

New, Little-Known and Characteristic Ciliate Species From the Apsheron Coast of the Caspian Sea

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Abstract: Three new, five little-known and five characteristic ciliate species are described and figured. All these species were found in the psammon and periphyton along the Apsheron coast of the Caspian Sea (Azerbaijan). The descriptions are based on the observations of living specimens and the analysis of slides impregnated with silver.

Key Words: Marine Ciliates, Psammon, Periphyton.

Hazar Denizi Abşeron Sahillerinin Yeni, Az Tanınmış ve Karakteristik Siliyat Türleri

Özet: Bu çalışmada, 3 yeni, 5 az tanınmış ve 5 karakteristik siliyat türlerinin tanımlama ve şekilleri verilmiştir. Tüm türler Hazar Denizi Abşeron yarımadası sahillerinin psammon ve perifitonun'da bulunmuştur. Tanımlamalar canlı (in vivo) örnekler, gümüş tuzu ve Ag - proteinat yöntemleri ile hazırlanmış preparatlara dayanılarak yapılmıştır.

Anahtar Sözcükler: Deniz Siliyatları, Psammon, Perifiton.

Introduction

Due to the rise level of the Caspian Sea the ecological conditions of its eastern littoral have changed considerably and are continuing to change. For example during this investigation the water salinity fluctuated between 6-10‰, whereas in 1987 minimum salinity was 10‰. A large area of land was flooded and it led to the appearance of qualitatively new biotops along with the other ecological conditions. All of the aforementioned dictate the continuation of investigations on the ciliate fauna of the Caspian Sea.

Materials and Methods

Free-living ciliates of the psammon and periphyton were the subject of these investigations. Samples were collected from different sections of the North and the South Apsheron coast of the Caspian Sea between 1991 and 1996.

The ciliates were observed on living specimens, then fixed by saturated mercuric bichloride, Bouin or Champy. In addition, they were impregnated using either silver nitrate method of Chatton and Lwoff (1) or the silver nitrate proteinate modified method (2). The nucleic acids were stained with the Feulgen nuclear reaction. All the

measurements were made on a minimum of 30 specimens. All drawings were made using a camera lucida. The type material of the new species has been deposited in the Protistological Laboratory, Institute of Zoology, Academy of Sciences of Azerbaijan, Baku.

Abbreviations used in the figures areas follows: AZM - adoral zone of membranelles; BD - buccal dikinetid; BE - buccal element; CC - caudal cirri; CE - collar element; Cp - cytophyge; CV - contractile vacuole; Cy - cytostome; DB - dorsal bristle; EM - endoral membrane; FC - frontal cirri; FTC - fronto - terminal cirri; LMC - left marginal cirri; M₁, M₂, M₃ - membranelle; Ma - macronucleus; Mi - micronucleus; MVC - midventral cirri; N - nematodesmata; P₁, P₂, P₃ - peniculus; Ph - pharynx; PM - paroral membrane; Pm - paramembranelle; PR - perizonal row; RMC - right marginal cirri; SR - somatic row; TC - transversal cirri; VC - ventral cirri; VS - ventral suture; UM - undulating membrane.

Tracheloraphis prenanti Dragesco, 1960 forma oligokineta Raikov et Kovaleva.

This is one of the abundant and typical psammobiotic species. For the first time it was found and described from fine sand on the Mediterranean coast of France (3).

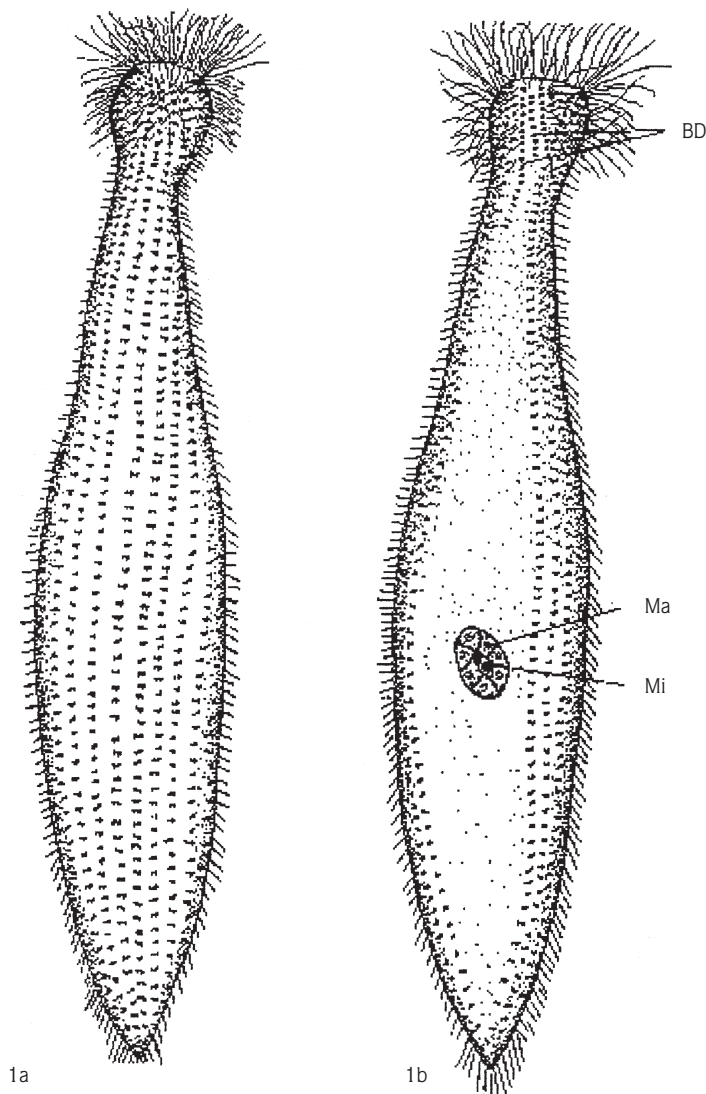


Figure 1. *Tracheloraphis prenanti* Dragesco, forma *oligokineta* Raikov et Kovaleva 1a- ventral side; 1b- dorsal side.

