens with serrated dorsal setae. Mucro with finely serrated dorsal edges.

*Discussion.* – Easily identified by the key characters and the characteristic antennae with whitish tip. Compared with the other Nordic Dicyrtomidae, the maxilla of *P. atra* is remarkably little developed, almost "isotomid" in appearance. This may reflect a different food and feeding habit.

*Distribution and ecology.* – Many records from Finland (Linnaniemi, 1912), few in other Nordic countries. Collected mostly in forest floor habitats, sometimes on fungi, also in wetlands. General distribution: Palaearctic.

# Family BOURLETIELLIDAE

The Nordic genera belonging to this family are recognised by presence of female subanal appendages which are directed backwards (Fig. 1H), long annulated ant.4 (Fig. 1J), presence of two pairs of trichobothria (D, E) on abd.5 (Fig. 1O) and presence of only one (anterior) seta on pretarsus (Fig. 1M). Four Nordic genera are present.

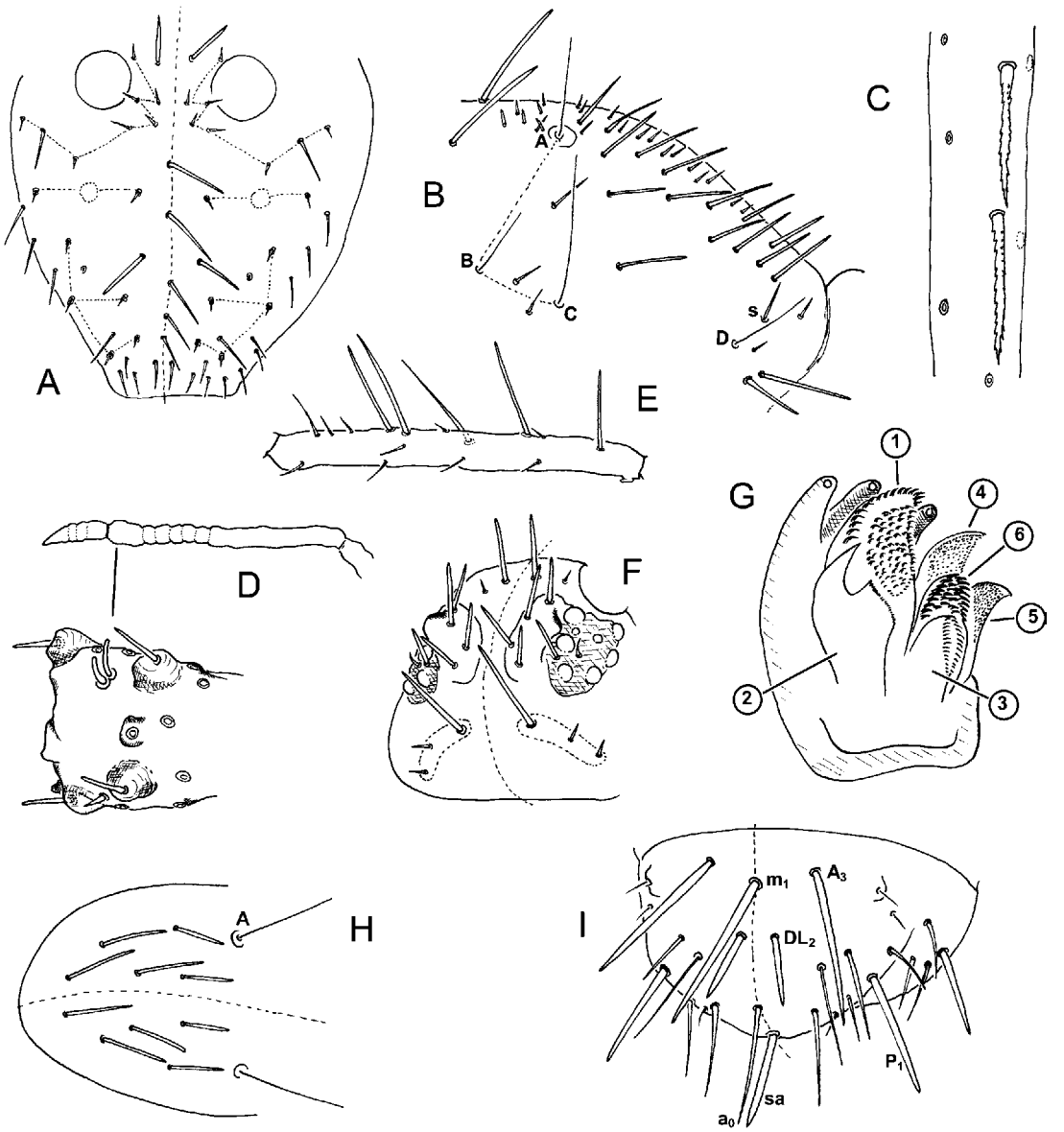


Fig. 122. *Ptenothrix atra*: (A) Frontal setae of head; (B) chaetotaxy of posterior part of greater abdomen, left side, showing trichobothria A–D and sensillum (s); (C) serrated macrochaetae on inner side of tib.3; (D) ant.3–4 with enlargement of ant.3 organ; (E) ant.2 with dorsal macrochaetae; (F) top of head with 3 + 3 postocular setae (encircled); (G) maxilla; (H) macrochaetae in anterior part of greater abdomen, dorsal view; (I) dorsal chaetotaxy of abd.6.

## Key to genera

1 Unguiculus on two last pairs of legs with narrow basal lamella which does not end abruptly at the terminal filament (Fig. 124E) . . . . . 2

– Unguiculus on last legs with a broad basal lamella, ending abruptly at the terminal filament (Fig. 1K) . . . . . *Heterosminthurus* Stach (p. 211)

2 Ventral setae of dens longer than distance between their bases (Fig. 125D). Unguiculus with a short needle-like subapical filament . . . . . 3

– Ventral setae of dens shorter than distance between their bases (Fig. 124H). Unguiculus simply pointed (Fig. 124E) . . . . . *Deuterosminthurus* Börner (p. 214)

3 Abd.6 with male organ (Fig. 125E) . . . . . *Bourletiella* Banks (p. 216)

– Abd.6 in males without modified dorsal setae . . . . . *Cassagnaudiella* Ellis (p. 219)

## Genus *Heterosminthurus* Stach, 1955

*Hterosminthurus*, Stach, 1955, Annls zool. Warsz. 16: 53. Type species: *Sminthurus insignis* Reuter, 1876, by original designation.

The broad basal lamella on unguiculus of the last two pairs of legs readily distinguish the four Nordic members of this genus from the rest of the family. When that character is difficult to see, three of the species may be recognised by colour alone (pale body with blue longitudinal stripes) while the fourth (*insignis*) differs from other genera by the very long inner setae on dens (Fig. 123G). Males smaller than females, with relatively longer antennae.

### Key to species

1 Inner setae on dens at least twice as long as diameter of the stem (Fig. 123G) . . . . . 2

– Setae on inner side of dens not longer than diameter of stem (Fig. 123H) . . . . . 3

2 Abdomen with a mid-dorsal line and 3–4 longitudinal bands on each side (Pl. 16: 2). Females with subanal appendages abruptly bent near base (Fig. 123I). Males with normal setae between eyes (Fig. 123A) . . . . . 383. *novemlineatus* (Tullberg)

– Abdomen not striped. Females with subanal appendages almost straight (Fig. 123J). Males with prolonged cephalic setae (Fig. 123B) . . . . . 384. *insignis* (Reuter)

3 Adult males with clavate setae on head (Fig. 123M). Females with 5 f-setae and one i-seta on sides of abdomen (Fig. 123N) . . . . . 385. *claviger* Gisin

– Adult males without clavate setae on head (Fig. 123L). Females with 4 f-setae and no i-seta on sides of abdomen . . . . . 386. *bilineatus* (Bourlet)

### 383. ***Heterosminthurus novemlineatus*** (Tullberg, 1871)

Fig. 123A, C, D, G, I; Pl. 16: 2

*Sminthurus novem-lineatus* Tullberg, 1871, Öfvers. K. VetenskAkad. Förh. 28: 145.

*Description.* – Body size up to 1.7 mm, males smaller. Colour pattern characteristic, although quite variable in intensity (Pl. 16: 2). Larger abdomen on each side with 3–4 longitudinal bluish bands, the two upper ones continue on the back side of the head. Mid-dorsal line on abdomen dark in anterior part. Anterior side of head with longitudinal bands below antennal bases. Abd.5–6 blue-striped on the sides. Antennae dark. Labrum with 6/554 setae. The three median setae of the upper row much shorter than the lateral ones (Fig. 123C). Labial palps with 6 proximal setae. Papilla E with 5 guards. Basal fields with 4 median and 5 lateral setae. Maxillary outer lobe with simple palp and one sublobal hair. Head with 1 + 1 postlabial setae. Maxilla (Fig. 123D) with longest lamella passing tip of the 3-toothed capitulum. Lam.1 with long marginal cilia and a denticulate proximal field. Lam.2 with marginal cilia and fine denticles. Lam.3 present as membranous flaps at base of lam.1. Lam.4 with coarse marginal cilia only, no denticulate field. Lam.5 with a narrow field of fine denticles. Lam.6 tongue-shaped, with fine denticles. Ant.4 with 7 subsegments. Males without enlarged setae between eyes (Fig. 123A). Ventral tube with 1 + 1 distal setae, no lateral seta on the main trunk. Subanal appendages slender, pointed, abruptly curved in basal 1/3. Retinaculum with 3 + 3 teeth and 3 setae. Tibiotarsi with 3-3-2 clavate apical hairs. Claws with small lateral teeth. Unguiculus slender on first pair of legs, with broad basal lamella on last two pairs. Dens with very long inner setae, twice as long as diameter of

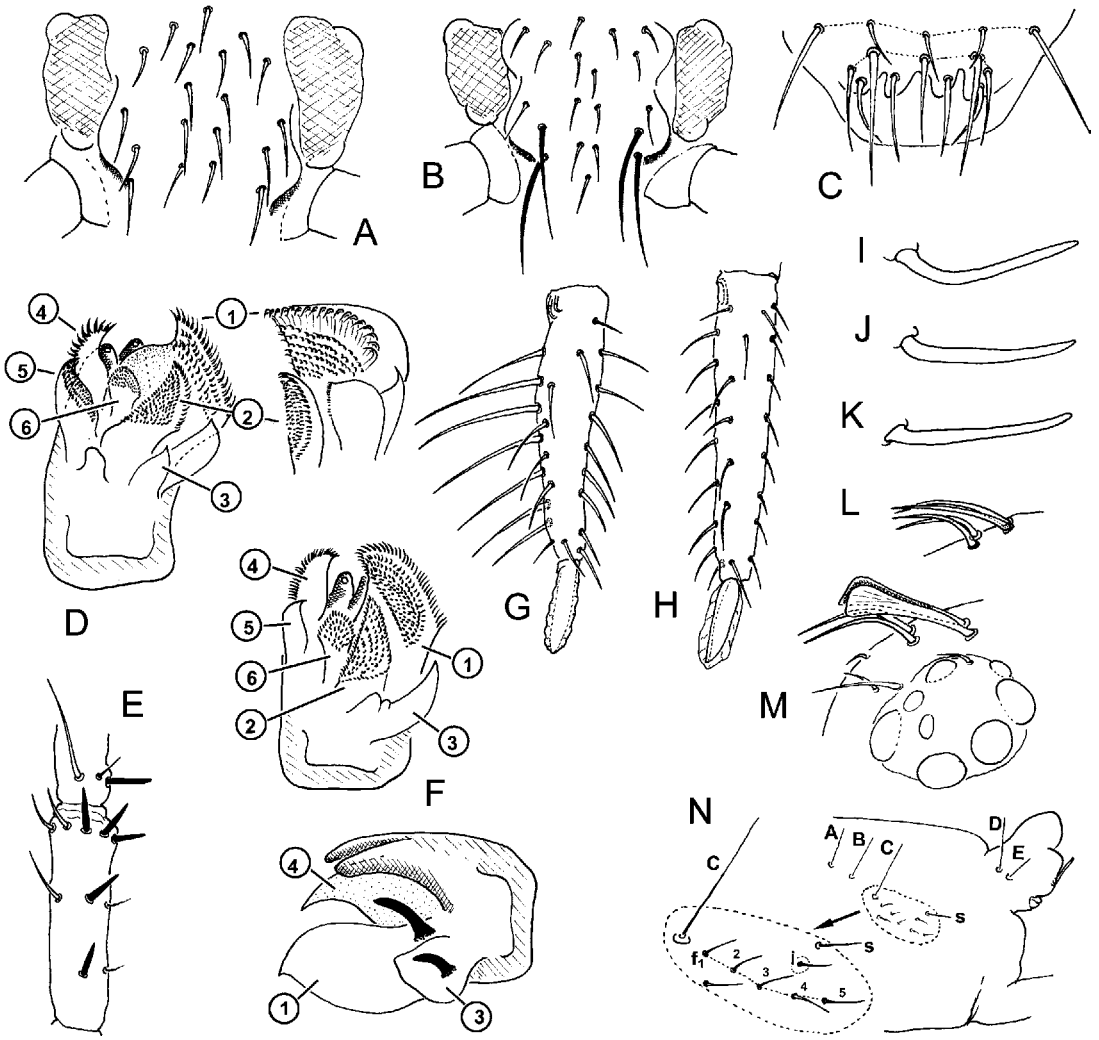


Fig. 123. *Heterosminthurus* spp.: (A–B) Setae between eyes and antennae in *novemlineatus* (A) and *insignis* (B); (C–D) *novemlineatus*, labrum (C) and maxilla (D); (E–F) *claviger*, enlarged dorsal setae (black) on ant.2–3 (E), maxilla (F) showing external spines (black) on lam.1–2 below; (G–H) right dens and mucro, dorsal, in *novemlineatus* (G) and *claviger* (H); (I–K) female subanal appendages in *novemlineatus* (I), *insignis* (J) and *claviger* (K); (L–M) modified male seta on top of head in *bilineatus* (L) and *claviger* (M); (N) *claviger* female, diagnostic setae (encircled) on left side of abdomen.

dens (Fig. 123G). Mucro with smooth lateral edges.

*Discussion.* – Large size and the characteristic striped abdomen normally identify the species. Pale individuals may be confused with *insignis*, but the latter is recognised by the more evenly curved subanal appendages in females (Fig. 123J) and the differentiated cephalic setae in males (Fig. 123B).

*Distribution and ecology.* – Widely distributed, on water in small lakes with abundant tall vegetation. Apparently it needs at least some open water as it is not present in bogs and wet meadows. General distribution: Palaearctic.

## 384. ***Heterosminthurus insignis*** (Reuter, 1876)

Figs 1J, K, 123B, J

*Sminthurus insignis* Reuter, 1876, Meddn Soc. Fauna Flora fenn. 1: 79.

*Description.* – Body size up to 1.9 mm. Ground colour yellow, often with diffuse darker pigmentation which never form distinct longitudinal bands as in *novemlineatus*. Details of mouthparts as in previous species. Dens with long inner seta like previous species. Males with 2+2 prolonged setae between eyes (Fig. 123B). Female subanal appendages evenly curved (Fig. 123J).

*Discussion.* – The uniform body colour and the secondary sexual characters distinguish this species from *novemlineatus*.

*Distribution and ecology.* – Common in various damp habitats like wet meadows, shores of lakes, Sphagnum bogs. Ascends high in the alpine (2.200 m in Norway). General distribution: Palaearctic.

## 385. ***Heterosminthurus claviger*** Gisin, 1958

Fig. 123E, F, H, K, M, N; Pl. 16: 3

*Bourletiella* (*Heterosminthurus*) *clavigera* Gisin, 1958, Revue suisse Zool. 65: 777.

*Description.* – Body size up to 0.9 mm. Males smaller than females, with longer antennae (Pl. 16: 3b). Ground colour pale, abdomen with one bluish brown lateral stripe on each side which continue to the sides of head. In addition there is one short posterolateral stripe on each side of abdomen (Pl. 16: 3). Mouth parts (labrum, labium, maxillary outer lobe) as in *H. novemlineatus*. Head with 1 + 1 post cephalic setae. Maxilla as Fig. 123F. Lam.1 broad and flattened, with fine denticles and marginal cilia. Lam.2 appears as an integrated basal part of lam.1. Lam.3 probably thin, without denticles, wrapped around base of lam.1. Lam.4 with marginal cilia only. Lam.5 smooth. Lam.6 tongue-shaped, with fine denticles. On the outer side of lam.1 and 3, near base, two thin stylets are projecting. Top of head in males with two pairs of long, modified setae. Anterior pair slender and curved, posterior pair clavate, flattened (Fig. 123M). Setae between antennal sockets with swollen bases. Dorsal side of ant.2 and base of ant.3 in males with some spine-like setae (Fig. 123E). Females with normal setae on head and antennae. Sides of abdomen with 5 f-setae and one i-seta in front of the sensillum (Fig. 123N). Ventral tube with 1 + 1 distal setae. Claws as in previous species. Dens and mucro as Fig. 123H, inner setae on dens shorter than diameter of stem. Female subanal appendages slender, almost straight (Fig. 123K).

*Discussion.* – Adult males of this species are easily recognised by the clavate cephalic setae, a character which is unique among our Symphypleona. Females may be confused with *bilineata*, but different setal patterns on sides of abdomen separate them.

*Distribution and ecology.* – Mostly in dry meadows and heaths (*Calluna*, etc.) both in lowland and mountains. Widely distributed, but formerly not separated from *bilineata*. General distribution: Palaearctic.

