

Brief descriptions of 12 ciliate species previously unrecorded (Protozoa: Ciliophora) in Korea

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Twelve ciliates were collected from freshwater, marine, and brackish water habitats in Korea and taxonomic descriptions are provided based on observations of living cells and protargol-impregnated specimens. These ciliates, recorded for the first time in Korea, were classified into 12 genera, 11 families, 10 orders, and five classes. We provide brief descriptions and remarks, including microphotographs, for the 12 ciliates: *Allotricha mollis*, *Amphileptus eigner*, *Didinium gargantua*, *Holophrya teres*, *Lacrymaria marina*, *Novistrombidium apsheronicum*, *Pelagostrobilidium conicum*, *Pseudochilodonopsis fluviatilis*, *Pseudourostyla subtropica*, *Strombidium conicum*, *Urocentrum turbo*, and *Uronema marinum*.

Keywords: diversity, morphology, silver impregnation, taxonomy

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INTRODUCTION

The ciliates are a phylum within the protists consisting of approximately 10,000 species worldwide (Finlay *et al.*, 1998). Since *Balantidium coli* from Korea was described in 1931, ciliate taxonomists have continued to reveal the diversity of Korean ciliates (Jung *et al.*, 2017). Publications on ciliate taxonomy are increasingly based on qualitative and quantitative analyses, and more than 330 new species have been reported in Korea (Jung *et al.*, 2017). However, the enormous diversity of this group suggests that further research of ciliate fauna is needed in order for the full extent of Korean ciliate biodiversity to be revealed.

We provide a brief taxonomical diagnosis of 12 previously undescribed Korean ciliates. These ciliates were collected from various habitats and classified into 12 genera, 11 families, 10 orders, and five classes.

MATERIALS AND METHODS

Twelve ciliates were collected from freshwater, brackish water, and marine habitats in Korea. Information about specific locations and collection dates is described in the 'Material examined' section for each species.

Cells were transferred from their original habitats to

a laboratory within hours. Approximately 200 mL water was transferred to a petri dish and rice grains were added to enrich bacterial growth, which acted as a food source for the ciliates. The samples were maintained at room temperature.

The ciliate morphologies were revealed by observing live and silver impregnated specimens using a stereomicroscope (Olympus SZ11, Japan), an optical microscope (Olympus BX53, Japan) at low ($\times 40$ -200) to high ($\times 400$ -1000) magnifications, and a digital camera (Olympus DP74, Japan). The silver impregnated specimens were prepared by the 'procedure A' protargol method and developed using an acetone developer (Foissner, 2014; Kim and Jung, 2017). One species (*Novistrombidium apsheronicum*) was prepared for scanning electron microscopy (SEM) according to Foissner (2014). Sequential through-focal images were merged using Helicon Focus software (HeliconSoft Ltd, Ukraine) for stained specimens.

The terminology and taxonomical classification follow Lynn (2008).

RESULTS AND DISCUSSION

Phylum Ciliophora Doflein, 1901



Fig. 1. *Pelagostrobilidium conicum* protargol impregnated specimens. A-C. Individuals that show the arrangements of somatic kineties 1-6 (arrow indicates somatic kinety 1, arrowhead denotes somatic kinety 2 in B). Scale bars: A-C = 10 μ m.

Class Spirotrichea Bütschli, 1889
 Subclass Oligotrichia Bütschli, 1887/1889
 Order Choreotrichida Small and Lynn, 1985
 Suborder Strobilidiina Small and Lynn, 1985
 Family Strobilidiidae Kahl in Doflein and Reichenow, 1929
 Genus *Pelagostrobilidium* Petz, Song and Wilbert, 1995

1. *Pelagostrobilidium conicum* (Kahl, 1932) Liu, Yi, Lin, Warren, and Song, 2012 (Fig. 1)

Material examined. Marine water (salinity 31‰) taken from Songji Lake, Oho-ri, Jugwang-myeon, Goseong-gun, Gangwon-do, Korea (N38°20'11", E128°30'58") on April 28, 2017.