It was found by Agamaliev in the Caspian Sea (4). This species was recorded by us at the north and south coast of the Apsheron peninsula. Below is a short description of it.

Size of living cells 300-700 μm . Body elongated, slightly flattened dorsoventrally and can strongly contract. Terminal cytostome with a number of cilia. On the dorsal side 3 short rows of buccal dikinetid near the cytostome.

Somatic ciliature consists of 15 rows of dikinetid, evenly covering the whole ventral part and partly covering the dorsal part of the body, the greater part of which is an unciliated area. Between somatic rows there are myonemes and mucocysts.

Endoplasm from brown to black with refractile

granules in the anterior end of the body. Nuclear apparatus represented by a single "nuclear capsule" (a clump of 7 macronuclei and 2 Fleulgen - positive micronuclei in a cluster, with individual nuclear membranes intact).

According to Dragesco (3) this species has 2 forms different from other species of genus *Tracheloraphis* in number of somatic rows (14-27 and 20-24), and presence of a single "nuclear capsule" consisting of 4 macronuclei and 2 micronuclei. Later these forms and one other with 16 somatic rows and 2 "nuclear capsules" with 2 micronuclei in each were found in the Sea of Japon. After revision of this species (5) the form with 14-17 somatic rows and a single "nuclear capsule" was named *T. prenanti* f. *oligokineta*.

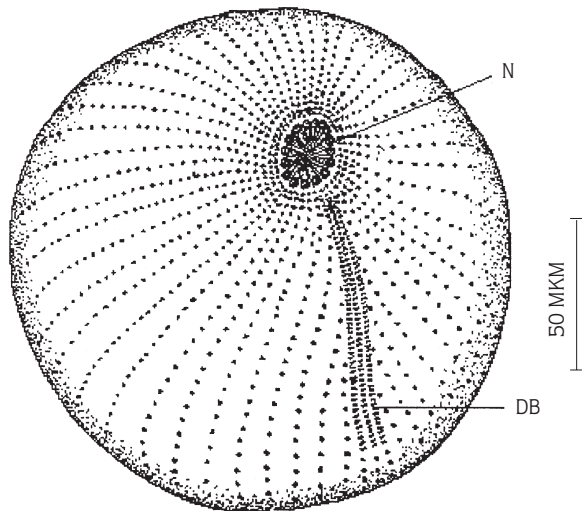


Figure 2. *Prorodon nucleolatus* Penard.

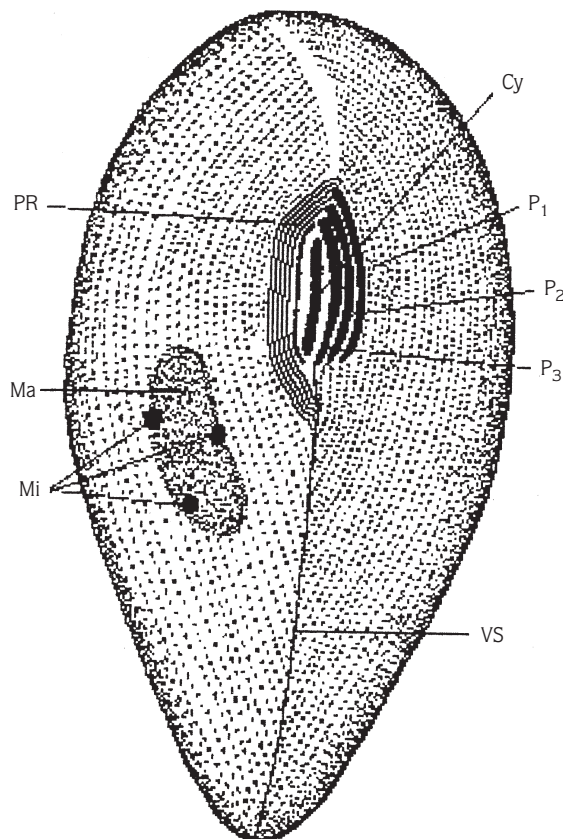


Figure 3. *Frontonia marina* Fabre-Damergue.

***Prorodon nucleolatus* Penard, 1938**

P. nucleolatus is a rather rare species, its modern description, based on impregnated cells, was by French

authors from the freshwater of Equatorial Africa (6). Prior to our investigations this species was not noted among the Caspian Sea fauna. Below we give a short description of *P. nucleolatus* found in the polluted part of the south coast of Apsheron.

Size of living cells 150-180 μm , after fixation up to 130 μm . Body oval. Apical cytostome with 17-20 nematodesmata and surrounded by 4-5 rows of adesmokineties (kinetosomes situated across the somatic rows in a ring). Dorsal brosse located near the cytostome and contains 3 close rows of double kinetosomes serving as a balance organ.

