

A C T A   Z O O L O G I C A  
C R A C O V I E N S I A

Tom XIX

Kraków, 31. V. 1974

Nr 7

Hieronim DASTYCH

**North Korean *Tardigrada***

[Pp. 125—146, pls VII—X, 38 text-figs.]

**Niesporczaki (*Tardigrada*) Północnej Korei**

**Тихоходки (*Tardigrada*) Северной Кореи**

Abstract. A list of 27 species of *Tardigrada* from North Korea (including 21 new in this territory) with the brief descriptions is given. Also a new form *Macrobiotus occidentalis* MURR. f. *striata* n.f. is described.

*Tardigrada* from the Korean peninsula are till now poorly known. In the literature only 12 species from this terrain are quoted; MARCUS (1936) mentions 2 species from Korea, without any more exact localization and IHAROS (1972) 10 species of *Tardigrada* from North Korea.

By the courtesy of Dr. Andrzej SZEPTYCKI I have received 21 samples of mosses from the Korean People's Democratic Republic \* and I should like to express him my deep-felt acknowledgement. Also my gratitudes to Dr. Robert SCHUSTER and to Dr. Giovanni PILATO for having lent me 2 paratypes of *Diphascon iltisi* SCHUST. & GRIG., as well as to Doc. Dr. Barbara WĘGLARSKA for the loan of the holotype and 6 paratypes *Itaquascon bartosi* (WĘGL.).

In the material under examination 5 samples do not contain *Tardigrada*. In 16 samples I found 907 specimens belonging to 27 species. Among those 21 are new in the Korean fauna. Also a new form of *Macrobiotus occidentalis* MURRAY, 1910 is described.

\* Found by Expedition of the Institute of Systematic and Experimental Zoology of the Polish Academy of Sciences in Kraków, 1971; members: Doc. Dr. J. PAWŁOWSKI, Doc. Dr. J. RAZOWSKI, Dr. A. SZEPTYCKI.

Table 1  
Occurrence of collected *Tardigrada* according to altitude a.s.l.

No. of samples	1	2	3	4	16	500-600	900	1300	1300	15	1800	2000	2100	2100-2200	2200	2400	2400	7	Number of specimens	Frequency
Altitude a.s.l. (m)																				
Species																				
<i>E. reticulatus</i> MURR.					7					4							31	34	72	3
<i>E. canadensis</i> MURR.										1									4	1
<i>E. spinulosus</i> DOY.																			1	1
<i>E. quadrispinosus</i> RICH.																				
<i>E. blumi</i> RICH.											33	2			4				35	2
<i>P. suillus</i> (EHRENB.)			1							1	5	1	2						4	1
<i>M. occidentalis</i> MURR.																			11	6
<i>f. striata</i>																				
<i>M. islandicus</i> RICH.		134		3	48														185	3
<i>M. richtersi</i> MURR.											1						1		1	1
<i>M. intermedius</i> PLATE										1	1	1						56	57	2
<i>M. harnsworthi</i> MURR.	2	3	2	3	1	10		7		27	31		20			12			15	4
<i>M. hibernicus</i> MURR.											16					2			108	11
<i>M. areolatus</i> MURR.		9														4			20	2
<i>M. hufelandi</i> SCHUL.											164	11							9	1
<i>M. avigianae</i> ROBOT.																			274	4
<i>M. echinogenitus</i> RICH.																2			16	1
<i>C. ornatus</i> (RICH.)								16								1			4	2
<i>I. tuberculatus</i> (PLATE)									1				2	3		6		1	7	2
<i>I. schaudinni</i> (RICH.)																			3	2
<i>H. dujardini</i> (DOY.)									6				1						6	1
<i>H. convergens</i> (URB.)											13								1	1
<i>H. oberhauseri</i> (DOY.)					15						1	4			4				17	2
<i>D. alpinus</i> (MURR.)											2		4						20	3
<i>D. scoticus</i> (MURR.)											3								7	3
<i>D. iltisi</i> SCHUST. & GRIG.											3								3	1
<i>M. tardigradum</i> DOY.					13							6							3	1
<i>It. bartosi</i> (WÆGL.)														5					18	2
Number of species	1	3	1	3	4	2	4	5	6	6	12	6	5	1	2	8	3		6	1



The mosses were collected in the following localities (I quote the Korean topographic names after SZEPTYCKI, 1973):

1. The town Phjǒngjang, Moran-bong park. Moss on stones on the ground; 13 VIII 1971.
2. Prov. Phjǒngjang-si, Jongak-san hills, southern exposition. Markedly dried moss on sun heated rock (conglomerate); 16 VIII 1971.
3. Prov. Phjǒngan-namdo, distr. Sunan. Wet moss on the ground (sandy clay) at the road, on the southern shore of lake Sǒkam-Čosudzi; 20 VIII 1971.
4. Prov. Phjǒngan-namdo, distr. Sunčhǒn; Džamo-san hills. Northern slope of valley (bushy pines, oak trees, chestnut-trees), moss from granite rocks; 27 VIII 1971.
5. Prov. Janggang-do, distr. Počhon, valley of the Karim-čhǒn stream, 5 km from the village Počhǒn-bo. Dry moss on basalt, 900 m a.s.l.; 1 IX 1971.
- 6—11. Prov. Janggang-do, distr. Samdžijǒn, Pektu-san Mt. 6 — Crater bottom, 2400 m a. s. l.; moss from the ground (mainly lava fragments forming a coarse gravel); 4 IX 1971. 7 — In the same place; moss from rocks (blocks of light lava of pumic-stone character); 4 IX 1971. 8 — South-eastern slope, timber line, 2000 m a.s.l.; moss from the base of a larch trunk; 5 IX 1971. 9 — South-eastern slope, brushwood scrubs (with *Dryas octopetala* L., *Rhododendron* sp., *Vaccinium* sp.) on volcanic tuff, 2100—2200 m a.s.l.; moss from stones (blocks of light lava); 5 IX 1971. 10 — South-eastern slope, 2100—2200 m a.s.l.; moss on gravel between lava blocks; 5 IX 1971. 11 — South-eastern slope, spruce forest with addition of larch, about 1800 m a.s.l.; wet mosses from the ground; 9 IX 1971.
12. — Prov. Janggang-do, distr. Samdžijǒn, Phote-čhǒn ravine. Rich low subalpine forest (mainly *Acer* sp., *Abies* sp.); moss from deciduous trees; 1300 m a.s.l.; 7 IX 1971.
13. — Prov. Janggang-do, distr. Samdžijǒn, southern slope of Namphode-san Mt. Mixed forest with larch and birch prevailing on granites; moss from granite stones; 2100 m a.s.l.; 8 IX 1971.
14. — Herein; forest thinned out at the timber line; moss from trunks of *Salix* cfr. *caprea*; 2200 m a.s.l.; 8 IX 1971.
15. — Prov. Janggang-do, distr. Samdžijǒn, southern slope of Soroyin-san hills, about 40 km north-eastern from Samdžijǒn. Moss from xerophilous turf on granites; 1300 m a.s.l.; 10 IX 1971.
16. — Prov. Janggang-do, distr. Hongam, abrupt slope of the Tuman-gang valley at the China frontier, 5 km east of Hongam. Rich mixed forest (*Acer* sp., *Tilia* sp., *Abies* sp. and others); moss from basalt stones; 500—600 m a.s.l.; 10 IX 1971.

List of species known from Korean peninsula (\*species quoted by MARCUS, 1936; \*\*species quoted by IHAROS, 1972. The remaining ones are new for this country.); I accept the systematics of PILATO (1969a):

\*1. *Echiniscus baius* MARCUS, 1928

2. *Echiniscus reticulatus* MURRAY, 1905

\*3. *Echiniscus canadensis* MURRAY, 1910

4. *Echiniscus spinulosus* DOYERE, 1840
5. *Echiniscus quadrispinosus* RICHTERS, 1902
- \*\*6. *Echiniscus testudo* (DOYÈRE, 1840)
7. *Echiniscus blumi* RICHTERS, 1903
- \*\*8. *Pseudechiniscus suillus* (EHRENBERG, 1853)
9. *Macrobiotus occidentalis* MURRAY, 1910 f. *striata* f.n.
10. *Macrobiotus islandicus* RICHTERS, 1904
- \*\*11. *Macrobiotus richtersi* MURRAY, 1911
- \*\*12. *Macrobiotus mahunkai* IHAROS, 1972
13. *Macrobiotus intermedius* PLATE, 1888
14. *Macrobiotus harmsworthi* MURRAY, 1907
15. *Macrobiotus hibernicus* MURRAY, 1911
16. *Macrobiotus areolatus* MURRAY, 1907
- \*\*17. *Macrobiotus hufelandi* SCHULTZE, 1833
18. *Macrobiotus aviglianae* ROBOTTI, 1970
19. *Macrobiotus echinogenitus* RICHTERS, 1904
20. *Calohypsibius ornatus* (RICHTERS, 1900)
21. *Isohypsibius tuberculatus* (PLATE, 1888)
- \*\*22. *Isohypsibius sattleri* (RICHTERS, 1902)
- \*\*23. *Isohypsibius granulifer* (THULIN, 1928) f. *koreanensis* IHAROS, 1972
- \*\*24. *Isohypsibius augusti* (MURRAY, 1907)
- \*\*25. *Isohypsibius schaudinni* (RICHTERS, 1904)
26. *Hypsibius dujardini* (DOYÈRE, 1840)
- \*\*27. *Hypsibius convergens* (URBANOWICZ, 1925)
28. *Hypsibius oberhaeuseri* (DOYÈRE, 1840)
29. *Diphascon alpinus* (MURRAY, 1906)
30. *Diphascon scoticus* (MURRAY, 1905)
31. *Diphascon iltisi* SCHUSTER and GRIGARICK, 1965
32. *Milnesium tardigradum* DOYÈRE, 1840
33. *Itaquascon bartosi* (WĘGLARSKA, 1959)

Hereafter I complete the descriptions of species which I found. Depending on the fact, if the given species is better or worse recognized, my descriptions are more less detailed.