## 386. ***Heterosminthurus bilineatus*** (Bourlet, 1842)

Figs 1O, 123L

*Sminthurus bilineatus* Bourlet, 1842, Annls Soc. ent. Fr. 10: 41.

*Description.* – Very similar to *claviger*, but adult males differ by having slender enlarged setae on top of head, not clavate (Fig. 123L). Females differ by having only 4 f-setae and no i-seta on sides of abdomen (compare Fig. 123N).

*Distribution and ecology.* – Present in dry, open meadows and heaths. A few records from Denmark and southern Finland (Bretfeld, 1989) and a single record from Norway (an adult male from a dry, sandy beach meadow at VE: Tjøme). General distribution: Palaearctic.

## Misidentified species

*Heterosminthurus linnaniemi* Stach, 1920 was recorded from Denmark by Petersen (1965), but this is a misidentification of *H. claviger* Gisin according to Bretfeld (1989: 313).

## Genus *Deuterosminthurus* Börner, 1901

*Deuterosminthurus* Börner, 1901, Zool. Anz. 24: 345. Type species: *Smynthurus bicinctus* Koch, 1840, by subsequent designation by Stach, 1955.

The differential claw characters, separating *Deuterosminthurus* and *Bourletiella*, are hard to observe but the longer ventral setae on dens in *Bourletiella* is a clear key character.

Species diagnostics in this genus is problematic. Bretfeld's (1999) concepts are followed here, but may not be the final arrangement of taxa. Specimens of this genus may often be swept in enormous numbers form vegetation in their respective habitats during early summer.

### Key to species

1 Tib.2–3 with outer setae not longer than inner setae. Lower anal flap in females with subequal circumanal setae (Fig. 124I). Males without notably enlarged setae on upper anal lobe. Individuals with two large dorsal spots on abdomen key out here (Pl. 16: 4) . . . . . 2

– Tib.2–3 with some outer setae almost twice as long as inner setae (Fig. 124F). Two upper circumanal setae on the lower anal flap in females much shorter than lower ones (Fig. 124J). Males with a pair of enlarged setae on tip of upper anal lobe (Fig. 124K) . . . . . 389. *sulphureus* (Koch)

2 Seta $d_7$ absent on femur on last pair of legs (Fig. 124D). Males without enlarged setae in lateral fields of clypeus, ant.1–2 setae simple (Fig. 124B). Larger abdomen either with two dark dorsal spots (Pl. 16: 4) or uniformly yellow . . . . . 388. *bicinctus* (Koch)

– Seta $d_7$ present (Fig. 124C). Males with enlarged setae in lateral fields of clypeus, ant.1–2 with spine-like dorsal setae (Fig. 124A). Larger abdomen either yellow or uniformly darkened, without two clear dorsal spots . . . . . 387. *pallipes* (Bourlet)

### 387. *Deuterosminthurus pallipes* (Bourlet, 1843)

Fig. 124A, C, E, G, H, I

*Sminthurus pallipes* Bourlet, 1842, Annls Soc. ent. Fr. 10: 41.
*Sminthurus repandus* Ågren, 1903.

*Description.* – Body size up to 1.0 mm, males smaller. Colour brownish violet with distal parts of legs and mouth region paler (principal form), or uniformly yellow (f. *repandus*), often slightly reddish in posterior part. Labrum with 6/554 setae. Labial palps with 6 proximal setae, papilla E with 5 guards. Basal fields with 4 median and 5 lateral setae. Maxillary outer lobe with one sublobal hair. Postlabial setae 1 + 1. Maxilla as Fig. 124G. Lam.3 and 4 with marginal ciliation only, other lamellae with denticulate fields. Males with spine-like setae dorsally on ant.1–2 and enlarged setae in the lateral fields of clypeus (Fig. 124A). Females with normal setae on antennae and face. Ventral tube with 1 + 1 distal setae. Retinaculum with 3 + 3 teeth and 3 setae. Tibiotarsi with 3-3-2 spatulate apical setae, outer setae not differentiated. Tip of femur on last pair of legs with seta $d_7$ present, rarely absent (Fig. 124C). Unguiculus on all claws simply pointed, without subapical filament (Fig. 124E). Inner setae of dens shorter than diameter of the stem. Mucro with smooth edges (Fig. 124H). Subanal appendages in females weakly curved, with finely serrated edges in distal part.

*Discussion.* – The uniformly violet form of this species is identified by colour alone. The yellow form may be confused with *sulphureus* or yellow *bicinctus*, but the above key characters will separate them. The enlarged clypeal setae of males are characteristic.

*Distribution and ecology.* – Common in dry, open meadow vegetation, often together with *sulphureus*. General distribution: Holarctic.

### 388. *Deuterosminthurus bicinctus* (Koch, 1840)

Fig. 124B, D; Pl. 16: 4

*Smynthurus bicinctus* Koch, 1840, Fauna Ratisbonensis 3: 353.
*Bourletiella* (*Deuterosminthurus*) *flava* Gisin, 1946.

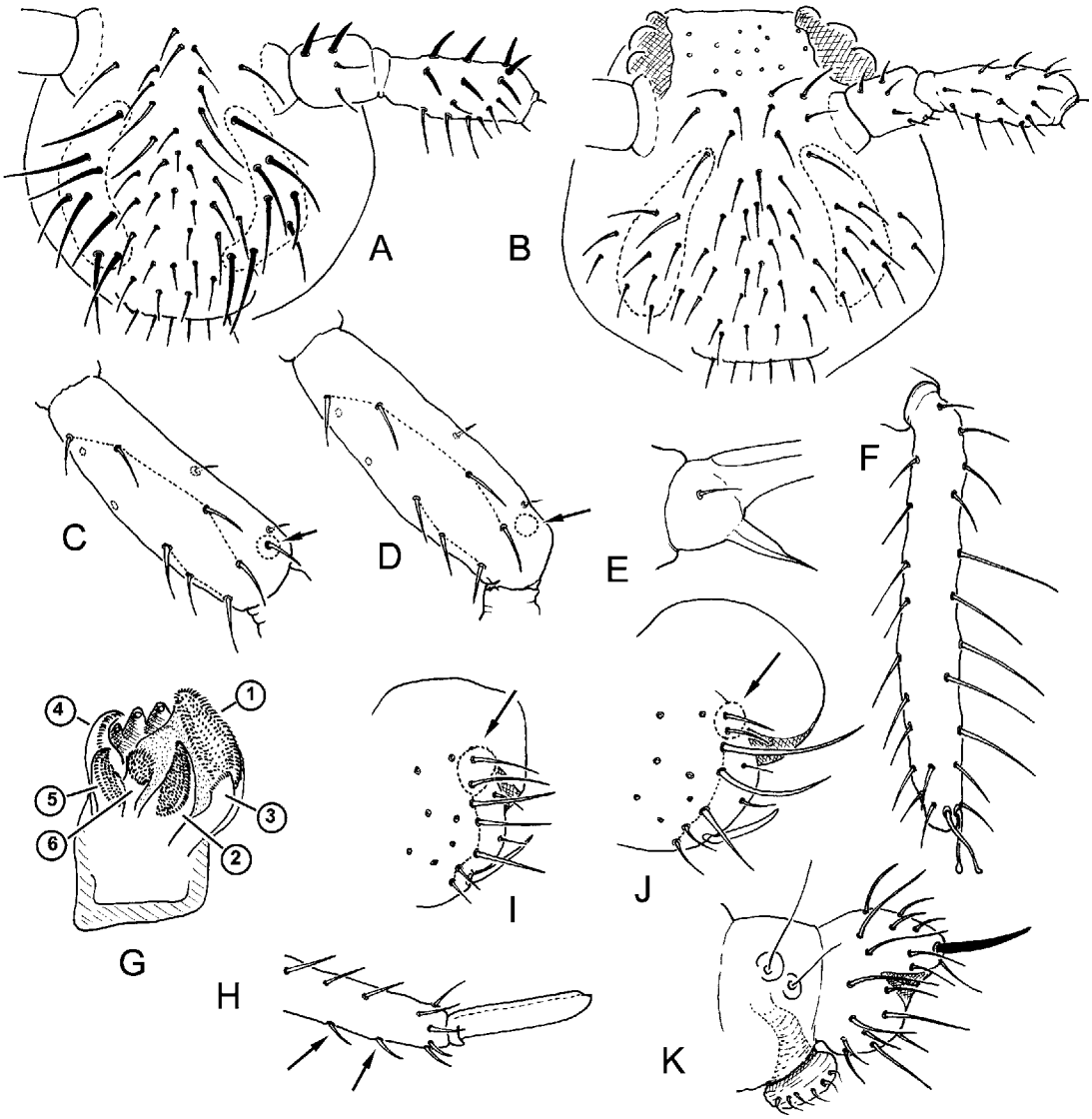


Fig. 124. *Deuterosminthurus* spp.: (A–B) Cephalic setae in males of *pallipes* (A) and *bicinctus* (B); (C–D) diagnostic $d_7$ seta (arrow) on femur of left hind leg in *pallipes* (C) and *bicinctus* (D); (E) *pallipes*, claw with simply pointed unguiculus; (F) *sulphureus*, left tib.3, female; (G) *pallipes*, maxilla; (H) *pallipes*, mucro and apical part of dens with short ventral setae (arrows); (I–J) diagnostic circumanal setae (arrow) on lower anal lobe in females of *pallipes* (I) and *sulphureus* (J); (K) *sulphureus*, male, with enlarged terminal seta (black) on abd.6.

*Description.* – Body size up to 0.8 mm. The principal form with two large dorsal spots on the pale abdomen (Pl. 16: 4), sometimes ground colour becomes diffusely reddish brown. The variety *flava* is uniformly yellow. In males most setae on top of head and between the eyes are slightly spiniform. Mouth parts, including maxillae, as in previous species. Last pair of femurs without apical seta $d_7$ (Fig. 124D).

*Discussion.* – The principal colour form, with two dorsal spots on abdomen, is immediately identified as no other Symphypleona in our fauna has this appearance. The yellow form is very similar to previous species, but males

do not have the spiniform antennal setae and the long setae of the clypeal field (compare Fig. 124A). Females of the yellow form (f. *flava*) are inseparable from yellow *pallipes* (f. *repandus*) apart from the absence of $d_7$ on last femurs (Fig. 124D).

*Distribution and ecology.* – The principal form is usually swept from tall undergrowth in lush deciduous forests during summer. The yellow form is more common in open meadow vegetation. Common in southern Scandinavia, but few records from Finland. General distribution: Palaearctic.

## 389. ***Deuterosminthurus sulphureus*** (Koch, 1840)

Fig. 124F, J, K

*Smynthurus sulphureus* Koch, 1840, Fauna Ratisbonensis 3: 353.

*Description.* – Body size up to 1.0 mm, males smaller. Colour uniformly yellow. Mouth parts as in previous species. Cephalic setae of males not clearly differentiated. Last femurs without seta $d_7$.

*Discussion.* – Very similar to yellow forms of the two previous species, but males are unique by having an enlarged pair of distal setae on the end of abdomen (Fig. 124K). Both males and females differ from previous species by having prolonged outer setae on tibiotarsi (Fig. 124F). Females are unique by having the two upper circumanal setae of the lower anal lobe shortened (Fig. 124J).

*Distribution and ecology.* – A characteristic species of dry open meadows, but also from wet habitats and undergrowth in lush forests. Linnaniemi (1912) had no clear concept of *sulphures* which was probably included in his records of '*Bourletiella bicincta* var. *repanda*'. The Finnish material has not been revised, but *sulphureus* is probably present. General distribution: Cosmopolitan.

## Genus *Bourletiella* Banks, 1899

*Bourletiella* Banks, 1899, Jl N.Y. ent. Soc. 7: 194. Type species: *Smynthurus hortensis* Fitch, 1863, by original designation.

Males have the dorsal setae on the back of greater abdomen (behind the A-B-C trichobothria) curved, spine-like, but quite variable. In females they are normal, slender.

### Key to species

1 Dens with 6 setae in the apical whorl, seta Ie present (Fig. 125H). Dorsal male organ on abd.6 with seta $m_2$ directed backward (Fig. 125E). Subanal appendages in females broad, pad-like (Figs 125F, 126C), circumanal setae on upper and lower flaps subequal (Fig. 126B) . . . . . 2

– Dens with 5 apical setae, Ie absent (Fig. 127B). Dorsal male organ on abd.6 with seta $m_2$ directed forward (Fig. 127A). Subanal appendages slender, ribbon-like (Fig. 127C), circumanal setae on the lower flaps much thicker than those on the upper flap (Fig. 127C) . . . . . 392. *pistillum* Gisin

2 Body mainly yellowish, sometimes more or less blue, but oral half of head always pale. Dorsal male organ on abd.6 with $DL_1$ much thicker than $DL_2$, both pointed in same direction (Fig. 125E). Female subanal appendages moderately broad (Fig. 125F) . . . . . 390. *viridescens* Stach

– Body dark blue, lighter dorsally, area between eyes yellow. Oral half of head dark, also in pale specimens. Male dorsal organ with $DL_1$ and $DL_2$ of subequal thickness, pointing in different directions (Fig. 126A). Female subanal appendages very broad (Fig. 126C) . . . . . 391. *hortensis* (Fitch)

## 390. ***Bourletiella viridescens*** Stach, 1920

Figs 1M, 125A–H

*Bourletiella viridescens* Stach, 1920, Bull. Acad. pol. Sci. Cl. math. nat. (B): 199.
*Sminthurus fulvus* Lie-Pettersen, 1896.
*Bourletiella lutea*: Linnaniemi 1912: 297, Gisin 1960: 287, Fjellberg 1980: 137, nec Lubbock, 1868.

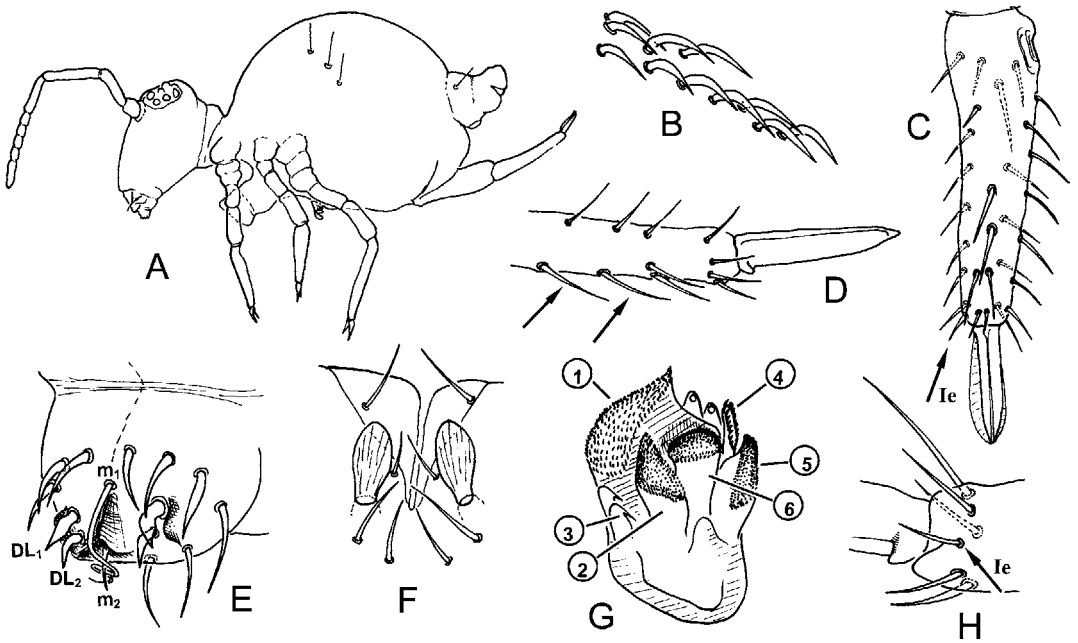


Fig. 125. *Bourletiella viridescens*: (A) Habitus, male; (B) spiniform setae on back of abdomen in male; (C) right dens and mucro, ventral; (D) mucro and apical part of dens with long ventral setae (arrows); (E) male dorsal organ on abd.6; (F) female subanal appendages, ventral view; (G) maxilla; (H) apex of dens with the diagnostic outer seta Ie.

*Description.* – Body size up to 1.5 mm, shape as Fig. 125A. Colour pale yellow, often with dirty violet coloration which is darkest in posterior part of abdomen. Mouth cone always pale. Labrum with 6/554 setae. Labial palp with 5 proximal setae. Papilla E with 6 guards. Basal fields with 4 median and 5 lateral setae. Maxillary outer lobe with one sublobal hair. Head with two postlabials. Maxilla as Fig. 125G. Lam.3 thin, membranous, with a few marginal serrations only. Other lamellae with fine denticles. Lam.1 broad, lam.6 swollen, ball-like, lying in a cavity on the inner side of lam.1. Ant.4 with 6–7 subsegments. Dorsal back of abdomen in males with a dense cover of short, curved spine-like setae (Fig. 125B). In females these setae are normal, slender. Ventral tube with 1 + 1 distal setae. Retinaculum with 3 + 3 teeth and 3–4 setae. Some of the outer setae on tibiotarsi slightly longer than diameter of the leg. Tibiotarsi with 3-3-2 clavate apical setae. Chaetotaxy of dens as Fig. 125C, D, H. Apical whorl with 6–7 setae, a small lateral seta Ie present (Fig. 125C, H). In adult females subanal appendages are spatulate (Fig. 126F), the circumanal setae on the upper anal lobe are slightly serrated, the lower circumanal setae are not dilated at base and only slightly thicker than the upper ones. Dorsal organ on abd.6 in males as Fig. 125E, the two hook like setae both point backwards.

