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On the fauna of *Collembola* from Spitsbergen

O faunie skoczogonków *(Collembola)* Spitsbergenu

Фауна *Collembola* Шпицбергена

In 1957 an Expedition to Spitsbergen was organized in Poland under the scheme of the Third International Geophysical Year and various geomorphological studies were undertaken on this archipelago. Among other scientists, Dr B. FERENS, an ornithologist, and Dr A. ŚRODOŃ, a botanist, took part in the Expedition. During their specialistic studies and explorations they found a large number of *Hypogastrura viatica* (TULLB.), the cosmopolitan species of the *Collembola*, among decaying seaweeds on the seashore. In the third year of the studies in Spitsbergen, in 1960, another member of the Polish Expedition, a geologist, Dr S. CZARNIECKI was so kind as to collect a material of *Collembola* for me apart from his regular, specialistic studies on the archipelago. Most material was collected by him at a distance from the main camp of the Expedition, on the bank of Hornsund Fjord, in the western part of Spitsbergen (about 77° N) in August and at the beginning of September. Although Dr CZARNIECKI had no suitable equipment to catch the *Collembola*, his collection is abundant and contains about half the number of the species known from Spitsbergen so far. Spitsbergen has been already well explored faunistically, nevertheless among the specimens collected by Dr CZARNIECKI there are three species new to science and four new to the fauna of this archipelago. Besides, this collection has enabled us to add some details to our knowledge of the *Collembola* of Spitsbergen.

I beg both biologists and first of all Dr S. CZARNIECKI to accept my best thanks for having collected the material of *Collembola* for my study.

The Apterygotan fauna of Spitsbergen is not rich in species and contains only the representatives of the order *Collembola*.

The first specimen of this group was found in Spitsbergen at Hornsund a hundred years ago and described by BOHEMAN (1866) as *Podura hyperborea* BOH. The diagnosis of the animal: „Oblonga, nigro-plumbea, opaca, antennis pedibusque brevibus; abdomine apice inermis. Long. 1 mm" is so insufficient that it is impossible to identify this species.

In 1876 TULLBERG recorded 6 species from Spitsbergen, four of which were new to science:

Lipura arctica TULLB.,
Lipura groenlandica TULLB.,
Achorutes viaticus TULLB.,
Xenylla humicola O. FABR.,
Isotoma palustris (GMELIN),
Sminthurus Malmgrenii TULLB.

In 1895 this number was augmented by SCHÄFFER who added two species described previously from Siberia by TULLBERG: *Achorutes longispinus* TULLB. and *Isotoma bidenticulata* TULLB. and in 1898 LUBBOCK recorded two others: *Isotoma spitsbergensis* LUBB. and *Isotoma quadrioculata* TULLB.

Almost at the same time, in 1899—1900, three authors, WAHLGREN, STSCHERBAKOV and SKORIKOV, examined new material gathered by various arctic expeditions in Spitsbergen and recorded three species new to Spitsbergen: *Anurida granaria* (NIC.), *Achorutes dubius* TULLB. and *Isotoma violacea* TULLB. In 1900 SCHÄFFER enumerated all the species, 17 in number, known from Spitsbergen at that time. In his list, however, he placed also the problematic *Achorutes hyperboreus* (BOH.), but did not mention the three foregoing species.

A pause, over twenty years long, followed these studies on the Collembolan fauna of Spitsbergen. The studies were re-started by CARPENTER & PHILLIPS (1922), SUMMERHAYES (1923), ZSCHOKKE (1926), CARPENTER (1927), SIG THOR (1930), LINNANIEMI (1935) and BROWN (1936).

The most important results are those of CARPENTER'S study and, above all, those obtained by SIG THOR on the whole of the Invertebrata of this archipelago.

Out of the 26 species recorded by THOR from Spitsbergen 5 were new to this archipelago: *Xenyllodes armatus* AXELS., *Willemia anophtalma* AXELS., *Isotoma olivacea* (TULLB.), *Isotomina thermophila* (AXELS.) and *Sira flava* ÅGR. Collection was carried out by means of a Berlese apparatus in the environs of Green Harbour Bay, Eis Fjord, Advent Bay and the settlement of Barentsburg, the area partly inhabited by man at that time. Owing to this fact the material obtained was more abundant than that of other authors.

As the material collected by Dr CZARNIECKI comprised 3 species new to science: *Hypogastrura spitsbergensis*, *Isotomina gracilis*, *Entomobrya subarctica* and 4 hitherto unknown from Spitsbergen: *Hypogastrura armata* (NIC.), *Folsomia regularis* HAMM., *Isotoma fennica* REUT. and *Sminthurinus concolor* (MEINT.), the number of the elements of the Collembolan fauna of this archipelago known at present amounts to 36.

List of Species So Far Known from Spitsbergen

Hypogastrura viatica (TULLB.)
Hypogastrura tullbergi (SCHÄFF.)
Hypogastrura spitsbergensis sp. n.
Hypogastrura longispina (TULLB.), questionable species
Hypogastrura (Ceratophysella) armata (NIC.)
Xenylla humicola (O. FABR.)
Willemia anophtalma BÖRN.
Anurida granaria (NIC.)
Xenyllodes armatus AXELS.
Onychiurus armatus (TULLB.), questionable in Spitsbergen
Onychiurus arcticus (TULLB.)
Onychiurus groenlandicus (TULLB.)
Tetracanthella arctica CASSAGNAU 1959 (*T. pilosa* WAHLGR.)
Folsomia fimetaria (L.)
Folsomia regularis HAMMER
Folsomia diplophtalma (AXELS.)
Folsomia quadrioculata (TULLB.)
Folsomia sexoculata (TULLB.)
Folsomia binoculata (WAHLG.), questionable species
Proisotoma schoetti (D. T.)
Archisotoma besselsi (PACK.)
Agrenia bidenticulata (TULLB.)
Isotomina gracilis sp. n.
Isotomina thermophila (AXELS.)
Isotoma fennica REUT.
Isotoma olivacea TULLB.
Isotoma violacea (TULLB.)
Isotoma viridis BOURL.
Entomobrya subarctica sp. n.
Sira flava ÅGR.
Lepidocyrtus lanuginosus (GMELIN)
Sminthurides malmgreni (TULLB.)
Arrhopalites binoculatus (BÖRN.) [*A. pygmaeus* (WANKEL)]
Sminthurinus aureus (LUBB.)
Sminthurinus niger (LUBB.)
Sminthurinus concolor (MEINERT)

The Apterygotan fauna of Spitsbergen may be considered to be poor in comparison with that of neighbouring Scandinavia and the more so in comparison with that of Europe. Up to the latest investigations all the species of

this fauna were also known from north Europe and Siberia except for *Folsomia binoculata* (WAHLGREN), the questionable species caught on Giles Island near Spitsbergen, and *Isotoma multisetis* CARP., which, however, was reported only from Bear Island. Such a close relationship between the Apterygotan fauna of Spitsbergen and that of arctic Eurasia is natural, if we take into consideration that this archipelago was very probably part of the European continent not very long ago.

In the Pleistocene this fauna, at any rate its greater part, was destroyed by the glaciers which then covered the Spitsbergen archipelago thoroughly. The origin of the new Collembolan fauna has been brought about by migration from north Eurasia, and at present some further elements have also come transported by man.

It is interesting that in the material examined by me there were present two species, *Folsomia regularis* HAMM. and *Sminthurinus concolor* (MEIN.), so far known only from arctic America, from where their transfer by man to Spitsbergen is rather doubtful. There were also three forms new to science: *Hypogastrura spitsbergensis*, *Isotomina gracilis* and *Entomobrya subarctica*.

Hypogastrura viatica (TULLBERG 1872)

The individuals of this species caught in large numbers on seaweeds in Spitsbergen do not differ in their characteristics from those found in other localities in Europe.

On all tergites, they have, besides fine short setae, some stout, stiff, indistinctly serrated bristles as long as ventral lamella of the claw; no eversible sack between third and fourth joints of antenna; a thick, simple, sensory papilla subapically on Ant. IV; postantennal organ with four vesicles arranged crosswise, smaller than one eye; claw with small inner tooth and minute lateral teeth; empodial appendage about half as long as the claw, with broad inner lamella; clavate tibiotarsal hairs, longer than the claw, arranged at the same distance from claw basis, 2 on foreleg, 3 on second and third pair of legs; tenaculum with 3 + 3 barbs and no seta; dens a little shorter than manubrium, with 6 setae; mucro about three times shorter than dens, with strongly incurved ventral margin and remarkably broad lamella emarginated before the apex; anal spines, measured together with papillae, half as long as ventral side of the claw; colour blackblue; length about 2 mm.

