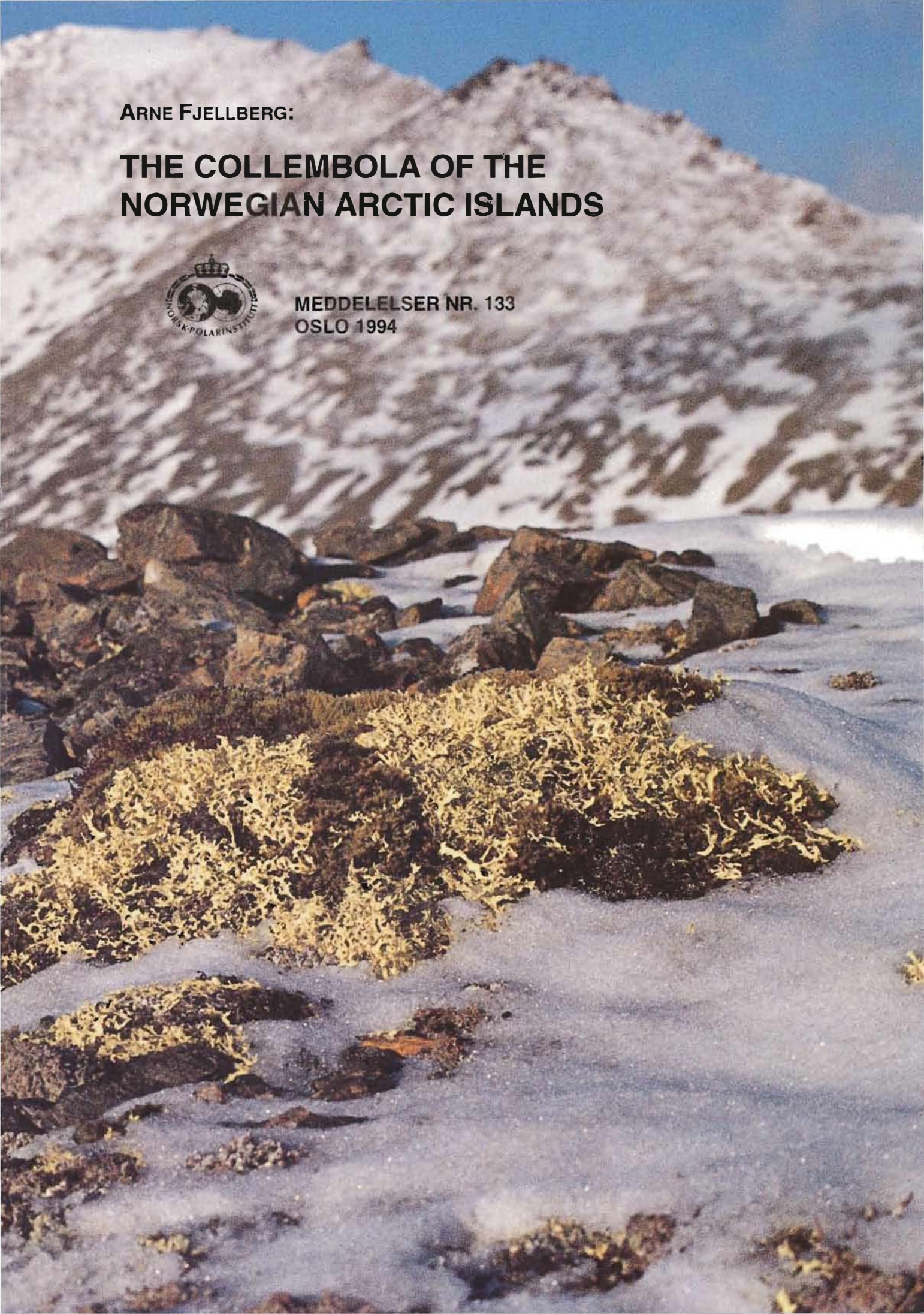


ARNE FJELLBERG:

THE COLLEMBOLA OF THE NORWEGIAN ARCTIC ISLANDS



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THE COLLEMBOLA OF THE NORWEGIAN ARCTIC ISLANDS

**NORSK POLARINSTITUTT
Oslo 1994**

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Cover photo: Lichen/moss community on a ridge at 500 m altitude near Ny-Ålesund, Western Spitsbergen. A typical habitat of the Collembola species *Hypogastrura tullbergi*, *Friesea quinquespinosa*, *Anurida polaris*, *Onychiurus groenlandicus*, *Folsomia regularis*, *Agrenia bidenticulata*, and *Sminthurides malmgreni*. (A. FJELLBERG 1973)

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Introduction

The arctic islands of Norway, and in particular West Spitsbergen, was the goal for many of the early arctic scientific expeditions. The very northern position, up to only 10 degrees from the North Pole, and the rather easy access during the summer months, acted like a magnet to explorers of many kinds. Boheman (1865) was the first to report a Collembola - described as the new species *Podura hyperborea* - collected by the Swedish zoologists Sundewall and Malmgren at Hornsund and Bellsund (Sundewall was member of a French expedition in 1838 and Malmgren followed Nordenskiöld's expeditions in 1858, 1861 and 1864).

Although very few Collembola specialists have actually collected in the Arctic themselves, more than 150 years of scientific activities have accumulated a considerable material. The results are published in some major works (Tullberg 1876, Schött 1893, Schäffer 1900, Skorikow 1900, Thor 1930, Gisin 1953, Stach 1962, Valpas 1967, Fjellberg 1984) and many smaller ones which all form the basis of the present publication. An important new material was collected by the Swedish Ymer expedition in 1980 from Kongsøya (Kong Karls Land).

To day a total of 58 recognised Collembola species are known from the arctic islands Jan Mayen, Bjørnøya, Hopen, Spitsbergen (including Prins Karls Forland), Edgeøya, Barentsøya, Kong Karls Land, Nordaustlandet and Kvitøya. Still many parts of the archipelago have never been searched for Collembola. New additions to the fauna will certainly appear when the large islands east of Spitsbergen become better investigated. The long north coast of Nordaustlandet - including the extreme northern Sjuøyane - is still terra incognita for the collembologists.

The present keys includes the about 30 additional species which are known from Novaya Zemlya and Franz Josef Land. Some of these will probably appear in the Norwegian Arctic in the future.

During the last few years several international research projects covering various aspects of soil invertebrates have become established on Spitsbergen. The present paper is written partly to assist soil ecologists in precise species identification of arctic Collembola. It is also a pilot study for a monographic work on the Collembola fauna of all the nordic countries (Denmark/Faroe Islands, Iceland, Sweden, Finland and Norway including the arctic islands). For that reason the morphological descriptions are kept at a minimum. Each species will be described in full in the monograph.

Short introduction to Collembola morphology

The Collembola have a pair of 4-segmented antennae, a head with 8 ocelli (single lenses) on each side, a 3-segmented thorax with three pair of legs, and a 6-segmented abdomen.

The body is covered with hairs (setae/chaetae) of various shapes and function (Fig. 1C). The very long, erect hairs are called macrochaetae. They are usually limited in number and have a fixed position on the body segments. The ordinary short hairs are called microchaetae which are often abundant and variable. The sensorial setae - supposed to have a sensorial function - are more thin-walled than other hairs and are thus detected by their greater optical transparency. Usually they are shorter and more blunt-tipped than ordinary setae. Their number and positions are usually fixed. Some very small spine-like sensilla, usually sitting in small pits on thorax and abdomen, are called microsensilla. On the abdomen of members of some genera

are specialised sensorial hairs called trichobothria, which are very long, delicate hairs densely covered by cilia.

Primarily the setae are set in three transverse rows on each body segment: Anterior (a-setae), median (m-setae) and posterior (p-setae). This is still the situation in the more primitive Collembola, while in the advanced groups the primary condition is obscured by a multiplication of microsetae (polychaetosis).

Certain structures of the integument provide good diagnostic characters. Within the family Onychiuridae the pseudocelli are excellent in species identification. Pseudocelli are small, circular openings of the integument, normally closed by "lids" of various kinds. By increasing the body pressure the individual may expell body fluid through the pseudocelli, probably acting as a defense mechanism. The number and position of the pseudocelli are usually fixed within the species. On Fig. 1J is shown a species with pseudocellar formula 33/233/33343 which means 3 on antennal base, 3 at posterior edge of head, 2 on Th.1, 3 on Th.2, 3 on Th.3 and 3-3-3-4-3 on each of the abdominal segments 1-5 (the formula give the numbers from one half side of the body). The subcoxae and the ventral side of the body also have pseudocelli, but these are not used in the present work.

The antenna has some structures which are useful in systematics: At apex of antennal segment 3 (Ant.3) there is a dorsal organ (Ant.3 organ) with sensorial function, consisting of two small sensilla set close together which are flanked by one larger sensillum (usually curved) on each side. These sensilla may be partly covered by integumentary folds or finger-like projections (Fig. 1E). The terminal segment, Ant.4, has a dorsal subapical organ with one very small rod-shaped or globular sensillum sitting in a shallow pit. In some genera Ant.4 has a so-called pin-seta near apex on the ventral side. It is an integumental conical papilla terminating in a sharp "pin". The papilla is either simple or bifurcate. In the latter case there is an additional "pin" closer to base (Fig. 1E).

The head has 8+8 ocelli which may be more or less reduced in number, even absent in some species. The Postantennal organ (PAO) is situated on each side of the head, between the eye-field and antennal base (Fig. 1A). It is a sensorial organ, probably chemoreceptorial. Its shape and construction is of prime systematic importance (Fig. 1I). Inside the head capsule are the mandibles and the maxilla. The maxilla offers good systematic characters in some species groups, but dissection is necessary. The maxillary outer lobe terminates in a maxillary palp which is found on each side near the base of labrum. It is either simple, bifurcate or trifurcate (Fig. 1H). Above labrum, just behind the incision which separates labrum from the frontal area, appear a transverse row of 2-4 prelabral setae (Fig. 1H). Their number may separate some problematic species.

The legs are composed of 5 subsegments: Precoxa 1, precoxa 2, trochanter, femur and tibiotarsus. Sometimes the apical setae of tibiotarsus are prolonged to tenent hairs, which are either acuminate or clavate (knobbed at tip, Fig. 1B). The claws, at tip of tibiotarsus, have an upper part - unguis - and a lower part - unguiculus. They often have characteristic shapes and dentations.

On ventral side of thorax, between the legs, is a longitudinal furrow, the ventral line, which runs from base of labium to the ventral tube on abdominal segment 1. On each side of the ventral line may appear groups of setae on Th.1-Th.3. Their presence/absence and numbers may provide excellent diagnostic characters.

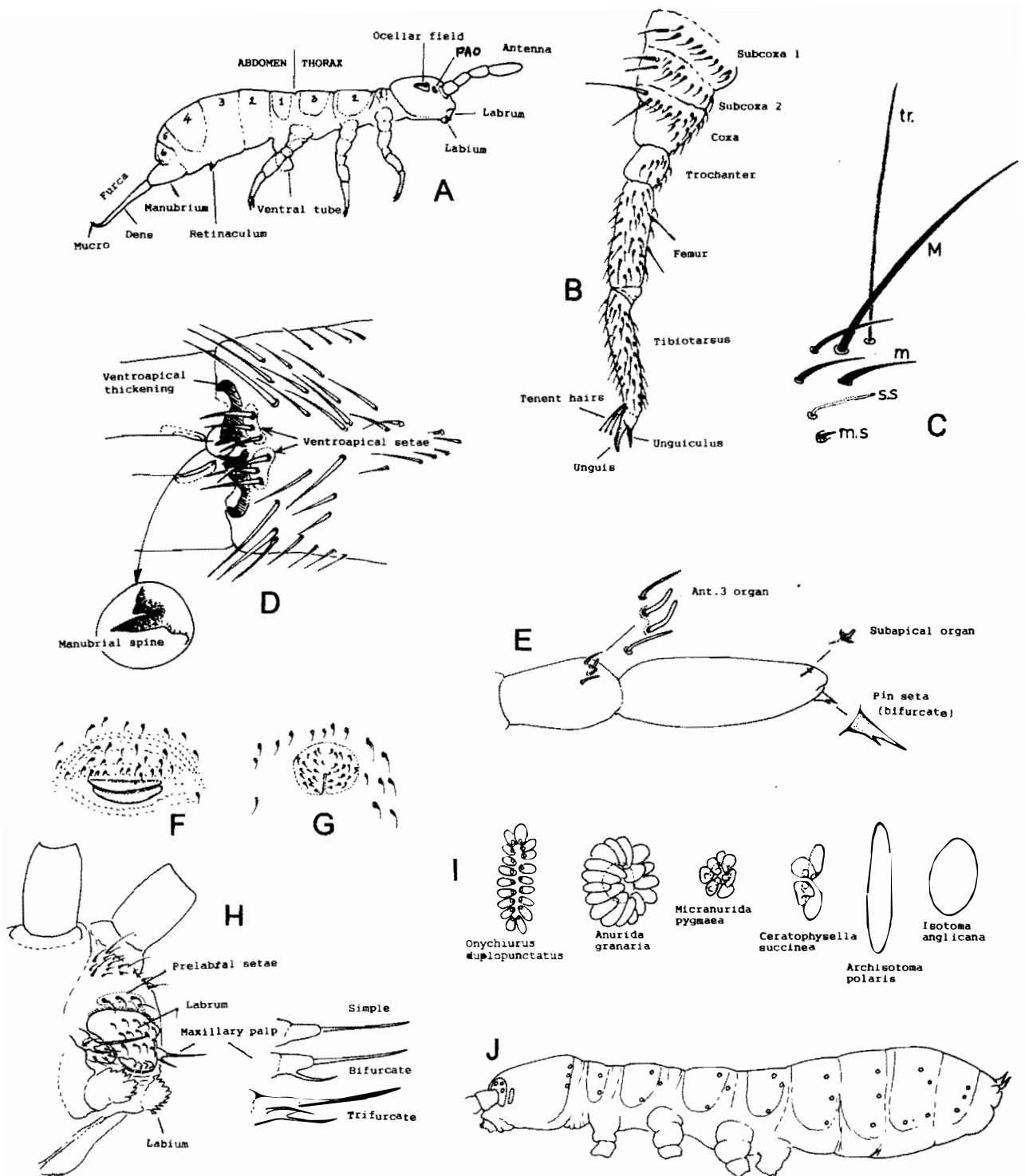


Fig.1: (A)General morphology of a Collembola (Isotomidae); (B)Leg with segments; (C)Hair types. tr: trichobothrium, M: macrochaeta, m: microchaeta, s.s: sensorial seta, m.s: microsensillum; (D)Ventral side of manubrium; (E)Antennal segments 3 and 4; (F)Genital field of female; (G)Ditto, male; (H)Mouth region of head with three types of maxillary palps; (I)Types of postantennal organs; (J)Position of pseudocelli in *Onychiurus duplopunctatus*.

The abdomen has three ventral structures which are derived from appendages: The ventral tube on Abd.1 is an eversible, sac-like structure with two separate apical lobes. Number and position of setae on ventral tube is important (anterior, posterior and lateral setae). On Abd.3 is the small organ retinaculum (or tenaculum) which has an unpaired basal part (sometimes with setae on it) and two apical rami, each with 1-4 teeth. The number of these retinacular teeth are used in systematics. The retinacular teeth grip into ridges on furca and hold this in position when it is folded forwards. The furca is the leaping organ and is attached to Abd.4. It has a basal section, the manubrium, and two long apical dentes (dens) with a claw-like structure at apex, the mucro. Both dorsal (posterior) and ventral (anterior) chaetotaxy of manubrium and dens are important. In some species even the mucro has one or more setae. The manubrial thickening is the thick, chitinized ventroapical part of manubrium on each side of its midline (Fig. 1D). It often has teeth of characteristic shape. The manubrial ventroapical setae are differentiated setae adjacent to the manubrial thickening. They are often spine-like or prolonged in relation to the ordinary setae of manubrium.

The terminal segment of the abdomen, Abd.6, has three lobes between which opens the anus. The dorsal lobe often has two or more anal apines which are thick, modified setae.

Males and females of collembola are identified by the shape of the external genital field on ventral side of Abd.5. In males the field is shaped like a roundish papilla with an incision from behind, covered with setae in a more or less circular arrangement (Fig. 1G). In females the field has two lips in transverse arrangement (Fig. 1F).

The genital fields are gradually differentiated during successive instars from juvenile to adult. The reproductive cycle of Collembola alternates between reproductive and unreproductive instars, separated by one or more moults. A reproductive individual will be recognised by a tubular or bulbous structure terminating in the genital papilla of the male, and by a pouch-like structure inside the genital lips of the female (both are easy to see microscopically in cleared specimens). Also the genital fields themselves become more strongly developed, and their setae may be modified. Sometimes also other parts of the body are modified in reproductive specimens (epitoky). Among the arctic species, epitoky is only observed in large reproductive males of *Folsomia stella* which has much shorter abdominal macrochaetae than unreproductive specimens.