*Discussion.* – A well-marked species by colour and the above key characters. Lie-Pettersen (1896) described *S. fulvus* from the Bergen area, saying it was very similar to Lubbock's (1868) *Sminthurus luteus* apart from body size which was always larger than 1.0 mm, almost twice as big as *luteus*. The only possible candidate for *fulvus* among our *Bourletiella* is *viridescens*. Bretfeld (1999) lists *luteus* as a synonym of *Deuterosminthurus sulphureus*.

*Distribution and ecology.* – In different meadow types, both lush wet meadows and dry short grass habitats. Uncommon, but locally abundant. General distribution: Cosmopolitan.

## 391. ***Bourletiella hortensis*** (Fitch, 1863)

Fig. 126A–C

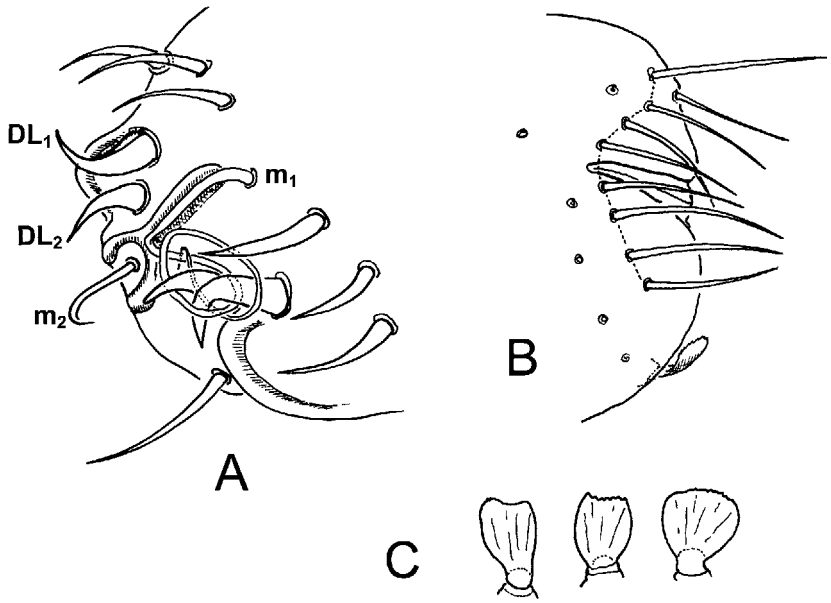


Fig. 126. *Bourletiella hortensis*: (A) male dorsal organ of abd.6; (B) subequal circumanal setae of female; (C) female subanal appendages, variations in shape.

*Smynthurus hortensis* Fitch, 1863, Trans. N.Y. St. agric. Soc. 22: 186.

*Description.* – Body size up to 1.8 mm. Body bluish black, head and back of abdomen often paler. Mouth cone always dark. Top of head has a distinct yellow patch between the eyes. Details of the mouthparts, including maxilla, as in *viridescens*.

*Discussion.* – Similar to previous species, but easily identified by the very short and broad subanal appendages in the female (Fig. 126C) and the diverging tips of the spine-like setae in the male abd.6 organ (Fig. 126A). Linnaniemi (1912: 295) referred to this species as *Bourletiella signata* (Nic.?, Ågr.).

*Distribution and ecology.* – Common in various grasslands, often in very dry habitats. In gardens specimens are often seen creeping on hot stones and slabs, or on bare soil. General distribution: Cosmopolitan.

## 392. ***Bourletiella pistillum*** Gisin, 1946

Fig. 127A–C

*Bourletiella pistillum* Gisin, 1946, Mitt. schweiz. ent. Ges. 20: 261.
*Bourletiella agreni* Stach, 1956.

*Description.* – Body size up to 1.1 mm. Colour dark violet blue, often paler on the back of abdomen. Area between eyes ochreous. Mouthparts, including details of maxilla, as in previous two species. Apart from the key characters very similar to these. The male dorsal organ on abd.6 is principally like that of *viridescens*, but the small posterior seta $m_2$ is curved forward, not backward (Fig. 127A).

*Discussion.* – The species differs from the two previous ones by absence of the lateroapical seta (Ie) on dens (Fig. 127B), the slender subanal appendages and the thick circumanal setae in the females (Fig. 127C), and details of the male dorsal organ (Fig. 127A).

*Distribution and ecology.* – Sometimes found in dry warm slopes and rocky habitats in the lowlands, but more common in alpine heaths up to 1.500 m. Common in Norway, other records uncertain. The early Scandinavian authors (Tullberg, 1871; Ågren, 1903; Linnaniemi, 1912; Agrell, 1943) may have included the species in *viridescens/hortensis/pruinosa* and their syn-

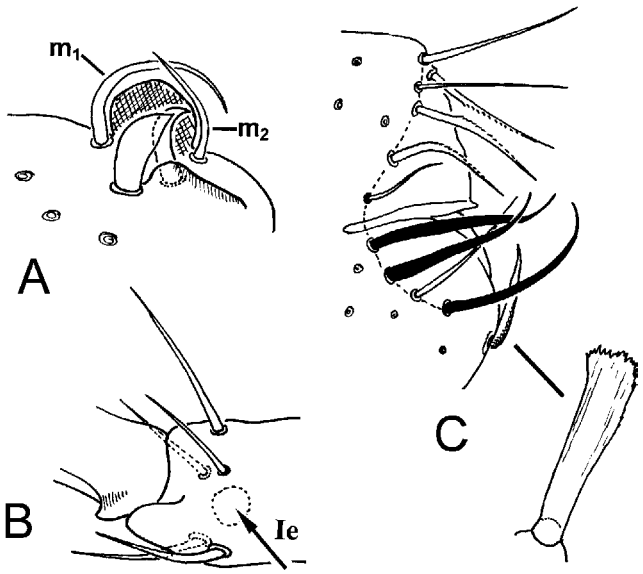


Fig. 127. *Bourletiella pistillum*: (A) Elements of male dorsal organ of abd.6, with forwardly directed seta $m_2$; (B) apex of dens with absence of the diagnostic outer seta Ie (arrow); (C) differentiated circumanal setae of female with enlargement of a subanal appendage.

onyms. According to Bretfeld (1999) Ågren's (1903: 164) and Linnaniemi's (1912: 296) '*pruinosus*/*pruinosa*' is *pistillum* (though see remark under *Cassagnaudiella*, below). Palissa (1966) reported the species from Finland under the name *Bourletiella agreni*. General distribution: Palaearctic.

## Genus *Cassagnaudiella* Ellis, 1975

*Cassagnaudiella* Ellis, 1975, Bull. zool. Mus. Univ. Amsterdam 4: 78. Type species: *Sminthurus pruinosus* Tullberg, 1871, by original designation.

Males without particular dorsal organ on abd.6, only normal setae. Also dorsal setae on back of the larger abdomen are normal, slender, unlike the thick spine-like setae of *Bourletiella* males. The taxon is sometimes considered as a subgenus of *Bourletiella* (Bretfeld, 1999).

One species in our area.

### 393. *Cassagnaudiella pruinosa* (Tullberg, 1871)

Fig. 128

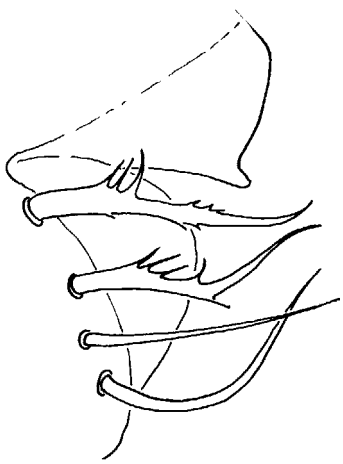

Fig. 128. *Cassagnaudiella pruinosa*, female, serrated circumanal setae on the lower anal lobe.

*Sminthurus pruinosus* Tullberg, 1871, Öfvers. K. VetenskAkad. Förh. 28: 145.

*Description.* – Body size up to 1.5 mm. Ground colour yellow, usually with a variable bluish pigmentation dispersed over the greater abdomen, most dark on lateral and ventral sides. Details of the mouth apparatus, including maxilla, as in *Bourletiella*. The two upper circumanal setae on

the lower lobe in females strongly serrated in basal part (Fig. 128). Subanal appendages slender, with parallel sides, apex with fine serrations (as in *B. pistillum*, Fig. 127C). Adult males without modified setae on abd.6.

*Discussion.* – The species is well characterised by the serrated circumanal setae and slender subanal appendages in the females, and the absence of a dorsal organ on abd.6 in adult males. According to Nayrolles (1995) the genus *Cassagnaudiella* differs from *Bourletiella* by absence of one of the inner setae on tib.2 and presence of a double ventral (anterior) edge on mucro.

*Distribution and ecology.* – Tullberg (1871) originally described the species from Gotland. In Norway the species is only recorded in dry meadows in Lom and Vågå (On). Danish specimens are seen from Mols (EJ). According to Bretfeld (1999: 229) the species is distributed all over Finland, with reference to Linnaniemi (1912: 296). However, the same source is used to document Finnish *B. pistillum* (see above). Until the material is revised, nothing can be said about the distribution in Finland. General distribution: Palaearctic.

# Family SMINTHURIDAE

The genera of this family have an annulated ant.4 which is longer than ant.3. On abd.5 there is at most one pair of trichobothria. Pretarsus of the claws have two setae (anterior, posterior).

## Key to genera

1 Neosminthuroid setae present (Fig. 129F). Dens with no more than 6 ventral setae . . 2
– Neosminthuroid setae absent. Dens with at least 9 ventral setae (Fig. 130A) . . . . . 3
2 Th.2 with finger-like vesicles (Fig. 129A). Abd.5 without trichobothrium . . . . . *Lipothrix* Börner (p. 220)
– Th.2 without vesicles. Abd. 5 with trichobothrium present . . . . . *Sphyrotheca* Börner (p. 222)
3 Trochanter of hind leg with a spine on the back side (Fig. 130D) . . . . . 4
– Trochanter only with normal seta on the back side . . . . . 5
4 Head with a short thick setae between antennal base and eye field (Fig. 130F) . . . . . *Allacma* Börner (p. 222)
– Head without such seta . . . . . *Caprainea* Dallai (p. 223)
5 Tibiotarsi with pointed apical setae . . . . . *Sminthurus* Latreille (p. 224)
– Tibiotarsi with clavate apical setae (Fig. 133A) . . . . . *Spatulosminthurus* Betsch & Betsch-Pinot (p. 225)

## Genus *Lipothrix* Börner, 1906

*Lipothrix* Börner, 1906, Mitt. naturh. Mus. Hamb. 23: 183. Type species: *Sminthurus lubbocki* Tullberg, 1872, by original designation.

Only one species in our area.

### 394. *Lipothrix lubbocki* (Tullberg, 1872)

Fig. 129A–H

*Sminthurus lubbocki* Tullberg, 1872, K. svenska VetenskAkad. Handl. 10: 33.

*Description.* – Body size up to 2.0 mm. Colour blackish blue or violet of variable intensity. Head and anterior abdomen with coarse skin structure and thick, blunt-tipped rough macrochetae (Fig. 129A). Antennae relatively short, ant.1–3 with no seta longer than diameter of the segments. Ant.4 with 5–6 subsegments. Labrum with 6/554 setae (Fig. 129C). Labial palps with 7 proximal setae, papilla E with 6 guards. Basal fields with 4 median and 5 lateral setae. Ventral

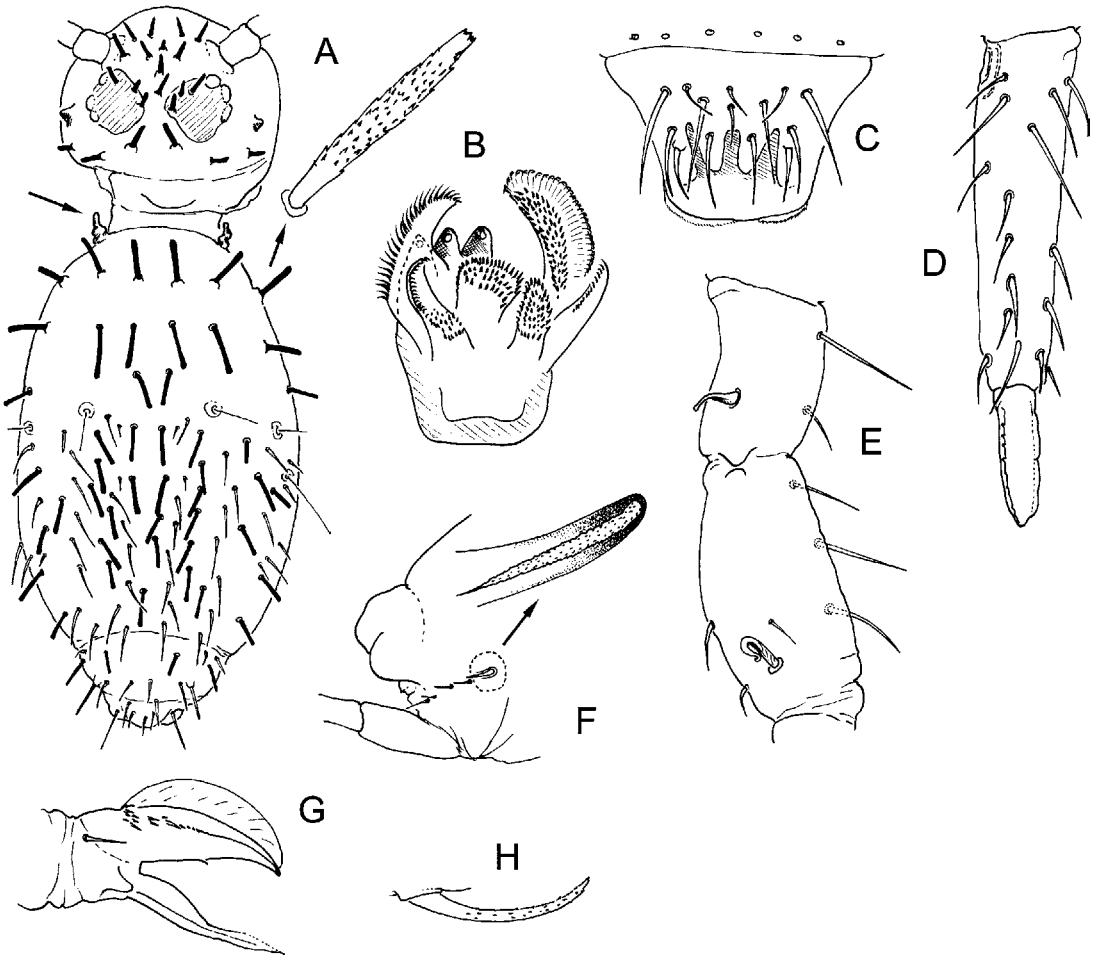


Fig. 129. *Lipothrix lubbocki*: (A) Dorsal side of the body, with enlargement of macrochaetae and marked (arrow) mesothorakal papilla; (B) maxilla; (C) labrum; (D) dens, dorsal; (E) modified setae on inner side of left trochanter and femur, hind leg; (F) neosminthuroid seta at base of furca, left side (enlargement above); (G) claw of hind leg; (H) female subanal appendage.

side of head with 1 + 1 postlabial setae. Maxillary outer lobe with 3 sublobal hairs. Maxilla as Fig. 129B. Ventral tube with 1 + 1 distal setae, retinaculum with 4 setae. Base of manubrium with one large neosminthuroid seta (Fig. 129F). Inner side of trochanters with a blunt-tipped spine. Femur on hind leg with a curved spine on inner side (Fig. 129E). Claws with tunica and serrated basolateral edges. Unguiculus with a long, flattened apical filament, in young individuals it is setaceous (Fig. 129G). Tibiotarsi without clavate apical setae. Female subanal appendages long, slender and curved (Fig. 129H). Dens with 3 ventroapical setae and a short ventral spine in basal 1/3, dorsal side as Fig. 129D. Mucro with broad ventral edge, no lateral seta. Inner dorsal edge with 7–8 blunt teeth, outer edge almost smooth.

*Discussion.* – The stout, blunt-tipped macrochaetae on head and abdomen readily identify this species from other Nordic outdoor Symphypleona.

*Distribution and ecology.* – Widely distributed in the forested zone, in moss and litter of the forest floor. General distribution: Palaearctic.

## Genus *Sphyrotheca* Börner, 1906

*Sphyrotheca* Börner, 1906, Mitt. naturh. Mus. Hamb. 23: 183. Type species: *Sminthurus multifasciatus* Reuter, 1881, by original designation.

Like previous genus it has a neosminthuroid seta at base of manubrium, but the finger-like vesicles on th.2 are absent and abd.5 has a single trichobothrium (D) on each side. Only one species recorded in our area.

### 395. *Sphyrotheca multifasciata* (Reuter, 1881)

*Sminthurus multifasciatus* Reuter, 1881.

*Description.* – Body size up to 1.6 mm. Background colour yellow, greater abdomen with distinct blue cross-stripes. Head and abdomen with rough spines and normal setae like in *L. lubbocki*. Antennae dark, about 1.5 as long as head diagonal, base of segments 2 and 3 paler. Ant.4 with 10–12 subsegments. Claws with setaceous apical filament on unguis. Femur 3 only with normal seta on the inner side. Mucro with a few teeth along inner lateral edge. Subanal appendages long and curved, pointed, with fine serrations in distal half.