Hypogastrura viatica (TULLB.) is a littoral species occurring commonly on shores of all seas as a cosmopolitan animal. It is widely distributed circumpolarly in the whole Holarctic and recorded from Spitsbergen by many authors.

It was found in abundance on the sea-shore among decaying seaweeds, or near the camp of the Expedition under stones, planks and tar-paper lying on the ground, in smaller numbers at Rewwatnet on the lake bank and at Hyrneodden under stones.

Hypogastrura spitsbergensis sp. n.

Pl. II fig. 1—5

Body sparely clothed with setae arranged on anterior abdominal segments in two pretty regular transversal rows, each composed of 8—12 setae. The setae are straight, pointed, smooth, on all tergites moderately long, about $^1/_3$ as long as the ventral side of the claw and on the last segment a little longer than on the preceding ones. Skin granules fine, uniformly densely disposed and equally large.

Antennae equally thick, a little shorter than head diameter; the ratio of these lengths is on avarage 11 : 14; relative lengths of joints I : II : III : IV are as 2 : 2 : 2.8 : 3.8. The basal joint is furnished only dorsally and the second joint all round with a row of setae; these are on the three proximal joints moderately long and on the last joint distinctly longer, straight, outstanding and fine. No eversible sack between third and fourth antennal joint. Sense organ of third antennal segment consists of two small sensory rods surrounded by 8—9 stout, short, spine-like sensillae. Fourth antennal joint with a simple retractile sensory papilla at the tip, protected by a group of straight, fine short setulae. Typical, stout, curved olfactory hairs are wanting.

Postantennal organ as long as one eye, composed of four small, almost equally large vesicles arranged crosswise; accessory boss difficult to perceive. Eight eyes on either side of the head, almost equally large on commonly dark-pigmented patch.

Claw with one small inner tooth placed in about half length of inner lamella. Empodial appendage, $^2/_3$ of length of inner lamella of the claw, furnished with broad, rounded inner lamella and with a fine, short apical needle at the tip. Clavate tibiotarsal hairs present, arranged near the claw basis in the same transversal line and an accessory one at a distance beyond them. The median hair is a little longer and more distinctly clavate at tip. All these clavate hairs are longer than the inner side of the claw, the ratio being 5 : 3. Two hairs are arranged near the basis of the claw on the first pair of legs and 3 on the second and third pairs.

Tenaculum with 3 barbs on each ramus and no seta on corpus. Furcula a little longer than half length of antennae. Manubrium with some setae dorsally. Dens tapering gradually towards the end, covered with fine granules similar to those on body. It is furnished with 6 setae, the basal one of which is the longest and outstanding. Mucro, about 4 times shorter than dens and twice shorter than claw, has the ventral edge of the shaft straight and slightly globularly thickened at the tip; median portion of the shaft is a little callous dorsally and a narrow, bow-like, curved lamella runs on both its sides. The ratio of the lengths of manubrium : dens : mucro is 3 : 3 : 0.7.

Anal spines relatively strong and curved but short, measured together with papillae, are as long as empodial appendage.

Colour of body uniformly black-violet. Length : 1.3 mm.

The new species comes near to *Hypogastrura sensilis* FOLSOM 1919, found in arctic Canada (Northwest Territories), by having many sensilles in the neighbourhood of the sensory rods in the sense organ of the third antennal joint, but differs from it in the shape of the postantennal organ and mucro as well as in the number and shortness of tibiotarsal hairs.

Caught near the camp of the expedition under old planks on 4 August 1960. 9 specimens.

Hypogastrura (Ceratophysella) armata (NICOLET 1841)

The only individual in the material from Spitsbergen differs a little from the specimens occuring in other localities of Europe. Its characteristics are as follows:

Skin granules uniformly dispersed on all body segments and equally fine; antennae shorter than head diameter at a ratio of 2 : 3; sense organ of third antennal joint with two small curved sensory rods guarded, only on the outer side, by a moderately plump and long sensory hair; eversible sack between third and fourth antennal joint not visible, very probably absent; Ant. IV with 5 pretty long curved olfactory hairs and with some short, hook-like, curved sensory setulae on ventral side; postantennal organ only 1.5 times longer than one eye and anterior vesicles not much elongated; claw armed with a small inner tooth, ventral lamella of claw longer than mucro, at a ratio of 3.4 : 2; empodial appendage shorter than half length of the claw, with broad rounded lamella and sharply pointed apical needle; tibiotarsal hair not clavate at tip, a little shorter than ventral side of the claw; dentes thick, furnished with 7 setae, of which two terminal ones on inner edge of the dens are thicker than the others and curved; mucro twice shorter than dens, canoe-like, with a large, almost triangular lobe on outer lamella; tenaculum with 4 + 4 barbs on rami and no seta on corpus; tubus ventralis with 3 + 3 setae. Colour: black-violet. Length: 1.8 mm.

The above-described individual differs from the typical form of *Ceratophysella armata* (NIC.) in the absence of the eversible sack and in having a little smaller postantennal organ and only 3 + 3 setae on tubus ventralis.

The specimen, being single, does not permit us to consider it a separate form occurring in Spitsbergen. The typical form of *Ceratophysella armata* (NIC.) has not been recorded from this archipelago so far.

Found on the sea-shore at Hyrneodden on 28 August 1960.

Xenylla humicola (O. FABRICIUS 1780) TULLBERG 1876

The individuals examined were of dark violet colour and about 1.8 mm. long. All their legs had two long, clavate tibiotarsal hairs; claw with small inner tooth; dens with two setae; mucro distinctly separated from dens, long,

straight, with a minute, tooth-like incision on ventral side and a long, narrow inner lamella not reaching up to mucro tip dorsally; anal spines small, sharply pointed, situated on papillae not touching each other basally.

Xenylla humicola (O. FABR.) is widely distributed in the Holarctic and registered by many authors from arctic territories of Eurasia and America. It has been also reported from Spitsbergen by several authors.

Found in the immediate neighbourhood of the sea-shore under seaweeds, usually in abundance and accompanied by *Hypogastrura viatica* (TULLB.). Some specimens were also collected near the camp of the Expedition, under stones and wood, in August and September.

Onychiurus arcticus (TULLBERG 1876)

Syn.: *Onychiurus armatus* var. *arctica* (TULLB.) — Ågren 1904

Pl. I fig. 1—7, Pl. II fig. 6—8

One of the commonest species of the *Collembolan* fauna of Spitsbergen, recorded by many scientists from this archipelago.

The taxonomical position of *Onychiurus arcticus* (TULLB.) was not established for a long time, and it was confused with *Onychiurus armatus* (TULLB.) or considered to be a variety of this species. It was only DENIS (1924) that ascertained that *Onychiurus arcticus* (TULLB.) differs from *Onychiurus armatus* (TULLB.) by having lateral teeth on the claw, but no trace of rudimentary furcula. Then GISIN (1953) enumerated other differences.

I have minutely examined many individuals of this species and found that its essential characteristics present in all forms are: long filament of empodial appendage, lateral teeth on the claw and lack of any trace of furcal fold. The other body characteristics, however, vary frequently.

The shape of its body is very similar to that of *Onychiurus armatus* (TULLB.). Most adult individuals are 3.8—4 mm. long. Granulation of the skin is uniform and fine. The setae are moderately long; the longest bristles are disposed laterally, some also dorsally on the tergites. The arrangement of the setae, especially that of the shorter ones varies remarkably on Thor. I, and a little in the vicinity of pseudocelli on Abd. V and Abd. VI.

Antennae cylindrical a little shorter than head diameter, at a ratio of 5.3 : 6. The ratio of the lengths of antennal joints averages 3 : 5 : 4.5 : 9. Sense organ of third antennal joint generally composed of 5 pretty high, conical, finely granulated papillae guarded by 5 strong setae; two narrow, short sensory rods and two globular, more or less coarsely granulated, straight sensory clubs are located beyond the papillae. Fourth antennal joint without typical olfactory hairs but with small subapical pit.