Somatic ciliature consists of 52 kineties, evenly covering the whole body. Endoplasm transparent, without inclusions, but often contains diatom algae. Nuclear apparatus consists of an oval macronucleus with centromere and one micronucleus. Contractile vacuole located at the caudal end.

Our form differs from the African specimens of the same species in the smaller number of somatic kineties and equal length of all rows of brosse.

***Frontonia marina* Fabre-Domergue, 1891.**

This species is one of the commonest of the psammon and periphyton ciliate communities of the Caspian Sea. It was found at the north and south coast of the Apsheron peninsula.

Size of living ciliates 70-110 μm , after fixation 50-90 μm . Body cigar-shaped, with tapered caudal end. Ventral cytostome located in the anterior part of the body. Size of preoral slit 25 μm . To the right of the cytostome there is an undulating membrane and 5 perizonal rows of closely adjacent kinetosomes. Perizonal rows begin at the front of the preoral unciliated suture and end at the ventral suture, dividing the posterior part of the ventral side in two. To the left of the cytostome there are 3 peniculus consisting of several rows of cilia. 4 postoral rows of kineties start below the peniculus and reach the ventral suture.

Somatic ciliature consists of 110-113 rows of dikineties beginning at the preoral unciliated suture and ending in the part at the caudal end of the body. Endoplasm bright-brown, with food vacuoles containing diatom algae. Nuclear apparatus represented by elongated macronucleus with 3 micronuclei. Simple contractile vacuole located at the caudal part of the body.

Our form differs from the specimens described by Agamaliev (4) by the fact that the number of perizonal

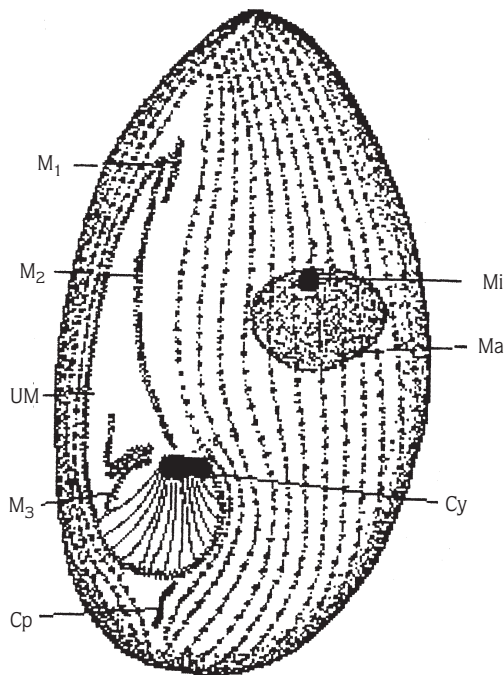


Figure 4. *Pleuronema marinum* Dujardin.

rows is are higher and the caudal end of the body is narrower.

***Pleuronema marinum* Dujardin, 1836**

This species is common in the periphyton of the Apsheron coast.

Size of living ciliates 60-75 μm , after fixation 45-65 μm . Body oval, with slightly pointed anterior end. Buccal cavity (40 μm) occupies almost 3/4 of the ventral side of the body surface. Position and form of undulating membrane and membranelles M_1, M_2, M_3 are given in Figure 4. Somatic ciliature consists of 35-38 rows of dikineties. Below buccal cavity 12-13 oral ribs diverge in a fan from the cytostome, carrying out a support function.

Endoplasm transparent, colourless, without inclusions. Nuclear apparatus represented by an oval macronucleus (15 μm) with a single micronucleus.

Two forms of this species have been described by Agamaliev (4), one of which differs in the absence of M_1 membranelle and the presence of 3 micronuclei, the second form differs in the structure of the nuclear apparatus and the presence of 7-8 micronuclei and 4 macronuclei. Obviously each description was of exconjugant-cells.

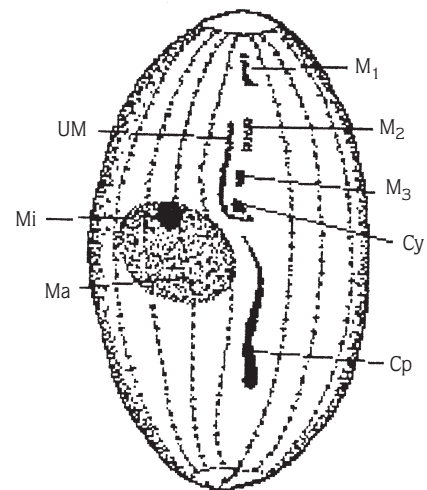


Figure 5. *Uronema marinum* Dujardin.

Our specimens are similar to those found in the White Sea (7) in terms of the number of somatic rows, but have fewer somatic rows than the forms found in the English Channer (8) and Florida (9).

***Uronema marinum* Dujardin, 1841**

This species is one of the most characteristic and widely distributed in the psammon and periphyton of the Apsheron coast.

Size of living ciliates 40-60 μm , after fixation up to 45 μm . Body oval. Buccal cavity (15 μm) located on the ventral side, contains an undulating membrane and 3 membranelles.

Somatic ciliature consists of 17-18 rows of kinetosome. The most central of the left kineties begins at the anterior end of the body and ends at the caudal part with a long cilium forming a so-called caudal cilies complex. All other rows end somewhat above the constituted anterior and posterior polar unciliated areas. Cytopyge located below the buccal cavity.

Endoplasm transparent, without inclusions.

Our form differs from the descriptions of Agamaliev (4) by the fact that the whole row of kineties are situated further left of the buccal cavity and the other structure of membranelles M_1, M_2 and M_3 .