*Discussion.* – The conspecificity of European outdoor specimens and the original greenhouse specimens from Helsinki has not been verified. A syntype is present in the Zoological Museum in Helsinki but has not been checked in recent times (Vilkamaa, 1988).

*Distribution and ecology.* – Originally described from a greenhouse in Helsinki by Reuter (1881). No further Nordic records, but reported from Great Britain, Spain, Bulgaria and former Yugoslavia. Some of these records are from outdoor habitats (Bretfeld, 1999). Total distribution: Cosmopolitane.

## Genus *Allacma* Börner, 1906

*Allacma* Börner, 1906, Mitt. naturh. Mus. Hamb. 23: 183. Type species: *Podura fusca* Linnaeus, 1758, by original designation.

The key characters and the large body size readily identify our single species. The larger abdomen posteriorly with cuticular glands.

### 396. *Allacma fusca* (Linné, 1758)

Fig. 130A–F; Pl. 17: 1

*Podura fusca* Linnaeus, 1758, Systema naturae, 10th ed.: 608.

*Description.* – Body size up to 3–4 mm. Colour violet brown, head usually paler. Body glossy, sometimes leopard-like spotted (Pl. 17: 1). Ant.2–3 with some setae which are longer than diameter of the segments. Ant.4 with about 15 subsegments. Head and body with long, rough setae which have a scalelike microstructure (Fig. 130E). A stub-like apically flossed postantennal setae present between antennal base and eye-field (Fig. 130F). Labrum with 6/554 setae, as in *L. lubbocki* (Fig. 129C). Labial palps with 7 proximal setae, papilla E with 6 guards. Basal fields with 4 median and 5 lateral setae. Head with 1 + 1 postlabial setae. Maxillary outer lobe with 3 sublobal hairs. Maxilla as Fig. 130C. Lam.1 very large, reaching well beyond tip of capitulum, with an apical fringe of incurved rakes and a broad basal field with hook-like serrations. Lam.3 with fine, delicate serrations. Lam.4 with very coarse teeth-like serrations along the edge, no denticulate field. Lam.6 with coarse denticles. Lam.2 and 5 with fine denticles. Ventral tube with 2 + 2 distal setae. Retinacuulum with 4 setae. Dorsal and ventral chaetotaxy of dens as Fig. 130A. Two particularly long dorsal setae on dens are apically knobbed. Inner edge of mucro with coarse teeth, outer edge smooth. Lateral seta present. Tibiotarsi with acuminate apical setae. Inner side of trochanter on hind leg with a flattened spine (Fig. 130D). Lateral edges of claws serrated in basal part, tunica prominent (Fig. 130B). Unguiculus with a setaceous subapical filament reaching tip of claw. Subanal appendages long and slender, apically serrated.

*Discussion.* – The species is recognised from other species of the family by the inner spine on the last trochanter, presence of 9 or more ventral setae on dens, and presence of a short thick postantennal setae on head.

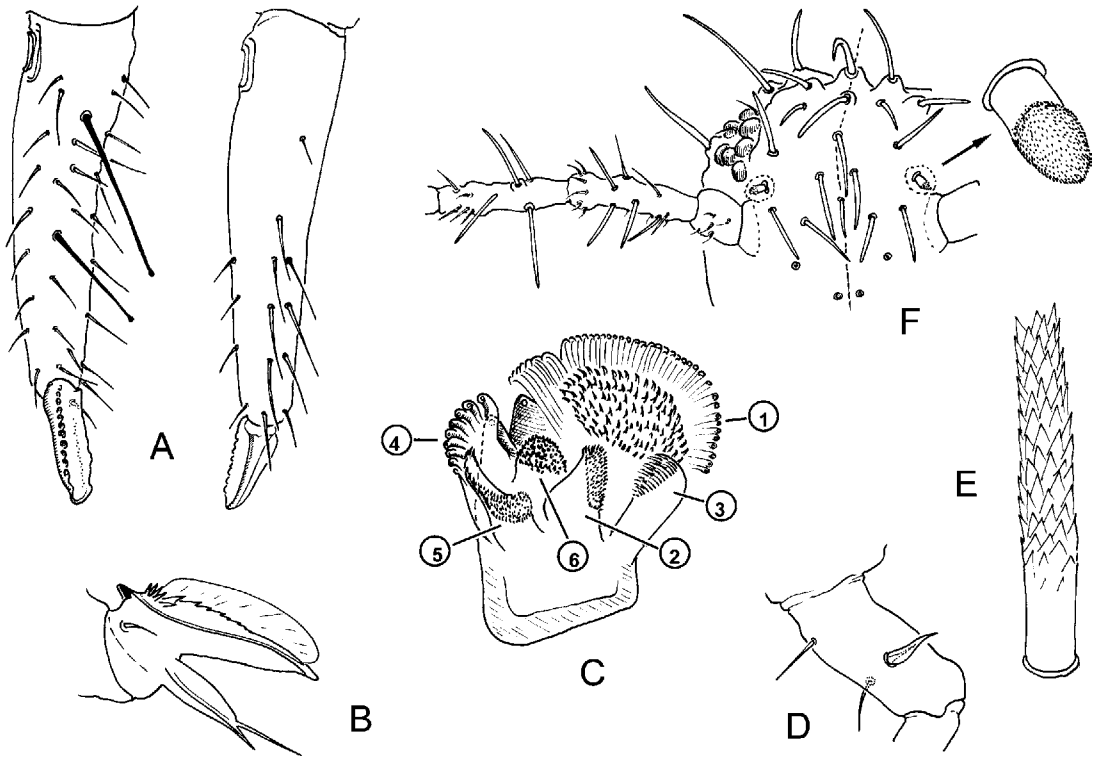


Fig. 130. *Allacma fusca*: (A) Dens and mucro, dorsal (left) and ventral (right); (B) claw of hind leg; (C) maxilla; (D) spine on back side of trochanter, hind leg; (E) scalelike microsculpture on abdominal macrochaeta; (F) antennofrontal area of head showing position of postantennal seta (enlarged).

*Distribution and ecology.* – This large species, reaching sizes not matched by any other Symphyplona in our area, is commonly found in moist forests where it is easily spotted while creeping on damp logs and stumps of wood. Widely distributed. General distribution: Holarctic.

## Genus *Caprainea* Dallai, 1970

*Caprainea* Dallai, 1970, Monitore zool. ital. 4. 52. Type species: *Sminthurus echinatus* Stach, 1930, by original designation.

Our single species is identified by the generic key characters. Unlike previous genus the larger abdomen has no cuticular glands in posterior part.

### 397. *Caprainea marginata* (Schött, 1893)

Fig. 131A–F

*Sminthurus marginatus* Schött, 1893, K. svenska VetenskAkad. Handl. 25: 25.

*Description.* – Body size up to 1.4 mm. Colour more or less rusty on pale background, no distinct patterns. General morphology as Fig. 131A. Top of head with pointed spine-like macrochaetae, postantennal stub-like seta absent (Fig. 131B). Greater abdomen with coarse spine-like macrochaetae, posterior part with a group of short setae on each side. Basal part of ant.3 with some setae which are much longer than diameter of the segment, no such setae on ant.2. Ant.4 with about 15 subsegments. Labrum with 6/454 setae and 3 narrow longitudinal ridges (Fig. 131E). Labial palp with 6 proximal setae. Labial papilla E with 5 guards. Maxillary outer

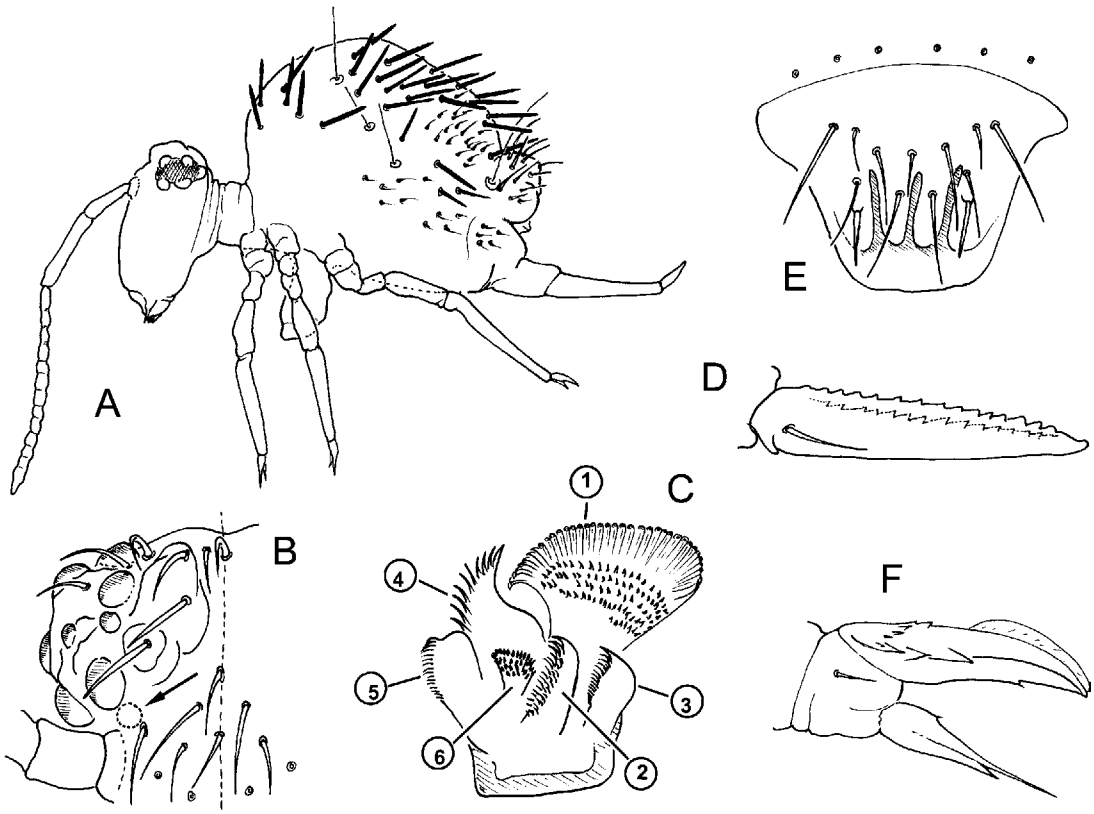


Fig. 131. *Caprainea marginata*: (A) Habitus; (B) antennofrontal area of right side of head showing absence of postantennal seta (arrow); (C) maxilla; (D) mucro; (E) labrum; (F) claw of hind leg.

lobe with 3 sublobal hairs. Maxilla (Fig. 131C) much like that of *Allacma fusca* (Fig. 130C), with a prominent lam.1 bearing long apical rakes, but the proximal field consists of 4–5 rows of fine hooks only. Also lam.3 and 5 are very delicate with only a single marginal row of small serrations, no denticulate fields. Lam.4 has much finer marginal teeth, of same strength as the apical rakes of lam.1. Head with 1 + 1 postlabial setae. Ventral tube with 1 + 1 distal setae. Retinaculum with two setae. Claws as Fig. 131F. Inner side of last trochanters with a curved spine-like seta. Ventral side of dens with 12–13 setae. Both dorsal edges of mucro serrated (Fig. 131D). Subanal appendages slender, curved, distal part split in a few short branches.

*Discussion.* – Distinguished from other Nordic Sminthuridae by presence of 12–13 ventral setae on dens, presence of inner spine on last trochanters and absence of stub-like postantennal seta.

*Distribution and ecology.* – The only Nordic records are Schött's (1893) original from Uppland and Wahlgren (1906) who reported a record from Scania. In Denmark Bartholin (1916) found the species at Lolland (Fuglsang Storskov). All records from forest habitats. General distribution: Palaearctic.

## Genus *Sminthurus* Latreille, 1802

*Sminthurus* Latreille, 1802, Histoire naturelle, Crustacés Insectes 3: 71. Type species: *Sminthurus aquaticus* Bourlet, 1842, by subsequent designation by Börner, 1906.

The two Nordic species of this genus are recognised from other Sminthuridae by the generic key characters.

## 398. *Sminthurus viridis* (Linnaeus, 1758)

Fig. 132A–F; Pl. 17: 4

*Podura viridis* Linnaeus, 1758, Systema naturae, 10th ed.: 608.

*Description.* – Body size up to 3.0 mm. Greater abdomen globular, with long slender setae. Background colour yellowish green, often with variable bluish green patterns laterally on greater abdomen (Pl. 17: 4). Distal part of antenna reddish. Labrum with 6/554 setae, apical ridges relatively short and broad (Fig. 132E). Labial palps with 7 proximal setae, papilla E with 6 guards. Basal fields with 4 median and 5 lateral setae. Maxillary outer lobe with 3 sublobal hairs. Head with 1 + 1 postlabial setae. Maxilla as Fig. 132A, lamellae not reaching beyond tip of capitulum. Lam.1 broad, with long apical rakes and a large denticulate proximal field. Lam.2 appears as an integrated part at base of lam.1. Lam.3, 5 and 6 with many rough denticles. Lam.4 with a single row of strong marginal teeth. Head with a short, pointed postantennal seta between antennal base and eye-field. Basal half of ant.3 with 4–5 macrochaetae which are longer than diameter of the segment. Ant.4 with about 20 subsegments. Ventral tube with 1 + 1 distal setae, retinaculum with 4 setae. Greater abdomen with a dense cover of slender, pointed macrochaetae. Outer setae of tibiotarsi longer than diameter of the segment (Fig. 132D). Apical setae pointed. Inner side of last trochanters with a small slender microchaeta. Subcoxa on last pair of legs with two outer macrochaetae (lower macrochaeta absent, only microseta present) (Fig. 132F). Claws with a long apical filament on unguiculus, passing tip of unguis. Ventral chaetotaxy of dens as Fig. 132C. Mucro slender, with smooth lateral edges, lateral seta present. Subanal appendages slender, weakly curved, smooth (Fig. 132B).

*Discussion.* – A large and common species which is identified by long-haired abdomen (similarly shaped *Bourletiella* are short-haired) and uniform yellowish green colour. The absence of the lower macrochaeta on subcoxa 3 (Fig. 132F) is the only clear character separating *viridis* from *nigromaculata*.

*Distribution and ecology.* – Usually in grassy meadow habitats, mostly dry. Distribution incompletely known because older records may have included both *viridis* and *nigromaculata*. General distribution: Cosmopolitan.

## 399. *Sminthurus nigromaculatus* (Tullberg, 1871)

Fig. 132G; Pl. 17: 3

*Sminthurus nigromaculatus* Tullberg, 1871, Öfvers. K. VetenskAkad. Förh. 28: 145.

*Description.* – Body size 2–3 mm. Colour variable from greenish to dark purple, more or less spotted (Pl. 17: 3). Apart from presence of 3 outer macrochaetae on the hind subcoxa (Fig. 132G), identical to *viridis*.

*Distribution and ecology.* – Common in meadow vegetation. Verified records indicate a wide distribution, but old records are mixed with *viridis*. General distribution: Holarctic (probably wider).

# Genus *Spatulosminthurus* Betsch & Betsch-Pinot, 1984

*Spatulosminthurus* Betsch & Betsch-Pinot, 1984, Pedobiologia 25: 216. Type species: *Sminthurus lesnei* Carl, 1925, by original designation.

Presence of clavate tibiotarsal setae and serrated mucro separates the species from members of *Sminthurus*. One species in our area.

## 400. *Spatulosminthurus flaviceps* (Tullberg, 1871)

Fig. 133A, B; Pl. 17: 2

*Sminthurus flaviceps* Tullberg, 1871, Öfvers. K. VetenskAkad. Förh. 28: 145.