Postantennal organ composed mostly of 25—35 simple vesicles arranged with their longer axis vertically to long axis of organ. Vesicles are narrowly elliptical, not touching each other laterally.

Claw generally long and armed with a pair of distinct, lateral teeth only. A weak inner tooth rarely appears in middle of inner lamella length or a little higher, and even then often on one leg only. Empodial appendage without inner lamella, but slightly thickened basally, with a long filament apically, projecting generally beyond tip of claw. Dorsal, tibiotarsal hair somewhat longer than ventral side of claw.

The arrangement of pseudocelli on the body is as follows:

Head dorsally with 3 pseudocelli on each antennal basis and 3 on posterior margin; ventrally 1 pseudocellus on either side in half length of head and one more sublaterally. Abnormally, only 2 pseudocelli occur on the posterior margin of the head and no sublateral pseudocellus at all.

Tergite of Thor. I without pseudocelli, sometimes with small circular area covered with fine granuli. Such areas appear also on the tergites of other segments.

Thor. II with 1 submedian and 1 lateral pseudocellus on either side, located in fact beyond the part of tergite covered with larger granuli.

Thor. III generally with 3 pseudocelli bilaterally (submedian, dorsolateral and lateral) of which the dorsolateral one is abnormally wanting.

Abd. I—III, each with 3 pseudocelli on either side; the submedian one lies higher on the tergite and the dorsolateral and lateral ones nearer posterior margin.

Abd. IV with 4 pseudocelli on either side, of which 2 lie near each other dorsolaterally, the third a distance from them laterally near the posterior margin and the fourth also laterally in about middle of tergite.

Abd. V generally with 3 pseudocelli on either side lying close to each other in straight or a little oblique line on the space between two long bristles. Abnormally, some specimens occur with 4 or even 5 pseudocelli arranged in a regular or irregular transversal row.

Precoxal parts of legs with 1 pseudocellus each.

On pro- meso- meta-notum no pseudocelli found. The pseudocelli generally appear on the segments ventrally only on Abd. II and III.

The formula of the arrangement of pseudocelli in the individuals of *Onychiurus arcticus* (TULLB.) from Spitsbergen is more similar to that given by GISIN for the specimens examined by him from Jan Mayen Island than to the formula made up by DENIS for the animals from Greenland. It is:

3,3 |0,2,3| 3,3,3,4,3 and ventrally:

2 |0,0,0| 0,1,1,0,0.

No trace of rudimentary furcula present.

Ventral organ in male absent. Genital area of male covered with many short setae. In its neighbourhood 3 stout, longer setae inserted one at front and a pair laterally, as well as some shorter, fine ones.

Anal spines strong, conical, only slightly curved, inserted in low papillae, not touching each other basally. Spines, measured together with papillae, a little longer than half length of inner side of claw.

Found in 21 localities in Spitsbergen, mostly under planks and pieces of wood or under stones, in very large quantities, in August and September 1960.

Folsomia sexoculata (TULLBERG 1871)

Juvenile 1 mm. long with 3 + 3 eyes; 2 anterior eyes very close to each other, near postantennal organ; coloured uniformly grey.

Only one specimen of this species was found in Spitsbergen by CARPENTER & PHILLIPS and only one distinguished by me in the material collected by Dr CZARNIECKI. SIG THOR reported it to be frequent at Barentsburg and Hiortham.

Taken at Treskellen, near a stream, under an old plank on 20 August 1960; 1 specimen.

Folsomia quadrioculata (TULLBERG 1871)

The length of adult individuals, without antennae and furcula, was 1.3—1.6 mm. Black pigment chiefly well developed, scattered over body in irregular circular spots. Body sparsely clothed with relatively long setae, arranged on Abd. I—III in 4 irregular transversal rows. Besides, 6 long, outstanding bristles present on each abdominal tergite, on last segment longer than dentes and 4—4.5 times as long as mucro.

Postantennal organ, slightly bent, somewhat longer than inner side of claw. Of the 2 + 2 eyes the anterior one is larger than the posterior. Claw without inner and lateral teeth; furcula always shorter than antennae, manubrium a little longer than dentes; on manubrium single pair of strong, long setae on ventral side near base of dentes. In one specimen an accessory seta was present higher, but only on one side. Dens mostly with 8 setae situated ventrally. Crenulations restricted only to middle part of dentes.

The geographical distribution of *Folsomia quadrioculata* (TULLB.) is very extensive. It occurs circumpolarly probably in the whole Holarctic and has been recorded from Spitsbergen, Bear Island, King Carl's Island, White Island, Novaja Semlja, West and East Greenland and Iceland.

Found under old planks, stones and old bones of a bear near the camp of the Expedition and at Treskellen, 4—18 August 1960.

Folsomia diplophtalma (AXELSON 1902)

Pl. III fig. 5

Characterized by 1 + 1 eys; no sensory hairs on ankylosed abdominal segments; postantennal organ narrowly elliptical subdivided into halves, longer than width of first antennal joint and twice as long as ventral side of claw;

claw untoothed; manubrium with only 1 pair of strong setae arranged ventrally; dentes distinctly shorter than manubrium, with only few crenulations in middle of its length; mucro straight, bidentate, about 3.5 times shorter than dens; straight bristles on last abdominal segment 4—5 times longer than mucro; length: up to 1.3 mm.

It is also widely distributed circumpolarly in the Holarctic, in Europe found mostly in the mountains. From Spitsbergen reported by THOR as frequent at Hiortham and Barentsburg. In my material rare.

Folsomia regularis M. HAMMER 1953

Pl. III fig. 1—4

The specimens determined by me as *Folsomia regularis* M. HAMMER agree in essential characteristics with the diagnosis of this species given by M. HAMMER save that the individuals from Spitsbergen have no sensory hairs on tergites of ankylosed abdominal segments, and somewhat larger numbers of setae often occur on the ventral side of the manubrium.

The length of adults, taken without antennae and furcula, is 1.5—1.65 mm. Blue-black pigment scattered over body in irregular spots. Setae on Abd. I arranged in 3 and on Abds. II—III in 4 irregular, transverse rows. Among them 6 outstanding bristles occur on each abdominal tergite and they become gradually longer on subsequent segments and are about 4 times longer than the mucro on the last segment. On the ankylosed abdominal segments there are no sensory hairs.

Antennae are as long as the diameter of the head, but sometimes a little shorter or longer. The ratio of the lengths of antennal joints is 1.5 : 3 : 3 : 6. Ant. I has a ring of about 10 setae and a pair of minute setulae at base.

Postantennal organ narrowly elliptical, slightly bent, as long as width of first antennal segment, or somewhat shorter. Black-pigmented eye on either side of head about 4 times shorter than postantennal organ. Claw moderately long, untoothed.

Tenaculum with 4 barbs on each ramus and 1 seta on corpus. Furcula shorter than antennae; manubrium always a little longer than dentes. The manubrium : dens : mucro ratio is on average 5.6 : 4.7 : 1.2. Manubrium chiefly with 3+3 or 4+4 setae arranged successively in two longitudinal rows ventrally. These rows are, however, mostly irregular and of various number of setae (3+3, 3+4, 3+5, 4+4, 4+5). The seta situated near the base of each dens is always the longest (1.5—2 times longer than mucro) and it is stouter than those placed higher, but not so strong as in *Folsomia diplophtalma* (AXELS.) or *Folsomia quadrioculata* (TULLB.). Dens furnished with 1 outstanding and 1 shorter seta at base and with 1 lateral hair in its middle. Each dens has 7—8 setae ventrally. Dorsal crenulations, usually 3—5 in number, distinctly

visible, restricted to middle of dens; mucro straight, armed with hook-like curved apical tooth and a little larger, erect anteapical tooth.

Folsomia regularis HAMM. belongs to the same group with *Folsomia similis* BAGNALL and *F. monophtalma* BAGNALL, which, however, have a little longer dentes armed with more setae ventrally. It has also no sensory hairs on ankylosed abdominal segments, and HAMMER hesitatingly considered some short setae occurring abnormally among the larger ones to be sensory hairs.

Folsomia regularis M. HAMMER is known, besides our material, only from the arctic island of Ellesmere.

Found by Dr CZARNIECKI frequently near the camp and at Treskellen under old planks and stones, 16 Aug. — 4 Sept. 1960.

Isotomina gracilis sp. n.

Pl. IV fig. 1—7

The length of the largest individual found, measured without antennae and furcula, is 1—1.2 mm. Colour white, without trace of pigment.