Another phenomenon affecting the external morphology is cyclomorphosis which is the regular occurrence of distinct summer and winter forms. It is observed in some of the arctic Isotoma where the winter forms have shorter apical tooth of mucro and a reduced (rod-shaped) subapical sensillum on antennal segment 4. Also the size of the postantennal organ and the sensilla on the tergites may be affected.

Abbreviations of morphological terms

- a: Anterior seta. Seta of the anterior transverse row on a tergite.
 a1, a2 ...: Anterior seta counted from the longitudinal midline of the tergite.
 Abd.: Abdomen (Abd.1-6: Abdominal segments 1-6)
 Ant.: Antenna (Ant.1-4: Antennal segments numbered from base to tip).
 m: Median seta. Seta of the median transverse row on a tergite.
 p: Posterior seta. Seta of the posterior transverse row on a tergite.
 PAO: Postantennal organ.
 ps.oc.: Pseudocellus
 Th.: Thorax (Th.1-3: Pro-, meso- and metathorax).
 Ti.: Tibiotarsus (Ti.1-3: Tibiotarsus on 1.-3. leg).

Nomenclature

The species names in this work are given in the combinations which are used by most current authors. In addition are given synonyms and deviating combinations as they appear in earlier arctic publications.

Key to families

(families in brackets are not present in the Norwegian arctic)

1. Body elongate, clearly segmented. Suborder **Arthropleona** (Figs. 2A-I, 3A,C,D,G)2
 - Body more or less globular, segments of thorax and anterior abdomen fused. Suborders **Neelipleona** and **Symphyleona** (Figs. 3B,E,F)8
2. First segment of thorax without dorsal setae. Generally well pigmented, slender forms with long extremities. The few white (unpigmented) species with furca present (except *Pseudanurophorus*), but anal spines absent. Section **Entomobryomorpha** 6
 - First segment of thorax with some dorsal setae. Most species short and thick, with shorter extremities. In the many white species the furca is absent, but anal spines present (except *Anurida*). Section **Poduromorpha**3
3. Mandibles strong, with granulated molar plate (Fig. 4A).....4
 - Mandibles reduced, without molar plate5
4. Head and body with pseudocelli (Fig. 1J). Ant.3 organ with finger-like papillae covering sensorial bodies (Fig. 4F). Only white, eyeless species with anal spines present, furca absent or reduced (Figs. 4D,E)..... ONYCHIURIDAE p.21
 - Without pseudocelli and antennal papillae. Mostly dark species with strong furca (only *Willemia* without pigment, ocelli and furca) HYPOGASTRURIDAE p.12
5. Two anal spines present. PAO star-shaped (Fig. 4G) ODONTELLIDAE p.19
 - Anal spines either absent or more than two. PAO absent or rosette-like NEANURIDAE p.19
6. Body with scales or a dense cover of ciliated macrochaetae. PAO absent. Eyes and pigment present in arctic species7
 - Body with an open cover of simple hairs only. PAO present (except in the white, blind *Isotomiella*) ISOTOMIDAE p.26

7. Mucro short, without setae (Fig. 4C). Ant.3 not longer than other segments together..... ENTOMOBRYIDAE p.40
 (TOMOCERIDAE p.41)
- Mucro long, with many setae (Fig. 4B). Ant.3 as long or longer than other segments together (Fig. 3C). (TOMOCERIDAE p.41)
8. Very small (0.5 mm), blind species. Antennae shorter than head (Fig. 3B). Suborder **Neelipleona**. NEELIDAE p.41
- Larger species, ocelli present, antennae longer than head. Suborder **Symphyleona** 9
9. Head with 1+1 ocelli. Pigmentation weak, reddish..... ARRHOPALITIDAE p.41
- Head with 8+8 ocelli. Darker species 10
10. Males with modified antennae (Fig. 4H). Females without modified setae below anus. SMINTHURIDIDAE p.41
- Males with simple antennae. Females with a pair of modified subanal setae (Fig. 4I)..... 11
11. Ant.4 simple (Fig. 3F) KATIANNIDAE p.42
- Ant.4 subdivided (Fig. 9H) (SMINTHURIDAE p.43)

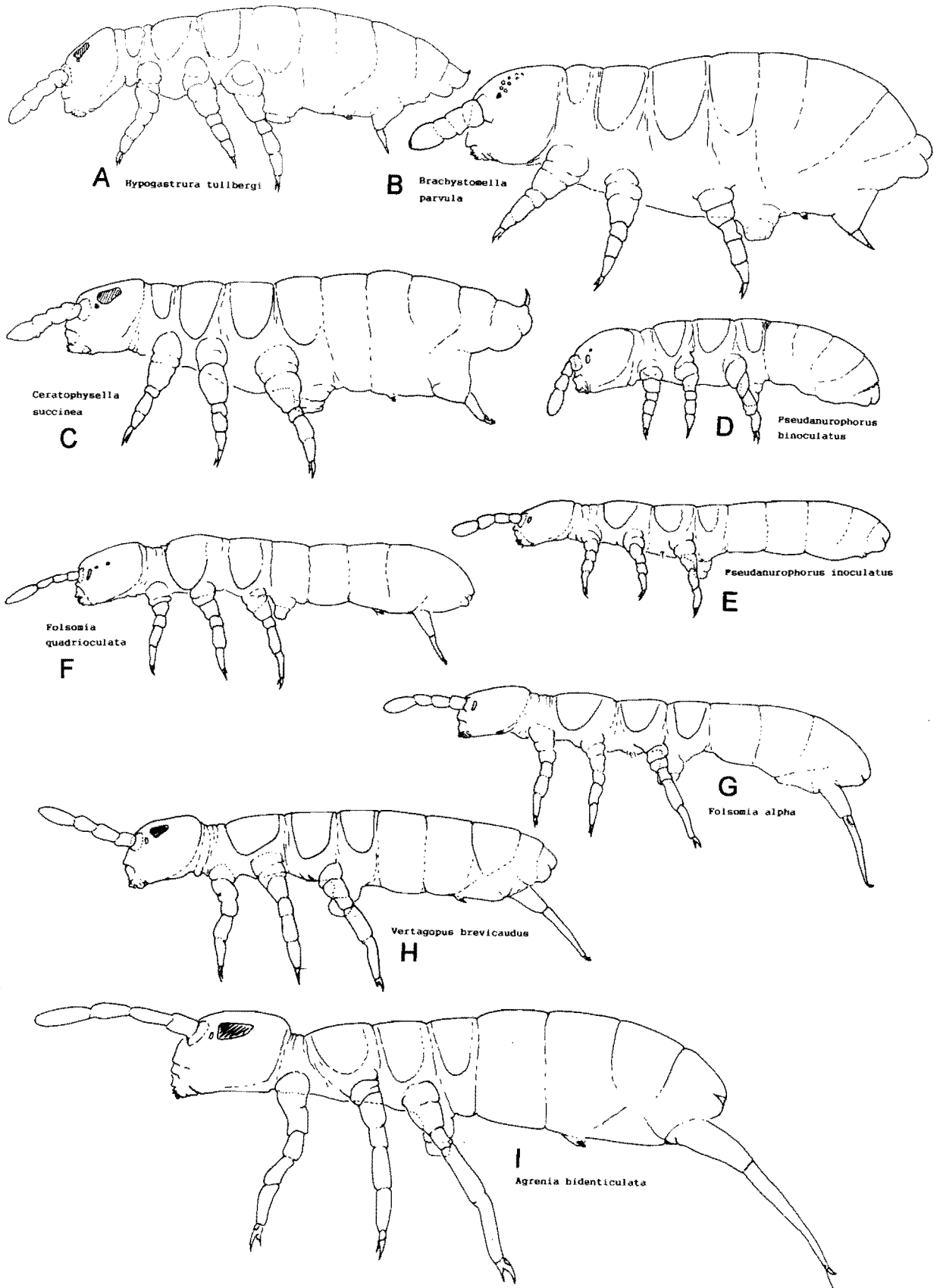


Fig.2: General morphology of selected arctic Collembola.

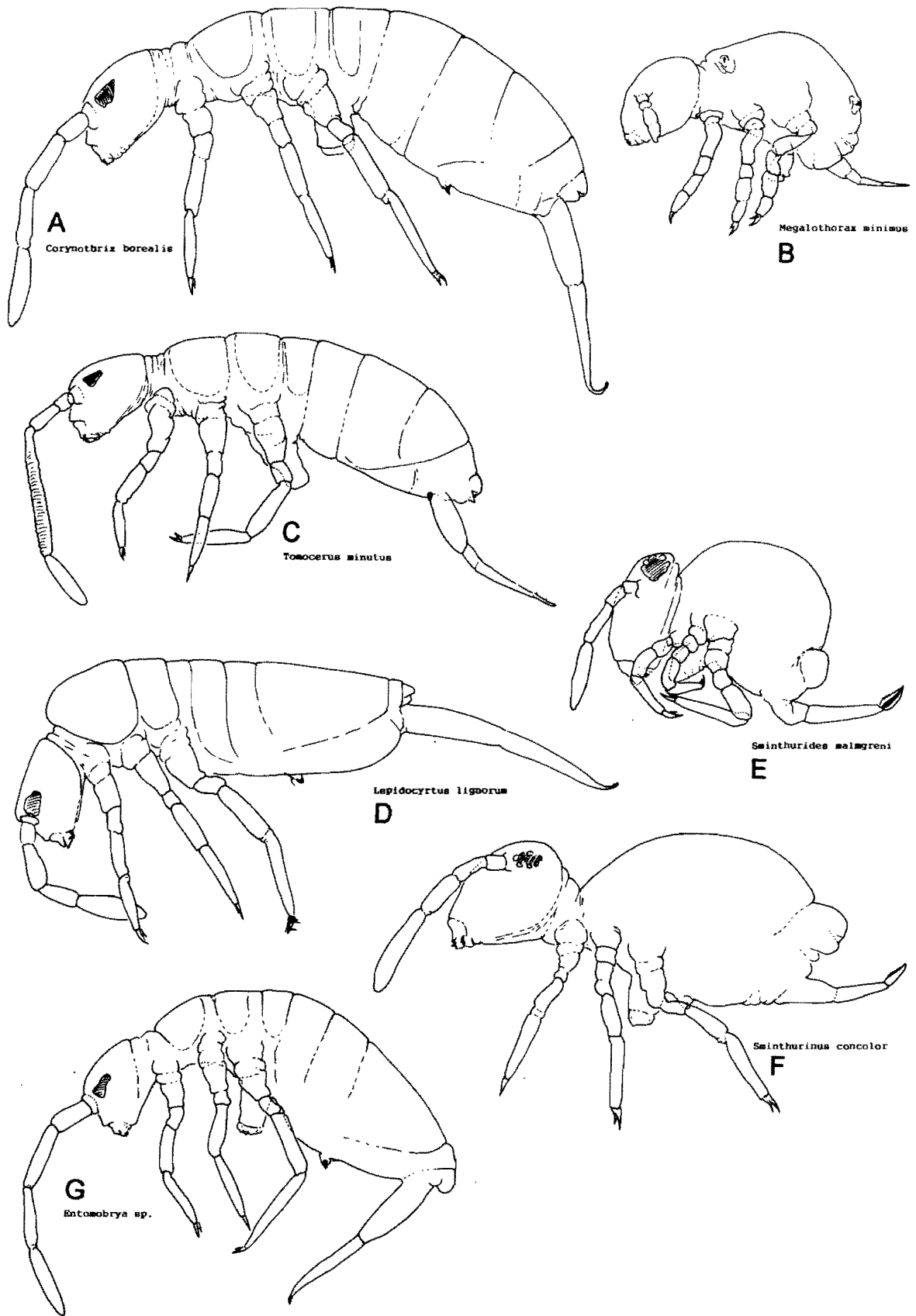


Fig.3: General morphology of selected arctic Collembola.

HYPOGASTRURIDAE

- | | |
|---|--------------------------|
| 1. Small (0.5 mm) white species without ocelli and furca | 6. <i>Willemia</i> |
| – Larger species with ocelli, furca and pigment | 2 |
| 2. Ocelli 8+8 | 3 |
| – Ocelli 5+5 or less | 4 |
| 3. Eversible sac present between Ant.3 and 4 (Fig. 4J). Anal spines long and curved. Mucro with broad apex (Fig. 4L). Macrochaetae usually strongly differentiated from short hairs (Fig. 4P) | 2. <i>Ceratophysella</i> |
| – Antennae without eversible sac. Anal spines shorter. Body hairs less differentiated. Mucro with narrow apex (Fig. 4O) | 1. <i>Hypogastrura</i> |
| 4. PAO absent. Mucro long and narrow (Fig. 4K) | 5. <i>Xenylla</i> |
| – PAO present. Mucro much shorter | 5 |
| 5. Ocelli 1-3 on each side of head. Abd.4 p1>p2 (as Fig. 4Q) | 3. <i>Bonetogastrura</i> |
| – Ocelli 5+5. Abd.4 p1<p2 (as Fig. 4P) | (4. <i>Schaefferia</i>) |

1. HYPOGASTRURA Bourlet, 1839

The arctic species are all dark blue or blackish, ranging from 1.5-2.0 mm

- | | |
|---|-----------------------|
| 1. Tenaculum with 3+3 teeth (rarely 3+4 or 4+4). Tibiotarsi with more than one clavate tenet hair, though sometimes very faintly knobbed (Fig. 5G) | 2 |
| – Tenaculum with 4+4 teeth (rarely 4+5 or 5+5). Tibiotarsi with at most one clavate tenet hair | 5 |
| 2. Mucro with wide, angular lateral lamella (Fig. 4M) | 3 |
| – Mucro with narrow lamella (Fig. 4N) | 4 |
| 3. Body hairs long. Macrochaetae p2 on anterior abd. segments more than twice as long as p1 (Fig. 5F). Anal spines longer, tibiotarsal hairs (2-3-3) distinctly clavate. Ant.3 organ simple | 1. <i>viatica</i> |
| – Body hairs shorter. Macrochaetae p2 on anterior abd. segments less than twice as long as p1. (Fig. 5E). Anal spines shorter, tibiotarsal tenet hairs weakly clavate, never more than 2 on each leg. Ant.3 organ often with additional spines (Fig. 5C)..... | 2. <i>sensilis</i> |
| 4. Ant.3 organ with additional spines (Fig. 5D) | 3. <i>tullbergi</i> |
| – Ant.3 organ normal (Fig. 5B) | 4. <i>concolor</i> |
| 5. Dens 2.5 as long as mucro (Fig. 5H) | (<i>trybomi</i>) |
| – Dens 3.5 as long as mucro (Fig. 5G) | (<i>fjellbergi</i>) |

Hypogastrura trybomi (Schött, 1893), originally described from Taimyr, is reported from Novaya Zemlya and Franz Josef Land (Babenko & Bulavintsev 1993.)

Hypogastrura fjellbergi Babenko & Bulavintsev, 1993 is present on Novaya Zemlya and Taimyr. Also reported from Alaska by Fjellberg (1985: 17, 33-34 as sp. near *trybomi*)

NOTE: A third species, *Hypogastrura theeli* Tullberg, 1876, was originally described from Novaya Zemlya and Siberia (Tullberg 1876). It is possibly a senior synonym of *trybomi*, but a verification is impossible since the types appear to be lost (Fjellberg 1985:33)

1. *Hypogastrura viatica* (Tullberg, 1871)

Figs. 4A,M, 5F

Achorutes viaticus Tullb.: Schäffer (1895), Schött (1893), Wahlgren (1899, 1900b), Carpenter & Phillips (1922), Carpenter (1927)

Achorutes viaticus Fourcr.: Stscherbakow (1899)

Achorutes viaticus (Fourcroy) Tullb.: Schäffer (1900)

Hypogastrura viatica var. *inermis* Axelson, 1905: Linnaniemi (1935a)

The broad mucronal lamella in combination with strongly clavate tibiotarsal hairs, long body hairs and simple Ant.3 organ readily identify this species.

Common and often very abundant in wet habitats rich in organic matter: Decaying seaweeds, edges of ponds and pools, shore meadows, bird cliffs. More rare in dry upland habitats. - Bjørnøya, Hopen, Kongsøya, Edgeøya (Kvalpynten), Barentsøya, Nordaustlandet (Kinnvika), Hinlopen (Fosterøyene, Bjørnsundet, Wahlbergøya), Spitsbergen (Hornsund, Recherchefjorden, Barentsburg, Klaas Billen Bay, Grønfjorden, Longyearbyen, Ny Ålesund, Prins Karls forland, Magdalenefjorden, Danskøya, Amsterdamøya, Sjørgattet, Flathuken, Reisdyrflya, Liefdefjorden, Bockfjorden, Kapp Klaveness, Diabashalvøya, Smeerenburg). - Range: Cosmopolitan.

2. *Hypogastrura sensilis* (Folsom, 1919)

Figs. 5C,E

Hypogastrura sp. near *sensilis* (Folsom, 1919): Fjellberg 1984

The mucro-shape of this species is very similar to that of *viatica*, but *sensilis* has much weaker tibiotarsal tenent hairs which are never more than two on each leg. The presence of additional spines in Ant.3 organ is an unreliable and highly variable character (Fjellberg 1985, 1986)

In moss on floodplain gravel and solifluction soil. Only a few records from Spitsbergen (Ny Ålesund). - Range: Circumpolar.