Diagnosis. Body size 29-35 \times 14-17 μ m in preparations; obconical to inverted pyriform; six somatic kineties commencing at same level; somatic kinety 1 posteriorly extending near posterior end, somatic kineties 2 and 3 converging posteriorly; single macronucleus, horizontal, C-shaped; 23-28 adoral membranelles.

Distribution. Czech Republic, Germany, Korea (this study).

Remarks. *Pelagostrobilidium conicum* is closely related to *P. kima* Agatha and Strüder-kypke, 2004, but has a different somatic kinety 1 length (extended vs. shortened) and the position of somatic kinety 2 is different (anteriad vs. posteriad) (Agatha and Strüder-kypke, 2004).

Voucher slides. Two slides, including protargol-impregnated specimens, were deposited at the National Institute of Biological Resources, Korea (NIBRPR0000107952, NIBRPR0000107953)

Order Strombidiida Petz and Foissner, 1992
 Family Strombidiidae Fauré-Fremiet, 1970
 Genus *Novistrombidium* Song and Bradbury, 1998

2. *Novistrombidium apsheronicum* (Alekperov and Asadullayeva, 1997) Agatha, 2003 (Fig. 2)

Material examined. Brackish water (salinity 17.8‰) taken from the River Gyeongpocheon, Unjeong-dong, Gangneung-si, Gangwon-do, Korea (N37°47'20", E128°54'34") on November 25, 2016.

Diagnosis. Body size, 70-85 \times 45-50 μ m in vivo; obconical with conspicuous apical protrusion located on anterior pole; hemitheca covering the posterior half of body; cytoplasm colorless, contains numerous 1-3 μ m diameter spherical and transparent granules; extrusomes rod-shaped in vivo; 1 J-shaped macronucleus, located anterior to posterior; 13-16 collar membranelles; 12-13 buccal membranelles continuous with anterior membranelles; girdle kinety composed of 49-52 dikinetids, spirally arranged; ventral kinety composed of 20-23 dikinetids, arranged longitudinally.

Distribution. Azerbaijan, Saudi Arabia, Korea (this study).

Remarks. *Novistrombidium apsheronicum* (Alekperov and Asadullayeva, 1997) Agatha, 2003 is separated from *N. testaceum* (Anigstein, 1914) by the arrangement of extrusomes (question mark-shaped in *N. apsheronicum* vs. C-shaped and almost horizontal in *N. testaceum*) and the location of the micronucleus (close to right end vs. near the macronuclear segment junction) (Agatha, 2003; Xu *et al.*, 2009).

Voucher slides. Two slides, including protargol-impregnated specimens, were deposited at the National Institute