***Echiniscus reticulatus* MURRAY, 1905 (fig. 1—7, phot. 1—2)**

Length 170—290  $\mu\text{m}$ ; larvae 120—125  $\mu\text{m}$  long. The body is red, the cuticle is thick. The cuticle surface is covered with hexagonal or round, flat swellings (fig. 1—3, phot. 2). These are well visible at the „upper” position of the microscope body-tube, in form of a reticle with big meshes, 5—6  $\mu\text{m}$  in diameter (fig. 2A). In the meshes of this reticle occurs a very tiny, close and irregular granulation. If the body-tube is lowered, the reticle is very faintly visible and the granulation can be seen then also in connetions of the meshes (fig. 2B). The body of larvae is covered with a fine regular granulation, resembling that of *Pseudechiniscus suillus* (EHRENB.). The appendage A is 65—100  $\mu\text{m}$  long. The third intersegmental plate has a tendency to fuse with the end plate. The end plate is faceted. The spine fringe has 7—12 teeth which are frequently bifurcated (fig. 7). The external claws on all the legs are smooth (fig. 4, 5); the inner

ones have a spine (fig. 6). The claws of the IV-th pair of legs are 17—35  $\mu\text{m}$  long, those of IV-th pair of legs in larva are 11  $\mu\text{m}$  long. In the exuvia are 2—4 eggs. The species is considerably variable.

Localities\*: 6 (31) 7 (34), 16 (7).

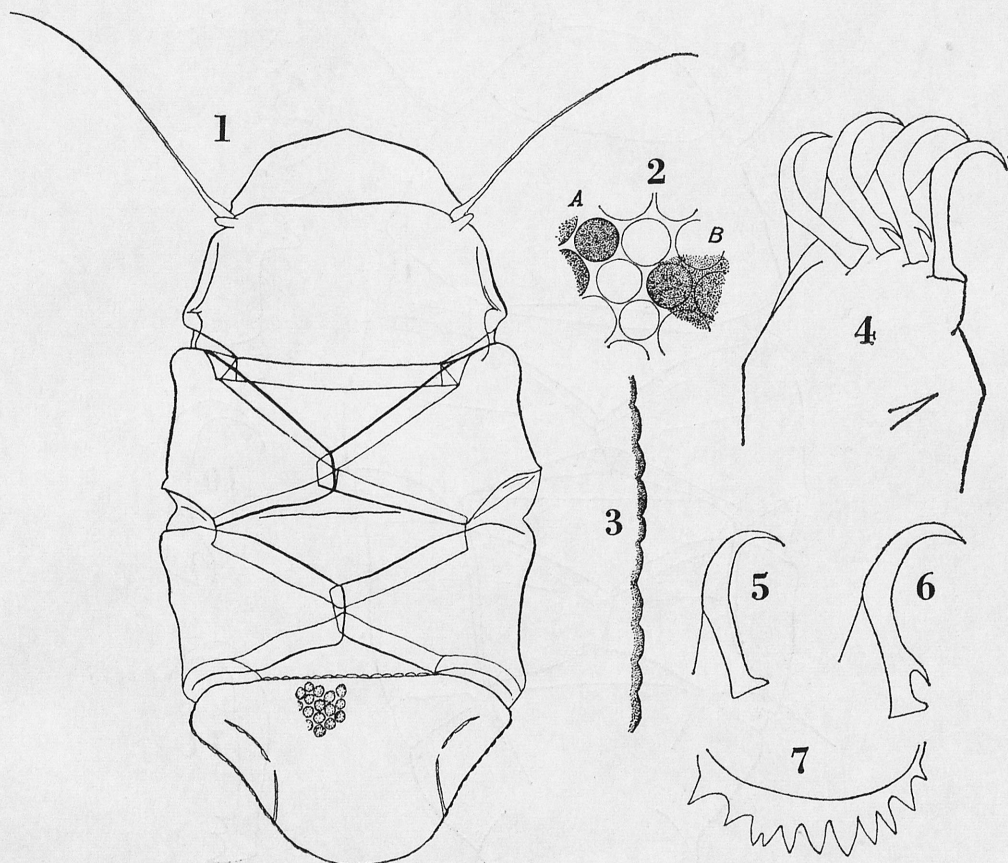


Fig. 1—7. *Echiniscus reticulatus* MURR.: 1 — dorsal view, 2 — swellings of cuticle surface (A — „upper” position of microscope body tube B — „lower” position of microscope), 3 — swellings of cuticle surface, lateral view, 4 — claws of I pair legs, 5 — external claw of II pair legs, 6 — inner claw of IV pair legs, 7 — spine fringe

***Echiniscus canadensis* MURRAY, 1910 (fig. 8—11)**

Length 210—270  $\mu\text{m}$ . The back of the body is covered with a regular polygonal granulation; the biggest one is on the shoulder plate and on the end plate. The appendages *A* are 42  $\mu\text{m}$  long, *C*<sup>2</sup> — 75  $\mu\text{m}$ , *D*<sup>2</sup> — 17  $\mu\text{m}$ . One specimen was without spines in the incision of the end plate (*E*). The spine fringe has 6—9

\* The figure before the bracket indicates the number of locality, in the bracket is the number of found specimens.



irregular teeth (fig. 9). The inner claws of all the legs have a spine (fig. 10); the external claws of the IV-th pair of legs have 2 spines (fig. 11). The claws of the IV-th pair of legs are 21  $\mu\text{m}$  long.

Locality: 15 (4). Quoted from Korea by MARCUS (1936).

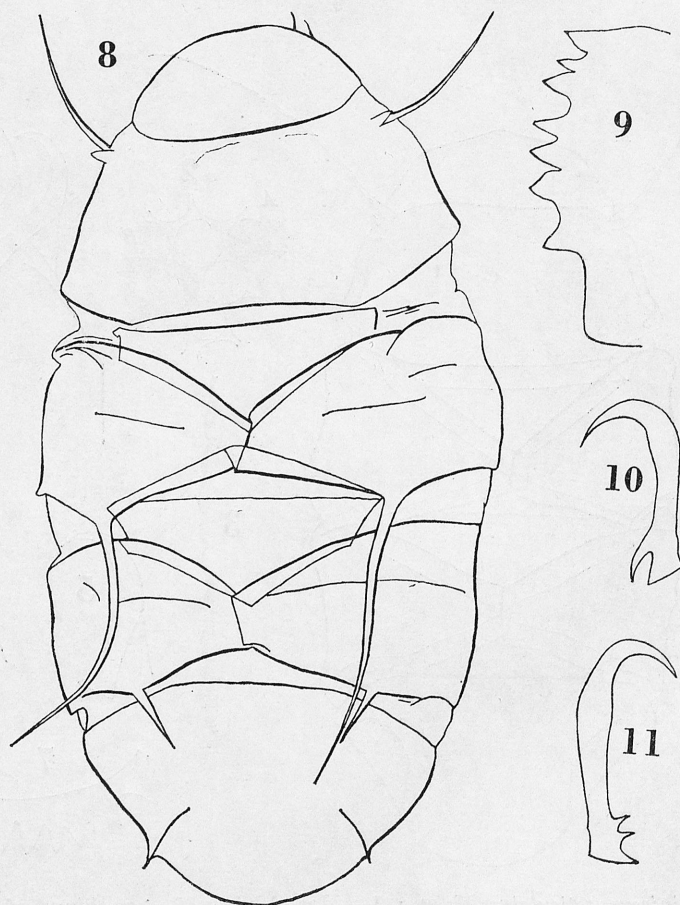


Fig. 8—11. *Echiniscus canadensis* MURR.: 8 — dorsal view, 9 — spine fringe, 10 — inner claw of IV pair legs, 11 — external claw of IV pair legs

***Echiniscus spinulosos* DOYÈRE, 1840 (fig. 12—14)**

Length 180  $\mu\text{m}$ . The body and the eyes are red. The dorsal side is covered with big and irregular spots. Between these occurs a tiny regular granulation. The lateral appendages, besides the appendages *A* (being 62  $\mu\text{m}$  long) are shaped as long spines (fig. 12). In the investigated specimen the appendages *B* and the right appendage *D* are absent. The appendages *C* are 25—27  $\mu\text{m}$  long, the appendage *D* is 22  $\mu\text{m}$  long, the appendages *E* are 25—27  $\mu\text{m}$  long. The dorsal appendages *C*<sup>2</sup> have a length of 17  $\mu\text{m}$ , *D*<sup>2</sup> is 27  $\mu\text{m}$  long. The third intersegmental

plate is lacking. The body has between the last pair of twin plates and the end plate a fine granulation. The end plate with incision, not faceted. The spine fringe has 8 and 9 irregular teeth (fig. 13). The external claws are smooth,

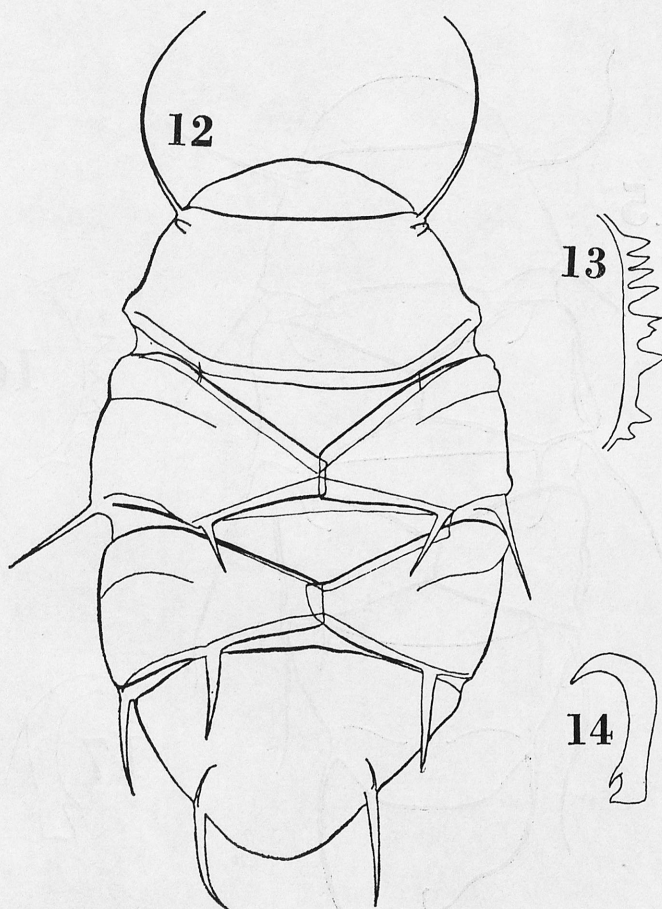


Fig. 12—14. *Echiniscus spinulosus* DOY.: 12 — dorsal view, 13 — spine fringe, 14 — inner claw of III pair legs

the inner ones have a spine, being markedly downward bent (fig. 14). The claws of the IV pair of legs are 14  $\mu$ m long.