***Strobilidium lacustris* Foissner, Skogstad, Pratt, 1988.**

This species was recently described for the first time

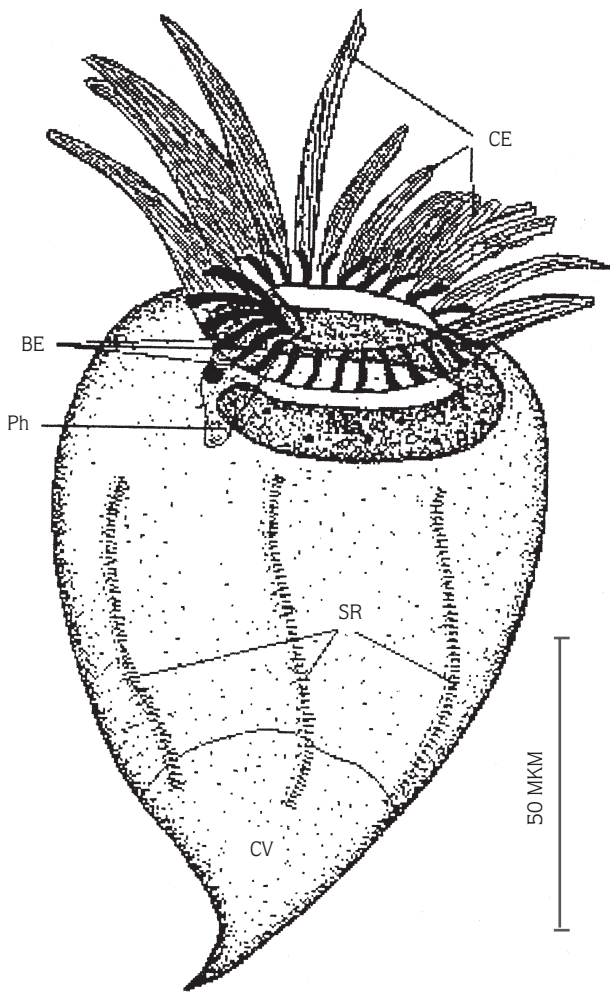


Figure 6. *Strobilidium lacustris* Foissner, Scogstad, Pratt.

from the fresh water of Norway (10) and prior to our investigation it had not been noted among the fauna of the Caspian Sea. Below is a description of *S. lacustris* found in the periphyton of the coastal rock of North Apsheron.

Size of living ciliates 55-70 μm , after fixation 50-60 μm . Body drop-shaped with wide anterior end and characteristic thorn in the caudal pole. Adoral zone of membranelles consists of 19-25 collars and 3 buccal elements, each consisting of 3 rows of closely adjacent large kinetosomes. Buccal membranelles are longer and have a single end stretched in a narrow bag-like pharynx.

Somatic ciliature consists of 8 short rows formed by closely adjacent monokinetes with short cilies. Endoplasm transparent, without inclusions. Nuclear apparatus

located under the adoral membranelles consists of a horseshoe-shaped macronucleus with large chromatin bodies and one micronucleus. Large contractile vacuole (20 μm) at the caudal end of the body.

The specimens of *S. lacustris* described here differ from the original description in that they have one fewer somatic rows and a much smaller number of adoral membranelles.

Amphisiella turanica sp. nov. Alekperov & Asadullayeva

Holotype M No 29/2.

Locus typicus. The species was found in the psammon of the North Apsheron coast.

Description. Size of living ciliates 170-210 μm , after fixation 130-180 μm . Body elongated, flattened dorsoventrally. Adoral zone of membranelles located at the anterior margin of the left side consisting of 70-85 elements. 7 frontal cirri are in two groups. 2 of them are located below the adoral zone at the anterior end of the body, the rest along the left margin of the peristome. In middle of the ventral side there is a row of 67 ventral cirri, beginning at the right margin of the adoral zone of membranelles and ending at 6 transversal cirri. There are 2 marginal rows: the right marginal row consisting of 41 cirri, the left one consisting of 46 cirri. Right side of the peristome restricted by 2 rows of small paroral and endoral membranelles. Caudal cirri absent. Dorsal side consists of 3 complete and one short.

Endoplasm transparent, much vacuolated. Nuclear apparatus represented by 4 macronuclei and 2 micronuclei. Contractile vacuole located near the left margin of the posterior end of the adoral zone.

Differential diagnosis. The species described above clearly differs from all known species of this genus in terms of structure of the nuclei. Species of *Amphisiella* with 2 macronuclei or nuclear apparatus scattering type have been described previously.

Amphisiella annulata (Kahl, 1928)

Prior to our investigation this species had not been described or noted among the Caspian Sea fauna. Below is a description of *A. annulata* found in the periphyton of the South Apsheron.