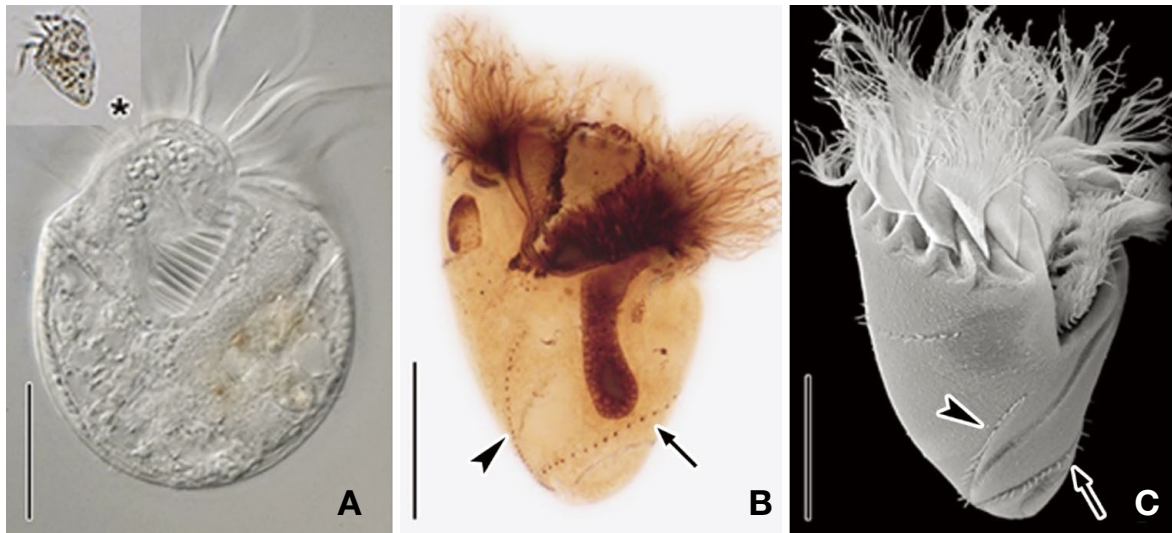


Fig. 2. *Novistrombidium apsheronicum* specimen in vivo (A), protargol impregnated specimen (B), and an SEM specimen (C). A. Squeezed individual in vivo, asterisk (*) indicates the original body shape in vivo. B, C. Ventral views that show the girdle and ventral kineties (arrows and arrowheads indicate girdle kinety and ventral kinety, respectively). Scale bars: A = 30 μ m, B and C = 20 μ m.

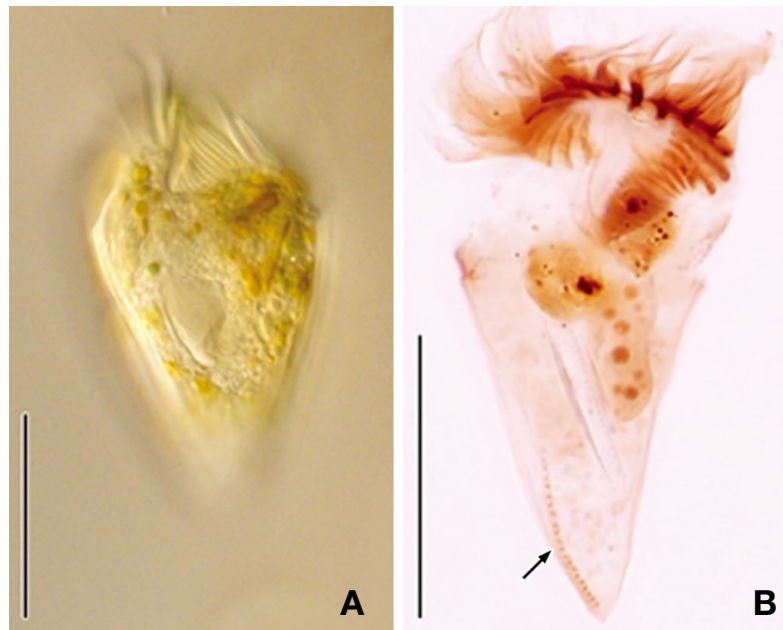


Fig. 3. *Strombidium conicum* specimen in vivo (A) and a protargol impregnated specimen (B). A. Typical individual in vivo. B. Ventral view that shows the ventral kinety (arrow indicates ventral kinety). Scale bars: 30 μ m.

of Biological Resources, Korea (NIBRPR0000107890, NIBRPR0000107891).

Genus *Strombidium* Clapaède and Lachmann, 1859

3. *Strombidium conicum* (Lohmann, 1908) Wulff, 1919 (Fig. 3)

Material examined. Brackish water (salinity 14‰) taken

from the River Gyeongpocheon, Unjeong-dong, Gangneung-si, Gangwon-do, Korea (N37°47'20", E128°54'34") on November 17, 2016.

Diagnosis. Body size 60-75 \times 35-40 μ m in vivo, elongated obconical shape; pointed posterior end; extrusomes distinctive in vivo, about 10 μ m in length; single macronucleus, elongated, ellipsoidal; about 13 buccal membranelles; about 16 collar membranelles; girdle ki-



Fig. 4. *Allotricha mollis* in vivo (A, B) and a protargol impregnated specimen (B). A. Typical individual in vivo. B. Ventral view that shows the somatic ciliature and cortical granules. C. Ventral view that shows the oral apparatus, somatic ciliature, and nuclear apparatus (arrow indicates transverse cirri). Scale bars: 30 μm .

nety closed, composed of 68-83 dikinetids; ventral kinety longitudinally arranged along right side of specimen, composed of 18-34 dikinetids.