3. *Hypogastrura tullbergi* (Schäffer, 1900)

Figs. 2A, 4N,O, 5A,D

Achorutes dubius Tullberg, 1876

Achorutes tullbergi Schäffer, 1900

Hypogastrura concolor var. *setosa* Schött, 1923

Hypogastrura spitsbergensis Stach, 1962

The key character of this species is the presence of additional spines in Ant.3 organ. Only *sensilis* may have a similar organ, but that species have a very different mucro.

Abundant in dry upland habitats (grassy meadows, moss cushions, lichen heaths, *Cassiope/Empetrum* heath). Also in bird cliffs. More rare in wet habitats. - Kongsøya, Barentsøya, Nordaustlandet (Kinnvika), Spitsbergen (Hornsund, Adventdalen, Longyearbyen, Colesdalen, Ny Ålesund, Van Mijenfjorden, Tempelfjorden, Widjefjorden, Reisdyrflya, Liefdefjorden, Danskøya). - Range: Circumpolar.

4. *Hypogastrura concolor* (Carpenter, 1900)

Fig. 5B

Achorutes dubius var. *concolor* Carpenter, 1900

Apart from absence of additional spines in the Ant.3 organ, there are few structural differences between this species and *tullbergi*. The latter species is often grayish blue, slightly spotted, while *concolor* is always (?) uniformly dark blue.

In moss, lichens, grass tussocks, etc. Both wet and dry habitats. - Kongsøya, Spitsbergen (Ny Ålesund, Van Mijenfjorden). - Range: Circumpolar.

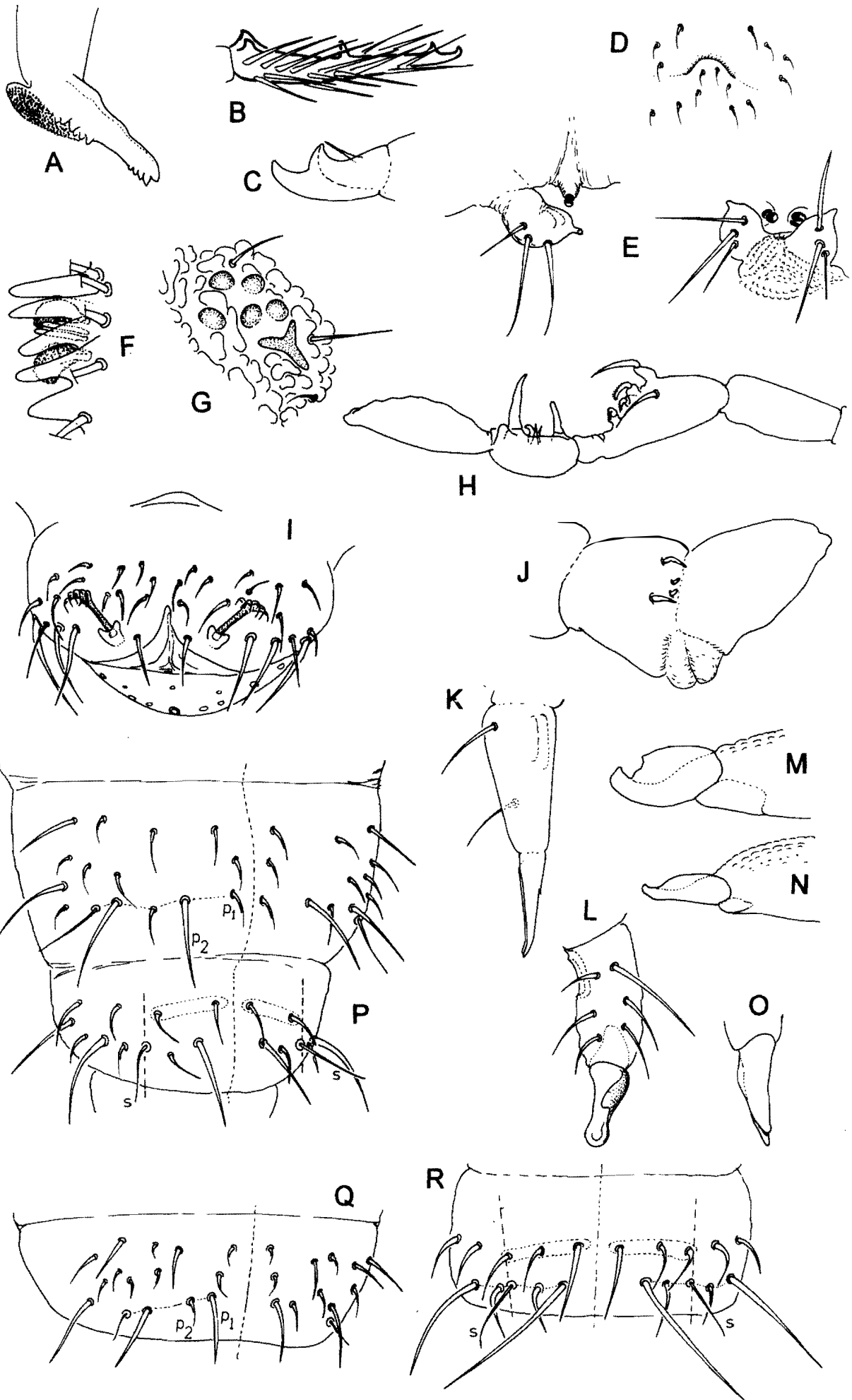
2. CERATOPHYSELLA Börner, 1932

The genus *Ceratophysella* was formerly given subgeneric rank under *Hypogastrura*. Some authors still prefer that classification.

- | | |
|--|----------------------|
| 1. Abd.4 with $p1 < p2$ (Fig. 4P) | 2 |
| - Abd.4 with $p1 > p2$ (Fig. 4Q) | 1. <i>longispina</i> |
| 2. Dens with 6 dorsal setae. Abd.5 with 2+2 a-seta between the sensilla (Fig. 4P) 2. <i>succinea</i> | |
| - Dens with 7 dorsal setae. Abd.5 with 3+3 a-setae between the sensilla (Fig. 4R) (<i>palustris</i>) | |

Ceratophysella palustris Martynova, 1978 (Fig. 4R) is widely distributed in northern Siberia and Alaska. Also reported from Novaya Zemlya (Babenko & Bulavintsev 1993).

 Fig.4: (A)Mandible, *Hypogastrura viatica*; (B)Mucro, *Tomocerus minutus*; (C)Ditto, *Lepidocyrtus lignorum*; (D)Reduced furca (furcal flap), *Onychiurus macfadyeni*; (E)Ditto, *Onychiurus furciferus*; (F)Ant.3 organ, *Onychiurus macfadyeni*; (G)Ocelli and PAO, *Xenyllodes armatus*; (H)Male antenna, *Sminthurides malmgreni*; (I)Anal field of female, *Sminthurinus concolor*; (J) Ant.3-4, *Ceratophysella succinea*; (K)Dens and mucro, *Xenylla humicola*; (L)Ditto, *Ceratophysella succinea*; (M)Apical part of dens with mucro, *Hypogastrura viatica*; (N)Ditto, *Hypogastrura tullbergi*; (O)Mucro, *Hypogastrura tullbergi*; (P)Abd.4-5, *Ceratophysella succinea*; (Q)Abd.4, *Ceratophysella longispina*; (R)Abd.5, *Ceratophysella palustris*.



1. *Ceratophysella longispina* (Tullberg, 1876)

Fig.4Q

Achorutes longispinus Tullberg, 1876

Hypogastrura longispina (Tullberg): Linnaniemi (1935a)

Hypogastrura (*Ceratophysella*) *armata* (Nicolet, 1841): Stach (1962)

Hypogastrura hirsuta Valpas, 1967

Ceratophysella arctica Martynova et al., 1973

A large (1.6 mm), dark blue or blackish species with thick, spine-like body hairs.

Usually in rich, wet habitats (moss/*Arctophila* bog, sewage bog, salt shore meadows, bird colonies). Some records from dry sites (calcareous rocks, floodplains). - Kongsøya, Edgeøya (Kvalpynten), Barentsøya, Nordaustlandet (Kinnvika), Hinlopen (Fosterøyene), Spitsbergen (Hornsund, Barentsburg, Van Mijenfjorden, Grønfjorden, Longyearbyen, Tempelfjorden, Ny Ålesund, Reinsdyrflya, Diabashalvøya, Liefdefjorden, Bockfjorden, Gråhuken, Isfjorden). - Range: Circumpolar

2. *Ceratophysella succinea* (Gisin, 1949)

Figs. 1I, 2C, 4J,L,P

Hypogastrura succinea Gisin: Valpas (1967)

Hypogastrura armata (Nicolet): Linnaniemi (1935a)

Generally smaller and paler than previous species, with finer body hairs and slender anal spines.

A few records from bird cliffs, moist meadow, bogs and alluvial gravel vegetation. - Jan Mayen, Hopen, Spitsbergen (Sassendalen, Flathuken, Adventdalen, Tempelfjorden, Ny Ålesund). - Range: Holarctic.

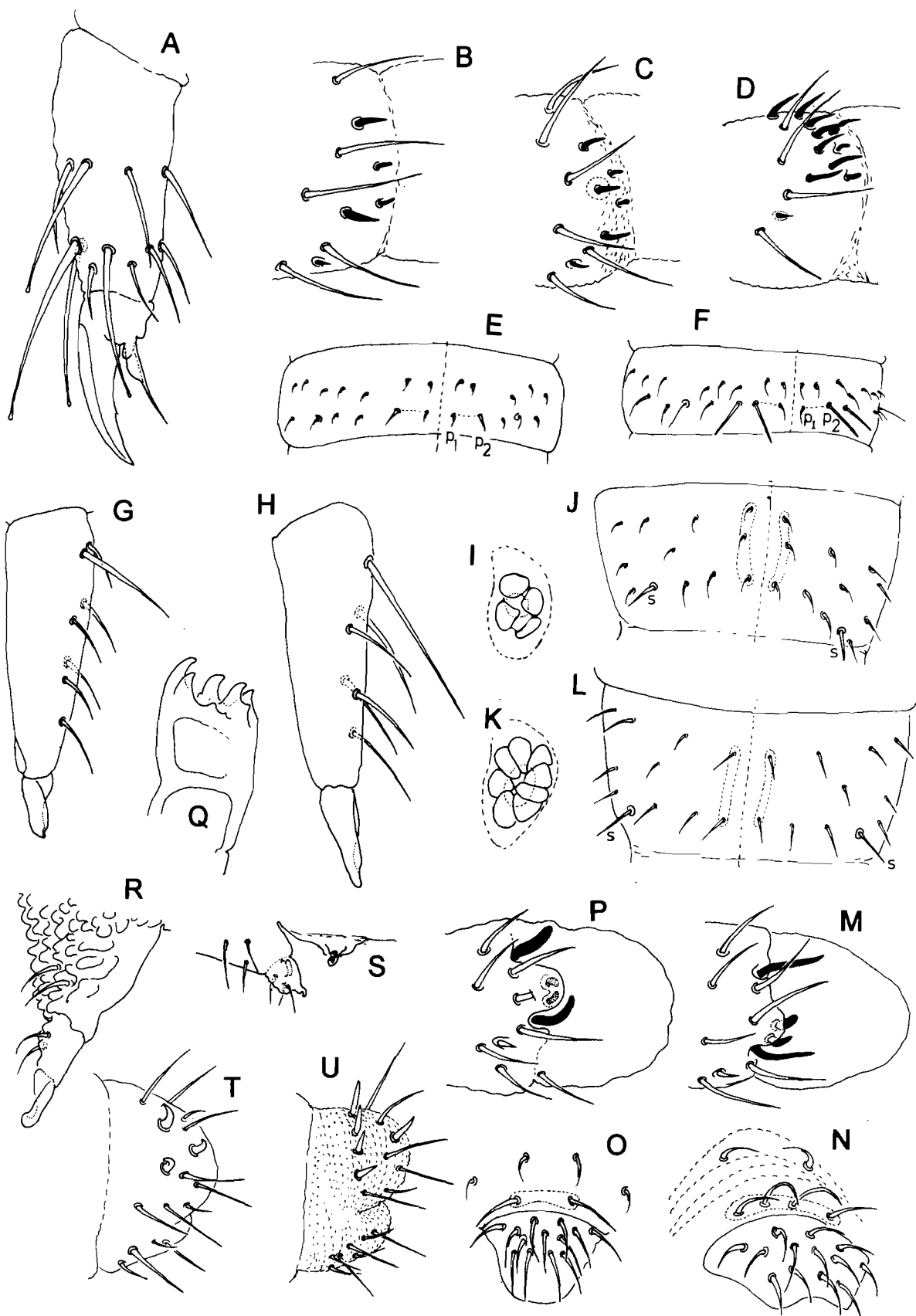
3. BONETOGASTRURA Thibaud, 1974

1. *Bonetogastrura variabilis* (Christiansen, 1951)

A pale species (body pigmentation reduced) resembling a *Ceratophysella*, but readily identified by the reduced eyes.

A single specimen was collected in a bird cliff on Kongsøya (Kong Karls Land) by the Swedish Ymer-expedition in 1980. Otherwise reported from Alaska and NE Siberia (Fjellberg 1985). - Range: Circumpolar.

Fig.5: (A)Tibiotarsus and claw, *Hypogastrura tullbergi*; (B)Ant.3 organ, *H. concolor*; (C)Ditto, *H. sensilis*; (D)Ditto, *H. tullbergi*; (E)Dorsal chaetotaxy of Abd.3, *H. sensilis*; (F)Ditto, *H. viatica*; (G)Dens and mucro, *H. fjellbergi*; (H)Ditto, *H. trybomi*; (I)PAO, *Willemia anophthalma*; (J)Abd.4, ditto; (K)PAO, *Willemia scandinavica*; (L)Abd.4 chaetotaxy, ditto; (M)Ant.3 organ, ditto; (N)Labrum and prelabral setae (encircled), *Willemia anophthalma*; (O)Ditto, *Willemia similis*; (P)Ant.3 organ, *Willemia anophthalma*; (Q)Mandible, *Brachystomella parvula*; (R)Furca, *Xenylloides armatus*; (S)Furca and retinaculum, *Friesea mirabilis*; (T)Abd.6, ditto; (U) Abd.6, *Friesea quinquespinosa*.



(4. **SCHAEFFERIA** Absolon, 1900)

Schaefferia czernovi (Martynova, 1978) is widespread in the Siberian arctic, and is also found on Novaya Zemlya (Babenko & Bulavintsev 1993).

5. **XENYLLA** Tullberg, 18691. **Xenylla humicola** (Fabricius, 1780)

Fig. 5H

A large (1.3 mm) bluish black species with a characteristic long, pointed mucro.

Often abundant in wet, rich sites (sea shore debris, sewage, bird cliffs. Uncommon in dry sites. - Bjørnøya, Jan Mayen, Hopen, Barentsøya, Kongsøya, Spitsbergen (Hornsund, Van Mijenfjorden, Longyearbyen, Tempelfjorden, Ny Ålesund, Prins Karls Forland, Reinsdyrflya, Liefdefjorden). - Range: Holarctic/cosmopolitan (S.America).

6. **WILLEMIA** Börner, 1901

Species of this genus are small (< 0.7 mm), white, without furca. They resemble *Tullbergia* and *Mesaphorura* in general habitus, but the body is slightly broader in the middle. The three arctic species have small anal spines. A fourth species, *W. denisi* Mills, 1932 (= *aspinata* Stach, 1949) is found on the Norwegian mainland and might show up in arctic samples. It differs from other *Willemia* by absence of anal spines.

- | | | |
|----|---|------------------------|
| 1. | Abd.4 with 3+3 setae along median line (Fig. 5J) | 2 |
| – | Abd.4 with 2+2 setae along median line (Fig. 5L). | 1. <i>scandinavica</i> |
| 2. | PAO with 6-9 lobes (as Fig. 5K). Two prelabral setae (Fig. 5O). Ant.3 organ broad, with exposed sensilla (as Fig. 5M) | 2. <i>similis</i> |
| – | PAO with 4 lobes (Fig. 5I). Four prelabrals (Fig. 5N). Ant.3 organ narrow, with hidden sensilla (Fig. 5P) | 3. <i>anophthalma</i> |

1. **Willemia scandinavica** Stach, 1949

Figs. 5K,L

Both wet and dry habitats, but most records from dry sites (plant cushions on rocks, bird cliffs, shore meadows, eider duck nests). - Bjørnøya, Jan Mayen, Kongsøya, Spitsbergen (Adventdalen, Colesdalen, Ny Ålesund). - Range: Holarctic.

2. **Willemia similis** Mills, 1934

Fig. 5O

Same habitats as previous species. - Bjørnøya, Kongsøya, Spitsbergen (Adventdalen, Colesdalen, Ny Ålesund). - Range: Holarctic.