Locality: 15 (1).

The specimen differs from the typical *E. spinuloides* DOY. (MARCUS, 1936) by a lack of faceted end plate and by a somehow different formation of appendages i.e. by features compared within the variability of this species.

***Echiniscus quadrispinosus* RICHTERS, 1902 (fig. 15—17)**

Length 125—195  $\mu$ m. The body is covered with an irregular granulation, in accordance with the description of MARCUS (1936). There occurs a third inter-

segmental plate (fig. 15). The spine fringe has 7—11 irregular teeth (fig. 16). The external claws of all the legs are smooth, the inner ones have a spine (fig. 17). Localities: **8** (2), **11** (33).

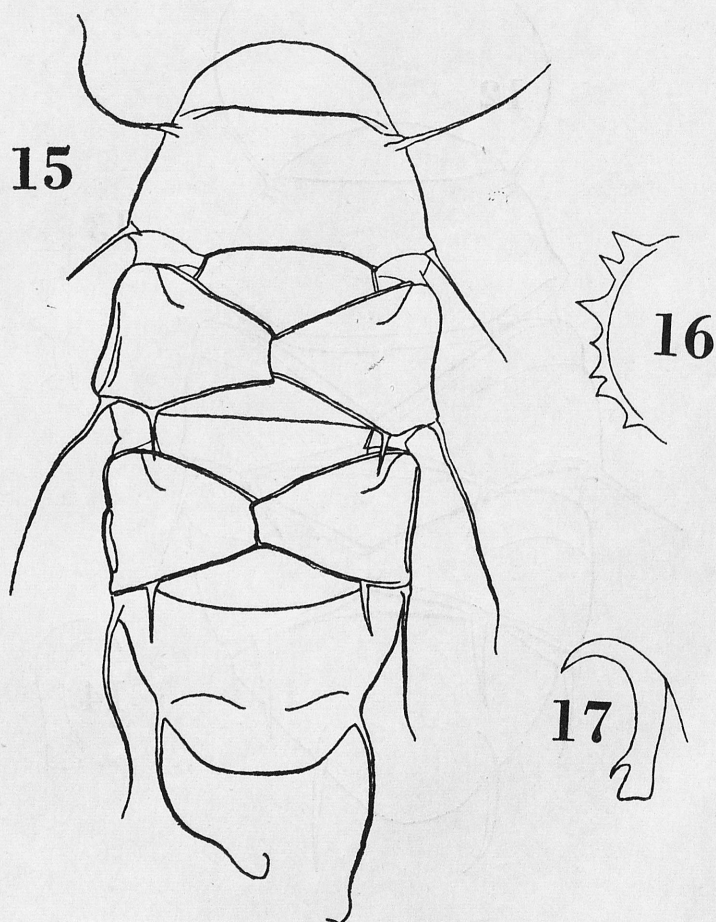


Fig. 15—17. *Echiniscus quadrispinosus* RICHT.: 15 — dorsal view, 16 — spine fringe, 17 — inner claw of IV pair legs

***Echiniscus blumi* RICHTERS, 1903**

Length 210—290  $\mu\text{m}$ . The specimens have typically shaped appendages. One specimen had in addition the appendage *E* in form of small tiny spines (being 3  $\mu\text{m}$  long and 1  $\mu\text{m}$  wide at the base). In another specimen the right appendage was bifurcated in a manner characteristic for *E. blumi* RICHT. f. *schizofitus* BARTOS, 1941.

Locality: **10** (4).



*Pseudechiniscus suillus* (EHRENBURG, 1853)

Length 112—185  $\mu\text{m}$ ; one specimen with four claws was 92  $\mu\text{m}$  long. Typical specimens. The limits between the dorsal plates and the incisions on the end plate were in three specimens less marked than in the other ones.

Localities: 4 (1), 8 (1), 11 (5), 12 (1), 13 (2), 15 (1).

The species from North Korea quoted by IHAROS (1972) originates from Kymgang-san mountains, prov. Kangvön-do („Kum-gang san prov. Kanvon” after MAHUNKA and STEINMANN, 1971).

*Macrobiotus occidentalis* MURRAY, 1910 f. *striata* n. f.

(fig. 18—22, phot. 3—8)

Length 175—360  $\mu\text{m}$ . The body is light-brown. The cuticle is smooth. Most of the full-grown specimens have numerous big clots of dark-brown irregularly distributed pigment under the cuticle (fig. 18, phot. 3). The occurring eyes are mostly big. The mouth opening is without lamella. The mouth tube is narrow, its inner diameter is 3—4  $\mu\text{m}$  and ends with apophyses (fig. 19). The oval pharynx is 27—35  $\mu\text{m}$  long and 25—30  $\mu\text{m}$  wide (the relation of its length to the width is 1,1:1 to 1,2:1). In the pharynx are two short, wide macroplacoids and a small microplacoid. The first macroplacoid is in his middle slightly narrowed, or has distinct lateral incisions and is broken in the middle. It is 1,4—1,8 times bigger than the second one. The first macroplacoid is 8  $\mu\text{m}$ , the second one 5  $\mu\text{m}$  long. Their width is 3  $\mu\text{m}$  (in the specimen being 320  $\mu\text{m}$  long). The claws are of „echinogenitus type” with distinct accessory spines and with a smooth lunule (fig. 20). The claws of the IV-th pair of legs are 10—14  $\mu\text{m}$  long. The eggs are white, their diameter with processes is 64—80  $\mu\text{m}$ , without processes 45—60  $\mu\text{m}$ . The processes are 7—13  $\mu\text{m}$  long, their diameter at the base is 3—5  $\mu\text{m}$ . The processes are conical shaped with an apex markedly extended into a flexible appendix. The ends of processes are mostly bent (phot. 5—7). The surface of all processes is covered with a characteristic tiny and transversal striation (therefore the name f. *striata*) being well visible with immersion (fig. 21, 22, phot. 8). This striation consists of tiny rings. The bases of processes are surrounded with a wreath of several small points. The distances between the bases of adjoining processes in bigger eggs (diameter without processes about 60  $\mu\text{m}$ ) are at the outmost of the same diameter as their bases (4—5  $\mu\text{m}$ ); as a rule they are smaller (2—3  $\mu\text{m}$ ). The smaller eggs (of 45—55  $\mu\text{m}$  in diameter without processes) have these distances equal to the process diameter, or they are at the outmost bigger by 2  $\mu\text{m}$ . The chorion surface between the processes is smooth.

Localities: 2 (134; 15 eggs), 4 (3), 5 (48; 17 eggs).