Distribution. Atlantic Ocean, Baltic Sea, China, Germany, North Sea, Norway, Korea (this study).

Remarks. The Korean population of *Strombidium conicum* (Lohmann, 1908) Wulff, 1919 is different from the Chinese population due to the number of girdle dikinetids (68-83 vs. 45-62) (Xu *et al.*, 2009). The Korean and German populations are identical (Agatha and Riedel-Lorjé, 1997).

Voucher slides. Two slides, including protargol-impregnated specimens, were deposited at the National Institute of Biological Resources, Korea (NIBRPR0000107892, NIBRPR0000107893).

Subclass Stichotrichida Fauré-Fremiet, 1961
Order Sporadotrichida Fauré-Fremiet, 1961
Family Oxytrichidae Ehrenberg, 1830
Genus *Allotricha* Sterki, 1878

4. *Allotricha mollis* Sterki, 1878 (Fig. 4)

Material examined. Brackish water (salinity 1.0‰) taken from the River Gyeongpocheon, Unjeong-dong, Gangneung-si, Gangwon-do, Korea (N37°47'20", E128°

54'34") on December 22, 2016.

Diagnosis. Body size 270-300 \times 85-105 μm in vivo; elliptical shape; flexible; acontactile; colorless; contractile vacuole on left side above mid-body; yellow to green cortical granules ca. 1 μm in diameter; about 65 adoral membranelles; 3 frontal cirri; 1 buccal cirrus; 4 frontoventral cirri; 3 postoral ventral cirri; 2 pretransverse cirri; 5 transverse cirri; 1 left marginal row with 37-43 cirri; 3 right marginal rows composed of 11-19 cirri in row 1, 32-33 cirri in row 2, 34-36 cirri in row 3; 8 dorsal kineties including 3 fragmented kineties; 3 caudal cirri; 2 macronuclear nodules, 7-10 micronuclei.

Distribution. Austria, Germany, Switzerland, U.S.A., Korea (this study).

Remarks. *Allotricha mollis* Sterki, 1878 is different from *A. antarctica* Berger, 1999. It has a larger body size (270-300 \times 85-105 μm vs. 90-125 \times 40-70 μm), and the arrangement of the transverse cirri (straight vs. hook-like), the number of adoral membranelles (60-82 vs. 30-37), and their habitat (freshwater vs. terrestrial soil) separate these two species (Berger, 1999).

Voucher slides. Two slides, including protargol-impregnated specimens, were deposited at the National Institute of Biological Resources, Korea (NIBRPR0000107894, NIBRPR0000107895).

Order Urostylida Jankowski, 1979
 Family Pseudourostylidae Jankowski, 1979
 Genus *Pseudourostyla* Borror, 1972

5. *Pseudourostyla subtropica* Chen, Miao, Ma, Al-Rasheid, Xu and Lin, 2014 (Fig. 5)

Material examined. Brackish water (salinity 10‰) taken from the River Gyeongpocheon, Unjeong-dong, Gang-



Fig. 5. *Pseudourostyla subtropica* protargol impregnated specimen. Scale bar: 100 μ m.

neung-si, Gangwon-do, Korea (N37°47'20", E128°54'34") on February 16, 2017.

Diagnosis. Body size 295–345 \times 90–110 μ m in vivo; elliptical body shape; colorless; spherical cortical granules, sparsely distributed, arranged irregularly; about 110 adoral membranelles; single buccal cirrus; about 30 frontal cirri as bicorona; 2 frontoterminal cirri; about 10 transverse cirri; about 18 midventral pairs; about 7 left and 5 right marginal cirral rows; numerous macronuclear nodules; two contractile vacuoles near left side of anterior and posterior parts; brackish habitat.

Distribution. China, Korea (this study).