3. *Willemia anophthalma* Börner, 1901

Figs. 5I,J,N,P

A few records from Dryas heaths and bird cliffs. - Jan Mayen, Spitsbergen (Colesdalen, Ny Ålesund, Magdalenefjorden, Reinsdyrflya). - Range: Cosmopolitan.

ODONTELLIDAE

Xenyllodes Axelson 1903

1. *Xenyllodes armatus* Axelson, 1903

Figs. 4G, 5R

A small (< 1.0 mm), bluish gray species with thick body and short extremities. The star-shaped postantennal organ (Fig. 4G) and the short furca with 2 setae on dens (Fig. 5R) are characteristic.

Only reported by Thor (1930) from Spitsbergen (Barentsburg, Longyearbyen). - Range: Holarctic.

NEANURIDAE

1. Maxilla short and strong with many small denticles (Fig. 5Q). Furca well developed (Fig. 5R) (1. *Brachystomella*)
- Maxilla of different shape, furca absent or reduced 2
2. Furca (Fig. 5S) and anal spines (Figs. 5 T,U) present..... 2. *Friesea*
- Furca and anal spines absent 3
3. Maxilla long, styliform. The single arctic species very small (0.5 mm), with 2+2 ocelli and weak pigmentation on body 3. *Micranurida*
- Maxilla shorter, with distinct lamellae. Ocelli either absent or more than 2+2 in arctic species. Either white or very dark..... 4. *Anurida*

(1. *BRACHYSTOMELLA* Ågren, 1903)

Brachystomella parvula (Schäffer, 1896)(Figs. 2B, 5Q) has recently been collected on Novaya Zemlya (Babenko & Bulavintsev 1993)

2. *FRIESEA* Dalla Torre, 1895

1. Abd.6 with 5 anal spines (Fig. 5U) *quinquespinosa*
- Abd.6 with 3 anal spines (Fig. 5T)..... (*mirabilis*)

Friesea mirabilis (Tullberg, 1871) is reported from Novaya Zemlya (Babenko & Bulavintsev (1993).

1. *Friesea quinquespinosa* Wahlgren, 1900

Fig. 5U

Friesea nauroisi Cassagnau, 1958

A medium-sized species (1.5 mm) with variable pigmentation (bluish gray to almost white). The five anal spines separate it from all other arctic Collembola.

Mostly from dry meadows, heaths, bird cliffs and plant cushions in rocky habitats. Few records in wet sites. - Kongsøya, Spitsbergen (Adventdalen, Colesdalen, Kapp Linné, Ny Ålesund, Reinsdyrflya). - Range: Circumpolar.

3. MICRANURIDA Börner, 1901

1. *Micranurida pygmaea* Börner, 1901

Fig. 1I

Anurida pygmaea (Börner): Valpas (1967), Brattbakk et al. (1976)

A small species (0.5 mm) with colour varying from white to bluish gray. The 2+2 ocelli in combination with a rosette-like postantennal organ (Fig. 1I) is an unique character combination.

In meadows with moss, grass, herbs. Also in bird cliffs and dry heaths with *Dryas*, *Cassiope*, lichens. Few records in wet habitats. - Bjørnøya, Jan Mayen, Hopen, Spitsbergen (Van Mijenfjorden, Colesdalen, Longyearbyen, Ny Ålesund, Reinsdyrflya). - Range: Cosmopolitan.

4. ANURIDA Laboulbene, 1865

Our three arctic species are large (1.5-2.0 mm), white or yellowish white, resembling an *Onychiurus*. They differ from that genus by absence of anal spines and by having large, rosette-like post antennal organs.

- | | |
|---|-------------------------|
| 1. Ocelli absent | 2 |
| - Ocelli present | 4 |
| 2. Abd.4 with 3+3 p-setae between sensilla p4 (Fig. 6A) | 3 |
| - Abd.4 with 2+2 p-setae between sensilla p4 (Fig. 6B) | 2. <i>granaria</i> |
| - Abd.4 with 1+1 p-setae between sensilla p4 (Fig. 6C) | (<i>subarctica</i>) |
| 3. Th.1 with at most 3+3 short setae between the lateral macrochaetae. Body sculpture and hairs finer. Median pair of macrochaetae (p1) on Abd.5 shorter than distance between them. PAO with irregular lobes (Fig. 6E) | 1. <i>polaris</i> |
| - Th.1 with more than 3+3 setae between lateral macrochaetae. Body sculpture coarser, hairs longer. Median pair of Abd.5 macrochaetae longer than distance between them. PAO with smooth, regular lobes (as Fig. 1I) | 3. <i>thalassophila</i> |
| 4. Ocelli 3+3 (Fig. 6D) | (<i>alpina</i>) |
| - Ocelli 4+4 | (<i>papillosa</i>) |

The species *Anurida alpina* Agrell, 1939, *subarctica* Fjellberg, 1985, and *papillosa* (Axelson, 1902) are all reported from Novaya Zemlya (Babenko & Bulavintsev 1993).

1. *Anurida polaris* (Hammer, 1954)

Figs. 6A,E

Anurida frigida Fjellberg, 1973

The irregular lobes of the post antennal organ and the abdominal chaetotaxy separates this species from *granaria*. In mixed alcohol samples of the two, *polaris* is usually spotted by its more pure white coloration and a more slender body shape.

Common in wet mossy habitats. Characteristic species under stones in melt water along snowfields. Also some records from bird cliffs and sea shore drifts. Avoids dry sites. - Bjørnøya, Jan Mayen, Hopen, Kongsøya, Nordaustlandet (Kinnvika), Spitsbergen (Van Mijenfjorden, Colesdalen, Longyearbyen, Ny Ålesund, Danskøya, Liefdefjorden). - Range: Circumpolar.

2. *Anurida granaria* (Nicolet, 1847)

Figs. 1I, 6B

Reported by various authors from Jan Mayen and Spitsbergen. The species might have been confused with *polaris*, and the only definite *granaria* I have seen come from a bird cliff at Blomstrandfjellet, Ny Ålesund (Spitsbergen). Also Valpas' (1967) report of a specimen from the shore of a brackish lagoon at Reinsdyrflya seems plausible. - Range: Holarctic/cosmopolitan (S.America)

3. *Anurida thalassophila* (Bagnall, 1939)

Anurida remyi denis, 1948: Gisin (1953)

Gisin (1953: 229) figures a specimen from wet cliff sites (moss, *Luzula*) at Jan Mayen which is probably *thalassophila*. No other arctic records are known. Along the Norwegian coast it is a common littoral species. - Range: Palearctic (N.Europe)

ONYCHIURIDAE

1. Ant.3 organ with two sensorial clubs protected by long, fingerlike papillae (Fig. 4F). Arctic species larger than 1.0 mm (subfam. **Onychiurinae**)..... 1. *Onychiurus*
- Ant. 3 organ with 2 or 3 exposed sensorial clubs (Fig. 7D). Arctic species smaller than 1.0 mm. (subfam. **Tullbergiinae**)..... 2
2. Ant.3 organ with 3 sensorial clubs (Fig. 7D). Anal spines subequal to claws. Abd.6 without crescentic ridges (Fig. 7A). Arctic species about 1.0 mm 2. *Tullbergia*
- Ant.3 organ with 2 sensorial clubs. Anal spines shorter than claws. Abd.6 with two crescentic ridges (Figs. 7B,C). Small species, usually less than 0.7 mm 3. *Mesaphorura*

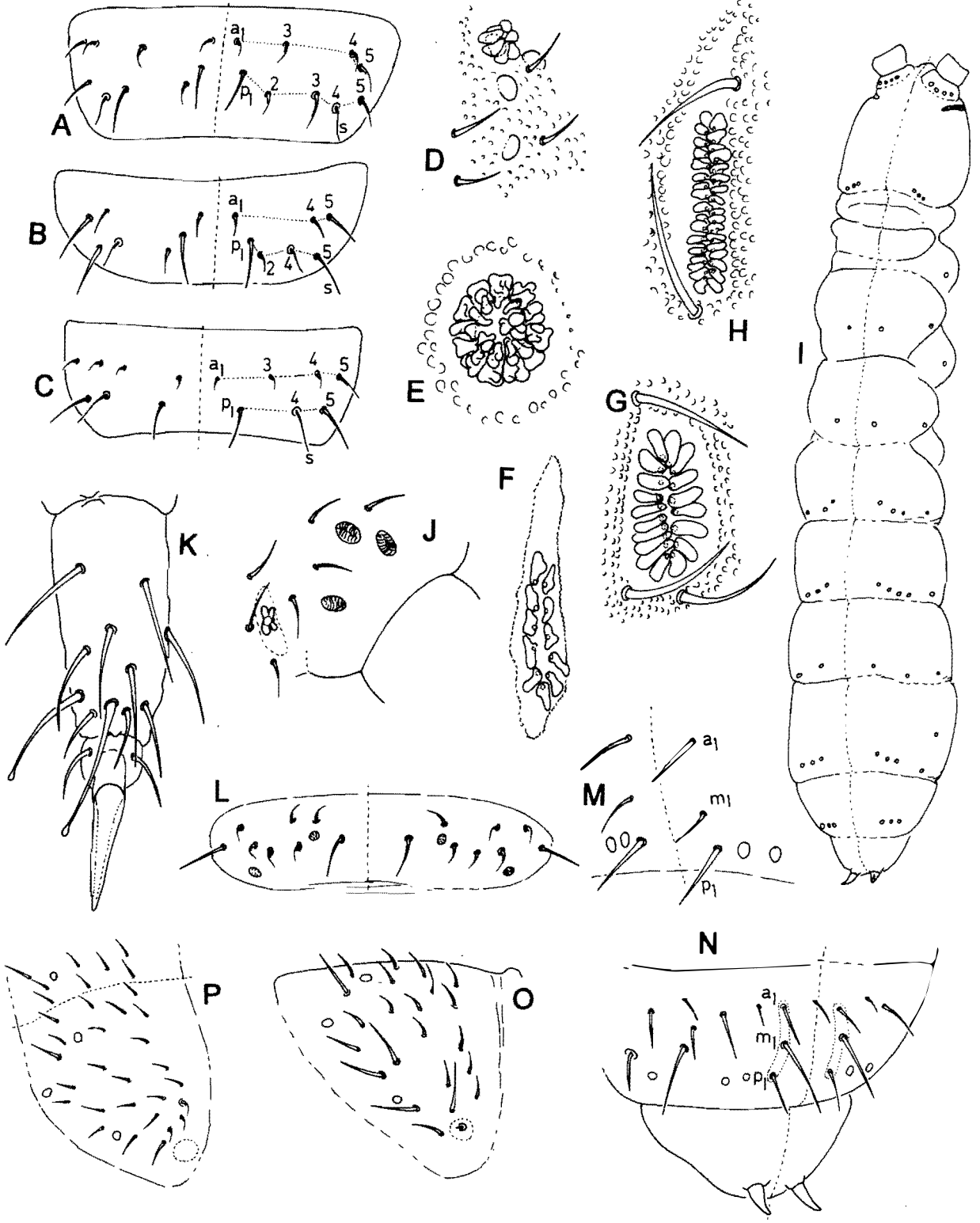
1. ONYCHIURUS Gervais, 1841

The large genus *Onychiurus* is traditionally split in a number of subgenera which are often given generic rank by recent taxonomists. For practical reasons I here use the old classification

1. PAO with at most 4 small vesicles (Fig. 6J) (s.gen. *Oligaphorura*) 2
- PAO with many vesicles in two rows 3
2. Th.3 with lateral microsensilla present (Fig. 6O). Abd.5 with seta m1 usually much longer than a1 and p1 (Fig. 6N). Ant.1 with 9 setae. Larger species (1.7 mm) 1. *groenlandicus*
- Th.3 without lateral microsensilla (Fig. 6P). Abd.5 with m1 normally shorter than a1 and p1 (Fig. 6M). Ant.1 with 8 setae. Smaller species (1.3 mm) 2. *ursi*
3. PAO with less than 15 slightly irregular vesicles (Fig. 6F). Pseudocellar formula in the arctic species 10/022/11112 (s.gen. *Hymenaphorura*)..... (*sibiricus*)
- PAO with more than 15 regular vesicles (Fig. 6G). Ps.oc. formula different..... 4
4. Tibiotarsi with acuminate tenent hairs (s.gen. *Protaphorura*) 5
- Tibiotarsi with clavate tenent hairs (Fig. 6K) (s.gen. *Uralaphorura*) (*schilovi*)
5. Th.1 without dorsal ps.oc. 6
- Th.1 with 2+2 dorsal ps.oc. (ps.oc. formula 32/233/33343, Fig. 1J)..... 3. *duplopunctatus*
6. No traces of furca. Largest species, up to 3.5 mm. Ps.oc. 32/023/33353. Live specimens yellowish 4. *arcticus*
- A paired furca is present (Fig. 4E). Ps.oc. 32/012/23233 (*furciferus*)
- = Furca present as a small unpaired fold (Fig. 4D) 7
7. Ps.oc. 43/023/44453, Fig. 6I (often somewhat irregular) 5. *macfadyeni*
- Ps.oc. 32/022/33342 (*pjasinae*)
- = Ps.oc. 32/022/33343 (*cancellatus*)
- = Ps.oc. 33/022/33342 (somewhat variable on Th.2-3) (*taimyricus*)
- = Ps.oc. 33/022/33332 (*subarcticus*)

The species *O. schilovi* (Martynova, 1976) (Fig. 6K) is found in North Norway (Fjellberg 1988) and Novaya Zemlya (Babenko & Bulavintsev 1993). *O. sibiricus* (Tullberg, 1876) (Fig. 6F), *cancellatus* (Gisin, 1952), *furciferus* (Börner, 1901) (Fig. 4E), *pjasinae* (Martynova, 1976), *subarcticus* (Martynova, 1976), and *taimyricus* (Martynova, 1976) are all reported from Novaya Zemlya (Babenko & Bulavintsev 1993).

Fig. 6: (A)Chaetotaxy of Abd.4, *Anurida polaris*; (B)Ditto, *A. granaria*; (C) Ditto, *A. subarctica*; (D)Ocelli and PAO, *A. alpina*; (E)PAO, *A. polaris*; (F)PAO, *Onychiurus sibiricus*; (G)PAO, *Onychiurus duplopunctatus*; (H)PAO, *O. macfadyeni*; (I)Distribution of dorsal pseudocelli, *O. macfadyeni*; (J)PAO and pseudocelli on antennal base, *O. ursi*; (K)Left Ti.2, *O. schilovi*; (L)Chaetotaxy and pseudocelli on Th.1, *O. duplopunctatus*; (M)Setae along midline of Abd.5, *O. ursi*; (N)Chaetotaxy of Abd.5, *O. groenlandicus*; (O)Right side of Th.3 (microsensillum encircled), *O. groenlandicus*; (P)Ditto, *O. ursi*.



Subgenus *Oligaphorura* Bagnall, 19491. **Onychiurus groenlandicus** (Tullberg, 1876)

Figs. 6N,O

Lipura groenlandica Tullberg, 1876*Aphorura groenlandica* Tullb.: Lubbock (1898), Stscherbakow (1899)

The two species of this subgenus are very similar, but the above key characters are generally consistent. Large specimens of *groenlandicus* usually have a broader abdomen (pear-shaped body) and a cream-white colour compared with the slender and pure white *ursi*.

In various habitats, but most common in wet, mossy sites. Some records from bird cliffs and shore drifts. - The species has been confused with *ursi*, but probably occurs in most of the arctic islands. I have seen specimens from Bjørnøya, Hopen, Kongsøya, Nordaustlandet (Kinnvika), Spitsbergen (Van Mijenfjorden, Colesdalen, Longyearbyen, Ny Ålesund. Published records (not verified) from Jan Mayen, Barentsøya, Hornsund, Tempelfjorden, Magadalenefjorden, Danskøya, Reinsdyrflya, Liefdefjorden. - Range: Circumpolar.

2. **Onychiurus ursi** (Fjellberg, 1984)

Figs. 6J,M,P

In moss and grass tufts in meadows. Also along ponds and shores of streams and lakes. - Bjørnøya, Kongsøya, Spitsbergen (Adventdalen, Colesdalen, Ny Ålesund). - Range: Holarctic.

Subgenus *Protaphorura* Absolon, 19013. **Onychiurus duplopunctatus** (Strenzke, 1954)

Figs. 1J, 6G,L

Aphorura neglecta Schäffer: Wahlgren (1900a, 1900b)*Onychiurus debilis* Moniez: Gisin (1953)

A small (1.0 mm), slender species with no traces of furca on Abd.4. The presence of pseudocelli on prothorax is an unique character.

In damp sites rich in organic matter (bird colonies, shore drifts, lagoons, beach meadows). - Bjørnøya, Jan Mayen, Spitsbergen (Ny Ålesund, Reisdryflya). - Range: Palaeartic (N.Europe).