Size of living ciliates 130-180 μm , that of fixed cells 110-145 μm . Body elongated, much flattened dorsoventrally. Adoral zone consists of 65-70

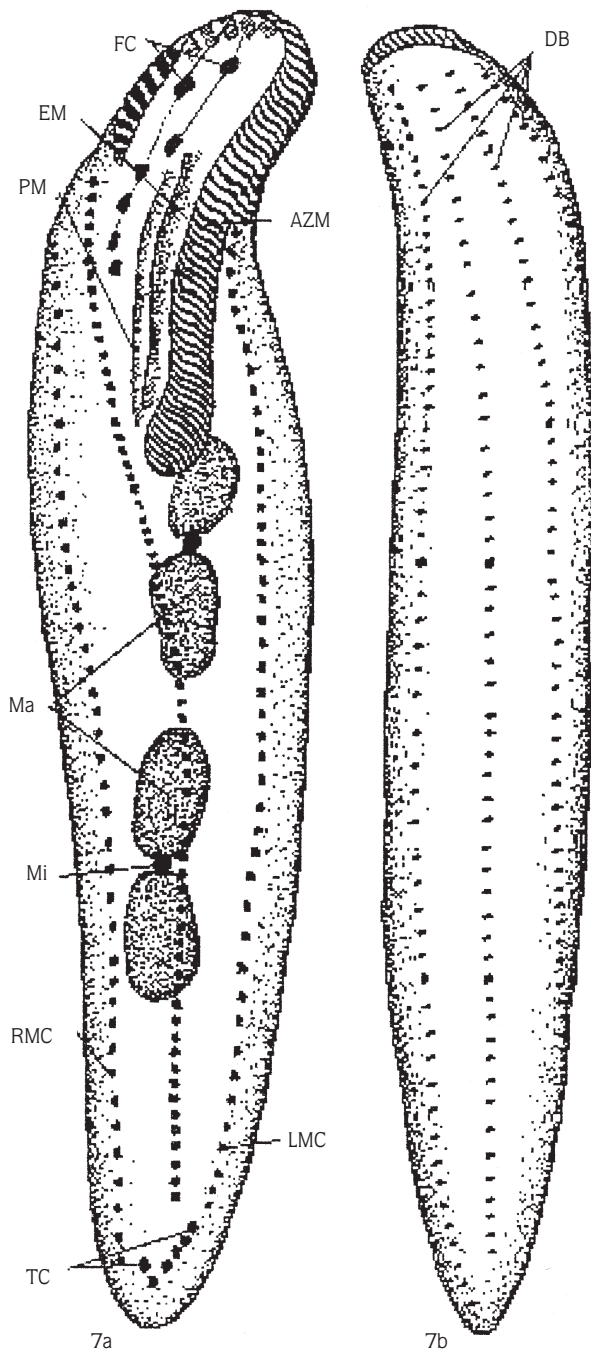


Figure 7. *Amphiella turanica* sp. nov. 7a-ventral side; 7b- dorsal side.

membranelles. Anterior end of the ventral side with 2 frontal cirri located under the adoral zone. Behind them there are 5 other frontal cirri located at the anterior margin of the paroral kineties. Ventral row consists of 48 cirri beginning somewhat below the frontal cirri and ending at the 6 transversal cirri on the posterior side of the body. Right marginal row consists of 55 cirri, left one consists of 40 cirri. Caudal cirri absent. Dorsal side with

4 rows of cirri, of which 3 are complete and one short.

Endoplasm transparent, without inclusions. Nuclear apparatus consists of 2 oval macronuclei and 2 micronuclei. Contractile vacuole located near the lower edge of the adoral zone of membranelles.

According to Borror (11) the *Amphiella* genus contains 7 species. Later Hemberger (12) distinguished a

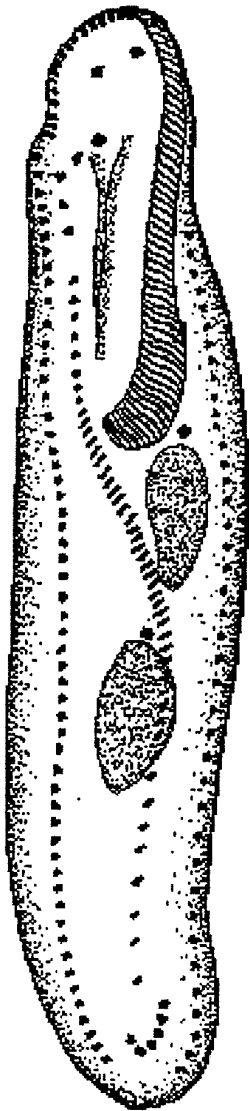


Figure 8. *Amphisiella annulata* (Kahl).

separate family *Amphisiellidae* with 8 genera. Later other genera of this family were found and distinguished (13-15).

Incidentally, the fam. *Amphisiellidae* was established by Jankowski (16) earlier than by Hemberger. Most species was brought together in synonyms by Hemberger, for example *A. annulata*, *A. milnei* and *A. marioni* were indicated as synonyms of *A. capitata* (Perejaslawzewa, 1886). However these species have clearly different nucleus structures and frontal cirrus arrangements. These signs are significant for *Hypotrichida*, therefore cannot agree with the opinion of this researcher.

Holosticha azerbaijanica sp. nov. Alekperov & Asadullayeva

Holotype. Slide Sh. no. 23-28.

Locus typicus. The species was found in the psammon and periphyton of the south coast of Apsheron.

Description. Size of living ciliates 220-300 μm , after fixation 170-250 μm . Body elongated, caudal end tapered, much flattened dorsoventrally. Adoral zone consists of 110-140 membranelles. Anterior end has 3 large frontal cirri. Near the right margin of the adoral zone there is a row of 10 fronto-terminal cirri, which is characteristic of this species. Midventral row (row of double ventral cirri in a zigzag) starting from the right margin of the adoral zone and ending nearer 5 transversal cirri at the caudal end. Row of marginal cirrus situated along each margin of the ventral side. Right marginal row consists of 110 cirri and the left one consists of 120. Buccal and caudal cirri absent. Ciliature of the dorsal side consists of 4 rows of bristles.