Body sparely clothed with moderately short setae arranged on tergite of Abd. I in 4, on Abd. II in 5—6 and on Abd. III in 6—7 irregular, transversal rows. The outstanding bristles, 6 in number, on each abdominal segment, are relatively short, the longest one being only twice as long as the ventral side of the claw; they do not form a brush-like tuft on the last segment. All setae are smooth.

Antennae only a little longer than head diameter (9.6 : 8). The ratio of antennal joint length I : II : III : IV is 1 : 2.4 : 2.2 : 4. Sense organ of third antennal joint consisting of two small, narrow, curved sensory rods situated in shallow recess. Ant. IV with distinct apical cone, very small subapical pit and untypical olfactory hairs, similar to common setae, at tip.

Eyes absent. Postantennal organ pretty broadly elliptical, neither constricted nor subdivided into halves. Its length varies a little, but mostly shorter than the width of the first antennal joint.

Claw always untoothed. Empodial appendage relatively long, about $^2/_3$ of ventral side of claw, pointed, but not narrowed into apical needle. No clavate tibiotarsal hairs.

Tenaculum with 4 barbs on each ramus and 1 seta on corpus.

Furcula well developed, a little longer than antennae. Manubrium always distinctly shorter than dens (at a ratio of 1 : 2), furnished dorsally and ventrally with some setae; more or less oblique row of 3 setae near each dens on ventral side, of which median seta longer and stronger than two others; higher, there are 1 or 2 pairs of setae and besides, one odd seta, 9—11 setae in all. Dentes tapering gradually endwards, crenulated distinctly almost up to base of mucro. Each dens furnished with 27—32 short, strong setae on ventral side, and with 3—4 setae near base on dorsal side, of which the proximal one is the

longest. Distally, it has 2 fine hairs situated laterally on either side. Mucro bidentate, with both teeth well developed, and curved; it is short, 17 times shorter than dens and about half as long as ventral side of claw.

The above-described species comes very near in its characteristics to *Isotoma coeruleogriseus* HAMMER 1938 from East Greenland, the species transferred rightly by GISIN (1960) to the genus *Isotomina* BÖRN. However, the new species differs from the latter in white colour of the body, the small length of the post-antennal organ, somewhat different shape of the empodial appendage, smaller length of the antennae in relation to the diameter of the head and smaller length of the third antennal joint in comparison with the second one. It is, however, possible that the described species is only a little modified form of *Isotomina coeruleogrisea* (HAMMER).

Found under old planks near the camp on 19 Aug. and 5 Sept. 1960. Several specimens.

Agrenia bidenticulata (TULLBERG 1876)

Isotoma bidenticulata TULLBERG 1876

Isotoma lanuginosa CARL 1899

The colour of the individuals caught in abundance by Dr CZARNIECKI is generally dirty yellowish with dark brownish or violetish-black obscured dorsum. Dark pigment usually forms a longitudinal, more or less broad stripe on the dorsum or transversal bands on all tergites. Black-violet patches are also on the head behind the antennal bases, medially, and on the posterior margin. Many adult individuals are also coloured almost thoroughly blackish (var. *nigra* LINNANIEMI).

It is a typical arctic animal, distributed very widely circumpolarly and recorded from Spitsbergen by many authors.

Found in a large quantity on the sea-shore at Hyrneodden and also numerously under stones and wood on the bank of a stream at Treskellen, on the lake-shore at Rewwatnet and on the Lorchbreen Glacier.

Isotoma viridis BOURLET 1830

Syn.: *Isotoma palustris* (GMELIN 1888) — TULLBERG 1876.

This species is common in arctic territories of the Holarctic and has been also recorded from Spitsbergen by TULLBERG (1876) as *Isotoma palustris* (GMELIN). The individuals occurring in this archipelago vary in colour from very light yellowish, greenish and reddish to dark green, violet or brown. Specimens with a dark longitudinal line situated medially on the dorsum were rarely found, more often those with a more or less dark, narrow cross stripe on each tergite.

All of the numerous adult individuals of both sexes from Spitsbergen examined by me have bidentate chitin plates situated ventrally on the manubrium and 2—4 spines in each group.

As to the identification of *Isotoma spinicauda* BONET from India and Afghanistan with *Isotoma viridis* BOURL., as supposed by HAARLOV (1957), it must be noted that *Isotoma spinicauda* BON. has a larger number of spines ventrally on manubrium, these spines are stronger and the manubrial plates end with only one thorn each; a sensory papilla of different shape appears at the tip of Ant. IV.

Collected in many localities near the camp and at Treskellen under old planks and stones, at Rewwatnet on the lake-shore and on the surface of a puddle as well as at Hyrnefiellet (at an altitude of 300 m.) under large stones throughout August and September. It occurs more frequently than *Agrenia bidenticulata* (TULLB.), but not in so large quantities as the latter.

Isotoma fennica (REUTER 1895)

Pl. III fig. 6—11

The individuals found in Spitsbergen agree in most characteristics with those caught by me in the Tatra Mts. (Poland).

The ratio between the antenna length and the head diagonal is on average 4.3 : 3.1. Ant. III as long as Ant. II, or a little shorter; sensory rods in sense organ of 3rd antennal joint pretty long and slender; postantennal organ broadly elliptical, only 1.5—2 times longer than diagonal of one eye and a little shorter than ventral side of claw, but somewhat longer than mucro (1 : 1.2 : .8). Eight eyes at either side of head equally large; claw untoothed; empodial appendage also untoothed, relatively long, furnished with broad, rounded inner lamella. Clavate tibiotarsal hairs absent; all abdominal segments distinctly separated. Tenaculum with 4 barbs on each ramus and several setae on corpus; manubrium abundantly setaceous both dorsally and ventrally; dentes mostly twice as long as manubrium, densely crenulated; distal, not crenulated portions of dentes about as long as mucro, or somewhat longer; mucro quadridentate, relatively long, as long as empodial appendage, armed with apical tooth a little curved upwards, distinctly larger, erect anteapical tooth and pair of smaller proximal teeth standing vertically almost in same line. Mucronal seta wanting. The manubrium : dens : mucro ratio is 6 : 14 : 0.7 or 4 : 7 : 0.3.

The material comprised individuals of two distinctly different colours. Most animals were pale bluish-grey. A black-blue cross stripe joining the eye-patches was situated behind the antennal bases on the head, then another angle-like patch in the centre of the head and behind it a pair of smaller spots. A more or less distant, narrow, bluish cross stripe was present dorsally on each posterior margin of Abds. II—IV. One individual caught at Treskellen, under a piece of wood near a stream, was coloured intensively brownish-yellow

with slightly developed dark patches on the head and with light yellow intersegments on the dorsum.

Isotoma fennica (REUT.) has not been hitherto known from Spitsbergen. THOR (1930) recorded only *Isotoma olivacea* (TULLB.), the species very similar in colour to *Isotoma fennica* (REUT.), but distinctly different to it in the characteristic shape of the mucro with a long and strong apical tooth.

Isotoma fennica has been hitherto mentioned from Swedish Lapland, Norway, Finland, Carpathian Mts. and Alps (Grossglockner). In the Tatra Mts. it occurs in the company of *Agrenia bidenticulata* (TULLB.), *Hydroisotoma schaefferi* (KRAUSB.) and the true winter-species *Isotoma hiemalis* SCHÖTT near brooks not wholly covered by ice. In summer it lives in wet mosses usually in immediate nearness of cold water.

Found near the camp under old planks, 4 specimens on 4 Aug. and 3 specimens coloured greyish on 5 Aug., at Treskellen under a piece of wood near a stream, 1 yellow specimen on 20 Aug.

Entomobrya subarctica sp. n.

Pl. V fig. 1—3

The only female individual in the material does not permit for exact description.

Body somewhat depressed dorso-ventrally, covered densely with numerous ciliated setae; head and anterior portion of dorsum with straight, outstanding bristles truncate at tips, posterior portion of dorsum with some long ciliated macrochaetae; trichobothria very fine, ciliated densely and shortly.

Only the basal joint has remained of the antennae.

Labrum armed with four papillae dorsally near frontal edge, of which lateral papillae longer than median ones; all furnished with very small secondary tubercles at tips (4 on lateral and 2 on median papillae) and these armed apically with a very minute setula each. Seta located near external labial papilla short and not thicker than other setae of papillae.