The specimens from Korea approach most by their type to those of *M. occi-*

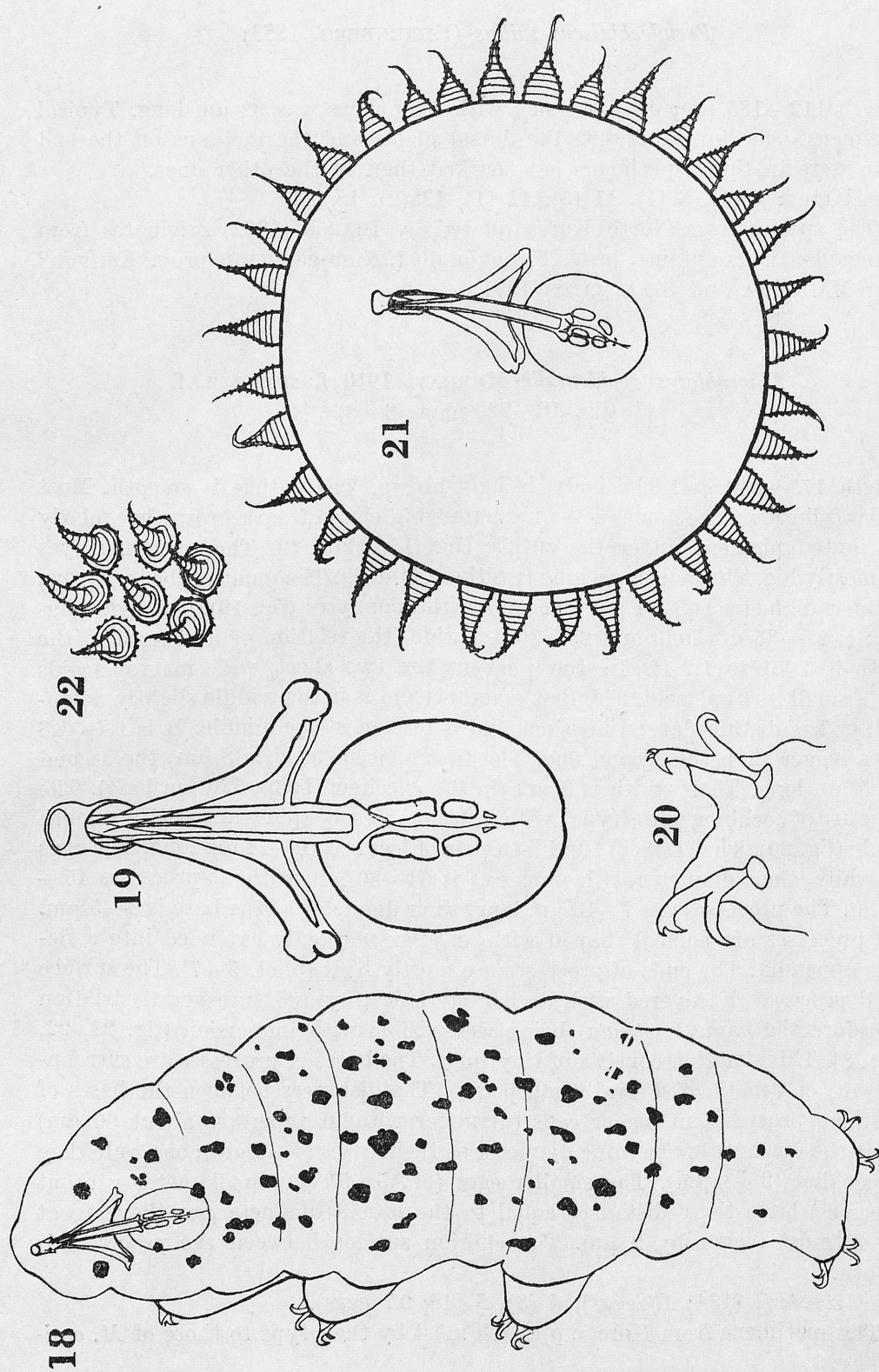


Fig. 18—22. *Macrobiotus occidentalis* MURR. f. *striata* f.n.: 18 — dorsal view, 19 — buccal apparatus, 20 — claws of IV pair legs, ventral view, 21 — egg, 22 — processes of egg

*dentalis* MURR. from Sweden (THULIN, 1911) and differ only by colour of body (from yellow colouring to orange-red). The essential difference why I distinguish in this species the *striata* form, is the formation of egg processes (a striation and a wreath of points at their base). *M. occidentalis* MURR. f. *primitivae* BARROS, 1942 differs from the form quoted above, by a granulated cuticle, by mouth lamellae and by smaller egg processes ( $5\text{ }\mu\text{m}$ ) which neither are striated and without any wreath of points at the base.

***Macrobiotus islandicus* RICHTERS, 1904 (fig. 23—25, phot. 9,10)**

Length  $325\text{ }\mu\text{m}$ . The body has a yellow-red colour, the cuticle is smooth. The eyes exist. The mouth opening has no lamella. The mouth tube is  $5\text{ }\mu\text{m}$  wide. The pharynx is oval ( $40 \times 35\text{ }\mu\text{m}$ ) with two macroplacoids (fig. 23). The first

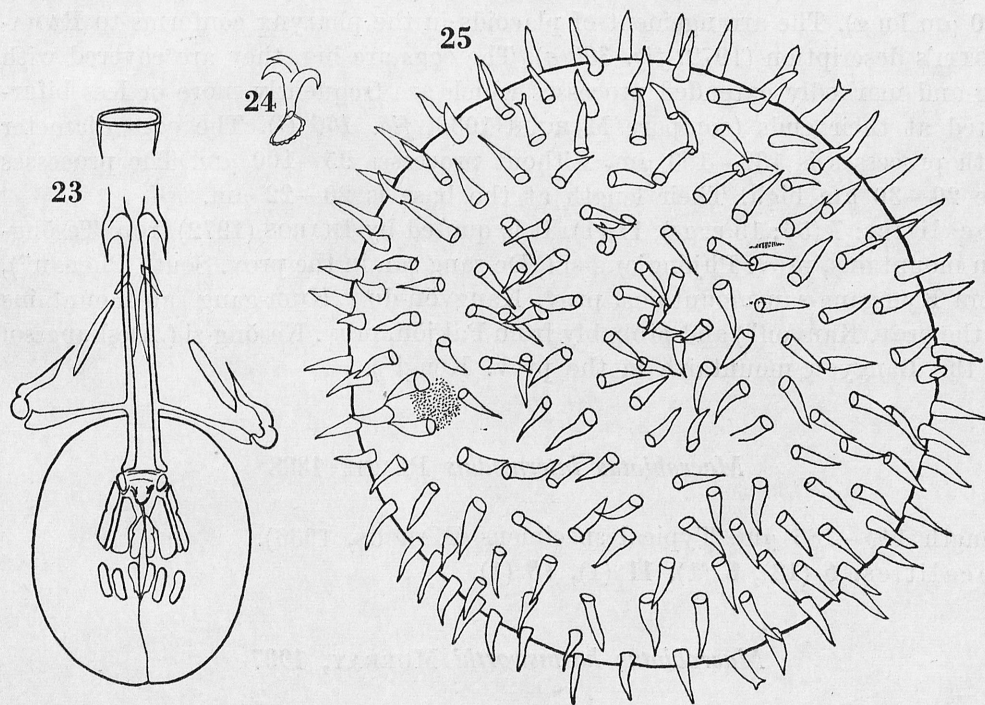


Fig. 23—25. *Macrobiotus islandicus* RICHT.: 23 — buccal apparatus, 24 — claw of IV pair legs, 25 — egg

macroplacoid is  $9\text{ }\mu\text{m}$  long with a tiny incision on the outside, the second one is  $5\text{ }\mu\text{m}$  long. Microplacoid is lacking. Position of macroplacoids in the pharynx conforms with PETERSEN's description (1951, fig. 19b). The claws are small with strong additional spines and with a gently curled lunule (fig. 24). The claws of the IV-th pair of legs are  $10\text{ }\mu\text{m}$  long. The egg is big and red. The egg surface is covered with processes (fig. 25, phot. 9, 10) which are  $7\text{--}9\text{ }\mu\text{m}$  high and  $2\text{ }\mu\text{m}$



wide at the base. The surface of processes is coarse. The chorion between the processes is covered with a tiny irregular granulation. A ring without granulation around the processes, mentioned by PETERSEN, does not occur. The shape of processes and their arrangement is similar to that described by PETERSEN (1951, *fig. 20b*) and by WEGLARSKA (1965, *phot. 6*). The egg diameter without processes is 90  $\mu\text{m}$ ; with processes 105–110  $\mu\text{m}$ .

Locality: **6** (1; 1 egg).

This specimen differs from the typical *M. islandicus* RICHT. having the body colour normally yellow or yellow-brown, as well as being slightly smaller egg processes and by colouring (compare MARCUS, 1936).

### *Macrobiotus richtersi* MURRAY, 1911

Length 240–610  $\mu\text{m}$ . The mouth tube is 15  $\mu\text{m}$  wide (in the specimen being 610  $\mu\text{m}$  long). The arrangement of placoids in the pharynx conforms to RAMAZZOTTI's description (1972, *fig. 390 a*). The eggs are big, they are covered with big and markedly extended processes which are frequently more or less bifurcated at their ends (compare MARCUS 1936, *fig. 166 G*). The egg diameter with processes is 132–153  $\mu\text{m}$ , without processes 95–100  $\mu\text{m}$ . The processes are 20–30  $\mu\text{m}$  high. Their length at the base is 20–22  $\mu\text{m}$ .

Localities: **7** (56; 15 eggs), **11** (1). It is quoted by IHAROS (1972) from Tesöng-san mountains, prov. Phjöngjang-si („De-sang san in the prov. South Phenan”), from Kymgang-san mountains, prov. Kangvön-do („Kum-gang san mountains in the prov. Kanvon”) and probably from Pakjön, prov. Kesöng-si („De-hung-sol in the Bangyon mountains in the prov. Kengi”).

### *Macrobiotus intermedius* PLATE, 1888

Length 145–185  $\mu\text{m}$ . Typical specimens (MARCUS, 1936).

Localities: **6** (12), **8** (1), **11** (1), **15** (1).

### *Macrobiotus harmsworthi* MURRAY, 1907

Length 150–520  $\mu\text{m}$ . Typical specimens with features conforming with the description of MARCUS (1936). Five specimens were without eyes. The egg processes are markedly extended at the ends and covered with a reticular structure of 1–2  $\mu\text{m}$  mesh diameter (compare SCHUSTER and GRIGARICK, 1965, *fig. 5 E*). The ends of the processes are frequently bent. The egg diameter with processes is 95–122  $\mu\text{m}$ ; without processes is 57–65  $\mu\text{m}$ . The processes are 15–30  $\mu\text{m}$  high.

Localities: **1** (2), **2** (3; 1 egg), **3** (2), **4** (3; 1 egg), **5** (10; 13 eggs), **6** (2), **11** (31; 1 egg), **12** (7; 14 eggs), **13** (20), **15** (27; 3 eggs), **16** (1).

*Macrobiotus hibernicus* MURRAY, 1911

Length 105—180  $\mu\text{m}$ . Typical specimens (MARCUS, 1936) with a characteristic belt of granulation on the dorsal side. The claws are small, 5  $\mu\text{m}$  long.

Localities: **6** (4), **11** (16).

*Macrobiotus areolatus* MURRAY, 1907

Length 280—450  $\mu\text{m}$ . Typical specimens (compare MARCUS, 1936). In 2 specimens the eyes were absent; 3 specimens had only very little eye pigment. The egg processes are covered with a characteristic structure, well visible only in immersion, in form of a reticle with lengthened meshes (compare SCHUSTER and GRIGARICK 1965, *fig 4 D*). The diameter of eggs with processes is 112—120  $\mu\text{m}$ ; without processes 80  $\mu\text{m}$ .

Locality: **2** (9; 2 eggs).

*Macrobiotus hufelandi* SCHULTZE, 1833

Length 137—320  $\mu\text{m}$ . The species and the eggs are typically developed (MARCUS, 1936). The diameter of eggs with processes is 77—95  $\mu\text{m}$ , without processes 67—77  $\mu\text{m}$ . The processes are 6—10  $\mu\text{m}$  high.