4. **Onychiurus arcticus** (Tullberg, 1876)*Lipura arctica* Tullberg, 1876*Aphorura arctica* Tullb.: Lubbock (1898), Stscherbakow (1899), Schäffer (1900), Wahlgren (1899, 1900a, 1900b), Brown (1936)*Onychiurus armatus* (Tullb.) var. *arcticus* Tullb.: Carpenter & Phillips (1922), Carpenter (1927)

Large (3.5 mm), live specimens yellow, fading to white in alcohol.

Common and abundant in bird colonies and along sea shores. Often observed in large accumulations under stones and in rock crevices. Seems to avoid the wet mossy habitats. In North Norway the species has been observed grazing algae on sea cliffs at low tide during night. - Bjørnøya, Jan Mayen, Edgeøya (Kvalpynten), Spitsbergen (Storfjord, Hornsund, Adventdalen, Longyearbyen, Dicksonfjorden, Ny Ålesund, Reinsdyrflya, Gipsdalen, Gråhøken, Isfjorden, Widjefjorden, Liefdefjorden). - Range: Palaearctic (N.Europe).

5. *Onychiurus macfadyeni* (Gisin, 1953)

Figs. 4D,F, 6H,I

? *Aphorura armata* Tullb.: Wahlgren (1900a, 1900b)

Aphorura octopunctata var. *edenticulata* Wahlgren, 1900b

Onychiurus duodecimpunctata Fol.: Bristowe (1922)

? *Onychiurus armatus* (Tullberg): Thor (1930)

A large species (2.0 mm), easily separated from *arcticus* by the pseudocellar formula and the presence of a furcal flap (reduced furca) on Abd.4.

In moss and grass, most frequent in beach meadows and bird colonies. - Bjørnøya, Jan Mayen, Spitsbergen (Colesdalen, Longyearbyen, Ny Ålesund). - Range: Palaearctic (N.Europe).

2. TULLBERGIA Lubbock, 1876

The two arctic species are about 1.0 mm, white, with very slender body shape.

1. Abd.5 with long a2 and short p2 (Fig. 7F). Ps.oc. 11/122/22221 1. *arctica*
 – Abd.5 with short a2, long p2 (Fig. 7A). Ps.oc. 11/111/11111 2. *simplex*

1. *Tullbergia arctica* Wahlgren, 1900

Fig. 7F

A few records from dry sites, partly with guano. - Originally described from Jan Mayen by Wahlgren (1900). Later reported by Gisin (1953) from the same island and by Valpas (1967) from Bockfjorden (Spitsbergen). In addition I have a few records from Ny Ålesund. - Range: Holarctic (arctic-alpine).

2. *Tullbergia simplex* Gisin, 1958

Fig. 7A,D

Some records from meadows and dry, rocky habitats. - Bjørnøya, Spitsbergen (Ny Ålesund). - Range: Holarctic (arctic-alpine).

3. MESAPHORURA Börner, 1901

Similar to species of previous genus, but smaller (< 0.7 mm) with relatively shorter anal spines.

1. Abd.5 with 3+3 short setae between the long a4 setae (Fig. 7C). Th.2 with 1+1 ps.oc. 2
 – Abd.5 with 2+2 short setae between a4 (Fig. 7B). Th.2 without ps.oc. 1. *jirii*

2. Th.3 with 2+2 ps.oc.(Fig. 7E). Abd.4 with unpaired median seta (x, Fig. 7C) 2. *tenuisensillata*
 – Th.3 with 1+1 ps.oc. Abd.4 without median seta 3. *macrochaeta*

1. **Mesaphorura jirii** Rusek, 1982

Fig. 7B

Only two records from Bjørnøya, in meadow vegetation (Kapp Posadowsky, 20.VIII.1983, O. Skifte leg.). - Range: Palaearctic (Europe).

2. **Mesaphorura tenuisensillata** Rusek, 1974

Figs. 7C,E

A few records from Bjørnøya and Jan mayen (O. Skifte and K. Vestergaard leg.). - Range: Palaearctic (Europe).

3. **Mesaphorura macrochaeta** Rusek, 1976

? *Tullbergia krausbaueri* Börner: Gisin (1953)

In lichen tundra, in eutrophic bog and in *Honckenya* on sea shore. - A few records from Jan Mayen and Spitsbergen (Ny Ålesund). - Range: Holarctic.

ISOTOMIDAE

1. Four anal spines present (Fig. 7G) 1. *Tetracanthella*
 - Anal spines absent 2
 2. Furca completely reduced (Fig. 2D,E) 2. *Pseudanurophorus*
 – Furca present 3
 3. Abd.4-6 fused, without intersegmental constrictions (Fig. 2F,G)
 6. *Folsomia*
 – All abdominal segments separated by constrictions, or at most Abd.5-6 fused 4
 4. White species without eyes and PAO 7. *Isotomiella*
 – Pigmented species, ocelli and PAO present 5
 5. Manubrium with many ventral setae, also in basal part 6
 – Manubrium at most with a few ventral setae near apex 10
 6. Claws with a serrated basal tunica (Fig. 7J). Dens with a very long subapical seta (Fig. 7K)
 8. *Agrenia*
 – Claws simple, without tunica. Dens with apical setae usually not passing tip of mucro 7
 7. Tibiotarsi with acuminate tenent hairs 8
 – Tibiotarsi with clavate tenent hairs (Fig. 7L) 9
 8. Abdomen with trichobothria (Fig. 7N) (9. *Isotomurus*)
 – Abdomen without trichobothria 12. *Isotoma*
 9. Abd.5-6 fused, mucro 3-toothed 10. *Pseudisotoma*
 – Abd.5-6 not fused, mucro 4-toothed (11. *Vertagopus*)
 10. Manubrium without ventroapical setae. Strictly marine littoral species with specialised mouthparts 3. *Archisotoma*
 – Manubrium with 1+1 or more ventroapical setae 11

11. Skin smooth. Dens with less than 10 dorsal and ventral setae..... (4.*Proisotoma*)
 – Skin distinctly granulate. Dens with numerous setae (Fig. 7M) (5.*Pachyotoma*)

1. TETRACANTHELLA Schött, 1891

1. Abd.1-3 with 2-2-3 macrochaetae on each side 1. *arctica*
 – Abd.1-3 with 2-3-3 macrochaetae on each side (Fig. 7H).....(*wahlgreni*)

Tetracanthella wahlgreni Linnaniemi, 1911 is reported from Novaya Zemlya (Babenko & Bulavintsev 1993).

1. *Tetracanthella arctica* Cassagnau, 1959

Fig. 7G

Tetracanthella pilosa Schött, 1893: Wahlgren (1899, 1900b)

Tetracanthella coerulea (Haller): Schäffer (1900)

Tetracanthella wahlgreni Linnaniemi: Thor (1930)

Shiny bluish black, 1.7 mm. Furca slightly reduced, dens with 3 setae, mucro absent. Easily identified by the four strong anal spines.

In beach meadows (eider duck nests), bird cliffs, in *Puccinellia* along lagoons, in moss cushions, etc. Both wet and dry sites. - Bjørnøya, Spitsbergen (Recherchefjorden, Ny Ålesund, Magdalenefjorden). - Range: Holarctic/amphiatlantic (not well known).

2. PSEUDANUROPHORUS Stach, 1922

1. Ocelli 1+1. Thorax without ventral setae 1. *binoculatus*
 – Ocelli absent. Th.3 with 1+1 ventral setae.....2. *inoculatus*

1. *Pseudanurophorus binoculatus* Kseneman, 1934

Fig. 2D

Small species (0.5 mm) with scattered pigmentation in eye-spots and on body.

Gisin (1953) reports the species from Jan Mayen. I have also seen a Jan Mayen specimen collected by K. Vestergaard in 1972. - Range: Holarctic.

2. *Pseudanurophorus inoculatus* Bødvarsson, 1957

Fig. 2E

Similar to previous species, but ocelli and pigment absent and body more elongate.

In grass, moss and lichens. - Bjørnøya, Kongsøya, Nordaustlandet (Kinnvika), Spitsbergen (Colesdalen, Adventdalen, Ny Ålesund). - Range: Palaearctic (N.Europe).

3. ARCHISOTOMA Linnaniemi, 1912

1. Claw on first leg without inner tooth. Clypeal field on head with <10 setae (Fig. 7P)2
 – Claw on first leg with inner tooth (Fig. 8A). Clypeal field on head with >10 setae (Fig. 7O).
 1. *megalops*
 2.Th.2 on each side of midline with a sensillum which is twice as long as surrounding hairs
 (Fig. 8C). Tib.3 with a strong apical spur-hair (Fig. 8B). Smaller (1.5 mm), dark species
2. *besselsi*
 – Th.2 with sensilla not longer than surrounding hairs (Fig. 8D). Tib.3 with spur hair not so
 strong. Larger (1.8 mm), pale species3. *polaris*

1. *Archisotoma megalops* (Bagnall, 1939)

Figs. 7O, 8A

A large (2.0-2.3 mm), grayish brown species.

Only from sea shores at Jan mayen and Spitsbergen (Ny Ålesund). - Range: Palaearctic (N.Europe).

2. *Archisotoma besselsi* (Packard, 1877)

Figs. 7P, 8B,C

?*Isotoma spitzbergensis* Lubbock, 1898

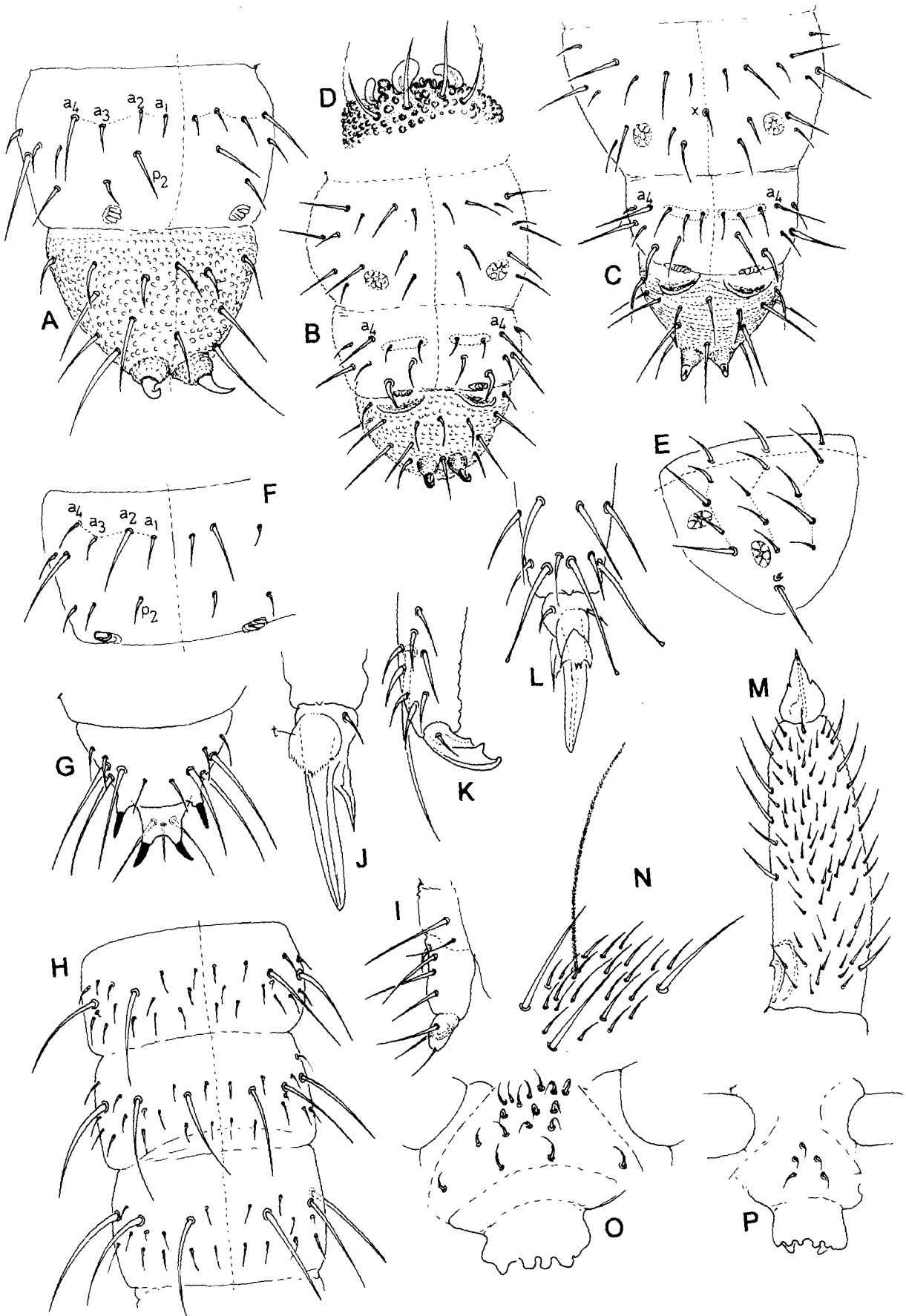
? *Isotoma arctica* Stscherbakow, 1899

Isotoma janmayensis Wahlgren, 1900

In the original description of *Isotoma spitzbergensis* Lubbock (1898) writes 2.0-2.5 mm as size of the animal. It is exceptionally large for a *besselsi*, even if antennae are included. Thus *spitzbergensis* may as well be one of the two other arctic species.

Common along marine shores (tidal zone). - Jan mayen, Kongsøya, Spitsbergen (Longyearbyen, Claas Billen Bay, Grønfjorden, Isfjorden, Tempelfjorden, Dicksonfjorden, Prins Karls Forland, Ny Ålesund, Bockfjorden, Liefdefjorden). - Range: Holarctic.

Fig. 7: (A)Chaetotaxy of Abd.5-6, *Tullbergia simplex*; (B)Chaetotaxy of Abd.4-6, *Mesaphorura jirii*; (C)Ditto, *Mesaphorura tenuisensillata* (x: unpaired median seta); (D)Ant.3 organ, *Tullbergia simplex*, (F) Chaetotaxy of Abd.5, *T. arctica*; (G)Abd.5-6, *Tetracanthella arctica*; (H)Chaetotaxy of Abd.1-3, *T. wahlgreni*; (I)Furca, *T.wahlgreni*; (J)Claw with tunica (t), *Agrenia bidenticulata*; (K)Apical part of dens with mucro, ditto; (L)Apical part of Ti.3 with claw, *Vertagopus brevicaudus*; (M)Dorsal side of dens and mucro, *Pachyotoma crassicauda*; (N)Trichobothrium and surrounding setae on Abd.4, *Isotomurus palustris*; (O) Labrum and clypeal field, *Archisotoma megalops*; (P)Ditto, *Archisotoma besselsi*.



3. *Archisotoma polaris* Fjellberg & Poinso, 1975

Figs. 1I, 8D

? *Isotoma arctica* Stscherbakow, 1899

The species may be confused with *megalops* having weak or absent inner tooth on claws. However, *polaris* has about 1/3 of dens devoid of setae in basal part on anterior face, while *megalops* has only 1/4. Also the ocelli are smaller and maxilla is different.

Muddy sea shores with *Puccinellia*, *Carex ursina*, etc. - Originally described from Spitsbergen (Ny Ålesund) where it is common in the right habitats. Also seen from Longyearbyen. - Range: Circumpolar.

(4. **PROISOTOMA** Börner, 1901)

Proisotoma is represented on Novaya Zemlya with two species: *P. subarctica* Gisin, 1950 and *P. ananevae* Babenko & Bulavintsev, 1993.

(5. **PACHYOTOMA** Bagnall, 1949)

Pachyotoma crassicauda (Tullberg, 1871) (Fig. 7M) is present on Novaya Zemlya (Babenko & Bulavintsev 1993)

6. **FOLSOMIA** Willem, 1902

- | | |
|--|--------------------------|
| 1. Ocelli present. At least some dark pigment on body | 2 |
| – Ocelli absent. Completely white forms | 5 |
| 2. Ocelli 1+1 | 3 |
| – Ocelli 2+2 | 4 |
| = Ocelli 3+3 | 1. <i>sexoculata</i> |
| 3. Manubrium with 1+1 ventroapical setae..... | (<i>diplophthalma</i>) |
| – Manubrium with 3+3 ventroapical setae or more | 3. <i>regularis</i> |
| 4. Manubrium with 1+1 ventroapical setae..... | 2. <i>quadrioculata</i> |
| – Manubrium with 3+3 ventroapical setae..... | (<i>microchaeta</i>) |
| 5. Th.3 with at least 1+1 ventral setae..... | 6 |
| – Th.3 without ventral setae | 7 |
| 6. Abd.5 with 2 thick sensillae on each side (Fig. 8K) | 6. <i>alpha</i> |
| – Abd.5 with hair-like sensillae only..... | 7. <i>stella</i> |
| 7. Manubrium with 1+1 ventroapical setae. Abd. 2-3 with microsensilla (Fig. 8E).. | 4. <i>taimyrica</i> |
| – Manubrium with more than 1+1 ventroapical setae. Abd.2-3 with macrosensilla only | 8 |
| 8. Manubrium with 2+2 ventroapical setae (Fig. 8I). Shorthaired species without conspicuous macrochaetae | 5. <i>bisetosa</i> |
| – Manubrium with 3+3 (2-4) ventroapical setae. Abdomen with long, outstanding, ciliate macrochaetae | (<i>ciliata</i>) |

The species *Folsomia diplophthalma* (Axelson, 1902), *microchaeta* Agrell, 1939 and *ciliata* Babenko & Bulavintsev, 1993 are all reported from Novaya Zemlya (Babenko & Bulavintsev 1993).