Legs normally long, covered densely with setae and with some outstanding, straight macrochaetae; tibiotarsus with a row of stout bristles ventrally; all setae and bristles densely ciliated. Subsegment of tibiotarsus distinct. Claw of normal length with indistinct outer tooth, minute pair of lateral teeth and weakly developed inner teeth, of which only median tooth better visible. Empodial appendage untoothed, lancet-like, about $^3/_4$ of length of inner lamella of claw. Tibiotarsal hair thick and long, its length to that of inner lamella of claw is as 2.5 : 2.

Furcula long, abundantly covered with setae; unringed parts of dentes only a little longer than mucro (at a ratio of 1 : .8); mucro about half as long as empodial appendage, with 2 strong teeth and 1 long basal spine.

Ground-colour of body white. Blue-black pigment present in small cross stripes behind antennae, on thoracic segments over leg bases and laterally on

Abds. IV and V as well as on parafurcal lobe. Terminal portion of femur of 3rd pair of legs pigmented a little dark.

Body length: 2 mm.

The new species differs from other known representatives of the genus *Entomobrya* ROND. in the shape of its labral papillae.

Collected at Treskellen near the stream under a stone, on 19 Aug. 1960. 1 specimen.

Lepidocyrtus lanuginosus (GMELIN) TULLBERG 1872

It is the only species of the genus *Lepidocyrtus* BOURL. known from Spitsbergen.

The individuals examined are 1.4—2.4 mm. long. Deprived of scales they are dirty yellow in colour with dark violet pigment on the head behind the antennae and on Abds. IV and V in the form of large patches laterally. Apical half of Ant. II and whole Ants. III and IV black violet; subcoxae of all legs also black violet. Parafurcal lobes and manubrium coloured pale violet. In smaller, young individuals the pale violet pigment forms a long, narrow transverse stripe on the anterior and posterior margins of Thor. II, then on the posterior margins of Thor. III — Abd. III, and lateral patches on Abds. IV and V;antennae also pale violet.

Mesonotum not projecting over base of head; antennae longer than head diameter at a ratio of 7.2 : 4.5. Eight eyes at either side of head, two medial ones being distictly smaller than others. Coxae with only one row of long bristles. Claw ventrally 1.5 times longer than mucro. It is furnished with one outer tooth, very minute lateral teeth, a pair of small basal teeth placed high and still higher two unpaired teeth, subapical of which is very minute. Empodial appendage, $^2/_3$ of claw length, lancet-like, with sharply pointed tip. Clavate tibiotarsal hair as long as ventral side of claw. Mucro with two equally large teeth and long basal spine. The manubrium : dens : mucro ratio is 15 : 18—19 : 1.

Found under old planks near the camp of the Expedition on 4 Aug. 1960 (16 specimens) and on a mushroom on the shore of a small lake on 5 Aug. 1960 (17 specimens).

Sminthurides malmgreni (TULLBERG 1876)

The specimens examined by me agree in all body characteristics with those known from other localities, but they are coloured uniformly violet only (f. principalis).

This species was described from Spitsbergen by TULLBERG in 1876 as new to science. Afterwards it was recorded from almost all continents. It is very widely distributed over whole Europe and arctic territory.

Found under a seaweed on the shore at Hyrneodden on 29 Aug. 1960, 2 specimens.

Sminthurinus concolor (MEINERT 1896)

Pl. V fig. 4—8

The segmentation of thorax and abdomen is in some individuals weakly marked. Anogenital segments are separated from each other and from furcal segment by distinct limits, and so *Sminthurinus concolor* belongs to the group „*niger*" and not „*aureus*". Skin finely granulated, head and large abdomen clothed sparsely with short setae. Trichobothrium situated laterally on genital segment also relatively short. In males trichobothrium guarded by thick bristle as long as trichobothrium itself.

Antennae longer than head at ratios of 3 : 2 in males and 4 : 3 in females. In females the ratio between the lengths of antennal joints is 2 : 4 : 6 : 12. Third antennal joint with simple papilla in basal half and sensory organ consisting of two fine sensory rods in terminal part. Fourth antennal joint with small retractile sensory papilla guarded by some short, straight, fine hairs at tip.

Eight eyes at either side of head, of which central distinctly smaller than others.

Claw moderately long, furnished with very weak teeth. Only odd median tooth on inner lamella of claw more distinct; basal, paired teeth and subapical tooth very minute or lacking. Empodial appendage with relatively broad inner lamella armed with small, fine tooth and subapical needle. On foreleg, lamella little narrower than on other pairs of legs and needle longer, extending beyond tip of claw. First strong bristle on ventral side of tibiotarsus of foreleg also longer and stouter than those of other legs. Clavate tibiotarsal hairs on all legs very well developed, 5 or 6 in number, 4 or 5 of which arranged almost at same distance from claw base and one a little higher. They are as long as the inner lamella of the claw or somewhat longer.

Furcula well developed; dens furnished dorsally, near its base with group of 4—5 setae, the basal one of which, situated medially is the longest; further, it has 4 setae on the inner and 3 setae on the outer edge, as well as 1 medial seta near the tip. Ventrally, 4 short setae are arranged in the neighbourhood of the mucro in a transverse row, a pair of longer, fine setae higher and one odd seta at a distance from the base. Both edges of mucro distinctly, densely serrated. Mucronal seta absent, mucro longer than half length of dens at a ratio of 7.3 : 4.1.

Subanal appendage about half as long as mucro, stout, apically slit into 7 strongly curved branches.

Anal valves furnished with long, stout bristles. The bristle located medially on the upper valve is deeply slit into two branches. In the row of 4 bristles present on each lateral valve, the first three ones are stout.

In males the genital area is in the shape of a cone armed subapically with a ring of small, curved setulae.

This species, found in Greenland and at first diagnosed erroneously by

MEINERT in 1896, has been described more accurately by TUXEN (1934). For many characteristics of the body, it comes very near to *Sminthurinus niger* (LUBB.) and is considered by GISIN (1960) as identical with that.

The individuals from Spitsbergen, however, differ in some details from *Sminthurinus niger* (LUBB.). The basal papilla on Ant. III is in the individuals from Spitsbergen simple, only one of the eyes, the central one, is distinctly smaller than the others, the clavate tibiotarsal hairs are relatively longer, densely arranged in the neighbourhood of the claw, 5 or 6 in number, a pair of fine, longer setae always appears on the dens behind the apical bristles and, finally, the strong bristles on the anal valves are not broadened laterally.

Up to now, *Sminthurinus concolor* (MEIN.) has been known only from Greenland and Spitsbergen.

Found near the camp of the Expedition, under old planks (9 specimens), and under stones (2 specimens) on 4 Aug. 1960 as well as under stones (8 specimens) and on a mushroom (1 specimen) on 5 Aug. 1960.

Kraków, 20 VI 1961
Zoological Institut Pol. Acad. Sc.

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STRESZCZENIE

W niniejszej pracy autor zestawia wyniki swych badań nad fauną Spitsbergenu.

Fauna bezskrzydłych Spitsbergenu ogranicza się tylko do jednego z rzędów tej podgromady, mianowicie do skoczogonków *(Collembola)*, i jest w porównaniu z fauną Skandynawii gatunkowo uboga. Jakkolwiek niemal każda wyprawa naukowa do Arktydy przywoziła nieco materiału przyczyniającego się do poznania tej fauny, a na opracowanie tego materiału złożyło się kilkanaście prac, to jednak do 1960 r. poznano z tego archipelagu tylko 29 gatunków skoczogonków.

Obfity materiał zebrany z tej grupy owadów przez dra S. CZARNIECKIEGO w czasie jego pobytu w lecie 1960 r. na Spitsbergenie dozwolił na zwiększenie tej liczby o trzy nowe dla nauki gatunki: *Hypogastrura spitsbergensis*, *Isotomina*

gracilis, *Entomobrya subarctica* i cztery dotychczas ze Spitsbergenu nie podawane: *Hypogastrura (Ceratophysella) armata* (Nic.), *Folsomia regularis* Hamm., *Isotoma fennica* Reut., *Sminthurinus concolor* (Mein.) oraz umożliwił dorzucenie nieco szczegółów do scharakteryzowania niektórych gatunków poprzednio opisanych.