Endoplasm transparent, bright yellow. Contractile vacuole located in 1/4 of the anterior part on the left side. Nuclear apparatus was scattering (represented by numerous spherical or elongated macronuclei and micronuclei).

Differential diagnosis. The taxonomy of the *Hypotrichida* is at the elaboration stage and is far from perfect. The diagnosis of the genus *Holosticha* was recorded by Borror (11) in a short: "Row of right and left marginal cirri. Transversal cirri presence. 3 frontal cirrus differentiated from midventral cirri. Usually 2 macronuclei." Jankowski (16) described the same signs and noted the possibility of distinguishing a separate genus for all species without frontal cirri.

The diagnosis of the genus *Holosticha* given by Hemberger (12) is also very short: "Row of right and left marginal cirri presence. 2 midventral rows typical for family. 3 differential frontal cirri as minimum".

The species described above have all the documented signs, therefore our species undoubtedly belong to the genus *Holosticha*. However the species found by us differs from most of the known species of this genus. There were no buccal cirri but there were 10 fronto-terminal cirri, which are characteristic of fam *Bakuellidae* Jankowski, 1979. Probably our species is a link between the *Holostichidae* and *Bakuellidae* families.

Euplotes raikovi Agamaliev, 1966

This species was first found and described from the

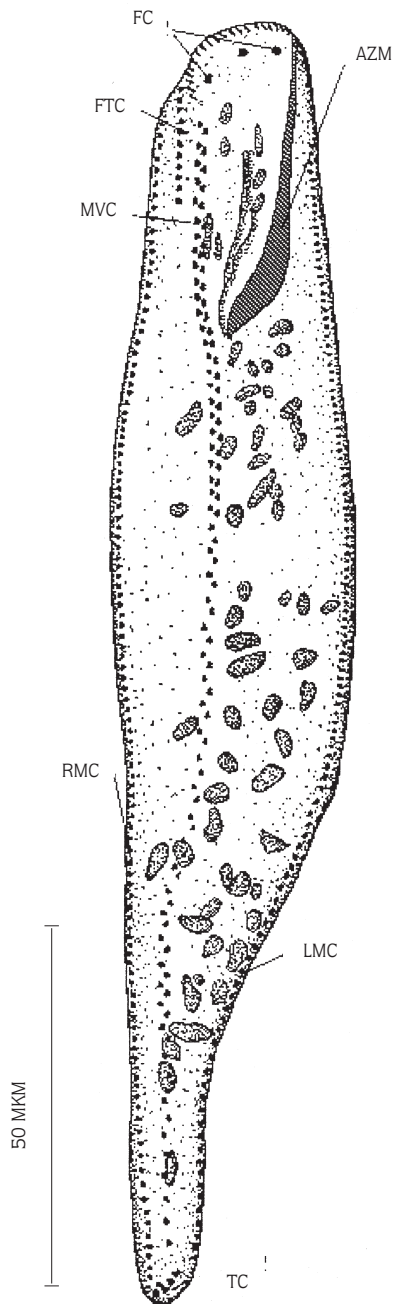


Figure 9. *Holosticha azerbaijanica* sp. nov.

psammon of the Apsheron coast (17). Later it was recorded at the Atlantic coast of the USA (18) and in the Mediterranean Sea (19). Below is a description of this species, characteristic of psammon and periphyton ciliate communities.

Size of living ciliates 45-50 μm , after fixation 30-40 μm . Body oval, much flattened dorsoventral. Peristome extended about 2/3 of body length. Adoral zone consists

of 45-50 membranelles. 7 fronto-ventral cirri, 5 transversal cirri and 3 caudal cirri on the ventral side. Fronto-ventral cirri located in 2 groups: first anterior group consisting of 5 cirri, second posterior one consisting of 2 cirri. Near the latter is an argentophilic spot which isn't cirrus.

Dorsal side has 6 rows of lateral bristles. Dorsal argyrom with double silverline system according to Tuffrau (patella type) (20). Endoplasm transparent, without inclusions. Contractile vacuole located below the transversal cirri. Nuclear apparatus consists of a C-shaped macronucleus and one micronucleus.

Our form differs from the specimens found by Agamaliev. It has one fewer rows of dorsal bristle, what is an important sign for the genus *Euplotes*.

***Uronychia multicirrata* sp. nov.** Alekperov & Asadullayeva

Holotype. Slide M No 29.

Locus typicus. The species was found in the psammon of the north coast of Apsheron.

Description. Size of living ciliates 35-60 μm , after fixation 25-45 μm . Body approximately oval, much flattened dorsoventrally with invagination of the pellicula in the caudal part. Buccal cavity occupies a large part of the ventral side. Adoral zone divided into 2 fragments: the anterior fragment consisting of 10 paramembranelles, the posterior one consisting of 4 paramembranelles. Under the buccal cavity on the ventral side there is pellicular invagination, at the top of which there are 4 large transversal cirri. Above the invagination to the right there are 3 small cirri, which were estimated to be ventral ones. 3 right marginal cirri practically displaced to the dorsal side of the body, 3 left marginal cirri to the left of the latter. Marginal cirri located in hollows of pellicula. 3 large caudal cirri on the dorsal side. 6 dorsal rows of bristles. Endoplasm transparent, often with diatom algae. Nuclear apparatus represented by 8-9 C-shaped macronuclei and 4-5 micronuclei.