1. *Folsomia sexoculata* (Tullberg, 1871)

Isotoma sexoculata Tullberg, 1871

Dark gray, 2.0 mm. Manubrium with 2+2, 3+3 or more ventroapical setae (often asymmetric). The 3+3 ocelli (of which the two anterior are set close together) separate this species from other arctic *Folsomia*.

Common in salt meadows and other littoral habitats. - Bjørnøya, Jan Mayen, Hopen, Nordaustlandet (Kinnvika), Spitsbergen (Hornsund, Barentsburg, Longyearbyen, Klaas Billen Bay, Isfjorden, Ny Ålesund, Liefdefjorden). - Range: Holarctic.

2. *Folsomia quadrioculata* (Tullberg, 1871)

Fig. 2F

Isotoma quadrioculata Tullberg, 1871

Spotted grayish brown, 1.5 mm. Abdomen with long, erect macrochaetae. Specimens without pigment are not uncommon in arctic populations. Still the 2+2 ocelli and 1+1 ventroapical manubrial setae will identify the species.

An eurytopic species present in both wet and dry habitats. - Bjørnøya, Jan Mayen, Hopen, Barentsøya, Kongsøya, Nordaustlandet, Spitsbergen (from almost all sites where Collembola has been collected). Probably the most common and abundant Collembola species in the arctic islands. - Range: Holarctic.

3. *Folsomia regularis* Hammer, 1953

? *Isotoma binoculata* Wahlgren, 1899

White, with dark ocellar spots, 1.1 mm. Body sometimes with traces of dark pigmentation. Abdomen with long macrochaetae. Habitually very similar to *quadrioculata*, but the 1+1 ocelli and 3+3 or more manubrial ventroapical setae separate the species.

Most abundant in wet upland sites near snowfields. Some records from sea shores and bird cliffs. - Kongsøya, Nordaustlandet (Kinnvika), Kvitøya (Wahlgren 1899: *Isotoma binoculata*), Spitsbergen (Hornsund, Longyearbyen, Ny Ålesund). - Range: Circumpolar.

4. *Folsomia taimyrica* Martynova, 1973

Fig. 8E

White, 1.5 mm, abdominal macrochaetae long. Body shape similar to previous two species. Specimens from the Norwegian arctic are completely white with no ocelli, while Siberian specimens frequently have 1+1 ocelli and some pigmentation. The presence of microsensilla on Abd. 2-3 separates the species from other arctic *Folsomia*.

A few records from wet habitats with moss, grass, *Salix polaris*. - Hopen, Spitsbergen (Adventdalen, Longyearbyen). - Range: Holarctic.

5. *Folsomia bisetosa* Gisin, 1953

Fig. 8I

? *Isotoma fimetaria* (L.) Tullb.: Schäffer (1900), Wahlgren (1900a)

? *Folsomia fimetaria* (Linné, 1758): Carpenter (1927), Thor (1930)

White, 0.8 mm. The only blind, white species with 2+2 manubrial setae and no ventral setae on thorax.

An eurytopic species which is common in meadows and upland heaths. Also in bird cliffs, but few records from littoral habitats and wet mossy sites. - Bjørnøya, Jan Mayen, Kongsøya, Spitsbergen (Adventdalen, Colesdalen, Longyearbyen, Ny Ålesund, Magdalenefjorden, Bockfjorden, Liefdefjorden, Reinsdyrflya). - Range: Circumpolar with southern extensions.

6. *Folsomia alpha* Grow & Christiansen, 1976

Figs. 2G, 8G,J,K

Folsomia sensibilis Kseneman, 1936: Gisin (1953), Valpas (1967)

Isotomina gracilis Stach, 1962, nec. Latzel 1922

Folsomia alpha Christiansen & Tucker, 1977

White, 1.2 mm. Manubrium usually with 3+3 ventroapical setae in oblique rows and 2-3 pairs of subapical setae (Fig. 8G). Dens long, with 8 dorsal setae (Fig. 8J). The presence of thick abdominal sensilla separates this species from other arctic *Folsomia*.

Some records from meadows, *Cladonia* heath and cushion-plant communities along lagoons and sea shores. - Jan Mayen, Kongsøya, Nordaustlandet (Kinnvika), Spitsbergen (Hornsund, Van Mijenfjorden, Colesdalen, Ny Ålesund). - Range: Circumpolar.

7. *Folsomia stella* Grow & Christiansen, 1976

Figs. 8F,H

Folsomia stella Christiansen & Tucker, 1977

White, 0.9 mm. Manubrium with 3+3(4) ventroapical setae in almost parallel rows (Fig. 8H). Abd.1-3 with upper sensillum in p-row (Fig. 8F). In other species - except *bisetosa* and *ciliata* - it is set in front of p-row (Fig. 8E). Large reproductive males have shorter abdominal macrochaetae than unreproductive specimens (epitoky).

In meadows and bird cliffs. - Jan Mayen, Kongsøya, Spitsbergen (Berzeliusdalen at Van Mijenfjorden). On the Norwegian mainland it has repeatedly been collected in salt beach meadows. - Range: Holarctic.

7. ISOTOMIELLA Bagnall, 1939

1. *Isotomiella minor* (Schäffer, 1896)

Habitually similar to a small *Isotoma* (1.1 mm). Easily identified by the white colour and absence of PAO. Ant.4 with some conspicuous, thick sensillae. Manubrium with many ventral setae.

Reported from Jan Mayen by Gisin (1953) and also collected from the same Island by a Danish expedition in 1972 (K.Vestergaard leg.) - Range: Cosmopolitan.

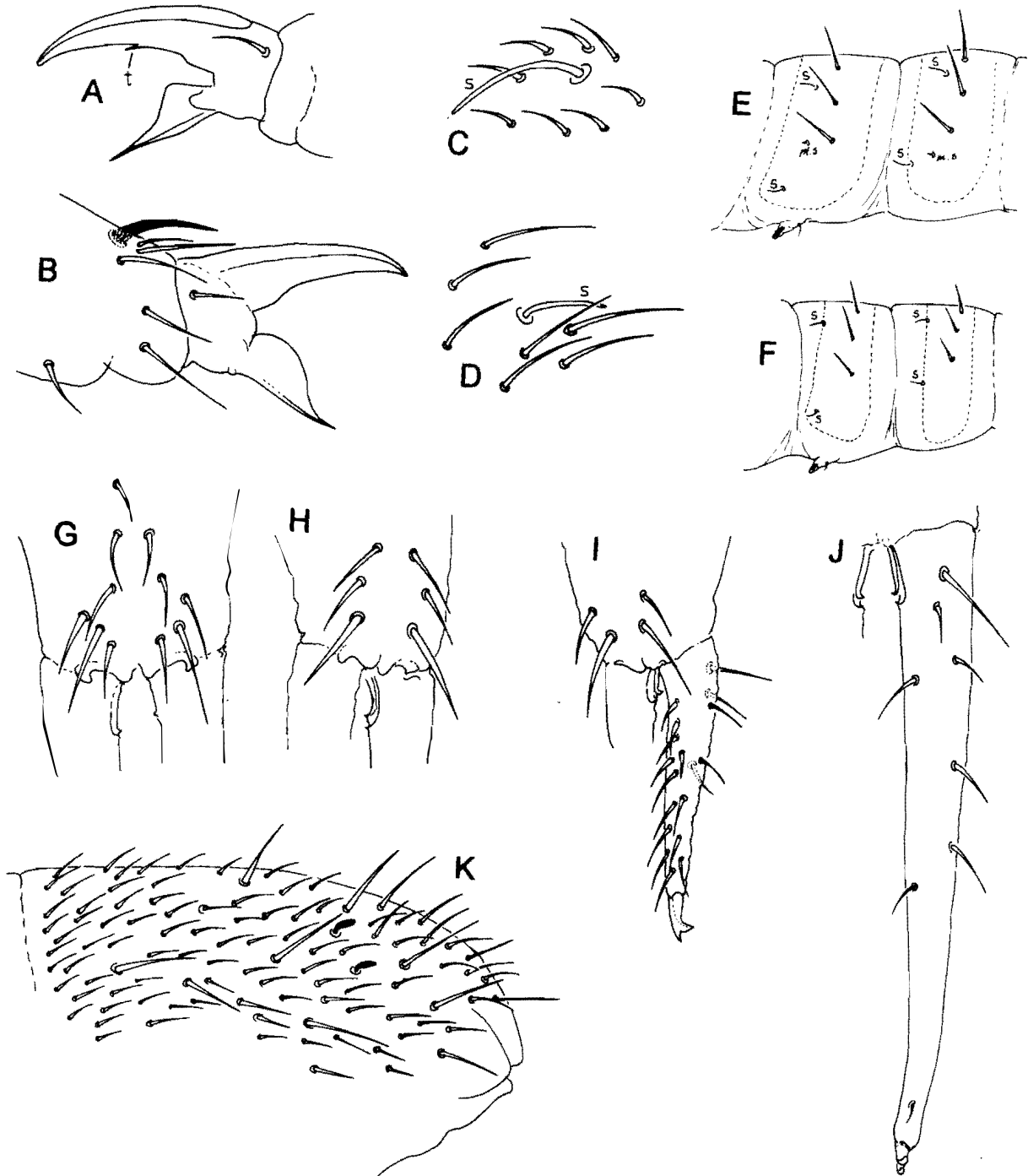


Fig. 8: (A) Claw with inner tooth (t), *Archisotoma megalops*; (B) Ti.3 with spur hair (black), *A. besselsi*; (C) Sensillum (s) and surrounding setae on Th.2, *A. besselsi*; (D) Ditto, *A. polaris*; (E) Sensilla (s) and microsensilla (m.s.) on Abd.2-3, *Folsomia taimyrica*; (F) Ditto, *F. stella*; (G) Ventral side of manubrium, *F. alpha*; (H) Ditto, *F. stella*; (I) Ditto, *F. bisetosa*, (J) Dorsal side of dens, *F. alpha*; (K) Left side of Abd.4-6, *F. alpha*.

8. **AGRENIA** Börner, 19061. **Agrenia bidenticulata** (Tullberg, 1876)

Figs. 2I, 7J,K

Isotoma bidenticulata Tullberg, 1876

Olive green to yellowish brown with darker mid-sections of tergites. 1.9 mm. The species looks like a short-haired *Isotoma*. The long subapical seta on dens is an unique character.

A common and characteristic species along the margins of snowfields, streams and ponds. - Bjørnøya, Hopen, Kongsøya, Edgeøya, Barentsøya, Nordaustlandet (Kinnvika), Hinlopen (Fosterøyene, Wahlbergøya), Spitsbergen (Hornsund, Isfjorden, Grønfjorden, Longyearbyen, Sassendalen, Ny Ålesund, Magdalenefjorden, Prins Karls Forland, Diabashalvøya, Bockfjorden, Liefdefjorden, Roosneset, Reinsdyrflya, Smeerenburg). - Range: Holarctic (arctic-alpine).

(9. **ISOTOMURUS** Börner, 1903)

Isotomurus stuxbergi (Tullberg, 1876) was originally described from Novaya Zemlya (Tullberg 1876). The species is probably a senior synonym of *Isotomurus ciliatus* Stach, 1947 (Babenko & Bulavintsev, 1993).

10. **PSEUDISOTOMA** Handschin, 19241. **Pseudisotoma sensibilis** (Tullberg, 1876)*Isotoma sensibilis* Tullb.: Bristowe (1921)

Originally described from Novaya Zemlya by Tullberg (1876). Reported from Jan Mayen by Bristowe (1921). - Range: Holarctic.

(11. **VERTAGOPUS** Börner, 1906)

1. Dark blue with white Ant.3-4 contrasting the dark basal segments *brevicaudus*
 – Pale bluish grey with antennae of uniform colour *pseudocinereus*

Vertagopus brevicaudus (Carpenter, 1900) (Fig. 2H) was originally described from Franz Josef Land. Probably a high arctic species, also present in Cap Cheljuskin, Ellesmere Island and King Christian Island (Fjellberg 1986).

Vertagopus pseudocinereus Fjellberg, 1975 was originally described from Ny Ålesund where it lived under bark on imported logs. Probably a boreal species. Also present in North Norway, NE Siberia and North America. Natural populations in arctic tundra seems unlikely.

12. **ISOTOMA** Bourlet, 18391. Eyespots small and square, at most 4 ocelli (s.gen. *Parisotoma*)..... 1. *notabilis*

- Eyespots larger, elongate, with 6-8 ocelli.....2

2. Mucro with 3 teeth (s.gen. *Isotoma*).....3
 – Mucro with 4 teeth (s.gen. *Desoria*)4
 3. Abdominal macrochaetae ciliated/serrated mostly on one side only. Claws with 2 inner teeth
 2. *anglicana*
 – Abdominal macrochaetae ciliated all around. Claws without or with one small inner tooth
multisetis
 4. Manubrial spines free (Fig. 9C).....4. *neglecta*
 – Manubrial spines integrated in the manubrial thickening5
 5. Mucro with lateral seta (Fig. 9B).....6
 – Mucro without lateral seta8
 6. Maxillary palp trifurcate. Labral edge with sharp folds (Fig. 9A)7
 – Maxillary palp simple (Fig. 1H). Labral edge with roundish folds
 7. *ruseki*
 7. Macrochaetae on Abd.5 0.5-0.6 as long as tergite (profile). Ant.4 pin-seta simple.....
6. *olivacea*
 – Macrochaetae longer, 0.7-1.0 as long as Abd.5 tergite. Ant.4 pin-seta bifurcate (Fig. 9D).....
 5. *tshernovi*
 8. Labrum with sharp apical folds. Maxillary palp bifurcate (Fig. 1H)..... (*violacea*)
 – Labrum with roundish apical folds. Maxillary palp simple (Fig. 1H) (*propinqua*)

Isotoma violacea Tullberg, 1876 and *propinqua* Axelson, 1902 have been reported from Novaya Zemlya (Babenko & Bulavintsev 1993.).

1. *Isotoma notabilis* Schäffer, 1896

Grayish brown, 1.0 mm. The smallest of the arctic *Isotoma* species. The small, almost square eye-spot identifies the species in mixed samples.

In dry meadows, heaths, rocky habitats and bird cliffs. Avoids very wet sites. - Bjørnøya, Jan Mayen, Spitsbergen (Adventdalen, Colesdalen, Ny Ålesund). - Range: Cosmopolitan.

2. *Isotoma anglicana* Lubbock, 1862

Fig. 11

Isotoma viridis Bourlet, 1839: Most authors

Isotoma palustris (Gmel.): Tullberg (1876)

Colour variable, but arctic specimens usually reddish or violet brown. 3.0-4.0 mm. The big size, 3-toothed mucro and long, serrated macrochaetae identify this species. The species has usually been reported as *Isotoma viridis* Bourlet, but *viridis* - as defined by Fjellberg 1980 - is not seen from the arctic islands.

An eurytopic species common in both wet and dry habitats. - Bjørnøya, Jan Mayen, Nordaustlandet (Kinnvika), Spitsbergen (Hornsund, Adventdalen, Longyearbyen, Colesdalen, Isfjorden, Tempelfjorden, Gipsdalen, Claas Billen Bay, Ny Ålesund, Prins Karls Forland, Widjefjorden, Liefdefjorden). - Range: Holarctic.

3. *Isotoma multisetis* Carpenter & Phillips, 1922

Yellowish with dark bands along posterior edges of tergites. 2.5 mm.

Originally described from Bjørnøya (Carpenter & Phillips 1922, Summerhayes & Elton 1923). Also reported from Spitsbergen (Longyearbyen) by Valpas (1967). Specimens were collected under stones, in meadows and in a scua nest. - Range: Holarctic.

4. *Isotoma neglecta* Schäffer, 1900

Figs. 1D, 9C

? *Isotoma violacea* Tullberg, 1877: Thor (1930)

? *Isotoma fennica* (Reuter, 1895): Stach (1962)

Usually reddish or greenish brown, 1.8 mm. Mucro without lateral seta. Maxillary palp bifurcate. The free manubrial spines is a unique character.

Winter specimens have shorter apical tooth on mucro than summer specimens (cyclomorphosis).

Not common, but some records from wet meadows, moss along ponds, bird cliffs. - The species has been confused with others, but I have seen specimens from Bjørnøya, Kongsøya, Spitsbergen (Longyearbyen, Van Mijenfjorden, Ny Ålesund). - Range: Holarctic.