Localities: **6** (2), **8** (11; 4 eggs), **11** (164; 5 eggs), **14** (97; 2 eggs). It is quoted by IHAROS (1972) from „Kum-gang san mountains in the prov. Kanvon” and from „De-hung-sol in the prov. Kengi”.

*Macrobiotus aviglianae* ROBOTTI, 1970 (fig. 26—29, phot. 11—14)

Length 212—340  $\mu\text{m}$ . The body is white; some specimens had a brown pigment on the back and at the body end. The eyes are small, posteriorly situated; they did not occur in 5 specimens. The buccal apparatus is very similar to that of *M. hufelandi* SCHUL. (fig. 26, phot. 11, 12). The mouth tube is 45  $\mu\text{m}$  long and 6  $\mu\text{m}$  wide (dimensions in the specimen being 324  $\mu\text{m}$  long). The pharynx is oval (40  $\times$  30  $\mu\text{m}$ ). The first macroplacoid is 12  $\mu\text{m}$ , the second one 7  $\mu\text{m}$ . The width of macroplacoids is 2,5  $\mu\text{m}$ . The microplacoid is 3,5  $\mu\text{m}$  long. The claws are intermediate between the „type hufelandi” and „echinogenitus” (fig. 27), with a smooth lunule. The claws of the IV-th pair of legs are 13  $\mu\text{m}$  long. The eggs are white and of „areolatus type” (fig. 28). The chorion processes are covered with a very fine granulation (composed of a reticle with very fine meshes?). It is visible as clearer or dark points (fig. 29, phot. 13). The size of granules does not exceed 1  $\mu\text{m}$ . Their mean size is even smaller i.e. about 0,5  $\mu\text{m}$ . The processes are often narrowed at their ends and slightly deflected (phot. 14; compare too ROBOTTI, 1970, *fig. 3*). The egg diameter with processes is 97—100  $\mu\text{m}$ .

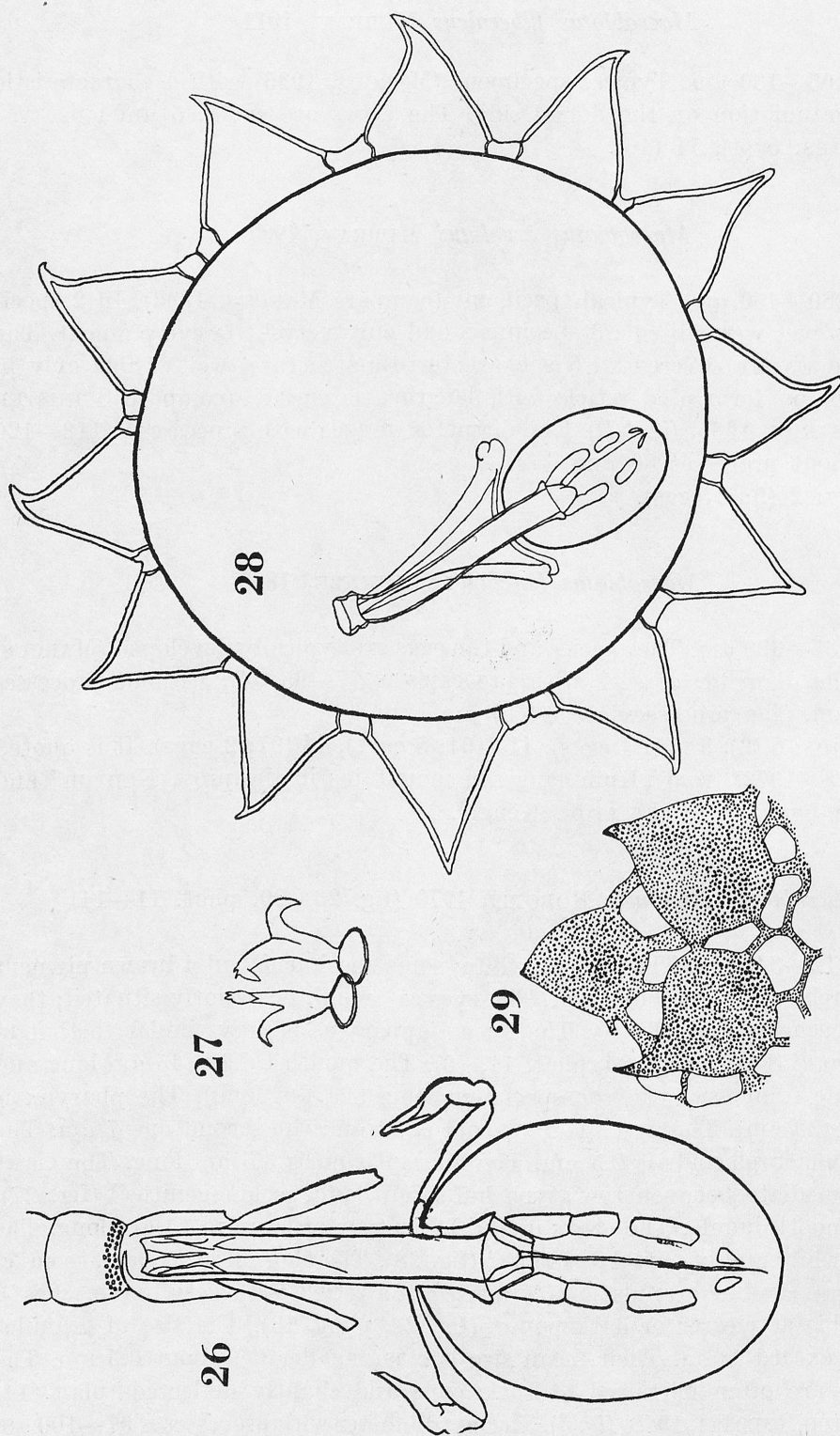


Fig. 26—29. *Macrobiotus aviglianae* Robot.; 26 — buccal apparatus, 27 — claws of IV pair legs, 28 — egg, 29 — processes of egg



without processes 67—70  $\mu\text{m}$ . The processes are 15—18  $\mu\text{m}$  high; their width at the base is 18  $\mu\text{m}$ .

Locality: **12** (16; 3 eggs).

As compared with the original description (ROBOTTI, 1970), the specimens from Korea differ inconsiderably by some dimensions. The egg dimensions are contained within the range of variability of this species (compare BINDA and PILATO, 1971). *M. aviglianae* ROBOT. was known till now only from Italy. It belongs to the species of „group grandis” which requires revision. It is probably a synonym of *Macrobiotus pallari* MAUCCI, 1954 (MAUCCI in litt; compare also MAUCCI, 1954).

#### *Macrobiotus echinogenitus* RICHTERS, 1904

Length 285—445  $\mu\text{m}$ . Typical specimens, conforming to the description of MARCUS (1936). The lunule of claws have characteristic denticles. The egg is oval, its diameter with processes is  $112 \times 125$   $\mu\text{m}$ , without processes  $87 \times 100$   $\mu\text{m}$ . The egg processes are 12  $\mu\text{m}$  high.

Localities: **6** (1), **9** (3; 1 egg).

#### *Calohypsibius ornatus* (RICHTERS, 1900)

Length 112—120  $\mu\text{m}$ . Typical specimens, with well developed dorsal spines. These are absent only in the row next to the last at the rear end of the body (compare BARTOS 1941, fig. 3—2). One of the specimens had reduced spines which were transformed into tubercles. They were elongated at the end of body and had there the biggest size. That specimen was most similar to the form described by BARTOS (1940, fig. 2—26). In this, however, the tubercles at the inner side of the IV-th pair of legs were absent.

Localities: **6** (5+1), **7** (1).

#### *Isohypsibius tuberculatus* (PLATE, 1888)

Length 120—195  $\mu\text{m}$ . The dorsal tubercles are covered with a fine reticular structure. The specimens conform to the description of MARCUS (1936). Besides the inner side of claws of the I—III pair of legs has cuticular swellings. The exuvium had 5 eggs.

Localities: **12** (1), **13** (2).

#### *Isohypsibius schaudinni* (RICHTERS, 1904)

Length 132—207  $\mu\text{m}$ . The eyes are big. The mouth opening is situated ventrally. The mouth tube is 3  $\mu\text{m}$  wide (in the specimen being 207  $\mu\text{m}$  long). The pharynx is oval ( $25 \times 21$   $\mu\text{m}$ ), with two macropylacoids and with a small micropylacoid. The first macropylacoid is markedly narrowed and divided into

2 equal parts. The second macroplacoid is smaller than the first one, but bigger than its particular parts. The main branches of claws are markedly developed, particularly on the IV-th pair of legs. The claws of the IVth pair of legs are 19  $\mu\text{m}$  long.

Locality: 12 (6).

I have reckoned these specimens as *I. schaudinni* RICHT. taking into account the ventral situation of the mouth opening and the lack of cuticular swellings on the inside of claw bases of the I—III pair of legs. These features are supposed to differentiate *I. schaudinni* RICHT. from a very similar *I. prosostomus* THUL. My specimens have however a macroplacoid arrangement being typical for *I. prosostomus* THUL. This confirms the opinion of vagueness concerning these species (CUENOT 1932, RAMAZZOTTI 1967, 1972).

*I. schaudinni* Richt. is known from North Korea, from the Kymgang-san mountains in the prov. Kangvön-do (IHAROS, 1972).

### *Hypsibius dujardini* (DOYÈRE, 1840)

Length 200  $\mu\text{m}$ . Typical specimen with distinct macroplacoid and with claws being characteristically formed in this species.

Locality: 13 (1).

### *Hypsibius convergens* (URBANOWICZ, 1925)

Length 130—190  $\mu\text{m}$ . Specimens conforming with the description of MARCUS (1936).

Localities: 11 (13), 14 (4). The species is quoted by IHAROS (1972) from Tesöng-san in the prov. Phjöngjang-si.