*Description.* – Body size up to 1.6 mm. Greater abdomen brownish black, including coxal parts of the legs and proximal part of abd.6. Head yellowish white, back side behind the eyes and a

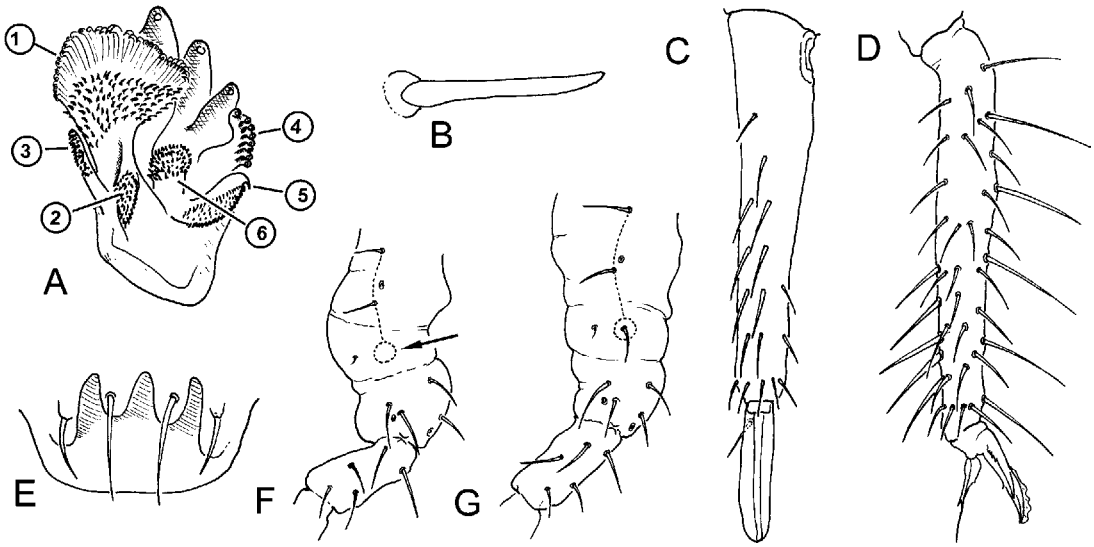


Fig. 132. *Sminthurus viridis* (A–F) and *S. nigromaculatus* (G): (A) Maxilla, (B) female subanal appendage, (C) dens and mucro, ventral, (D) claw and tibiotarsus, hind leg, (E) labrum, apical edge; (F–G) basal part of right hind leg, showing position of the diagnostic subcoxal seta (arrow) being absent in *viridis* (F), present in *nigromaculatus* (G).

roundish spot between antennal bases and some elongate spots in the frontoclypeal field dark. Legs beyond coxae pale (Pl. 17: 2). Labrum with 6/554 setae. Apical ridges similar to those of *viridis* (Fig. 132E). Maxillary outer lobe with 3 sublobal hairs. Labial palps with 7 proximal setae, papilla E with 5 guards. Basal fields with 4 median and 5 lateral setae. Head with $1 + 1$ postlabial setae. Maxilla similar to that of *viridis* (Fig. 132A), lam.1 shorter than apical teeth of capitulum, with a broad apical rake and an extensive proximal field of fine denticles. Basal part of ant.3 with 5 long setae. Ant.4 with about 15 subsegments. Postantennal seta stout, pointed, ciliated at tip. Ventral tube with $2 + 2$ distal setae (one short and one long on each side). Retinaculum with 4 setae. Greater abdomen with stiff macrochaeta which are thick and blunt-tipped in anterior part of the body, more slender and pointed in posterior part. Lower sides of abd.5 also with a pair of thick, blunt setae. Tibiotarsi with one clavate apical seta. Uguiculus on last two pairs of legs with small inner teeth and a short setaceous apical filament (Fig. 133A). Ventral chaetotaxy of dens as in *viridis* (Fig. 132C). Mucro with both lateral edges serrated (Fig. 133B).

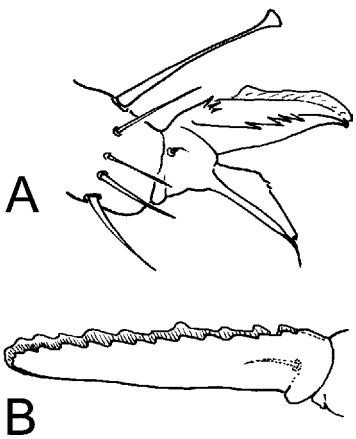


Fig. 133. *Spatulosminthurus flaviceps*: (A) Claw of hind leg; (B) mucro.

*Discussion.* – Typically coloured specimens are easily identified by the dark body and the contrasting yellow or white head.

*Distribution and ecology.* – Only few records from southern parts of Denmark, Sweden and Norway. Several of these records are from wet salt meadows with tall vegetation near seashores. General distribution: Palaearctic.

Plate 1. *Isotomurus* spp., lateral colour patterns: (1) *antennalis*, Denmark: Bornholm; (2) *balteatus*, Russia: Karelia; (3) *stuxbergi*, Sweden: Scania; (4) *fucicola*, Sweden: Scania; (5) *graminis*, Sweden: Scania; (6) *italicus*, Norway: Vestfold; (7) *maculatus*, Norway: Hordaland; (8) *palustris*, Norway: Vestfold; (9) *plumosus*, Sweden: Scania; (10) *unifasciatus*, Norway: Vestfold.

Plate 2. *Isotomurus* spp., dorsal colour patterns: (1–5) same specimens as Pl. 1. (1) *antennalis*, (2) *balteatus*, (3) *maculatus*, (4) *palustris*, (5) *plumosus*, (6–10); variation in *unifasciatus*, specimens from (6–8) Norway: Vestfold, inds. from same sample, (9–10) Norway: Hordaland, inds. from same sample.

Plate 3. *Vertagopus* spp., colour patterns: (1) *westerlundi*, Sweden: Abisko; (2) *sarekensis* Norway: Oppland, Snøhetta; (3) *cinereus*, Denmark: Fyn; (4) *arboreus*, Denmark: E. Jylland; (5) *arcticus*, Norway: Svalbard.

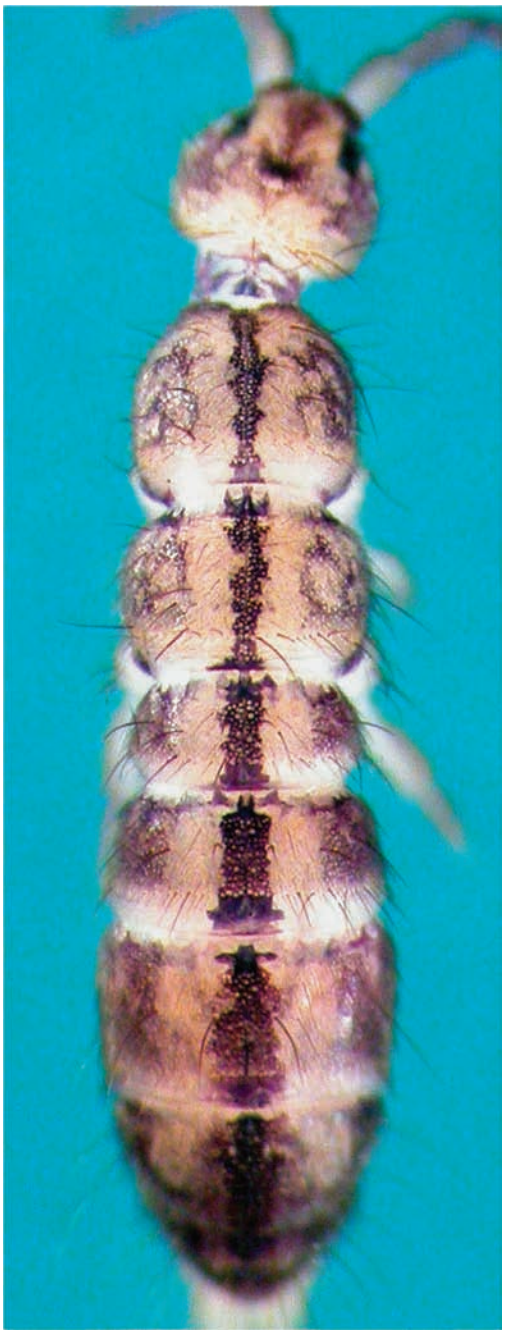

Plate 4. *Isotoma riparia*, dorsal colour pattern (Sweden: Scania).

Plate 5. *Entomobrya* spp., colour patterns, dorsal (a) and lateral (b): (1a) *nivalis*, Norway: Vestfold; (1b) ditto, Iceland: Akureyri; (2a–b) *multifasciata*, Sweden: Scania; (3a–b) *nicoleti*, Norway: Vestfold; (4a–b) *marginata*, Norway: Vestfold.

Plate 6. *Entomobrya* spp., colour patterns, dorsal (a) and lateral (b): (1a–b) *albocincta*, Sweden: Scania; (2) *corticalis*, Norway: Vestfold; (3a–b) *superba*, Poland: Bialowieza.

Plate 7. *Entomobrya arborea*, dorsal and lateral pigment patterns (old specimens from Finland: Reval, 1905).

Plate 8. *Entomobrya muscorum*, dorsal and lateral colour patterns (Nederland: Gronsveld).

Plate 9. *Willowsia buskii*, colour pattern, lateral (Norway: Vestfold).

Plate 10. *Orchesella* spp., colour patterns: (1) *cincta*, Norway: Vestfold; (2) *flavescens*, Norway: Vestfold; (3a–b) *villosa*, Sweden: Scania; (4) *bifasciata*, Norway: Vestfold; (5a–b) *spectabilis*, Sweden: Öland; (6) *cincta*, head and two basal segments of antenna, Sweden: Scania; (7) *flavescens*, ditto, Norway: Vestfold.

Plate 11. *Pogonognathellus* (1–2) and *Tomocerus* (3–4), habitus: (1) *P. longicornis*, Sweden: Scania; (2) *P. flavescens*, Sweden: Scania; (3) *T. minor*, Sweden: Scania; (4) *T. vulgaris*, Norway: Vestfold.

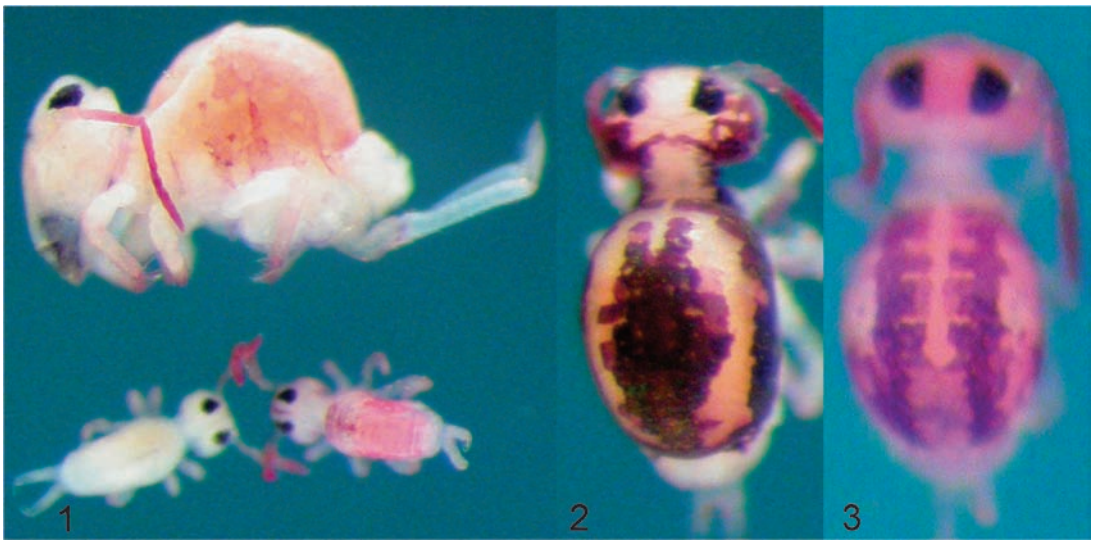


Plate 12. *Sminthurides* spp., habitus and colour patterns: (1) *aquaticus*, adult female above adult male (right) in courtship with a juvenile female (left), Iceland: Akureyri; (2) *malmgreni*, Sweden: Scania; (3) *schoetti*, Iceland: Akureyri.

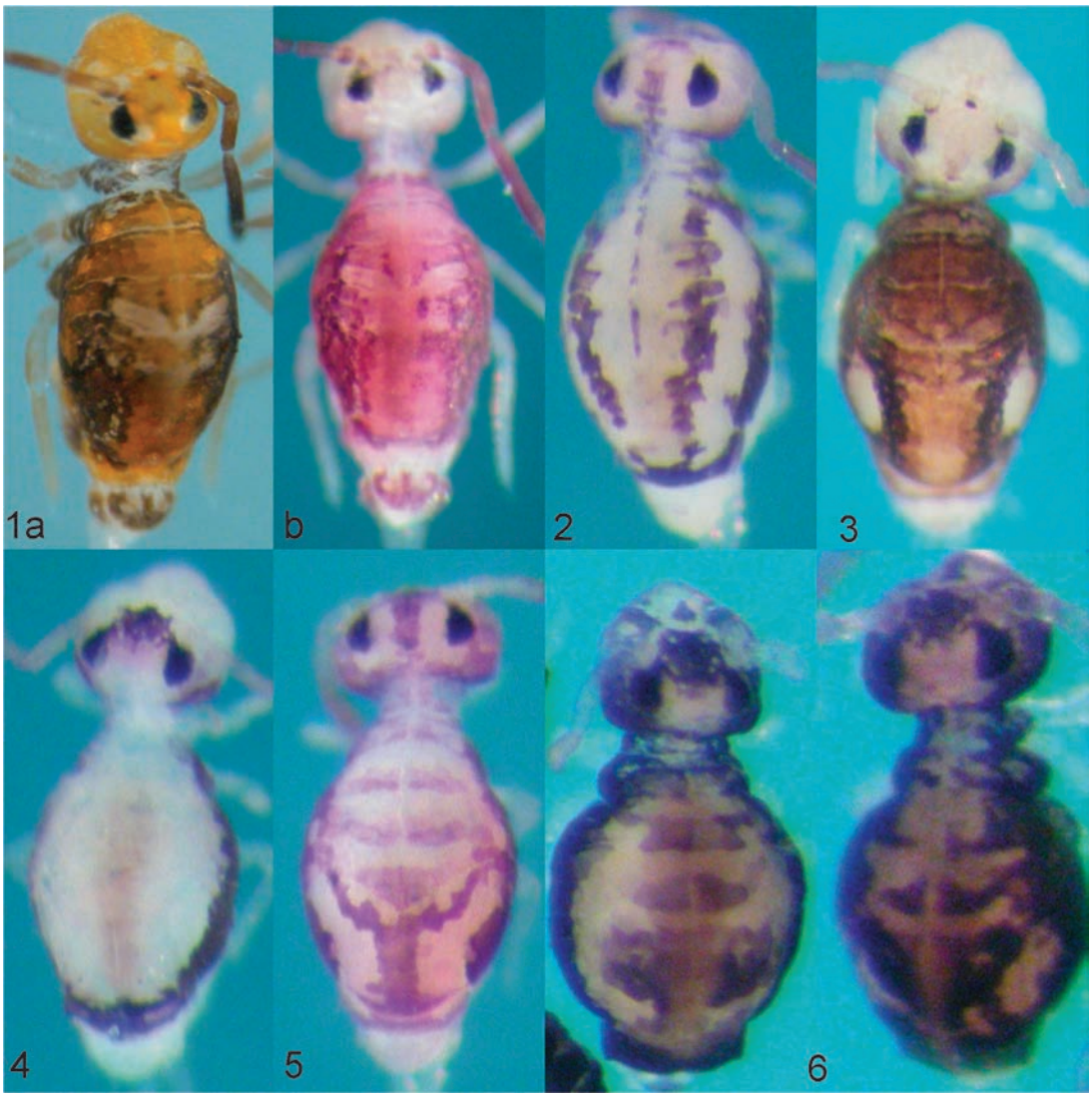


Plate 13. *Sminthurinus* spp., dorsal colour patterns: (1) *domesticus*, freshly collected (a) and after one year in alcohol (b), Sweden: Scania; (2) *elegans*, Sweden: Scania; (3) *trinotatus*, Sweden: Uppland; (4) *signatus*, Denmark: Hillerød; (5) *reticulatus*, Sweden: Scania; (6) *transversalis*, female (left) and male (right), syntypes from Finland, Hailuoto, 1902 (Zool. Mus., Helsinki).

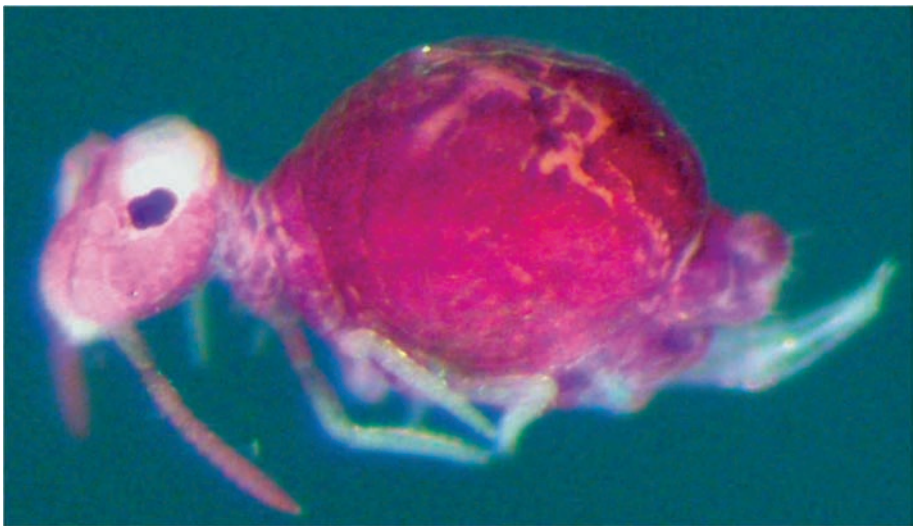

Plate 14. *Rusekianna albifrons*, habitus (Norway: Buskerud).

Plate 15. *Dicyrtoma fusca* (1) and *Dicyrtomina* spp. (2–6), colour patterns: (2 and 4) *ornata*, Sweden: Scania; (3) *minuta*, Denmark: Silkeborg; (5) *saundersi*, Norway: Aust Agder; (6) *flavosignata*, Sweden: Scania.