Remarks. The Korean and type population have slightly different body sizes (295–345 \times 90–110 μ m vs. 300–450 \times 100–200 μ m) (Berger, 2006; Chen *et al.*, 2014). *Pseudourostyla subtropica* Chen *et al.*, 2014 is closely related to *P. cristata* (Jerka-Dziadosz, 1964) Borror, 1972, but has different numbers of left marginal rows (7 vs. 4–6) and right marginal rows (5 vs. 4 or 5) (Berger, 2006; Chen *et al.*, 2014).

Voucher slides. Two slides, including protargol-impregnated specimens, were deposited at the National Institute of Biological Resources, Korea (NIBRPR0000107900, NIBRPR0000107901).

Class Litostomatea Small and Lynn, 1981
 Order Haptorida Corliss, 1974
 Family Didiniidae Poche, 1913
 Genus *Didinium* Stein, 1859

6. *Didinium gargantua* Meunier, 1910 (Fig. 6)

Material examined. Marine water (salinity 31‰) taken from Songji Lake, Oho-ri, Jugwang-myeon, Goseong-

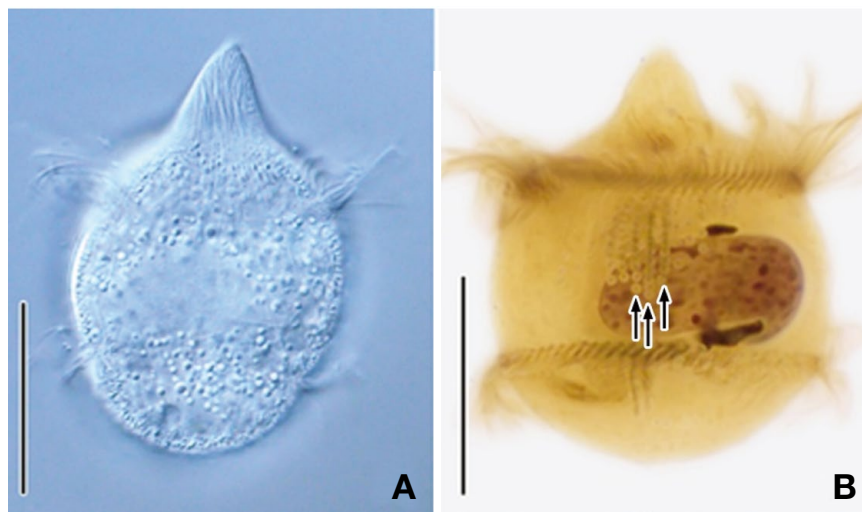


Fig. 6. *Didinium gargantua* specimen in vivo (A) and a protargol impregnated specimen (B). A. Typical individual in vivo. B. Lateral view that shows the somatic ciliature (arrows indicate dorsal brush rows). Scale bars: 30 μ m.