### *Hypsibius oberhaeuseri* (DOYÈRE, 1840)

Length 150—250  $\mu\text{m}$ . The dorsal side is covered with a desing forming a characteristic pigment pattern. The cuticle in full-grown specimens has a granulation which is the biggest one at end of body. Other features are also typical for this species (MARCUS, 1936).

Localities: 5 (15), 8 (4), 11 (1).

### *Diphascon alpinus* (MURRAY, 1906)

Length 150—165  $\mu\text{m}$ . Specimens with 3 macroplacoids of increasing size, with microplacoid and septulum. Other features are also in accordance with the PETERSEN's description (1951)

Localities: 11 (2), 13 (4), 15 (1).

*Diphascon scoticus* (MURRAY, 1905)

Length 360—365  $\mu\text{m}$ . The body is light-brown. A septulum is absent, there occurs only a microplacoid. The feature distinguishing my specimens from those described by MARCUS (1936) and PETERSEN (1951) is the occurrence the cuticular swellings at the claw inside of the I—III pair of legs.

Locality: 11 (3).

*Diphascon iltisi* SCHUSTER and GRIGARICK, 1965 (fig. 30 — 35, phot. 15, 16)

Length 150—215  $\mu\text{m}$ . The body back has 10—11 cylindrical and transversal gibbositities (fig. 30, 31, phot. 15). Whole the dorsal side is covered with a fine polygonal granulation (fig. 30, 32, phot. 16). It is bigger on the gibbositities, in the middle line of the body (2—3  $\mu\text{m}$ ) and smaller on its sides (about 1  $\mu\text{m}$ ). The mouth tube is narrow, about 1,5  $\mu\text{m}$  wide (dimensions of the specimen being 190  $\mu\text{m}$  long). In the pharynx (24  $\times$  20  $\mu\text{m}$ ) are apophyses, two macroplacoids (5 and 3  $\mu\text{m}$  long) and a microplacoid (2  $\mu\text{m}$ ). The first macroplacoid is narrowed in the middle (fig. 33). The claws are of different size, the external ones are bigger (fig. 34). The main branches of claws have very small, scarcely visible accessory spines. On the inner side of the claw base of the I—III pair of legs appear cuticular swellings (fig. 35). The external claw of the IV-th pair of legs is 11  $\mu\text{m}$  long, the inner one is 8  $\mu\text{m}$  long.

Locality: 11 (3).

The specimens are conforming in features with SCHUSTER's and GRIGARICK's description (1965). They differ from those only in size. I have observed in paratypes of this species cuticular swellings at the claws of the I—III pair of legs as well. These have not been quoted by the mentioned authors in original description. The species had been known till now only from California (l. c., RAMAZZOTTI, 1972).

*Milnesium tardigradum* (DOYÈRE, 1840)

Length 235—545  $\mu\text{m}$ . The body is brown-rosy. The specimens are typical (MARCUS, 1936). In exuvia groups of 1, 2 and 3 oval eggs.

Localities: 5 (13), 10 (5).

*Itaquascon bartosi* (WĘGLARSKA, 1959) (fig. 36 — 38)

Length 280—420  $\mu\text{m}$ . The body is white, the cuticle is smooth (fig. 36). The stilets are slightly bent, 18  $\mu\text{m}$  long (in the specimen measuring 280  $\mu\text{m}$ ). The mouth tube is 45  $\mu\text{m}$  long and 3  $\mu\text{m}$  wide. The pharynx is oval, 25  $\times$  15  $\mu\text{m}$ . On both sides of the pharynx inside measurement are visible 2 tiny, thin and long swellings (fig. 37). The claws are of „Diphascon type”. The base of main branches of external claws has a blistery enlargement, markedly deflecting the light (fig. 38). The claws of the IV-th pair of legs are 17  $\mu\text{m}$  long. Two specimens had cuticular swellings at the claw base outside of the III-rd pair of legs.

Locality: 8 (6).



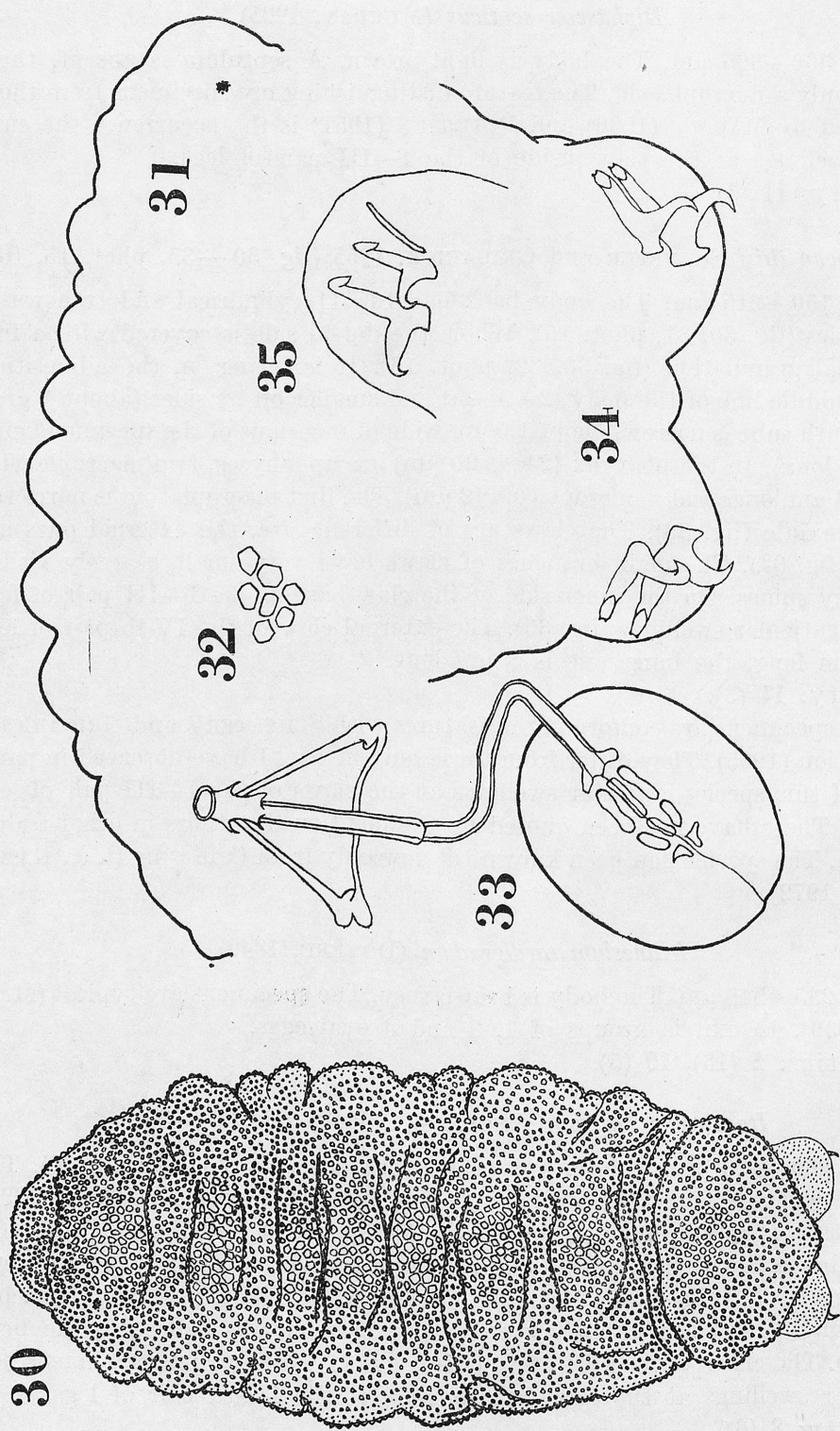


Fig. 30—35. *Diphascon illisi* SCHUST. & GRIG.: 30 — dorsal view, 31 — dorsal granulation of body, 32 — dorsal gibbosities, 33 — claws of IV pairs of legs, ventral view, 34 — claws of III pair of legs, ventral view, 35 — granulation of body, ventral view

These specimens differ from the holotype and paratypes *It. bartosi* (WĘGL.) only in a smaller length of salivary glands and are identical with the description of *It. ramazzotti* IHAROS. This vagueness originates mainly from a lack of data in the original description of *It. bartosi* (WĘGL.) concerning in this species the

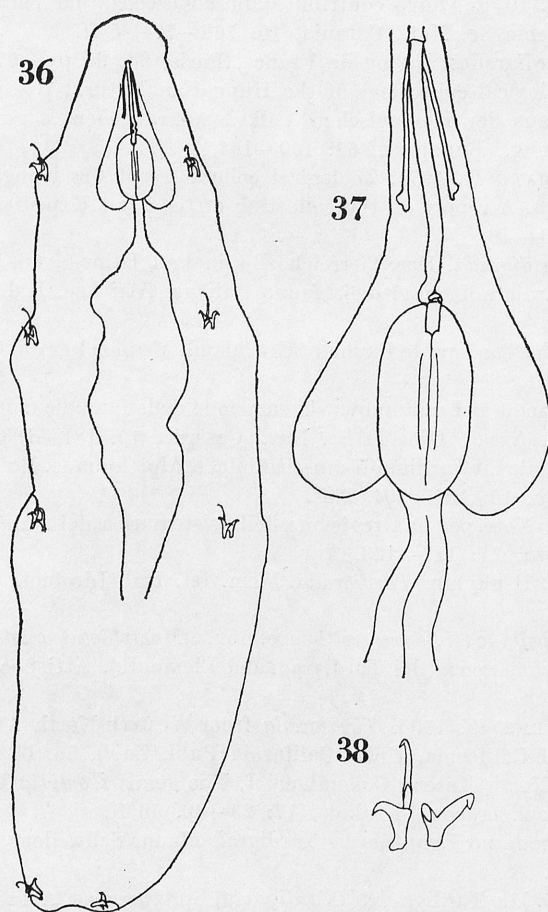


Fig. 36—38. *Itaquiscon bartosi* (WĘGL.): 36 — ventral view, 37 — buccal apparatus, 38 — claws of III pair legs

occurrence of 2 tiny, thin and long swellings at the sides of the inner pharynx diameter (wall swellings in the triangular inner diameter? — compare PILATO, 1969b). I have observed these swellings in the holotype and paratypes *It. bartosi* (WĘGL.). PILATO (1969b) considers *It. ramazzotti* IHAROS, to be a synonym of *It. trinacriae* ARCIDIACONO. For that reason both these species are the synonyms of insufficiently described *It. bartosi* (WĘGL.).