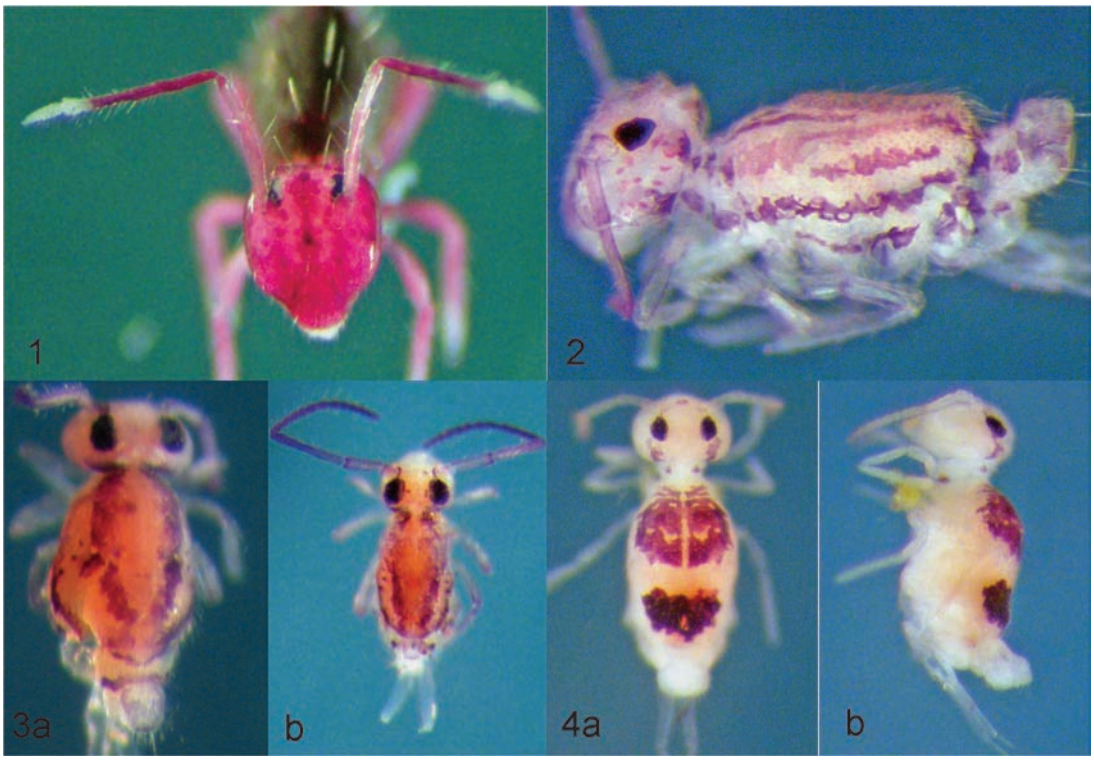


Plate 16. Colour patterns of (1) *Ptenothrix atra*, Sweden: Scania; (2) *Heterosminthurus novemlineatus*, Norway: Vestfold; (3a–b) *Heterosminthurus claviger*, female (a) and male (b), Germany: Dubringer Bog; (4) *Deuterosminthurus bicinctus*, Sweden: Scania.

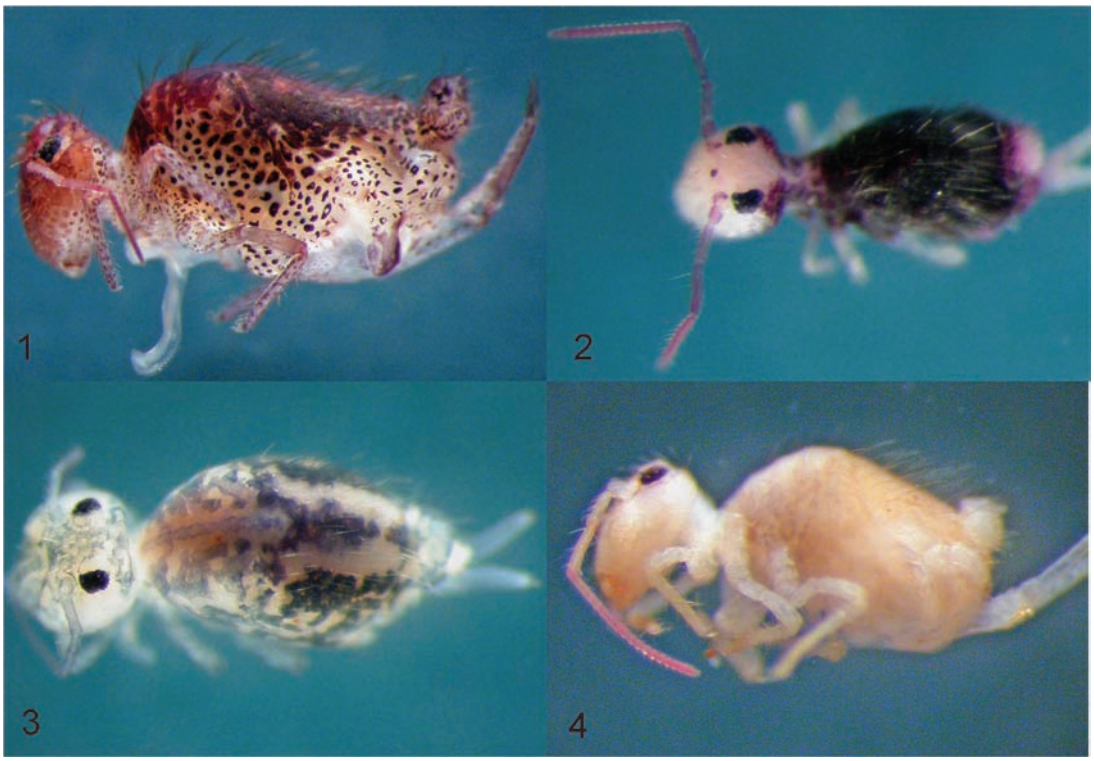


Plate 17. Habitus and colour patterns of (1) *Allacma fusca*, Sweden: Scania; (2) *Spatulosminthurus flaviceps*, Denmark: Lolland; (3) *Sminthurus nigromaculatus*, dark specimen, East Greenland: Jameson Land; (4) *Sminthurus viridis*, pale specimen, Iceland: Reykjavik.

# Nordic Collembola. Catalogue

| | | Faroe Is. | Iceland | Arctic Is. | DENMARK | | | | | | | | | | | | SWEDEN | | | | | | | | | | | |

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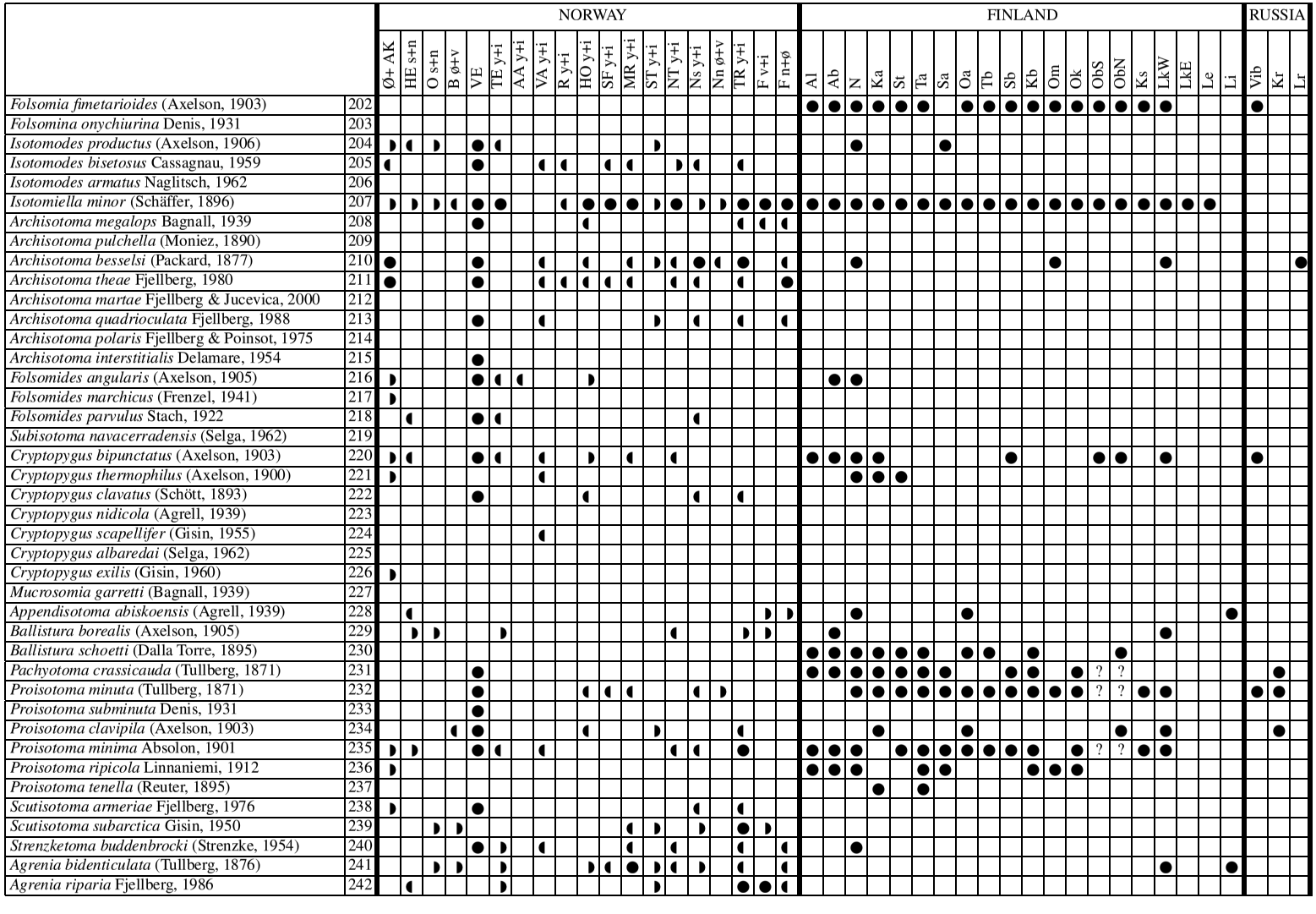
| *Tetracanthella arctica* Cassagnau, 1959 | 162 | | | | | | | | | ◖ | ◖ | ◖ | ◖ | | | ◖ | | ◖ | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Tetracanthella fjellbergi* Deharveng, 1987 | 163 | | | | ● | | | | ◖ | ◖ | ● | ◖ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Tetracanthella wahlgreni* Linnaniemi, 1907 | 164 | ◗ | ◗ | ◗ | ◗ | ● | ● | | | ◗ | ● | | ◗ | ◖ | ◗ | ◗ | ◗ | ● | ● | ● | | | | | | | | ● | | | | | | | | | ● | | | ● | | | | | |
| *Tetracanthella brachyura* Bagnall, 1949 | 165 | | | ◗ | ◗ | | ◗ | | ◖ | | ◗ | ◖ | ◗ | ◗ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Tetracanthella strenzkei* Gisin, 1949 | 166 | | ◖ | | | | | | | | ◖ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Tetracanthella pilosa* Schött, 1891 | 167 | | | | | | | | | | | | | | | | | ● | | | | | ● | | | | | | | | | | | | | | ● | | | | | | | |
| *Pseudanurophorus isotoma* Börner, 1903 | 168 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Pseudanurophorus binoculatus* Kseneman, 1934 | 169 | ◗ | ◗ | ◗ | ◗ | ● | | | ◖ | | ● | | ● | ◗ | ◖ | ◖ | | ● | ● | ● | | | ● | | ● | | ● | | ● | ● | | ● | | | | ● | ● | ● | | | | | | |
| *Pseudanurophorus alticolus* Bagnall, 1949 | 170 | | ◖ | | | | ◗ | | ◖ | | | | | ◗ | ◖ | ◗ | ◗ | ◖ | ◖ | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Pseudanurophorus psammophilus* (Potapov & Stebaeva, 2002) | 171 | | | | | | | | | | | | | | | | | ◖ | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Jesenikia filiformis* Rusek, 1997 | 172 | | | | | ● | | | ◖ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Isotomodella pusilla* Martynova, 1967 | 173 | | | ◗ | | | | | | | | | | | | | | ◖ | | ◖ | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Anurophorus laricis* Nicolet, 1842 | 174 | ● | ● | | ◗ | ● | | | | ◖ | ● | | ◖ | ◗ | ◖ | ◖ | | ● | ◗ | ◖ | ? | ● | ● | ? | ? | ? | ? | ? | ● | ? | ? | ? | ? | ? | ? | ? | ? | ? | | | ? | ? | ? |
| *Anurophorus palaearcticus* Potapov, 1997 | 175 | ◗ | ◗ | | | | ◗ | | | | | | | ◗ | ◖ | | | | | | | | | | | | | | ● | | | | | | | | | | | | | | | | |
| *Anurophorus fulvus* Fjellberg, 1988 | 176 | | | | | | | | | | | | | | | | ◗ | ● | ◖ | ◖ | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Anurophorus septentrionalis* Palissa, 1966 | 177 | ◗ | ◗ | ◗ | ◗ | ● | | | | | | | | | | | | ◗ | ◗ | ◖ | | ● | | ● | | ● | | ● | ● | | ● | | | ● | ● | ● | ● | | | ● | | | | |
| *Anurophorus atlanticus* Fjellberg, 1974 | 178 | ◗ | ◗ | | | ● | | | ◖ | | ◖ | | | | | | | | | | | | ● | | | | | ● | | | | | | | | | | | | | | | | |
| *Micranurophorus musci* Bernard, 1977 | 179 | ◖ | ◗ | ◗ | | ● | ● | | ◖ | | | | ◖ | | | | | ◖ | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Folsomia fimetaria* (Linnaeus, 1758) | 180 | ● | ◗ | | | ● | ◖ | | ◖ | ◖ | | ◖ | ◖ | ◗ | | ● | ◗ | ● | | ◖ | | ● | ● | | | ● | | | ● | | | | | | | ● | | | | | | | | |
| *Folsomia candida* (Willem, 1902) | 181 | ◗ | | | | | | | ◖ | | ◖ | | | | | | | | | | | | ● | | | | | ● | | | | | | | | | | | | | | | | |
| *Folsomia stella* Grow & Christiansen, 1976 | 182 | ● | | | | ● | | | ◖ | ◖ | | ◖ | | | | ◖ | ◗ | ● | ◖ | ● | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Folsomia dovrensis* Fjellberg, 1976 | 183 | ◗ | ◗ | ◗ | | ● | | | ◖ | | ◖ | | ◖ | ◗ | | ◖ | | ● | ◗ | ◖ | | ● | ● | ● | | ● | | ● | ● | | | | | | | | | ● | | | | | | | |
| *Folsomia bisetosa* Gisin, 1953 | 184 | | | | | ● | ◗ | | | | | | | ◗ | | | ◗ | ● | ◖ | ◖ | | | | | | | | | | | | | | | | | ● | | | | | | | |
| *Folsomia bisetosella* Fjellberg, 2005 | 185 | ◖ | | | | ● | ◖ | | ◖ | | | ◖ | ● | | | ◖ | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Folsomia litsteri* Bagnall, 1939 | 186 | | ● | ◗ | | ● | ◖ | | | | | | | | | | | | | | | | | | | ● | | | | | | | | | | ● | | | | | | | | |
| *Folsomia inoculata* Stach, 1947 | 187 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Folsomia coeruleogrisea* (Hammer, 1938) | 188 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Folsomia sensibilis* Kseneman, 1936 | 189 | ◗ | ◗ | ◗ | ● | ● | | | ◖ | | ● | | ◗ | ◗ | ◖ | | | ● | ● | ● | | | | | | | | | | | | | | | | | ● | ● | | | ● | | | | |
| *Folsomia quadrioculata* (Tullberg, 1871) | 190 | ◗ | ● | ◗ | | ● | ● | | ◖ | ◖ | ● | ◖ | ● | ◗ | ● | ◖ | | ● | ● | ◖ | ● | ● | ● | ● | ● | ● | ● | ● | | ● | | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| *Folsomia manolachei* Bagnall, 1939 | 191 | ● | ● | ◗ | ◖ | ● | ● | | ◖ | ◖ | ◖ | ◖ | ● | ◗ | ◗ | ◖ | ◗ | ● | ● | ◖ | | ● | | | | | | | | | | | | | ● | ● | ● | | | | | | | |
| *Folsomia palearctica* Potapov & Babenko, 2000 | 192 | | | ◗ | | | | | | | ◗ | | | ◗ | | | | ● | ● | ● | | | ● | | | ● | | | | | | | | ? | ● | | ● | ● | | | | ● | ● |
| *Folsomia brevicauda* Agrell, 1939 | 193 | | | ◗ | ◗ | | ◗ | | ◖ | ◖ | ● | ◖ | ● | ◗ | ◖ | ◗ | ● | ● | ● | ◖ | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Folsomia taimyrica* Martynova et al., 1973 | 194 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Folsomia binoculata* (Wahlgren, 1899) | 195 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Folsomia agrelli* Gisin, 1944 | 196 | | | ◗ | ◗ | | | | | | | | ◖ | | | | | ● | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Folsomia spinosa* Kseneman, 1936 | 197 | ◖ | | | ◖ | ● | | | ◖ | | ◖ | | ◖ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Folsomia penicula* Bagnall, 1939 | 198 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Folsomia sexoculata* Tullberg, 1871 | 199 | ◗ | | | | ● | | | ◖ | | | | ◖ | ◗ | | | | ◖ | | ◖ | ● | ● | ● | | ● | | | ● | | | | | | | | | | | | | | | |
| *Folsomia thalassophila* Bagnall, 1940 | 200 | ◗ | | | | | | ◖ | | | ◖ | | ◖ | | | | ◗ | ● | | ◖ | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Folsomia microchaeta* Agrell, 1939 | 201 | | | | | | | | | | | | | | | | | ● | | | | | | | | ? | | | | | | | | | | | | | | | | ? | | |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| *Isotomurus palustris* (Müller, 1776) | 243 | ● | | | | ● | | | ◖ | ◖ | | | | ◗ | ◗ | | | ? | | | ? | ? | ? | ? | | ● | ? | ? | ● | | ? | ? | | | | ● | | | | ? | ? | ? | |
| *Isotomurus maculatus* (Schäffer, 1896) | 244 | | | | | | | | | | ◖ | | | | | | | | | | | ? | | ? | ? | ? | | | | | ? | | | | | | | | | | | | |
| *Isotomurus italicus* Carapelli et al., 1995 | 245 | | | | | ● | | | | ◖ | | | | | | | | | | | | | | | | | | | | | ● | | | | | | | | | | | | |
| *Isotomurus fucicola* (Schött, 1893) | 246 | | | | | ● | | | | ◖ | ◖ | | ◗ | | | | | | | | ? | ● | ? | | ? | ● | | ? | | ? | ? | ? | ? | ? | ? | | ? | | | | | ? | |
| *Isotomurus unifasciatus* (Börner, 1901) | 247 | | | | | ● | | | | ◖ | ◖ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Isotomurus graminis* sp. nov. | 248 | | ● | | | ● | | | | ● | ◖ | | ◗ | | | | | | | | | | | | | | | | | | | | | | ● | | | | | | | | |
| *Isotomurus plumosus* Bagnall, 1940 | 249 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Isotomurus stuxbergi* Tullberg, 1876 | 250 | ◗ | ◖ | | | | | | | | | | | ◗ | ◖ | | | | | | | ● | | | | ● | | | | | | | | | | | | | | | | | | |
| *Isotomurus balteatus* (Reuter, 1876) | 251 | | | | | | | | | | | | | | | | | | | ● | | ● | ● | | ● | ● | ● | ● | | ● | ● | ● | | ? | ? | | ● | | | | ● | ● | |
| *Isotomurus antennalis* Bagnall, 1940 | 252 | ◖ | | | | | | | | ◖ | | | | | | | | | | | | | ● | ● | | | | | | | | | | | | | | | | | | | | |
| *Vertagopus arboreus* (Linnaeus, 1758) | 253 | | | | | | | | | | ◖ | ◖ | ◗ | ◗ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Vertagopus pseudocinereus* Fjellberg, 1975 | 254 | | | | | ● | ◖ | | | | | | | | | | | | | ◗ | | | | | | | | | | | | | | | | | | | | ● | | | | |
| *Vertagopus cinereus* (Nicolet, 1842) | 255 | ◗ | ◗ | | ◖ | ● | | ◖ | ◖ | | ◖ | | | ◗ | ◖ | ◗ | | ● | | ◖ | ● | ● | ● | ● | ● | ● | ● | ● | | ● | ● | ● | ● | ? | ● | ● | ● | ? | | | ● | ● | |
| *Vertagopus haagvari* Fjellberg, 1996 | 256 | | ◗ | | ◖ | ● | | | ◖ | | | | | | | | | | | | | ● | | | | ● | | | ● | | | | | | | | | | | | | | |
| *Vertagopus westerlundi* (Reuter, 1898) | 257 | | ◗ | ◗ | | ● | ◗ | | | | | | | ◗ | | | | ● | ◗ | | | | ● | | | | ● | ● | ● | ● | ● | | | | | | ? | ? | | | ● | | ● |
| *Vertagopus sarekensis* (Wahlgren, 1906) | 258 | | ◗ | ◗ | | | | | | | | | ◖ | ◗ | | ◗ | ◗ | ● | ◖ | | | | | | | | | | | | | | | | | | | | | | | | |
| *Vertagopus arcticus* Martynova, 1969 | 259 | | | ◗ | | | | | | | | | | | | | | ● | | ◖ | | | | | | | | | | | | | | | | | | | | | | | |
| *Pseudisotoma sensibilis* (Tullberg, 1876) | 260 | ● | | | | ● | | | ◖ | ◖ | ● | ◖ | ● | | ◖ | ● | ◗ | ● | ◖ | ◖ | ● | ● | ● | ● | | | ● | | | ● | | ● | ● | | | | | | | ● | ● | |
| *Pseudisotoma monochaeta* (Kos, 1942) | 261 | | | | | | | | | | ◖ | ◖ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Marisotoma canaliculata* Fjellberg, 1997 | 262 | | | | | | | | | | ◖ | ◖ | ◖ | | ◖ | ◖ | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Marisotoma tenuicornis* (Axelson, 1903) | 263 | | ◖ | | | ● | | | | | | | | | | | | | | ◗ | | | ● | | | | ● | | | | | | ● | | | | | | | | | | |
| *Parisotoma notabilis* (Schäffer, 1896) | 264 | ● | ● | ◗ | ● | ● | ◖ | | ◖ | ● | ● | ◖ | ● | ◗ | ● | | ◗ | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | | | ● | ● | ● | ● |
| *Parisotoma agrelli* (Delamare Deboutteville, 1950) | 265 | ◖ | | | | ● | | | ◖ | ◖ | ◖ | | ● | ◗ | | ◖ | | ● | | ◖ | | | | | | | | | | | | | | | | | | | | | | | |
| *Parisotoma ekmani* (Fjellberg, 1977) | 266 | | | | | | | | | | ◗ | | | | | | | ● | ● | ◗ | | | | | | | | | | | ● | | | | | ● | ● | ● | | | | | |
| *Parisotoma trichaetosa* (Martynova, 1977) | 267 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | ● | ● | ● | | | | | | |
| *Halisotoma maritima* (Tullberg, 1871) | 268 | ◗ | | | | ● | ◖ | ◖ | ◖ | ◖ | | | ● | ◗ | ◖ | | ◗ | ● | | ◖ | ● | ● | ● | | | | | | | | | | | | | | | | | | | | ● |
| *Halisotoma poseidonis* Bagnall, 1939 | 269 | | | | | ● | | | | | | | ◖ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Isotoma viridis* Bourlet, 1839 | 270 | ◗ | ◗ | ◗ | ◖ | ● | | | ◖ | ◖ | ● | ● | ◖ | ◗ | | ◗ | ◗ | ● | ● | ● | | ● | ● | ● | ● | ● | | ● | ● | | ● | | | ● | ● | ● | ● | | ● | ● | | | |
| *Isotoma riparia* (Nicolet, 1842) | 271 | | | | | ● | | | | | | | ● | | | ◖ | | ◗ | | | ● | ● | ● | ● | ● | | ● | ● | | ● | ● | ● | ? | ● | ● | ? | ? | | ● | ● | | | |
| *Isotoma caerulea* Bourlet, 1839 | 272 | ◗ | | | | ● | | | | | ◗ | ◖ | ◗ | ◗ | | | | | | | | ● | ● | ● | | | | ● | ● | | | | | | ● | | ● | | | | | | |
| *Isotoma anglicana* Lubbock, 1862 | 273 | | ◖ | | | ● | | | | | | | ◗ | | | ◖ | | | | | | ● | ● | | | | | ● | ● | | | | | | | | ● | | | | | | |
| *Desoria olivacea* (Tullberg, 1871) | 274 | ◗ | | ● | ● | ● | ◗ | | ◖ | ◖ | ● | ● | ◗ | ◗ | ◖ | ● | ◗ | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | | ● | | | ● | | | ● | ● | ● |
| *Desoria infuscata* (Murphy, 1959) | 275 | | | ◗ | ◗ | | | | | | ● | | ● | | | | ◗ | ● | ◖ | ◖ | | | | | | | | | | | | | | | | | | | | | | |
| *Desoria tshernovi* Martynova, 1974 | 276 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Desoria fennica* (Reuter, 1895) | 277 | ◗ | ◖ | | | ● | ◗ | | | | | | | ◗ | | | | ◖ | | | | ● | ● | | | | ● | | | ● | | | | | | | ● | | | | | ● | |
| *Desoria tolya* sp. nov. | 278 | ◗ | ● | ◗ | ◗ | ● | ◗ | | | | ◖ | | | ◗ | | ◗ | | | | | | ● | | | | ● | | | ● | | ● | | | | | ● | ● | ● | | | | | |
| *Desoria hiemalis* (Schött, 1893) | 279 | ◗ | | ◗ | ◖ | ● | ◗ | | | | | ◗ | | ◗ | ◖ | ● | | ● | ● | ◗ | | ● | ● | ● | | ● | ● | ● | ● | ● | ● | | | | | ● | ● | ● | | | | ● | |
| *Desoria neglecta* (Schäffer, 1900) | 280 | ◗ | ● | ◗ | | | | | | | ◗ | | | ◗ | | | | ● | ● | ● | | | ● | ● | | ● | ● | | ● | ● | ● | ● | ● | ● | ● | ● | ● | | | | ● | ● | |
| *Desoria blufusata* (Fjellberg, 1978) | 281 | ◗ | ◖ | | | ● | | | | | | | | ◗ | | | | ◗ | | ● | | | | | | ● | | | | ● | | | | | | | | | | | | |
| *Desoria blekeni* (Leinaas, 1980) | 282 | ◗ | | ◗ | ◗ | ● | | | | | | | | ◗ | ◖ | ◖ | | ◗ | ◗ | | | ● | ● | | | ● | | | ● | | | | | | | | | | | | | |