Differential diagnosis. Systematic of the genus *Uronychia* is very difficult and has been elaborated poorly. The important distinctive signs are: measurement of body, presence and disposition of the cirri, number of dorsal rows and structure of the nuclei. In the latest revision of this genus carried out by English specialist many species were brought together in synonyms (21) and a total of 6 species were established in the composition of *Uronychia*. Later a new species *U. invicta* was described (22) from the freshwater of Azerbaijan.

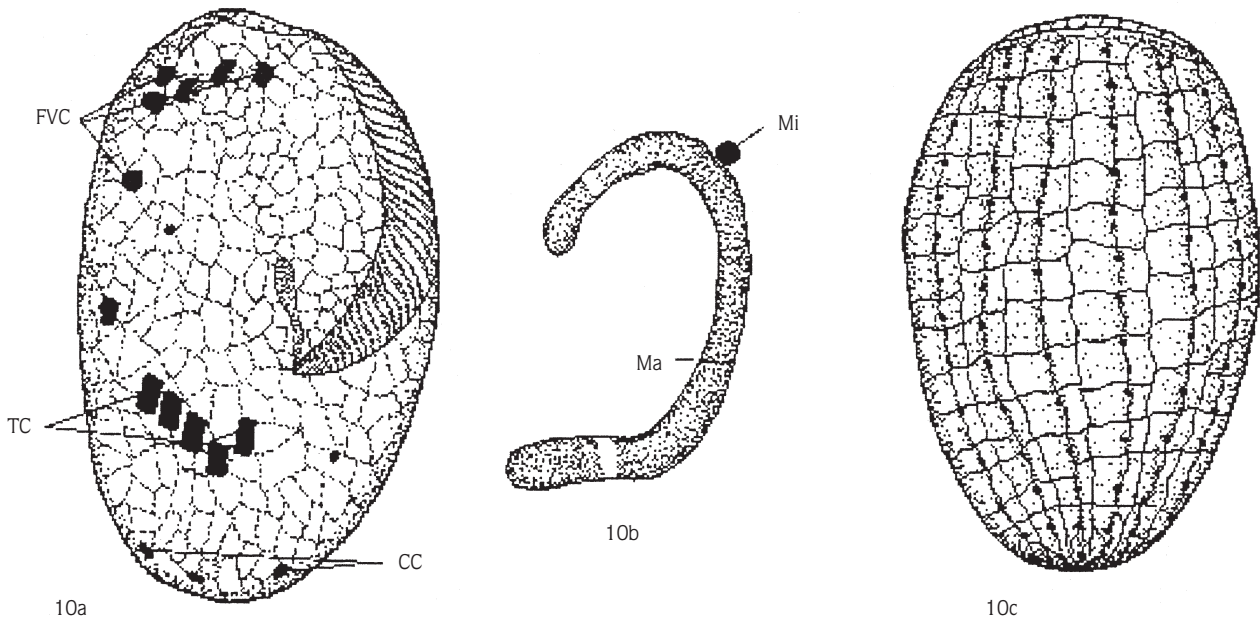


Figure 10. *Euplotes raikovi* Agamaliev. 10a- ventral side; 10b- nuclear apparatus; 10c- dorsal side.

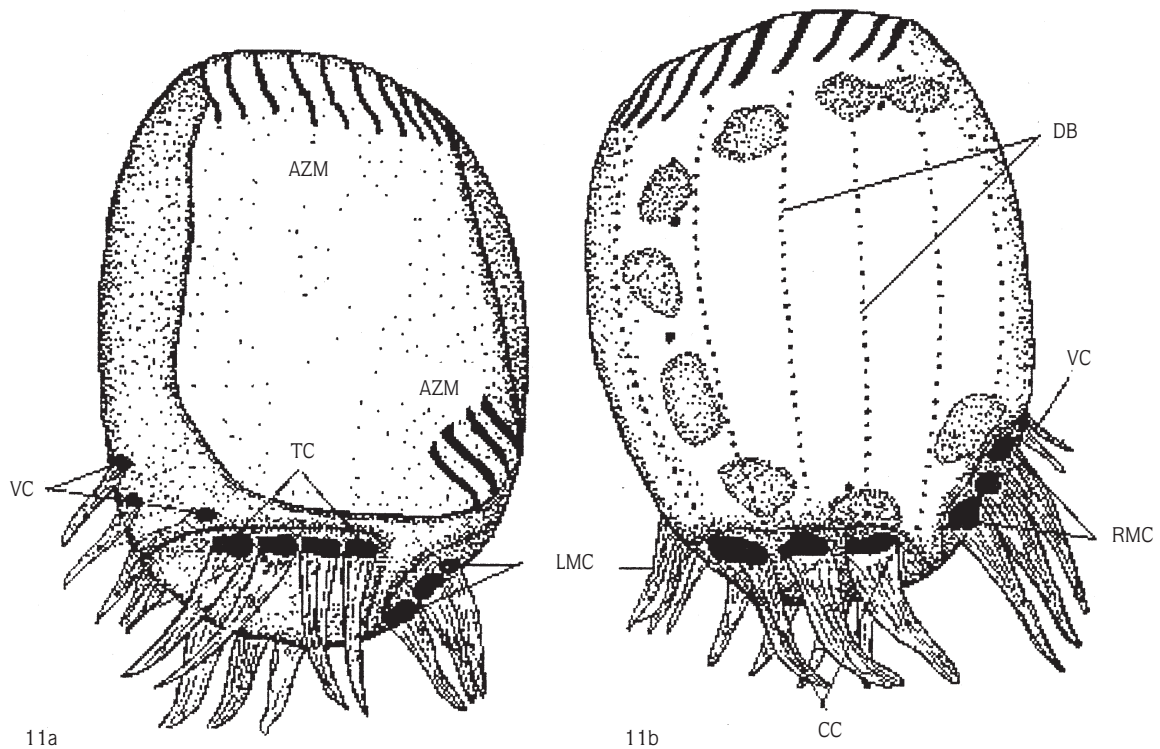


Figure 11. *Uronychia multicirrata* sp.nov. 11a-ventral SLde; 11b-dorsal side.