Department of Animal Morphology  
A. MICKIEWICZ University  
Fredry 10, 61-701 Poznań, Poland

## REFERENCES

- BARTOS E. 1940. Über die Variation der Art *Hypsibius ornatus* RICHT. (*Tardigrada*). Zool. Jahrb. Abt. Syst., Jena, **73**: 369—384.
- BINDA M., PILATO G. 1971. Nuovo contributo alla conoscenza dei Tardigradi di Sicilia. Boll. Sed. Accad. Gioenia Sc. Nat., Catania, **10**: 766—774, 5 ff.
- CUENOT L. 1932. Tardigrades. Faune de France, Paris, **24**, 96 pp., 97 ff.
- IAROS G. 1972. Zoological collectings of the Hungarian Natural History Museum in Korea. 5. Tardigraden aus der Koreanischen Volksdemokratischen Republik. Ann. Hist. Nat. Mus. Nation. Hung., Budapest., **63**: 159—164, 1 ff.
- MAHUNKA S., STEINMANN H. 1971. Zoological collectings of the Hungarian Natural History Museum in Korea. A report on the collecting of the First Expedition. Folia Ent. Hung., Budapest, **24**: 21—46.
- MARCUS E. 1936. *Tardigrada*. Das Tierreich, Berlin und Leipzig, **66**, 340 pp., 306 ff.
- MAUCCI W. 1954. Tardigradi nuovi della fauna italiana. Atti Soc. Ital. Sc. Nat., Milano, **93**: 576—585, 3 ff.
- PETERSEN B. 1951. The Tardigrade Fauna of Greenland. Meddelelser om Grønland, København, **150**, 94 pp., 38 ff.
- PILATO G. 1969 a. Schema per una nuova sistemazione delle famiglie e dei generi degli *Eutardigrada*. Boll. Sed. Accad. Gioenia Sc. Nat., Catania, **10**: 181—193.
- PILATO G. 1969 b. Su alcuni Tardigradi muscicoli delle Alpi Apuane. Boll. Sed. Accad. Gioenia Sc. Nat., Catania, **10**: 194—204, 2 ff.
- RAMAZZOTTI G. 1967. Note per una revisione della sistematica dei *Tardigradi*. Mem. Ist. Ital. Idrobiol., Pallanza, **21**: 117—128.
- RAMAZZOTTI G. 1972. Il phylum *Tardigrada*. Mem. Ist. Ital. Idrobiol., Pallanza, **28**, 732 pp., 478 ff.
- ROBOTTI C. 1970. *Hypsibius* (H.) *ramazzotti* spec. nov. e *Macrobiotus aviglianae* spec. nov. (Primo contributo alla conoscenza dei Tardigradi del Piemonte). Atti Soc. It. Sc., Milano, **110**: 251—255, 3 ff.
- SCHUSTER R., GRIGARICK A. 1965. *Tardigrada* from Western North America with Emphasis on the Fauna of California. Univ. California Publ. Zool., **76**, 67 pp., 43 ff.
- SZEPTYCKI A. 1973. North Korean Collembola. I. The genus *Homidia* BÖRNER 1906 (*Entomobryidae*). Acta zool. cracov., Kraków, **17**: 23—40, 56 ff.
- THULIN G. 1911. Beiträge zur Kenntnis der Tardigradenfauna Schwedens. Ark. Zool., Stockholm, **7**, 60 pp., 31 ff.
- WĘGLARSKA B. 1965. Die Tardigraden (*Tardigrada*) Spitzbergens. Acta zool. cracov., Kraków, **11**: 43—51, 8 ff.

## STRESZCZENIE

Autor podaje wykaz 27 gatunków niesporczaków z mchów zebranych przez ekspedycję Zakładu Zoologii Systematycznej i Doświadczalnej Polskiej Akademii Nauk do Koreańskiej Republiki Ludowo-Demokratycznej w 1971 roku, opisuje nową formę *Macrobiotus occidentalis* MURR. f. *striata* n.f. oraz uzupełnia opisy innych gatunków.



Автор приводит список 27 видов тихоходок собранных на мхах участниками экспедиции Института Систематической и Экспериментальной Зоологии Польской Академии Наук в Корейской Народно-Демократической Республике, описывает новую форму *Macrobiotus occidentalis* MURR. f. *striata* f.n. а тоже наиболее существенные признаки других видов.

Plate VII

Phot. 1. *Echiniscus reticulatus* MURR., habitus

Phot. 2. *Echiniscus reticulatus* MURR., swellings on cuticle surface

Phot. 3. *Macrobiotus occidentalis* MURR. f. *striata* n.f., specimen with pigment

Phot. 4. *Macrobiotus occidentalis* MURR. f. *striata* n.f., specimen without pigment

Phot. J. SKIBIŃSKI

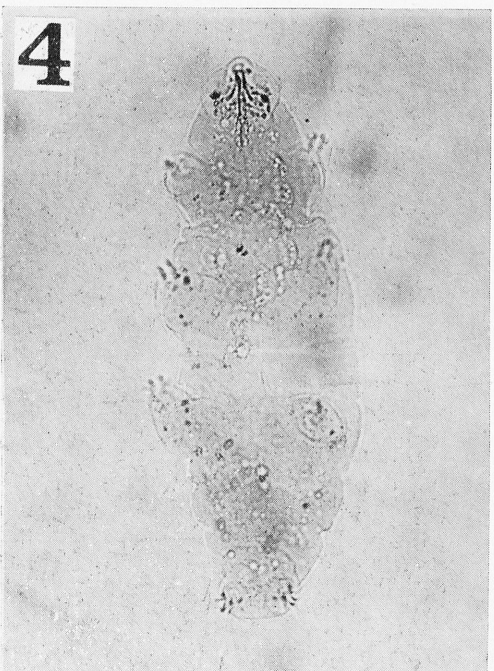
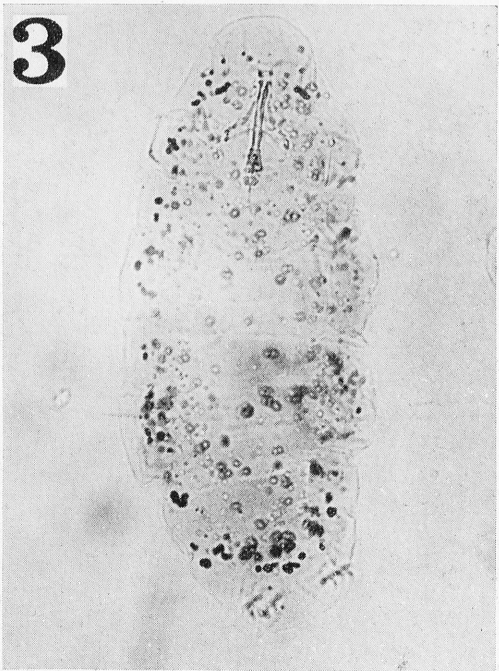
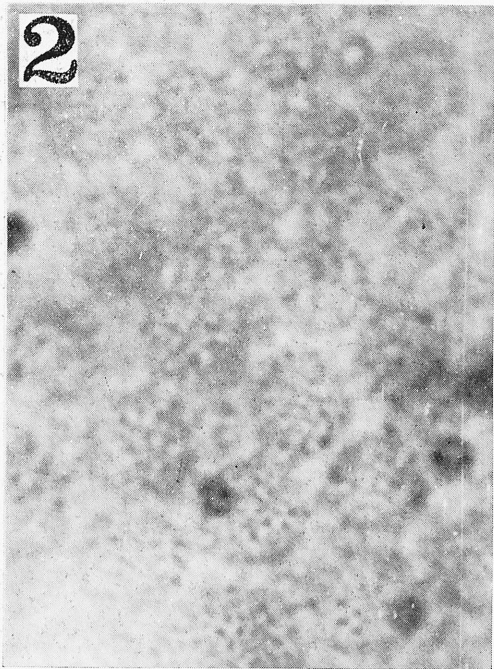
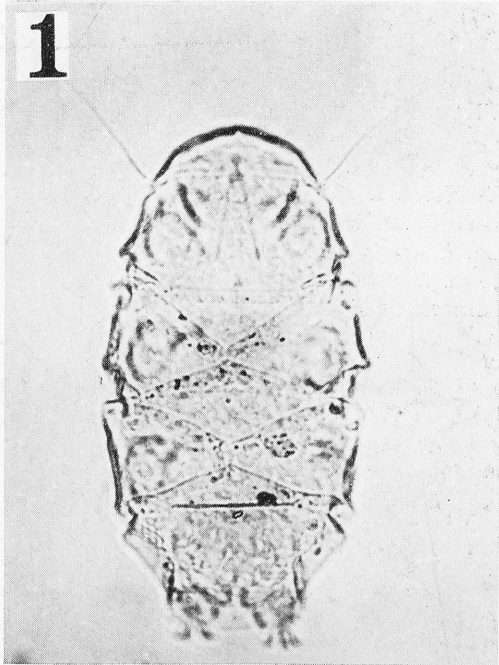