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| | | Ø+ AK | HE s+n | O s+n | B ø+v | VE | TE y+i | AA y+i | VA y+i | R y+i | HO y+i | SF y+i | MR y+i | ST y+i | NT y+i | Ns y+i | Nn ø+v | TR y+i | F v+i | F n+ø | Al | Ab | N | Ka | St | Ta | Sa | Oa | Tb | Sb | Kb | Om | Ok | ObS | ObN | Ks | LkW | LkE | Le | Li | Vib | Kr | Lr |
| *Desoria nivea* (Schäffer, 1896) | 283 | ◗ | ◗ | | | ● | | | ◗ | | | | | ◗ | ◖ | ◗ | | ● | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Desoria intermedia* (Schött, 1902) | 284 | ◗ | | | | ● | | | | | | | | ◗ | | | | | | | | ● | | | | | | | | | | | | | | | | | | | | |
| *Desoria potapovi* sp. nov. | 285 | | | ◗ | | ● | | | | | | | | | | | | ◖ | | | | | | | | | | | | | | | | | ● | | | | | ● | | |
| *Desoria propinqua* (Axelson, 1902) | 286 | ◗ | | | | ● | | | | | | | | ◗ | | | | ◗ | | | | | ● | ● | ● | | ● | | | ● | | | ● | ● | ● | | ● | | | | | | |
| *Desoria divergens* (Axelson, 1900) | 287 | | | | | | | | | | | | | | | | | | | | | | ● | ● | | | | ● | | ● | ● | | | | ● | ● | | | | | ● | ● | |
| *Desoria tigrina* Nicolet, 1842 | 288 | | ◗ | | | ● | | | | | | | | | | | | | | | | ? | ? | ? | | ● | | ? | | | ? | | | | ? | | | | | | | | |
| *Desoria grisea* (Lubbock, 1869) | 289 | ◗ | ◖ | | | ● | | | | ◖ | ◖ | | | | | ◖ | | | | | | ? | ? | ? | | | | ? | | | ? | | | | ? | | | | | | | | |
| *Desoria trispinata* (MacGillivray, 1896) | 290 | ◗ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Desoria multisetis* (Carpenter & Phillips, 1922) | 291 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Sinella tenebricosa* Folsom, 1902 | 292 | ◗ | | | | | | | | | ◖ | | | | | | | | | | | | ● | | | ● | | ● | | ● | ● | | | | ● | | | | | | ● | |
| *Sinella curviseta* Brook, 1882 | 293 | | | | | | | | | | ◖ | | | | | | | | | | | | ● | | | | | | | | | | | | | | | | | | | |
| *Entomobrya lanuginosa* (Nicolet, 1842) | 294 | ◗ | | | | ● | ◗ | ◖ | | | | | | | | | | | | | ● | ● | ● | | | | | ● | | | | | | | ● | | | | | | ? | ? | |
| *Entomobrya marginata* (Tullberg, 1871) | 295 | ◗ | ◗ | ◗ | ◗ | ● | ◖ | ◖ | | | | | | | ◖ | | | | ◗ | | ● | ● | ● | ● | ● | | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | | | | ● | | |
| *Entomobrya albocincta* (Templeton, 1835) | 296 | ● | ◗ | | | ● | | | | ◗ | | ● | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Entomobrya corticalis* (Nicolet, 1842) | 297 | ◗ | ● | | | ● | | ◖ | ◖ | | | | | ◗ | ◗ | | | | | | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | | | | ● | | |
| *Entomobrya arborea* (Tullberg, 1871) | 298 | | | | | | | | | | | | | | | | | | | | | ● | ● | | | | | | | ● | | ● | | ● | | | | | | | ● | |
| *Entomobrya nivalis* (Linnaeus, 1758) | 299 | ● | ● | ◗ | ● | ● | ◗ | ◖ | ◖ | ● | ● | | | ◗ | | ● | | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | | ● | ● | | ● | ● | ● | ● | ● |
| *Entomobrya nicoleti* (Lubbock, 1868) | 300 | | | | | | | | | | | | | | | | | | | | | | | | | | | | ● | | ● | | | | | | | | | | | |
| *Entomobrya multifasciata* (Tullberg, 1871) | 301 | ◗ | | ◗ | | ● | | | | | | | | | | | | | | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | | | | ● | | | | | | ● | ● | |
| *Entomobrya superba* (Reuter, 1876) | 302 | | | | | | | | | | | | | | | | | | | | ● | ● | ● | | | ● | ● | | | ● | | | | | | | | | | ● | ● | |
| *Entomobrya spectabilis* Reuter, 1890 | 303 | | | | | | | | | | | | | | | | | | | | | | ● | | | | | | | | | | | ● | | | | | | | | |
| *Entomobrya muscorum* (Nicolet, 1841) | 304 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Entomobryoides myrmecophilus* (Reuter, 1886) | 305 | | | | | | | | | | | | | | | | | | | | | ● | ● | | | | | | | | | | | | | | | | | | | |
| *Lepidocyrtus fimetarius* Gisin, 1964 | 306 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Lepidocyrtus lignorum* (Fabricius, 1793) | 307 | ◗ | ● | ◗ | ● | ● | ● | | ◗ | ● | ● | ◗ | ● | ◗ | ◖ | ● | ◗ | ● | ● | ● | ● | ● | ● | ● | | ● | | ● | ● | | ● | | | ● | ● | ● | ● | | | ● | | |
| *Lepidocyrtus lanuginosus* (Gmelin, 1790) | 308 | ◗ | ◗ | | | ● | | | | | ◖ | | | | | | | | | | | ● | | | | | | | | | | | | | | | | | | | | |
| *Lepidocyrtus violaceus* (Geoffroy, 1762) | 309 | ● | ● | ◗ | ● | ● | | | ◖ | | ● | | ● | ◗ | | | ◗ | | | | ● | ● | ● | ● | | ● | | | ● | | | | | | | | | | | | | |
| *Lepidocyrtus cyaneus* Tullberg, 1871 | 310 | ◗ | ● | ◗ | ◖ | ● | | | | ◖ | ● | | | | | | | | | | | ● | | ● | | | | | ● | | | | | | | ● | ● | ● | | | | | |
| *Lepidocyrtus curvicollis* Bourlet, 1839 | 311 | ◗ | | | | | | | | | ◖ | | | | | | | | | | | | ● | | | | | | | | | | | | | | | | | | | | |
| *Lepidocyrtus paradoxus* Uzel, 1890 | 312 | | | | | | | | | | | | | | | | | | | | | | ● | | | | | | | | | | | | | | | | | | | | |
| *Lepidocyrtus pallidus* Reuter, 1890 | 313 | | | | | ● | | | | | ◖ | | | ◗ | | | | | | | | | ● | | | | ● | | | | ● | | | | | | | | | | | | |
| *Lepidocyrtus weidneri* Hüther, 1971 | 314 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Pseudosinella alba* (Packard, 1873) | 315 | ◗ | | | ◖ | ● | ◖ | | ◖ | | ◖ | | ● | ◗ | ◗ | ◖ | ◗ | ◖ | | | | ● | ● | ● | | ● | | ● | ● | | | | | | | | | | | | ● | | |
| *Pseudosinella octopunctata* Börner, 1901 | 316 | ◗ | | ◗ | | ● | | | | | | | | | | | | | | | | | | | | ● | | | | | ● | | | | | | | | | | ● | | |
| *Pseudosinella sexoculata* Schött, 1902 | 317 | | | | | ● | | | | | | | | | | | | | | | | ● | | ● | | | | | | | | ● | | | | | | | | | | |
| *Pseudosinella halophila* Bagnall, 1939 | 318 | | | | | ● | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Pseudosinella immaculata* (Lie-Pettersen, 1896) | 319 | | | | | ● | | | | | ◖ | | ◖ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Pseudosinella decipiens* Denis, 1924 | 320 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Pseudosinella petterseni* Börner, 1901 | 321 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Willowsia buskii* (Lubbock, 1870) | 322 | ● | | | ◗ | ● | | | | | | | ◗ | ◗ | | | | ● | | | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | | | | ● | ● | ● |
| *Willowsia nigromaculata* (Lubbock, 1873) | 323 | ◗ | | | ◗ | ● | | | | | | | | | | | | | | | ● | ● | ● | ● | | | ● | | | ● | | | | | | | | | | ● | | |