Fauna skoczogonków Spitsbergenu nosi cechy fauny arktycznej, jednak wiele z jej elementów rozprzestrzenionych jest szeroko w Europie, a nawet należy do kosmopolitów. Brak w niej form endemicznych; nie jest jednak wykluczone, że taką formą okaże się któryś z gatunków obecnie opisanych jako nowe dla nauki. Spitsbergen jako cząstka kontynentu europejskiego, prawdopodobnie dopiero w niezbyt odległej przeszłości oderwana od Laponii, posiadał faunę skoczogonków podobną zapewne do żyjącej w arktycznej Eurazji, lecz stracił ją w okresie zlodowaceń plejstoceńskich, kiedy lodowce pokrywały cały ten archipelag. Elementy nowej fauny napływać zaczęły na ten archipelag w holocenie głównie z północnej Europy i ta imigracja trwa też obecnie. Jest interesujące, że wśród nowych gatunków tej fauny Spitsbergenu znalazły się obecnie dwa: *Folsomia regularis* Hamm. i *Sminthurinus concolor* (Mein.), znane dotychczas tylko z arktycznej Ameryki.

РЕЗЮМЕ

В настоящей работе автор сопоставляет итоги своих исследований фауны *Collembola* Шпицбергена.

Фауна *Apterygota* Шпицбергена ограничивается только до одного ряда этой подгруппы, именно до *Collembola*, которая по сравнению с фауной Скандинавии качественно очень бедна. Несмотря на то, что почти каждая научная экспедиция в Арктику привозила некоторый материал, способствующий к познанию этой фауны, а на обработку его сложилось несколько работ, однако до 1960 года из этого архипелага были известны только 29 видов *Collembola*.

Богатый материал, собранный из этой группы насекомых Докт. С. Чарнецким, во время его пребывания на Шпицбергене летом 1960 года, позволил на увеличение этого числа на три новые для науки вида: *Hypogastrura spitsbergensis*, *Isotomina gracilis*, *Entomobrya subarktica* и четыре до сих пор из Шпицбергена не цитированные: *Hypogastrura (Ceratophysella) armata* (Nic.) *Folsomia regularis* Hamm., *Isotoma fennica* Reut., *Sminthurinus concolor* (Mein.) а также сделал возможным добавить несколько деталей для охарактеризования некоторых видов, раньше описанных.

Фауна *Collembola* Шпицбергена имеет черты арктической фауны, однако многие ея элементы широко распространены в Европе а даже принадлежат к космополитам. Недостает у нея эндемических форм, не выключено однако, что такой формой явится какой нибудь из видов в настоящее время описанный, как повый

для науки. Шпицберген, как частица европейского континента, вероятно еще не так давно отделился от Лапландии и имел фауну *Collembola* похожую вероятно на живущую в арктической Евразии, но потерял ее в период плейстойенских обледенений, когда глетчеры покрывали весь этот архипелаг. Элементы новой фауны начали наплывать на этот архипелаг в голоцене главным образом с Северной Европы и эта иммиграция продолжается до настоящего времени. Очень интересно, что среди новых видов этой фауны Шпицбергена нашлись теперь два: *Folsomia regularis* Hамм. и *Sminthurinus concolor* (Mein.) известные до сих пор только из арктической Америки.

PLATES

Plate I

Onychiurus arcticus (TULLB.)

Fig. 1. Half of Thor. I.
Fig. 2. Half of Thor. I of another specimen.
Fig. 3. Genital plate of a male specimen; enlargement greater than that of Figs. 1 a. 2.
Fig. 4—7. Tergite of Abd. V with various number of pseudocelli; enlargement same as in fig. 3.

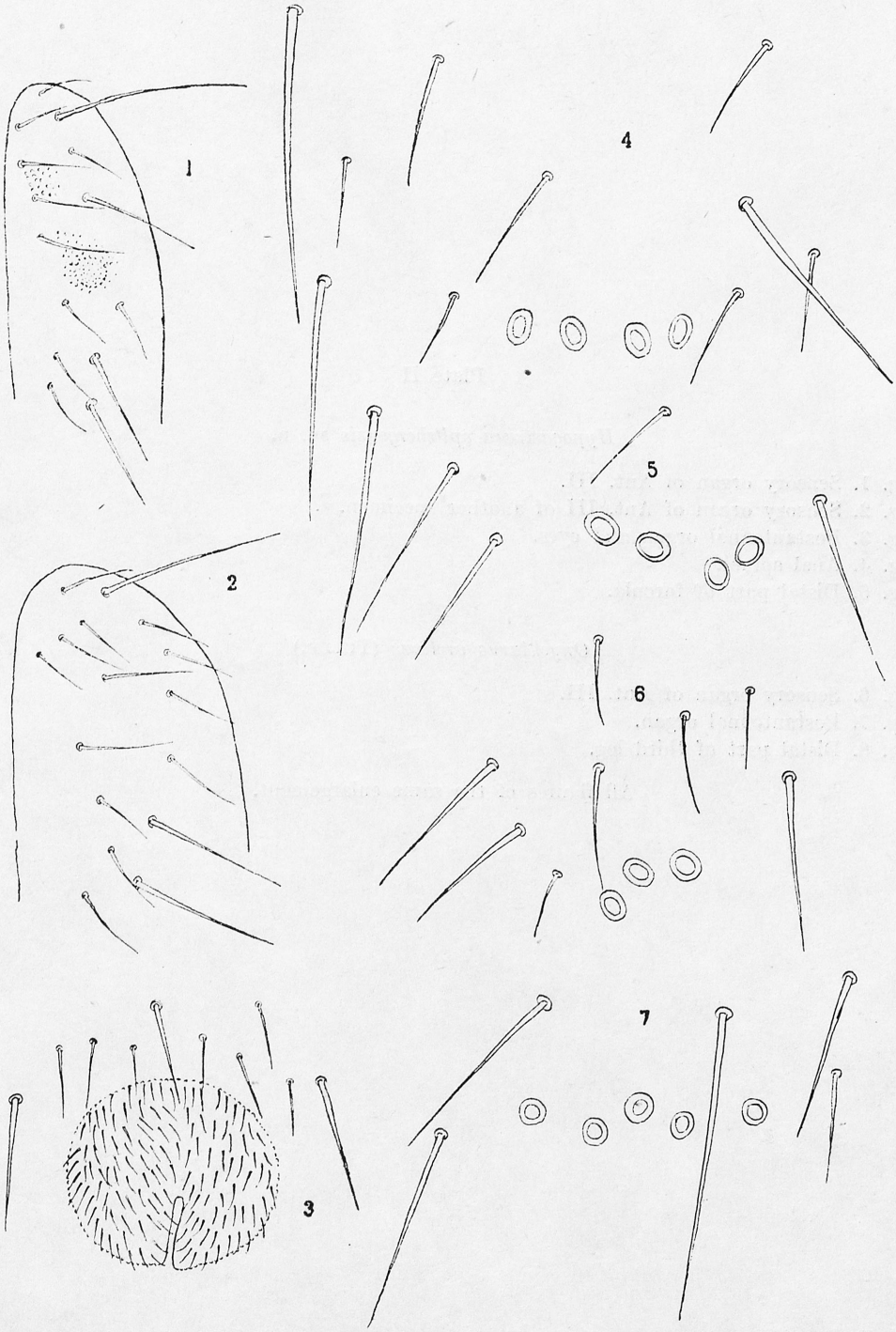

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Plate II

Hypogastrura spitsbergensis sp. n.

Fig. 1. Sensory organ of Ant. III.
Fig. 2. Sensory organ of Ant. III of another specimen.
Fig. 3. Postantennal organ and eyes.
Fig. 4. Anal spines.
Fig. 5. Distal part of furcula.

Onychiurus arcticus (TULLB.)

Fig. 6. Sensory organ of Ant. III.
Fig. 7. Postantennal organ.
Fig. 8. Distal part of third leg.

All figures of the same enlargement.