5. *Isotoma tshernovi* Martynova, 1974

Figs. 9D-F

? *Isotoma fennica* (Reuter, 1895): Stach (1962)

? *Isotoma olivacea* (Tullberg, 1871): Carpenter (1927), Valpas (1967)

Isotoma nanseni Fjellberg, 1978

Colour varying from light yellowish brown to dark olive green, 1.5 mm. Maxillary palp bifurcate (reported as bifurcate by Fjellberg (1980:103), which is incorrect (Babenko & Bulavintsev 1993). Specimens collected in ecdysis from Ellesmere Island proves that *nanseni* is the summer form of the cyclomorphic species *tshernovi* (winter form). Apart from shape of mucro (apical tooth shorter in winter), also the sensillary equipment is affected: In the winter form the tergal sensilla are only half as long as in the summer form, the PAO is reduced in size and shape of the subapical sensillum on Ant.4 changes from globule to rod (Figs. 9D-F).

Common in wet meadows, moss along ponds, snowfields, bird cliffs. Less abundant in dry sites. - Bjørnøya, Hopen, Kongsøya, Spitsbergen (Grønfjorden, Colesdalen, Adventdalen, Longyearbyen, Van Mijenfjorden, Ny Ålesund). - Range: Circumpolar.

6. *Isotoma olivacea* Tullberg, 1871

Figs. 9A,B

Very similar to *tshernovi*, but separated by the shorter abdominal macrochaetae and the simple pin-seta on Ant.4.

Common in damp habitats on the Norwegian mainland, but so far only from Bjørnøya in the arctic (O. Skifte leg. 1983). - Range: Palearctic (N.Europe).

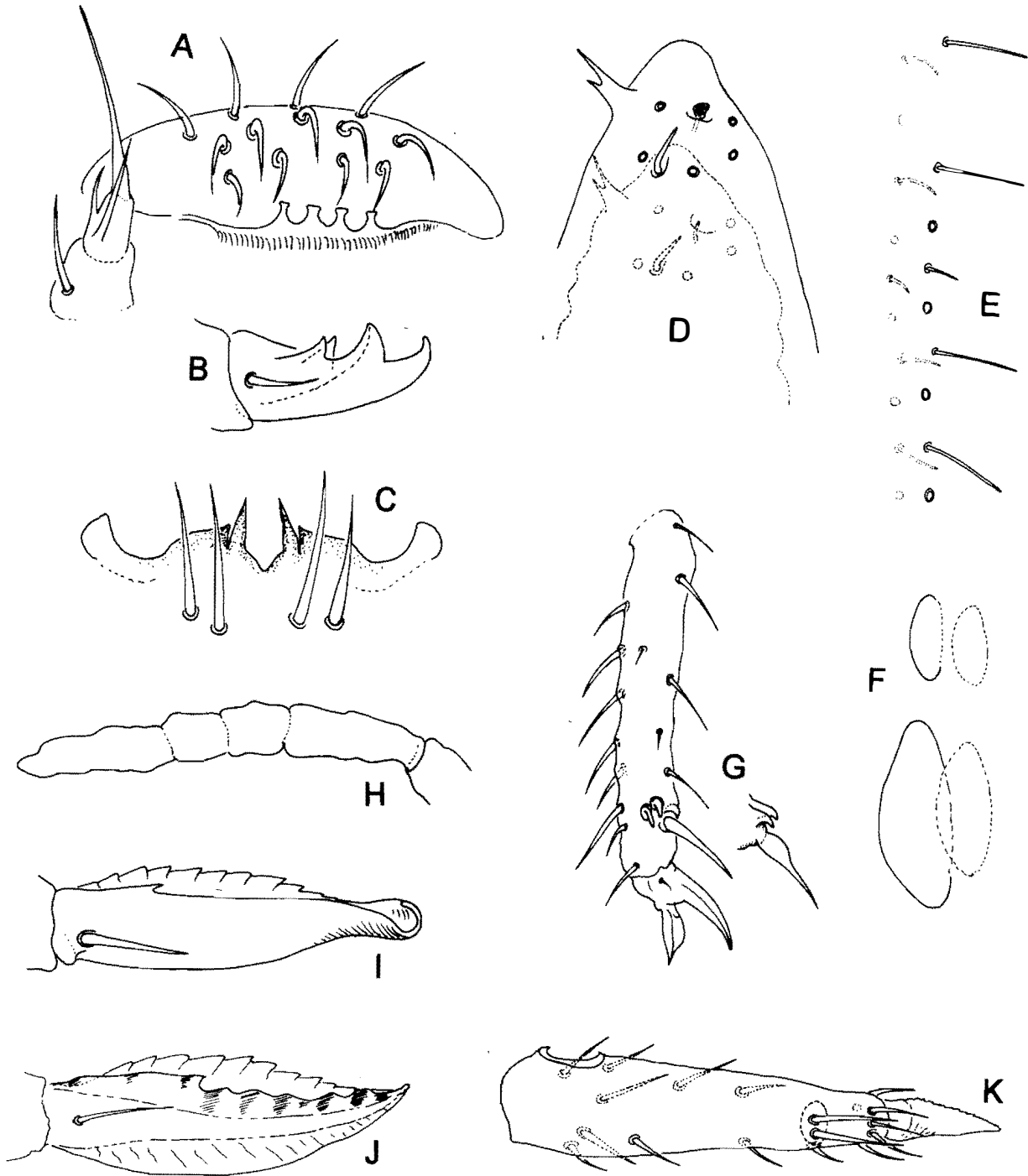


Fig.9: (A) Labrum and maxillary palp, *Isotoma olivacea*; (B) Mucro, *I. olivacea*; (C) Manubrial ventroapical thickening and setae, *I. neglecta*, (D-F) *Isotoma tshernovi* in transformation from summer form (*nansenii*) to winter form (*tshernovi*, stippled) showing apical part of Ant.4 (D), sensilla in p-row on Abd.3 (E), PAO and nearest ocellus (F); (G) Ti.3 and claw, *Sminthurides aquaticus*. Incerted: Apical organ of *S. malmgreni*; (H) Ant.4, *S. schoetti*; (I) Mucro, ditto; (J) Mucro, *S. malmgreni*; (K) Ventral side of dens (subapical setae encircled), *Sminthurinus concolor*.

7. *Isotoma ruseki* Fjellberg, 1979

Also very similar to the previous two species, but the simple maxillary palp (unique character) and different shape of labral edge is characteristic.

Only once from Bjørnøya (O. Skifte leg. 1983). - Range. Palaeartic (N.Europe).

ENTOMOBRYIDAE

- 1. Body with normal hair cover only2
- Body with transparent scales in addition to hair cover 3.*Lepidocyrtus*
- 2. Abd.4 at least 3 times as long as Abd.3 (Fig. 3G)..... 1.*Entombrya*
- Abd.4 subequal to Abd.3 (Fig. 3A) (2.*Corynothrix*)

1. ENTOMOBRYA Rondani, 1861

1. *Entombrya subarctica* Stach, 1962

Colour pale white, with dark pigment at antennal base, at base of legs, and laterally on Abd.4-5. 2.0 mm.

Stach (1962) described this species (a single female) from Hornsund at Spitsbergen. No further records are known.

(2. *CORYNOTHRIX* Tullberg, 1876)

Corynothrix borealis Tullberg, 1876 (Fig. 3A) is reported from Novaya Zemlya and Kola Peninsula (Babenko & Bulavintsev 1993).

3. LEPIDOCYRTUS Bourlet, 1839

1. *Lepidocyrtus lignorum* Fabricius, 1793

Figs. 3D, 4C

Lepidocyrtus lanuginosus (Gmelin, 1788): Most authors

White, with bluish pigment on antennae, head and at base of legs. 2.0 mm.

In dry meadows and bird cliffs. - Nordaustlandet, Spitsbergen (Hornsund, Grønfjorden, Longyearbyen, Adventdalen, Barentsburg, Colesdalen, Ny Ålesund). - Range: Holarctic.

TOMOCERIDAE

(TOMOCERUS Nicolet, 1841)

Tomocerus minutus Tullberg, 1876 (Fig. 3C) was originally described from Novaya Zemlya. Present in subarctic and alpine habitats in Norway, but so far not from the arctic islands.

NEELIDAE

MEGALOTHORAX Willem, 1900

1. *Megalothorax minimus* Willem, 1900

Fig. 3B

Neelus (Megalothorax) minimus Will.: Gisin (1953)

White, 0.4 mm. The body shape, short antennae and small size readily identify this species.

A few records from meadows and moss/lichens in rocky habitats. - Jan Mayen, Spitsbergen (Ny Ålesund). - Range: Cosmopolitan.

ARRHOPALITIDAE

ARRHOPALITES Börner, 1906

1. *Arrhopalites principalis* Stach, 1945

Arrhopalites binoculatus (Börner, 1901): Thor (1930)

Pale brownish red or almost white, 1.0 mm.

Few records only. Jan Mayen, Spitsbergen (Ny Ålesund, in *Dryas* and *Cassiope* on calcareous rocks). - Range: Palearctic (arctic-alpine).

SMINTHURIDIDAE

1. Inner side of Tib.3 with apical organ (Fig. 9G)..... 2.*Sminthurides*
 – Inner side of Tib.3 without apical organ 1.*Sphaeridia*

1. **SPHAERIDIA** Linnaniemi, 19121. **Sphaeridia pumilis** (Krausbauer, 1898)

Pale grayish brown, 0.5 mm.

Only one record from moss and *Salix polaris* at Kolhamna in Ny Ålesund (Spitsbergen) (A.Fjellberg leg. 1973).

- Range: Cosmopolitan.

2. **SMINTHURIDES** Börner, 1900

1. Ant.4 in females simple. 2
 - Ant.4 in females with 4 subsegments (Fig. 9H). Mucro as Fig. 9I.....
 (*schoetti*)
 2. Mucro slender, less than half as wide as long (Fig. 9J). Long seta in apical organ of Tib.3
 with broad lamella at base (Fig. 9G, inserted). Smaller species (0.6 mm) 1. *malmgreni*
 - Mucro broad, about half as wide as long. Long seta in Tib.3 organ with narrow base (Fig.
 9G). Larger species (1.0 mm) 2. *aquaticus*

Sminthurides schoetti (Axelson, 1903) is reported from Novaya Zemlya (Babenko & Bulavintsev 1993.).

1. **Sminthurides malmgreni** (Tullberg, 1876)

Figs. 3E, 4H, 9G,J

Sminthurus malmgreni Tullb.: Schött (1893), Schäffer (1895, 1900), Stscherbakow (1899), Wahlgren (1900b)

Ground colour pale yellow with blue or violet dorsal and lateral bands on the fused abdomen, sometime covering most of the dorsal side. 0.6 mm.

Common in very damp habitats (wet meadows, ponds, along snowfields, sea shores and lagoons). - Bjørnøya, Jan Mayen, Kongsøya, Edgeøya, Nordaustlandet, Spitsbergen (Hornsund, Isfjorden, Longyearbyen, Ny Ålesund). - Range: Cosmopolitan.

2. **Sminthurides aquaticus** (Bourlet, 1843)

Fig. 9G

Reported from Jan Mayen by Bristowe (1924). - Range: Holarctic.

KATIANNIDAE

SMINTHURINUS Börner, 1901

1. Dens with a pair of subapical setae on ventral side (Fig.)..... 1. *concolor*
 - Dens without subapical setae pair (Fig.)..... (*alpinus*)

Sminthurinus alpinus Gisin, 1953 is reported from Novaya Zemlya (Babenko & Bulavintsev 1993).

1. **Sminthurinus concolor** (Meinert, 1896)

Figs. 3F, 4I, 9K

Sminthurinus niger (Lubbock, 1867): Thor (1930), Wahlgren (1900b)

Most of head and body uniformly black. 0.8 mm.

Under stones and in vegetation in rocky, dry sites. Also in bird cliffs. - Jan Mayen, Bjørnøya, Kongsøya, Spitsbergen (Hornsund, Longyearbyen, Ny Ålesund, Widjefjorden). - Range: Palearctic (N.Europe).

SMINTHURIDAE

(**Sminthurus** Latreille, 1804)

Sminthurus viridis (Linné, 1758) was reported from Novaya Zemlya by Tullberg (1876).

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Species originally described from the Norwegian arctic islands

Original name	Author	Type locality	Status
<i>Podura hyperborea</i>	Boheman, 1865	Spitsbergen	<i>Hypogastrura</i> or <i>Ceratophysella</i> , unclear species
<i>Lipura arctica</i>	Tullberg, 1876	Spitsbergen, Novaya Zemlya	<i>Protaphorura arctica</i> (Tullberg, 1876)
<i>Lipura groenlandica</i>	Tullberg, 1876	Spitsbergen, Greenland	<i>Oligaphorura groenlandica</i> (Tullberg, 1876)
<i>Sminthurus malmgreni</i>	Tullberg, 1876	Spitsbergen, Novaya zemlya	<i>Sminthurides malmgreni</i> (Tullberg, 1876)
<i>Isotoma arctica</i>	Stscherbakow, 1899	Spitsbergen	Synonym of either <i>Archisotoma besselsi</i> (Packard, 1877) or <i>A. polaris</i> Fjellberg & Poinsot, 1975
<i>Isotoma binoculata</i>	Wahlgren, 1899	Giles Land ("Hvita öen")	Possible senior synonym of <i>Folsomia regularis</i> Hammer, 1953
<i>Isotoma janmayensis</i>	Wahlgren, 1900a	Jan Mayen	Junior synonym of <i>Archisotoma besselsi</i> (Packard, 1877)
<i>Tullbergia arctica</i>	Wahlgren, 1900a	Jan Mayen	Unchanged
<i>Isotoma multisetis</i>	Carpenter & Phillips, 1922	Bjørnøya	Unchanged, revision necessary
<i>Folsomia bisetosa</i>	Gisin, 1953	Jan Mayen	Unchanged
<i>Onychiurus macfadyeni</i>	Gisin, 1953	Jan Mayen	<i>Protaphorura macfadyeni</i> (Gisin, 1953)
<i>Friesea nauroisi</i>	Cassagnau, 1958	Spitsbergen	Junior synonym of <i>Friesea quinquespinosa</i> Wahlgren, 1900a
<i>Hypogastrura spitsbergensis</i>	Stach, 1962	Spitsbergen	Junior synonym of <i>Hypogastrura tullbergi</i> (Schäffer, 1900)
<i>Isotomina gracilis</i>	Stach, 1962	Spitsbergen	Not available senior synonym of <i>Folsomia alpha</i> Grow & Christiansen, 1976
<i>Entomobrya subarctica</i>	Stach, 1962	Spitsbergen	Unchanged, revision necessary
<i>Hypogastrura hirsuta</i>	Valpas, 1967	Spitsbergen	Junior synonym of <i>Ceratophysella longispina</i> (Tullberg, 1876)
<i>Onychiurus ursi</i>	Fjellberg, 1984	Hopen	<i>Oligaphorura ursi</i> (Fjellberg, 1984)

Dubious records.

Cryptopygus thermophilus (Axelson, 1900). Reported by Thor (1930) as *Isotomina thermophila* (Axels.) from moss at Longyearbyen (Spitsbergen). Should be verified by new records.

Isotoma grisesiens Schaffer. Bristowe (1921) reports this species from Jan Mayen. It is probably a misprint for *Isotoma griseus* Schaffer, 1896 which is a junior synonym of *Isotoma tigrina* (Nicolet, 1841). There are no arctic records of this species so far.

Proisotoma schoetti (Dalla Torre, 1895). Reported from Spitsbergen by Schött (1893) as *Isotoma litoralis* n.sp. Should be verified by new records.

Willowsia buski (Lubbock, 1869). Reported as *Sira flava* Ågren, 1904 by Thor (1930) from Adventdalen. This thermophilic species may have been introduced. It is often present in houses.