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| *Willowsia platani* (Nicolet, 1842) | 324 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Orchesella cincta* (Linnaeus, 1758) | 325 | ● | ◗ | | ◗ | ● | | | ◖ | | ◖ | | | | | ? | | | ? | | ● | ● | ● | ● | ● | | | ● | | | ● | | | | | | | | | | ● | | |
| *Orchesella bifasciata* Bourlet, 1839 | 326 | ◗ | ● | | ◗ | ● | ◖ | ◖ | | | | | | | | ? | | ? | | | ● | ● | ● | ● | ● | ● | ● | ● | | ● | ● | | ● | ● | | | | | | | ● | ● | |
| *Orchesella flavescens* (Bourlet, 1839) | 327 | ◖ | ◖ | | ● | ● | | | | | | | | ◗ | | | | | | | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | | ● | ● | | | ● | ● | | |
| *Orchesella spectabilis* Tullberg, 1871 | 328 | | | | | | | | | | | | | | | | | | | | ● | ? | | | | | | | | | | | | | | | | | | | | | |
| *Orchesella villosa* (Geoffroy, 1762) | 329 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Heteromurus nitidus* (Templeton, 1835) | 330 | | | | ◖ | ● | | | | | ◖ | | | ◗ | ◗ | | | | | | | ● | ● | | | ● | | | | | | | | | | | | | | | ● | | |
| *Cyphoderus albinus* Nicolet, 1841 | 331 | ◖ | | | ◖ | ● | | | | | ◖ | | | | | | | | | | ● | ● | ● | | | ● | ● | | | ● | | ● | | | | | | | | | ● | | |
| *Pogonognathellus flavescens* (Tullberg, 1871) | 332 | ◗ | ● | ◗ | ◖ | ● | ◗ | | ◖ | ◗ | ◖ | | | ◗ | ◖ | ◗ | | | | | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | | | ● | ● | | |
| *Pogonognathellus longicornis* (Müller, 1776) | 333 | | | | | | | | | | | | | | | | | | | | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | | ● | ● | | | | | | ● | | |
| *Tomocerus minor* (Lubbock, 1862) | 334 | ◗ | | | | ● | | | ◖ | | ◖ | ◖ | | ◗ | | | | | | | | ● | ● | | ● | ● | | | | | | | | | | | | | | | | | |
| *Tomocerus vulgaris* (Tullberg, 1871) | 335 | ◗ | | | | ● | | | | | | | ◗ | | | | | | | | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | | | | | | ● | | |
| *Tomocerina minuta* (Tullberg, 1876) | 336 | | | ◗ | | | | | | | | | | | | | | ◗ | ● | ◗ | | | ● | ● | | | | | | ● | | ● | | ● | ● | ● | ● | ● | ● | ● | | ● | ● |
| *Oncopodura crassicornis* Shoebotham, 1911 | 337 | | | | | ● | ◖ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Megalothorax minimus* Willem, 1900 | 338 | ◗ | ◗ | ◗ | ● | ● | ◖ | | ◖ | ◖ | ● | | ● | ◗ | ● | ◖ | | ● | ● | ◗ | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | | ● | ● | ● | ● | | | ● | ● | | ● |
| *Neelus murinus* Folsom, 1896 | 339 | | | | | | | | | | ◖ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Neelides minutus* (Folsom, 1901) | 340 | | ◖ | | | ● | | | | | ◖ | | ◖ | | ◖ | | | | | | ● | | ● | | | | | | | ● | | | | | | | | ● | | | | | ● |
| *Mackenziella psocoides* Hammer, 1953 | 341 | | | | | | | | | | | | | | | | | ◖ | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Sphaeridia pumilis* (Krausbauer, 1898) | 342 | ◗ | ◗ | ◗ | ◖ | ● | | | | ◖ | ● | ◖ | ● | ◗ | ◖ | ◖ | | ● | ● | ● | | ● | ● | ● | ● | | ● | ● | ● | ● | | ● | ● | ● | ● | ● | ● | | | | ● | ● | |
| *Sminthurides aquaticus* (Bourlet, 1842) | 343 | | ● | | | ● | | | ◖ | | | | | ◗ | | ◖ | ◗ | ● | ◖ | ◖ | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ? | ? | | ? | ? | | ● | ● | ● | ● |
| *Sminthurides penicillifer* (Schäffer, 1896) | 344 | | | | | | | | | | | | | | | | | | | | ● | | | ● | | | | | | | ● | | ● | ● | | ● | | | | | ● | | |
| *Sminthurides malmgreni* (Tullberg, 1876) | 345 | ◗ | ◗ | ◗ | | ● | ◗ | | ◖ | | ● | ◖ | ◖ | ◗ | ◖ | ◗ | ◗ | ● | ● | | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | | | ● | ● | |
| *Sminthurides signatus* (Krausbauer, 1898) | 346 | | | | | ● | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Sminthurides armatus* Bretfeld, 2000 | 347 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Sminthurides cruciatus* Axelson, 1905 | 348 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | ● | | | | | | | | ● | |
| *Sminthurides annulicornis* Axelson, 1905 | 349 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | ● | |
| *Sminthurides schoetti* Axelson, 1903 | 350 | | ● | ◗ | | | | | | ◖ | ● | | ◖ | ◗ | ◖ | | | ● | ● | ● | ● | | ● | ● | ● | ● | ● | ● | ● | ● | ● | | ● | ● | | ● | | | ● | ● | | |
| *Sminthurides pseudassimilis* Stach, 1956 | 351 | | ◖ | | | | | | | | | | | | | | | | | | ● | | ● | | | | ● | ● | | ● | | ● | ● | ● | ● | | ● | | | | ● | | |
| *Sminthurides parvulus* (Krausbauer, 1898) | 352 | ◗ | | ◗ | | ● | | | | | ◗ | | | ◗ | | | ◗ | ◖ | ◗ | ● | | | ● | | | | | ● | | | | | | | | | | | | | | | |
| *Stenacidia violacea* (Reuter, 1881) | 353 | | | | | | | | | | | | | | | | | ? | | | | ● | | ● | | | | | ● | | | ● | | | ● | | | | | | ● | ● | |
| *Arrhopalites caecus* (Tullberg, 1871) | 354 | ◗ | | | | ● | | | | | | | | | | ◖ | | | | | ● | | ● | | | | | | | ● | ● | ● | ● | ● | | | ● | | | | | | |
| *Arrhopalites cochlearifer* Gisin, 1947 | 355 | ◗ | ◖ | | | ● | | | | | | | | | ◖ | | | | | | | | | ● | | ● | | | | | | | | | | | | | | | | | |
| *Arrhopalites spinosus* Rusek, 1967 | 356 | | | | | | | | | | | | | | | | | | | | | | ● | | | ● | | | | | | | | | | | | | | | | | |
| *Arrhopalites principalis* Stach, 1945 | 357 | | ◖ | | | | | | | | ◗ | | | ◗ | ◖ | ◗ | | ● | ◗ | ● | ● | | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | | | ● | | ● |
| *Arrhopalites sericus* Gisin, 1947 | 358 | | | | | | | | | | ◖ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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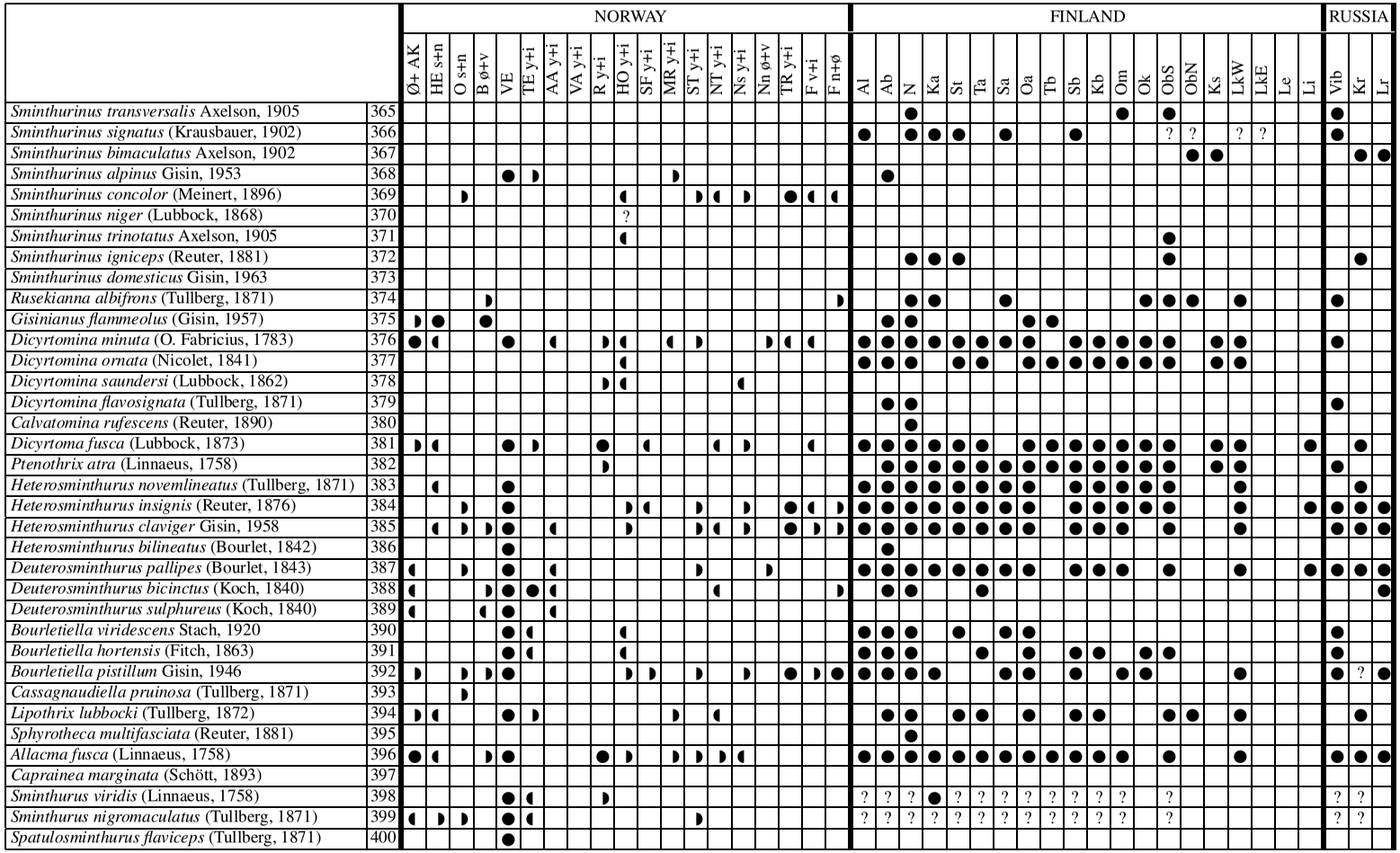
| *Arrhopalites pseudoappendices* Rusek, 1967 | 361 | | | | | | | | | | | | | | | | | | | | | ● | | | | | | | | | | | | | | | | | | | | | |
| *Sminthurinus aureus* (Lubbock, 1862) | 362 | ◗ | | ◗ | | | | | | | ● | ◗ | | ◗ | | | | ◗ | | ◖ | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | | ● | ● | | ● | ● | ● | | | | ● | ● | ● |
| *Sminthurinus elegans* (Fitch, 1863) | 363 | ◗ | | | | ● | | | | | ◖ | | | | ◖ | | ◗ | | | | ● | ● | ● | ● | | | ● | ● | | ● | ● | ● | | ● | | | | ● | ? | | | ● | | |
| *Sminthurinus reticulatus* Cassagnau, 1964 | 364 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |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# Corrections and additions to: Fjellberg, A. 1998: The Collembola of Fennoscandia and Denmark. Part I: Poduromorpha. – Fauna Entomologica Scandinavia, vol. 35

p. 14 Figure text line 3, read: (G) *Friesea baltica* Szeptycki [not (G) *Friesea baltica* sp. n.]
p. 19 Column 1, line 7 from below, read: 11 [not 10]
p. 22 Column 2, line 2 from below, delete: M [Fig. 3M is *S. ununguiculata*]
p. 23 Figure text line 5, read: *S. ununguiculata* (M) [not *C. inermis* (M)]
p. 24 Column 2, line 3, add: M
p. 24 Column 2, line 16 from below, read: Fig. 6L, M [not Fig. 6L]
p. 45 Column 2, line 6, read: *emucronata* [not *emucronoata*]
p. 99 Column 2, line 13, read: (Fig. 2C) [not Fig. 1C]
p. 113 Fig. 91A, *P. armata*: Th.2 is shown with 3 + 3 instead of 2 + 2 ps.oc.
p. 129 Fig. 101A–G, *Metaphorura affinis*, is missing! Presently added overleaf.
p. 131 Column 1, line 13, read: *Mesaphorura* [not *Measphorura*]
p. 131 Column 2, replace key to species with the following:

1 Abd.6 without anterolateral tubercles . . . . . 2
– Abd.6 with a pair of anterolateral tubercles (Fig. 104C) . . . . . 137. *denisi* Bagnall
2 On th.2–3 seta $m_1$ short, subequal to $p_2$. Seta $m_0$ absent on abd.4 . . . . . 136. *quadrispina* Börner
– On Th.2–3 seta $m_1$ long, seta $m_0$ often present on Abd.4 (Fig. 104A) . . . . . 136a *lubbocki* Bagnall

Khanislamova et al. (1997) examined the holotype of *denisi* and found 2 + 2 ps.oc.on Abd.4. Thus there are no differences between *denisi* s.str. and *parisi*, and the latter falls as a junior synonym.

The Nordic material of "*quadrispina*" consists of two species: *quadrispina* s.str. and *lubbocki* Bagnall, 1935. Fig. 104A is *lubbocki*. Both species are widespread.

p. 132 Figure text line 1, read: *Stenaphorura lubbocki* (A) [not *Stenaphorura quadrispina* (A)]
p. 133 Column 1, delete lines 1–13 from below [species 138. *Stenaphorura parisi* is a junior synonym of species 137. *S. denisi*]
p. 137 In Table 1 row '*italica*' and column Th.3 ps.oc., read: L [not M]

# Species of poduromorph Collembola recorded from the Nordic countries after 1998:

*Choreutinula kulla* Fjellberg, 2007 [Sweden (SK), Norway (VE)]
*Willemia unispina* Fjellberg, 2007 [Norway (HOy)]
*Deutonura stachi* (Gisin, 1952) [Norway (AK, HEs)]
*Mesaphorura arbeai* Simon et al., 1994 [Iceland, Sweden (Ha)]

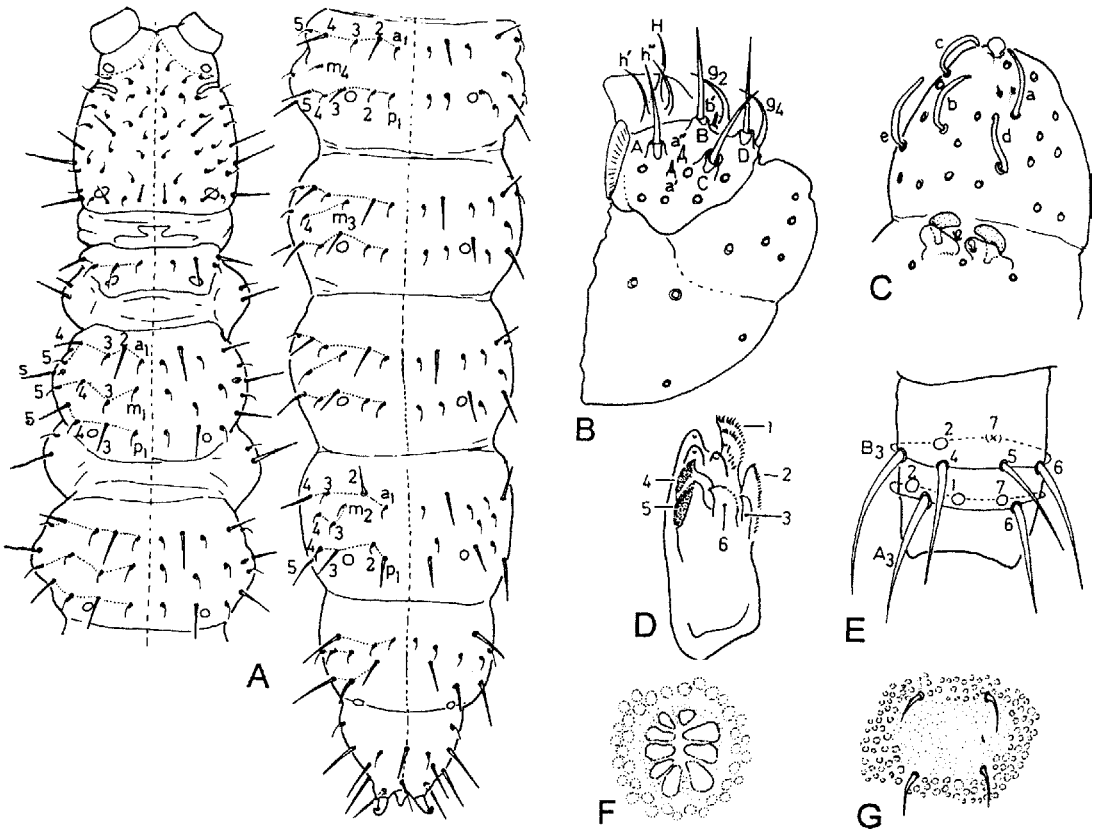


Fig. 101. *Metaphora affinis*: (A) Dorsal chaetotaxy; (B) labium; (C) ant. 3–4 sesilla; (D) maxilla; (E) tibiotarsal chaetotaxy, inner side; (F) pseudocellus; (G) furcal field.

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