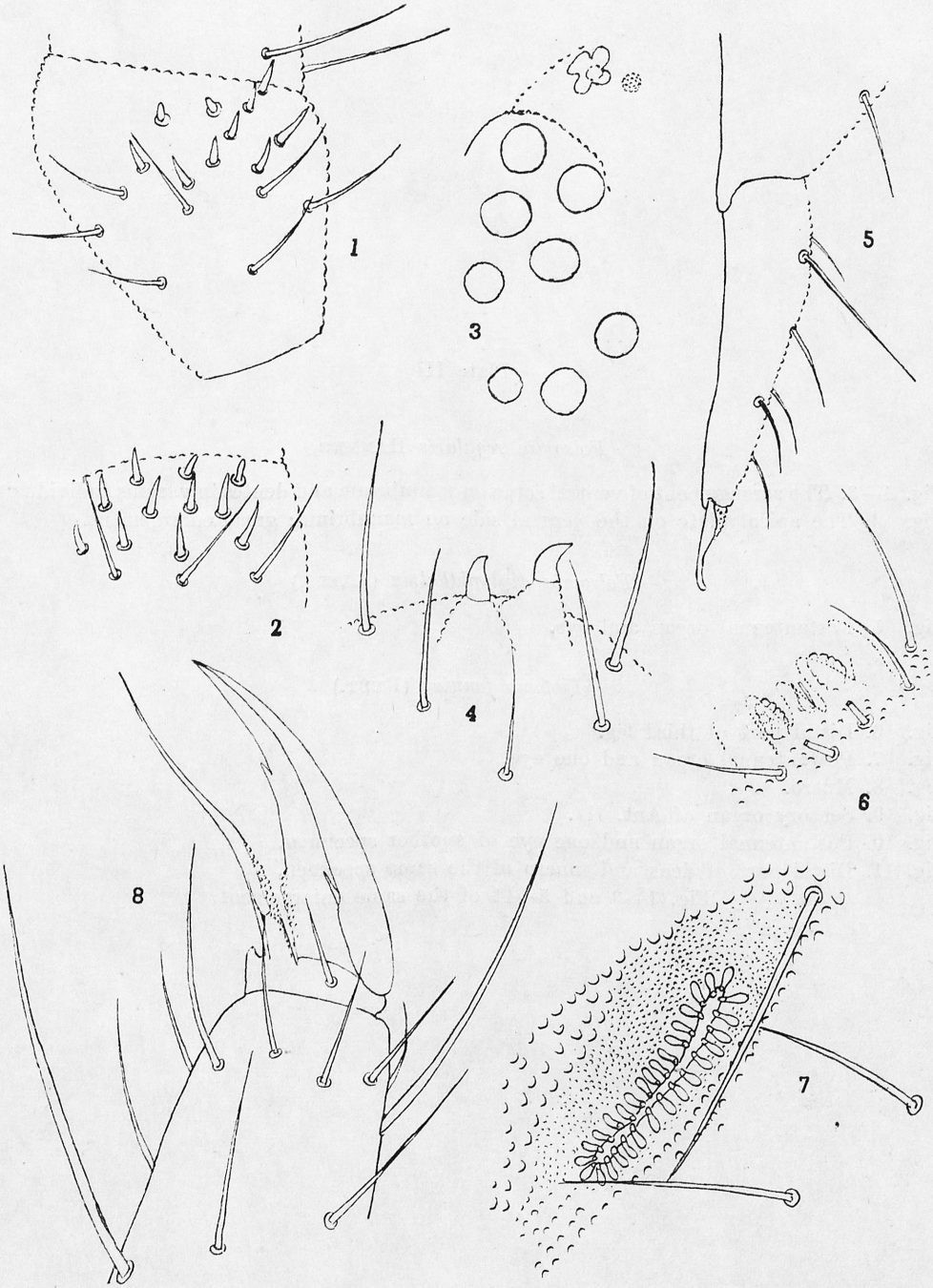

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Plate III

Folsomia regularis HAMMER

Fig. 1—3. The arrangement of ventral setae on manubrium and dentes in various individuals.
Fig. 4. The apical plate on the ventral side on manubrium; great enlargement.

Folsomia diplophthalma (AXELS.)

Fig. 5. Postantennal organ and eye.

Isotoma fennica (REUT.)

Fig. 6. Distal part of third leg.
Fig. 7. Postantennal organ and one eye.
Fig. 8. Mucro.
Fig. 9. Sensory organ of Ant. III.
Fig. 10. Postantennal organ and one eye of another specimen.
Fig. 11. Distal part of dens and mucro of the same specimen.
Fig. 1—3 and 5—11 of the same enlargement.

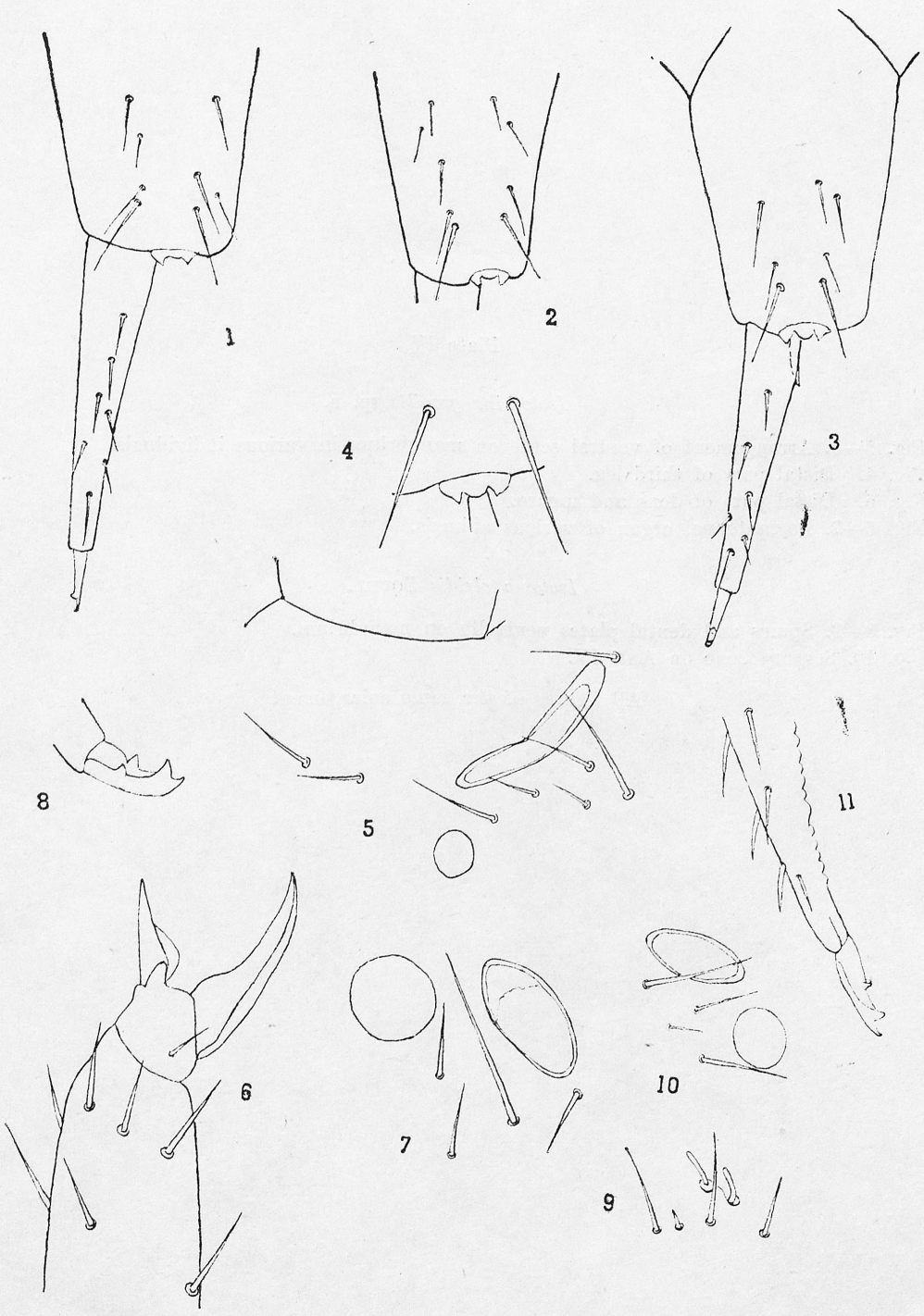

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Plate IV

Isotomina gracilis sp. n.

Fig. 1—3. Arrangement of ventral setae on manubrium in various individuals.
Fig. 4. Distal part of third leg.
Fig. 5. Distal part of dens and mucro.
Fig. 6—7. Postantennal organ of various animals.

Isotoma viridis BOURL.

Fig. 8—9. Spines and dental plates ventrally on manubrium.
Fig. 10. Sensory cone on Ant. IV.