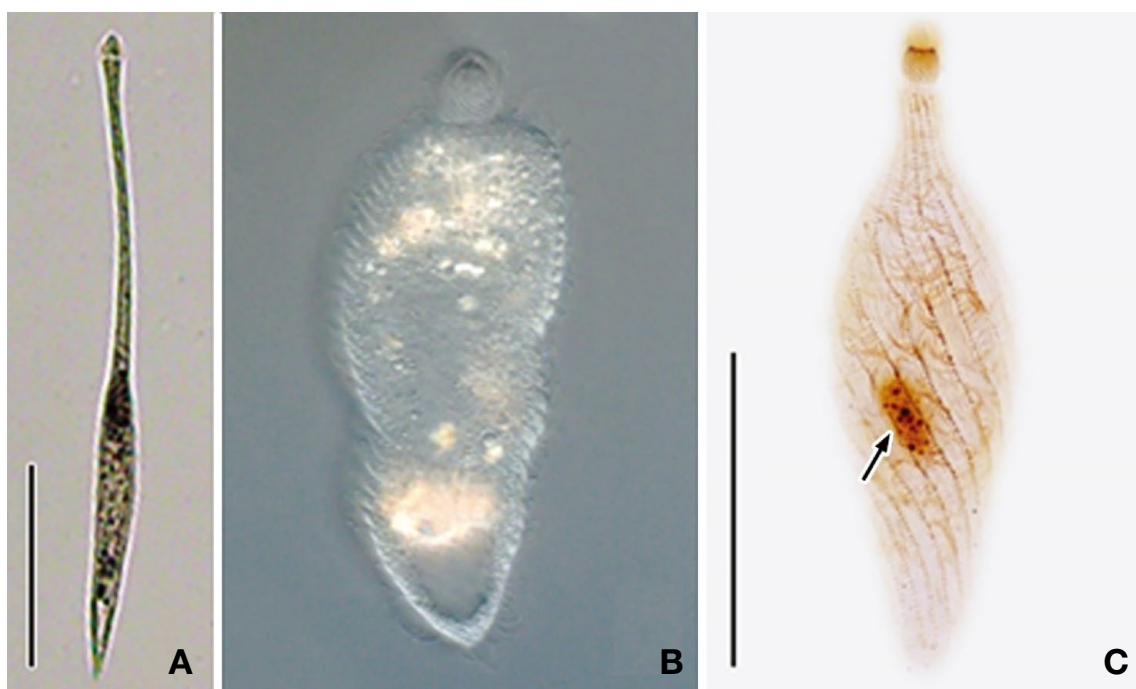


Fig. 7. *Lacrymaria marina* specimens in vivo (A, B) and a protargol impregnated specimen (C). A. Extended individual in vivo. B. Contracted individual. C. Lateral view that shows the ciliature (arrow indicates macronucleus). Scale bars: A = 100 μ m, C = 30 μ m.

gun, Gangwon-do, Korea (N38°20'11", E128°30'58") on April 28, 2017.

Diagnosis. Body size 55-60 \times 35-40 μ m in vivo; club-shaped; prominent proboscis; single contractile vacuole terminally located; proboscis extrusomes densely packed, length about 10 μ m; colorless globules conspicuous, about 1.0 \times 0.7 μ m in size; spindle shaped cytoplasmic extrusomes sparsely scattered; number of somatic kineties associated with number of anterior and posterior ciliary girdles; anterior girdle kineties about 85 in number; posterior girdle kineties about 75 in number; 3 dorsal brush rows at anterior and posterior ciliary girdles; single macronucleus C or sausage shaped; marine habitat.

Distribution. China, U.S.A., Weddell Sea, Korea (this study).

Remarks. The Korean population of *Didinium gargantua* Meunier, 1910 can be separated from the population in the Weddell Sea by its body size (55-60 \times 35-40 μ m vs. 70-200 \times 50-120 μ m), and the number of somatic and ciliary girdle kineties (75-85 vs. 50-75) (Petz *et al.*, 1995). The Korean and U.S.A. populations of *D. gargantua* also have different body sizes (55-60 \times 35-40 μ m vs. 70-100 \times 40-80 μ m), and numbers of somatic and ciliary girdle kineties (75-85 vs. 55-60) (Alekperov *et al.*, 2007/8).

Didinium gargantua can be separated from *D. nasutum* (Müller, 1773) Stein, 1859 by body size (55-

60 \times 35-40 μ m vs. 80-200 \times 60-140 μ m), the number of dorsal brush rows (3 vs. 5), the position of the contractile vacuole (terminal vs. subterminal), and habitat (saline water vs. freshwater; Foissner *et al.*, 1995).

Voucher slides. Two slides, including protargol-impregnated specimens, were deposited at the National Institute of Biological Resources, Korea (NIBRPR0000107904, NIBRPR0000107905).

Family Lacrymariidae de Fromentel, 1876

Genus *Lacrymaria* Bory de St. Vincent, 1824

7. *Lacrymaria marina* Kahl, 1933 (Fig. 7)

Material examined. Marine water taken from Hupohang port, Hupo-ri, Hupo-myeon, Uljin-gun, Gyeongsangbuk-do, Korea (N36°40'52", E129°27'23") on April 5, 2017.