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APPENDIX

Simplified keys to Collembola species present in the Norwegian Arctic Islands

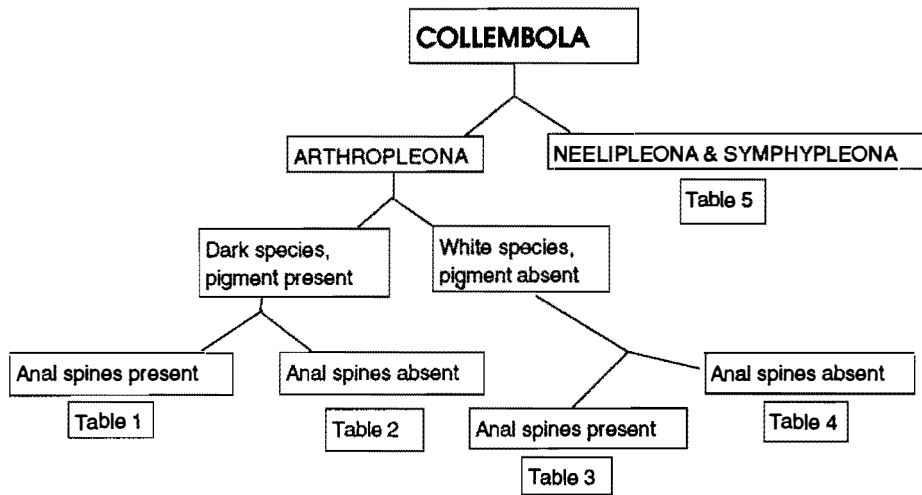


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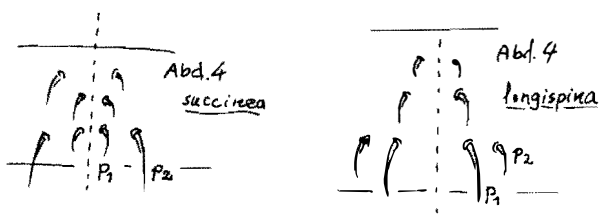
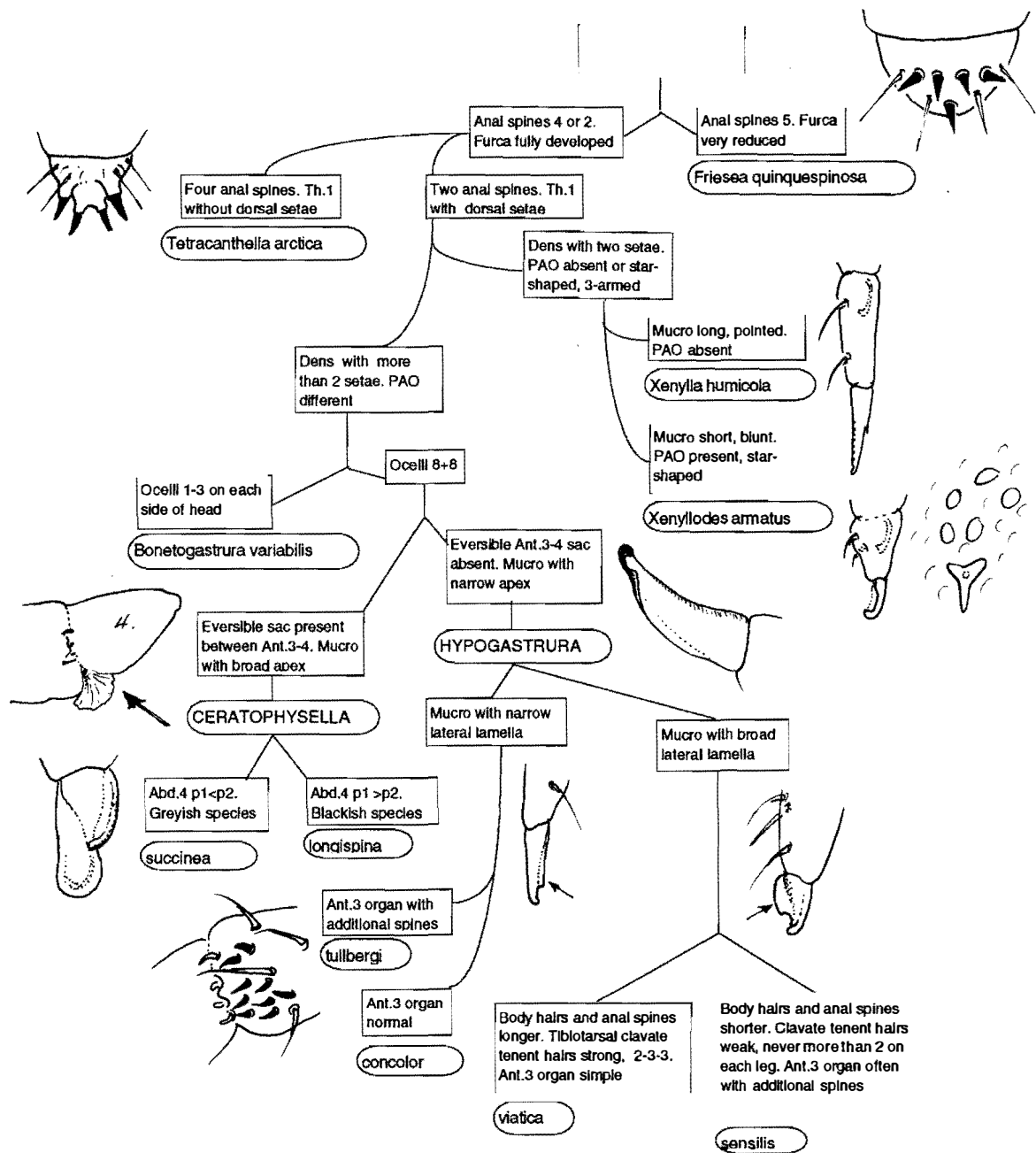


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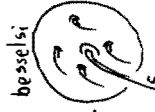
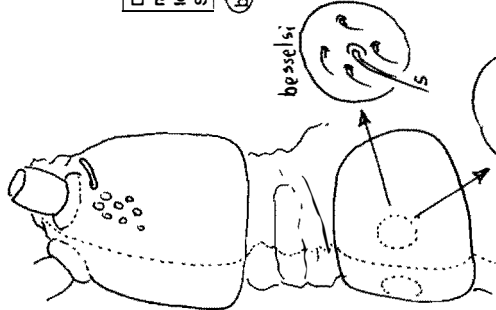
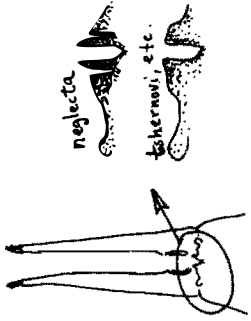
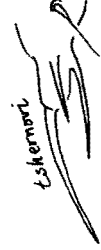
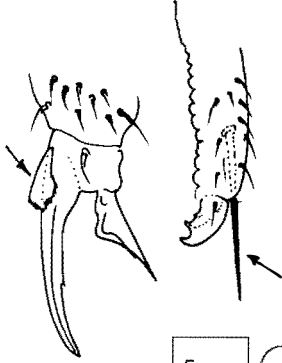
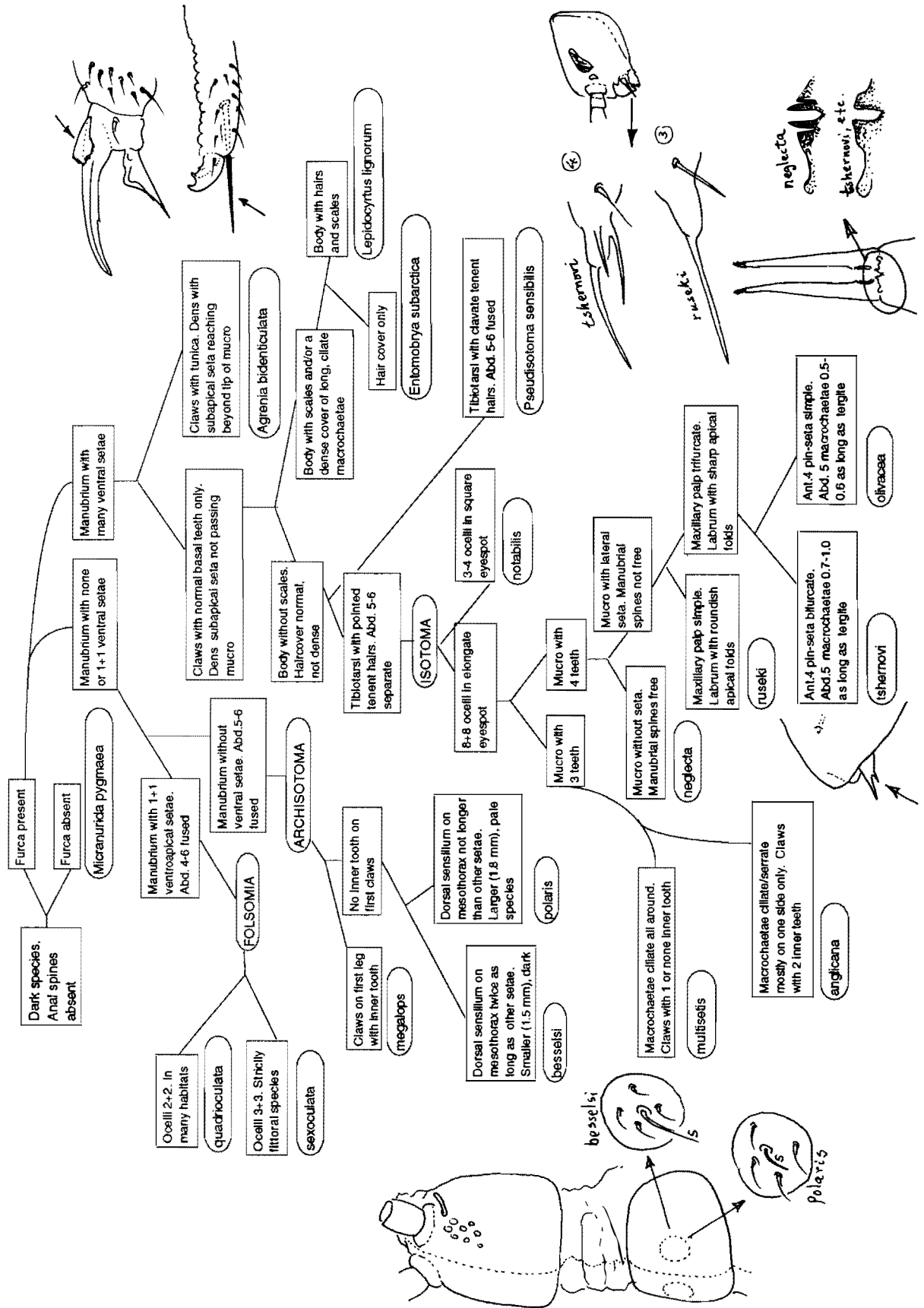


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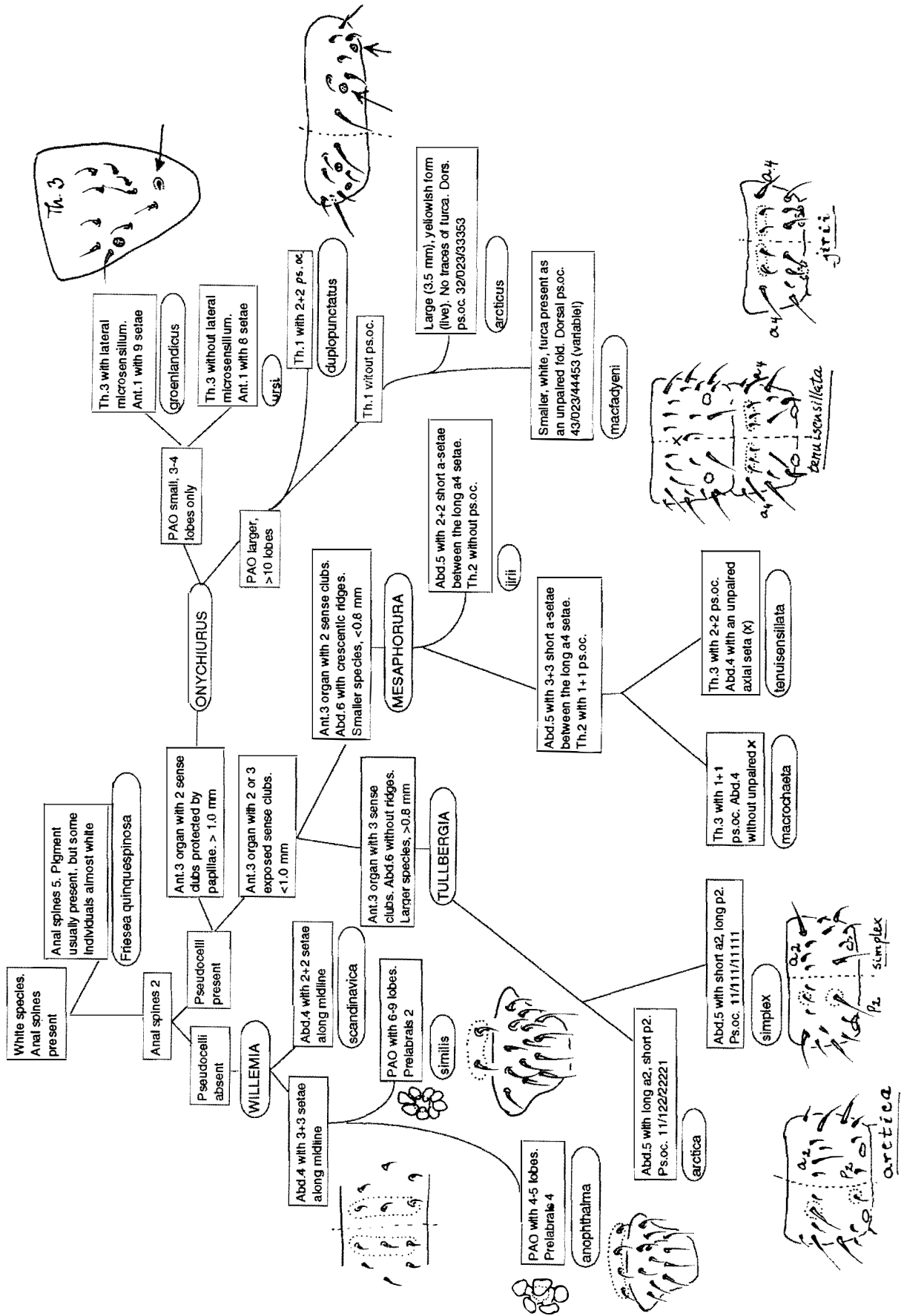


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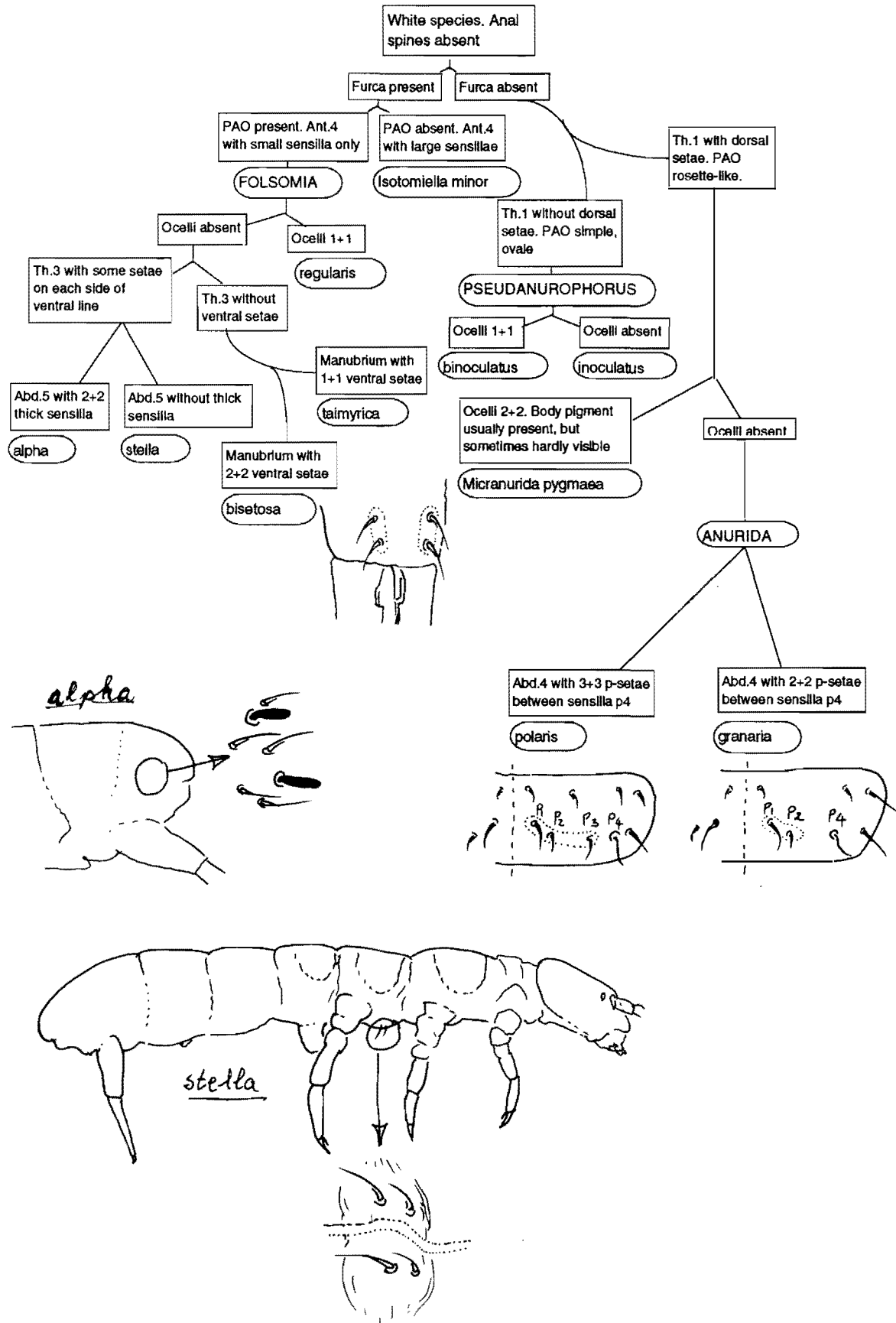


Table 5