The new species *U. multicirrata* described above is clearly distinguished from the known species of same

genus by the presence and situation of 3 well developed ventral cirri, the presence and displacement of right

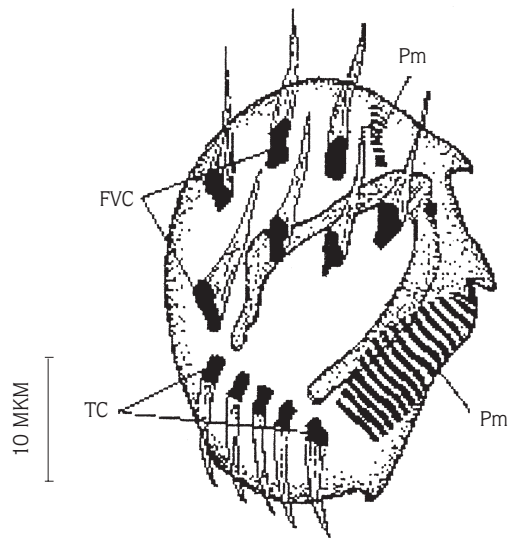


Figure 12. *Aspidisca steini* Buddenbrock.

marginal rows from 3 cirri to the dorsal side of the body, the presence of 6 dorsal rows and double number of micronuclei.

***Aspidisca steini* Buddenbrock, 1920**

Before our investigations this species had not been noted among the Caspian Sea fauna. It was found by us in the psammon of the south coast of Apsheron.

Size of living ciliates 20-35 μm . Body approximately oval, flattened dorsoventrally. On the left margin of the body there are 3 easily noticeable thorns. Adoral zone divided into two parts: the anterior part consisting of 8 paramembranelles, the posterior one consisting of 16. On the ventral side 7 fronto-ventral cirri are situated in 2 groups of 3 and 4 cirri. 5 transverse cirri. Dorsal side has 4 rows of dorsal bristles consisting of 3-6 kinetosomes.

Endoplasm transparent, without inclusions. Nuclear apparatus represented by a horseshoe-shaped macronucleus with a single micronucleus.

Our form differs from the African specimens described by French researchers (6) by having almost twice the number of paramembranelles in the adoral zone.

***Diophrys peloetes* Borror, 1965**

For the first time this species was found and described by Borror (11) from Florida (USA) and before our investigation it had not been noted among the Caspian Sea fauna. It was found by us in the periphyton of the

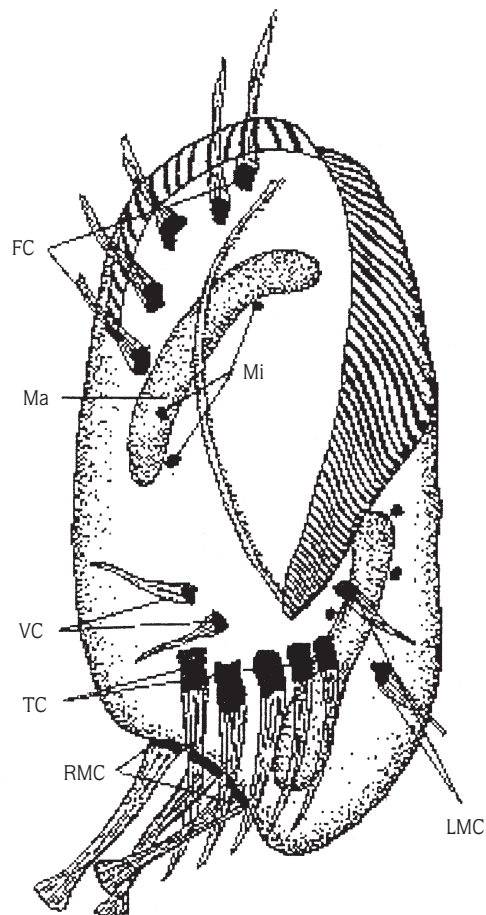


Figure 13. *Diophrys peloetes* Borror.

south coast of the Apsheron peninsula.

Size of living ciliates 45-65 μm , after fixation 35-50 μm , characteristic of members of the genus *Diophrys* with a concave right margin of the caudal part. Adoral zone extended to the whole anterior margin, most of the left ventral side, consisting of 60-65 membranelles. Frontal cirri located to the left of the peristome in groups of 2-3. 5 transversal cirri. To the right above them there are 2 small ventral cirri. 2 marginal cirri are situated on the posterior margin of the adoral zone. 3 right marginal cirri displaced to the ventral margin of the caudal part. Unlike all other species of this genus, the dorsal side has 8 latero-dorsal rows of bristles. Sylverline system (argyrom) is represented by a fine-mesh argentophilic polygonal network.

Nuclear apparatus has 2 elongated macronuclei and 7-8 micronuclei.

Our form has a body half the size of specimens found in Florida.

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