All figures of the same enlargement

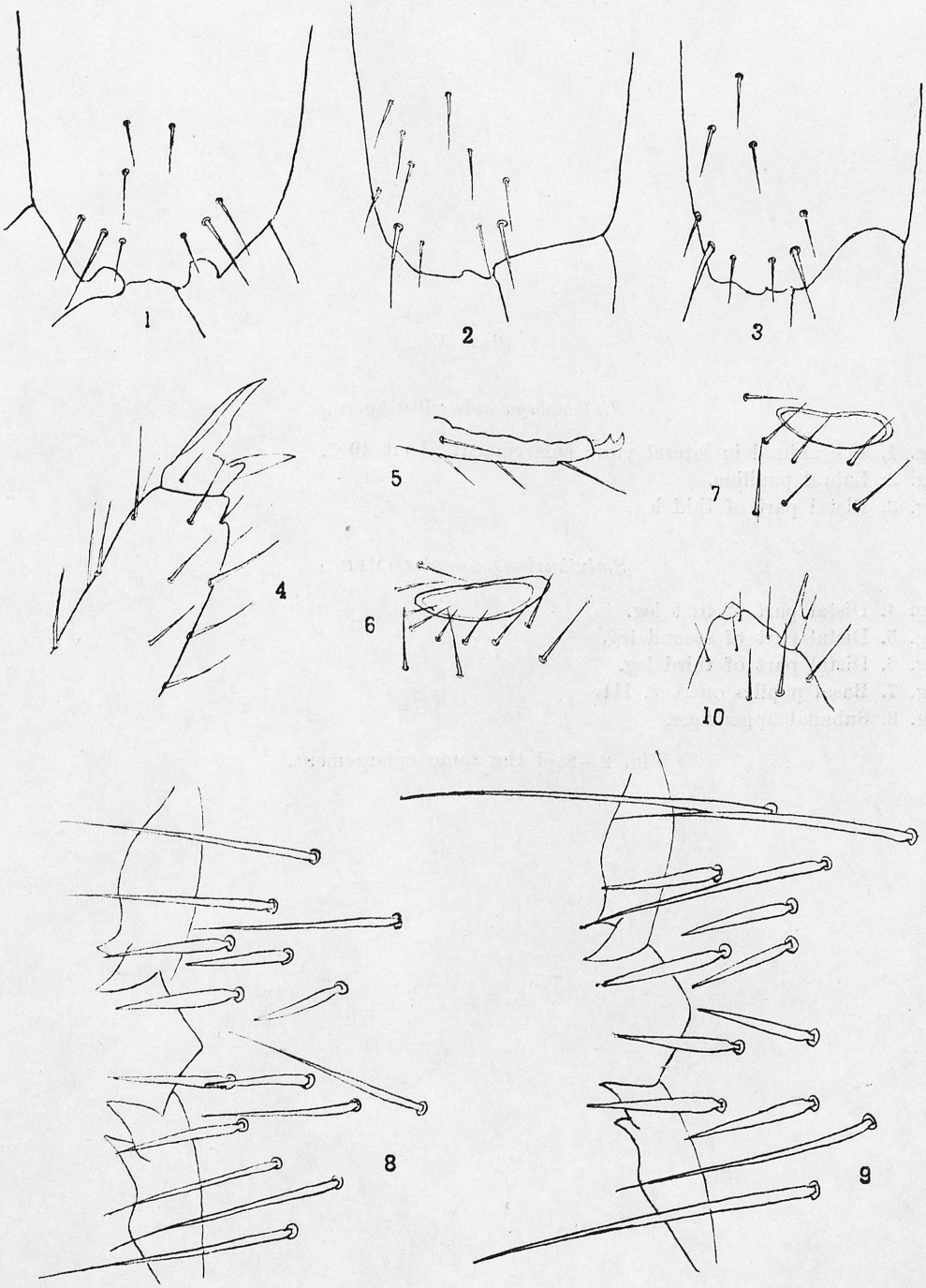

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Plate V

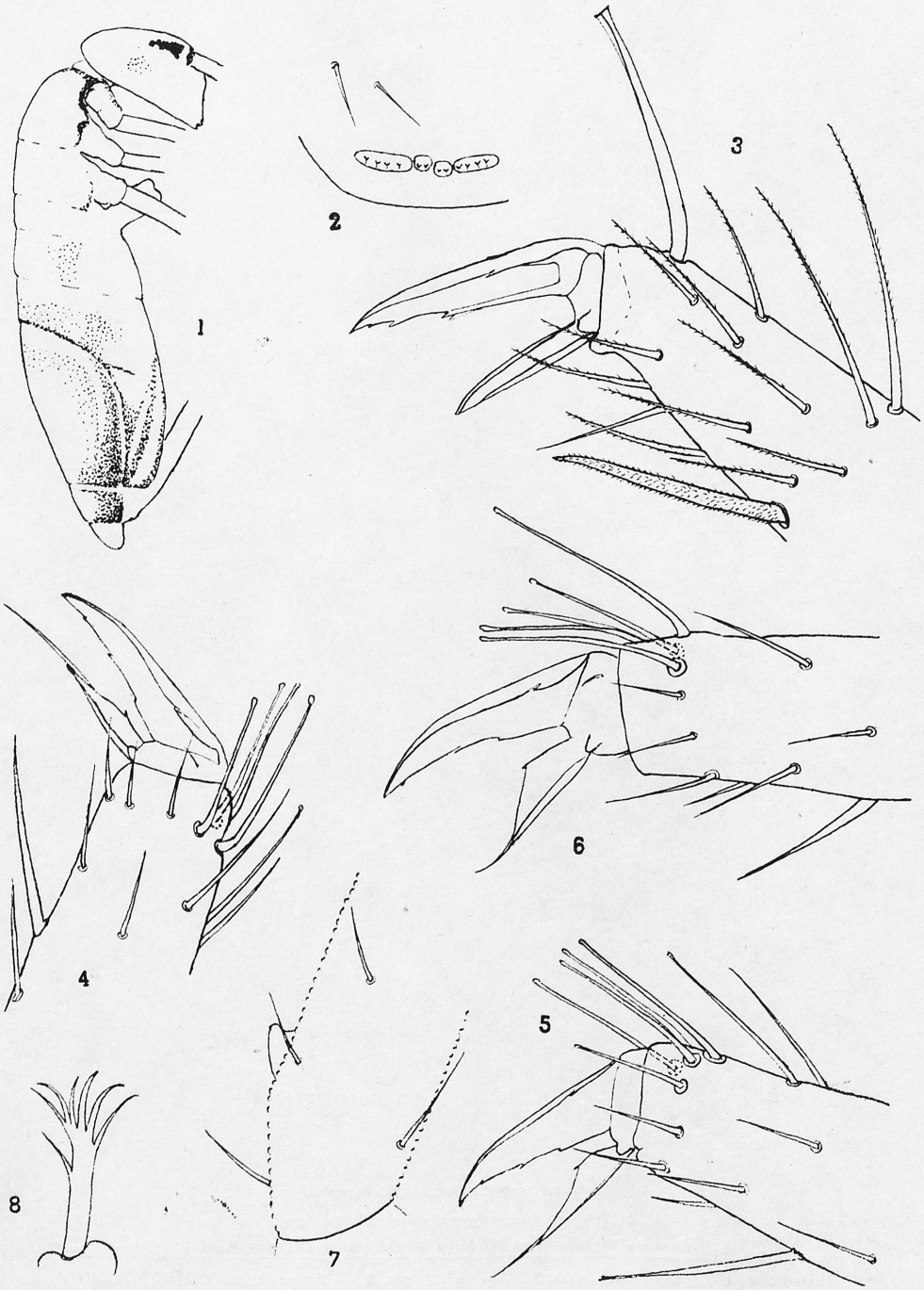
Entomobrya subarctica sp. n.

Fig. 1. The animal in lateral viev; enlargement about 40×.
Fig. 2. Labral papillae.
Fig. 3. Distal part of thid leg.

Sminthurinus concolor (MEIN.)

Fig. 4. Distal part of first leg.
Fig. 5. Distal part of second leg.
Fig. 6. Distal part of third leg.
Fig. 7. Basal papilla on Ant. III.
Fig. 8. Subanal appendage.

Fig. 2—8 of the same enlargement.



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