Plate VIII

Phot. 5. *Macrobotus occidentalis* MURR. f. *striata* n.f., egg

Phot. 6. *Macrobotus occidentalis* MURR. f. *striata* n.f., eggs

Phot. 7. *Macrobotus occidentalis* MURR. f. *striata* n.f., processes of egg

Phot. 8. *Macrobotus occidentalis* MURR. f. *striata* n.f., processes of egg

Phot. J. SKIBIŃSKI

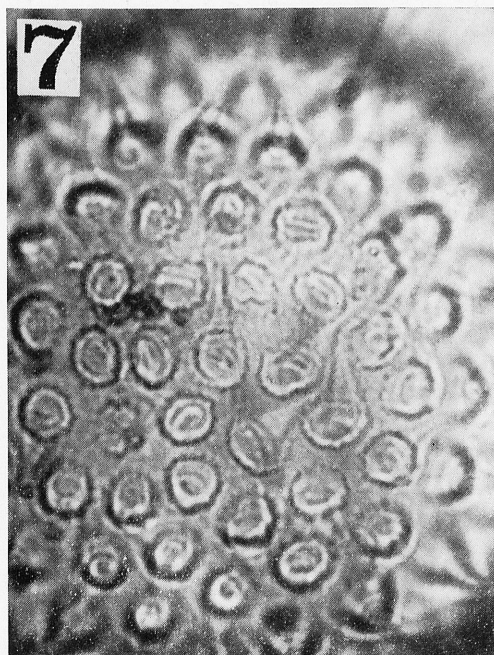
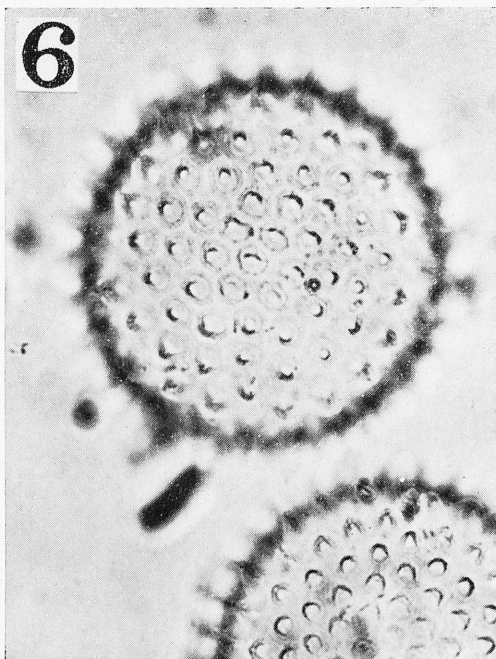
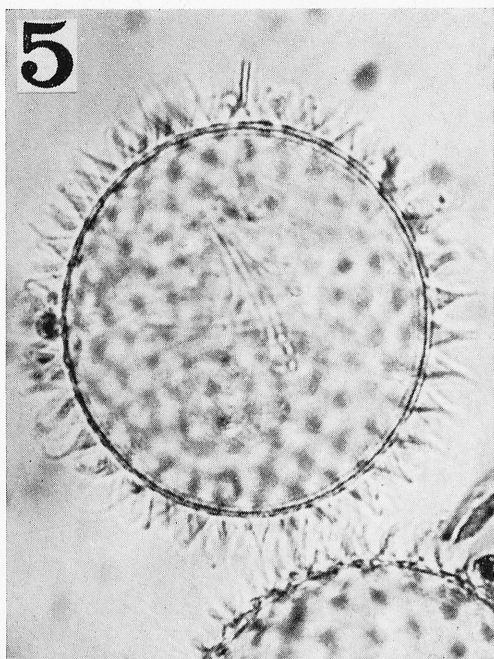


Plate IX

Phot. 9. *Macrobiotus islandicus* RICHT., egg

Phot. 10. *Macrobiotus islandicus* RICHT., processes of egg

Phot. 11. *Macrobiotus aviglianæ* ROBOT., front body of specimen

Phot. 12. *Macrobiotus aviglianæ* ROBOT., front body of specimen and egg

Phot. J. SKIBIŃSKI



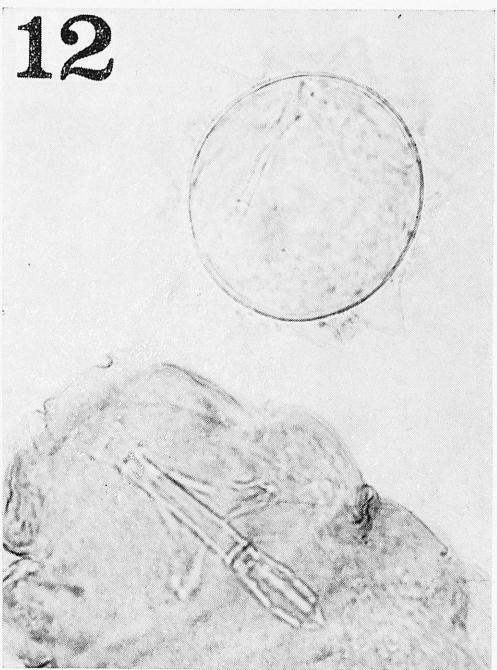
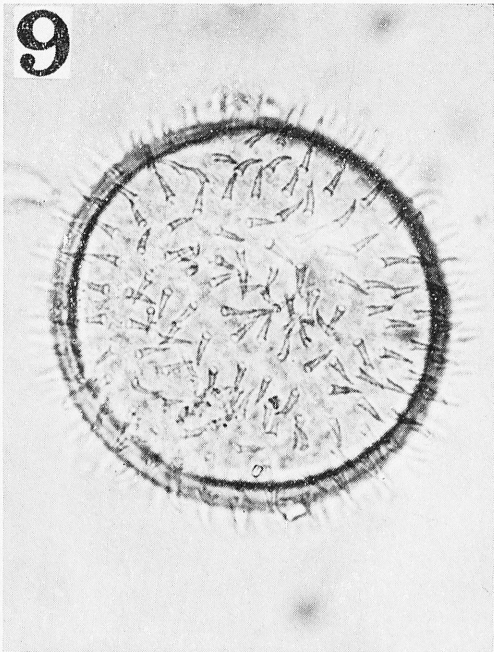


Plate X

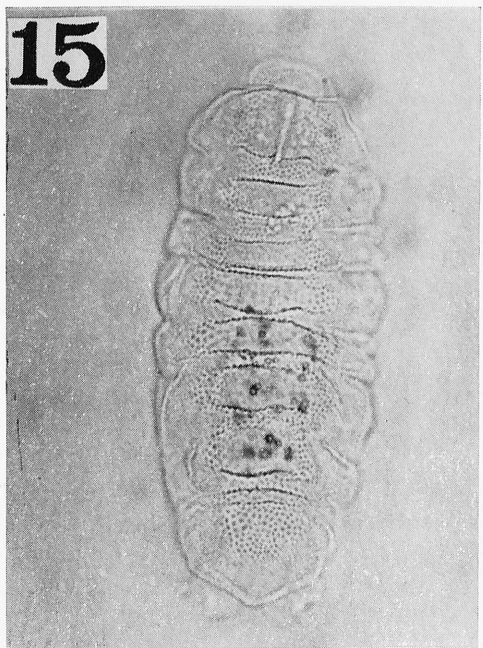
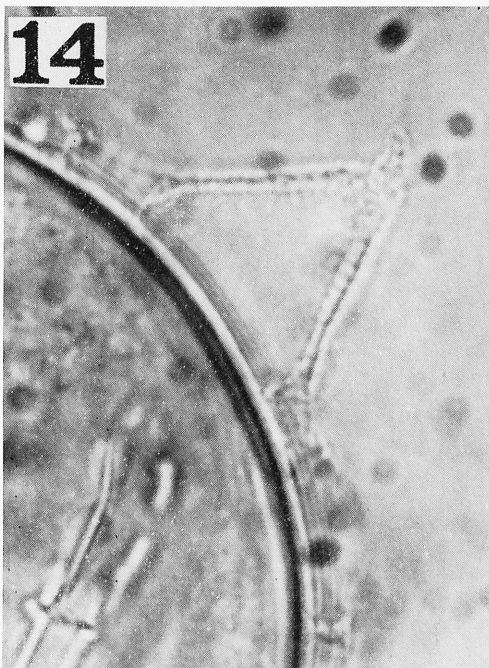
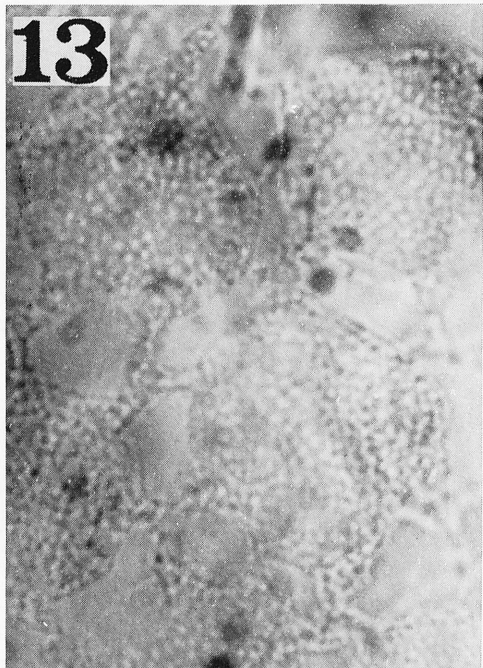
Phot. 13. *Macrobiotus avighianae* ROBOT., processes of egg

Phot. 14. *Macrobiotus avighianae* ROBOT., processes of egg

Phot. 15. *Diphascon iltisi* SCHUST. & GRIG., habitus

Phot. 16. *Diphascon iltisi* SCHUST. & GRIG., granulation of dorsal gibbosities

Phot. J. SKIBIŃSKI





Redaktor zeszytu: doc. dr J. Pawłowski

---

PAŃSTWOWE WYDAWNICTWO NAUKOWE — ODDZIAŁ W KRAKOWIE — 1974

Nakład 700+90    Ark. wyd. 2    Ark. druk.  $1\frac{6}{16} + 4$  wkładki    Papier druk. kl. III, 70×100 70 g  
Zam. 78/74    Cena zł 16,—

---

DRUKARNIA UNIwersytetu Jagiellońskiego w Krakowie