Diagnosis. Body size 150-300 \times 20-25 μ m in vivo; extended spindle to vase-like shape; highly contractible neck; cell colorless; cortical granules colorless, regularly arranged in between somatic kineties; single contractile vacuole, conical shape and located terminally; papillary head with obliquely arranged oral ciliary rows, 10-12 in number; spiral somatic kineties on contracted body, 17-20 somatic kineties; 1 ellipsoidal macronucleus.

Distribution. China, Germany, Korea (this study).

Remarks. *Lacrymaria marina* Kahl, 1933 can be sep-

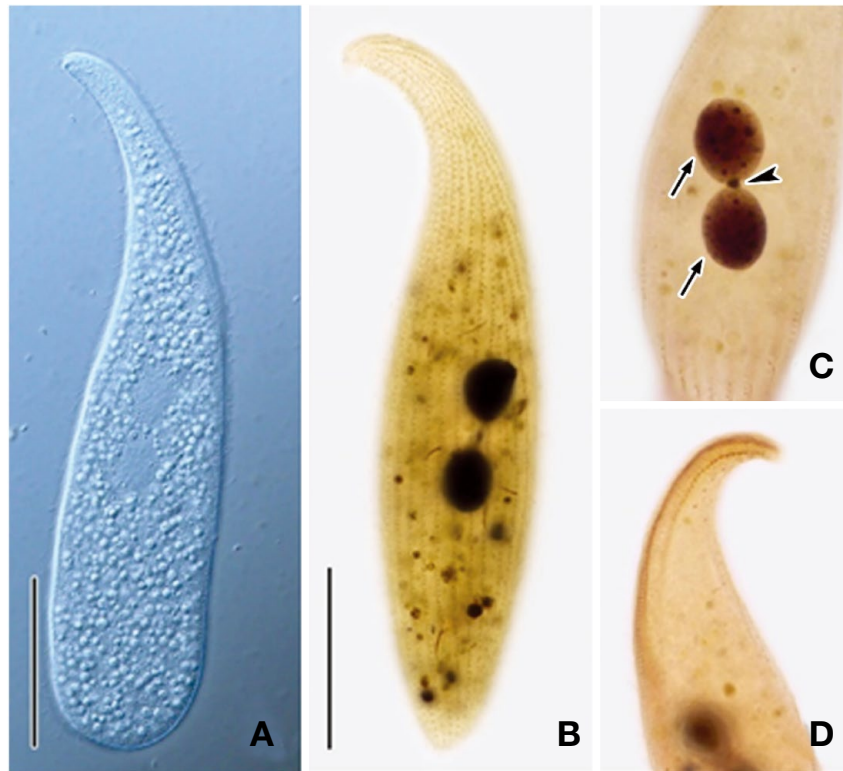


Fig. 8. *Amphileptus eignerii* specimen in vivo (A) and protargol impregnated specimens (B-D). A. Slightly squeezed individual in vivo. B. Right side of an individual. C. Macronuclei (arrows) and micronucleus (arrowhead). D. Anterior left side view. Scale bars: 50 μ m.

arated from *L. olor* (Müller, 1786) Bory de St. Vincent, 1824 by the number of macronuclear nodules (1 vs. 2), and habitat (saline water vs. freshwater) (Kahl, 1930).

Lacrymaria marina can be separated from *L. nana* (Vuxanovici, 1961) Song and Wilbert, 1989 by the number of somatic kineties (15–20 vs. about 13), the shape of contractile vacuole (conical vs. spherical), and the position of the contractile vacuole (terminal vs. subterminal) (Song and Wilbert, 1989).

Voucher slides. Two slides including protargol-impregnated specimens were deposited at the National Institute of Biological Resources, Korea (NIBRPR0000107906, NIBRPR0000107907).

Order Pleurostomatida Schewiakoff, 1896
Family Amphileptidae Bütschli, 1889
Genus *Amphileptus* Ehrenberg, 1830

8. *Amphileptus eignerii* Lin, Song and Li, 2007 (Fig. 8)

Material examined. Brackish water (salinity 10‰) taken from Songji Lake, Oho-ri, Jugwang-myeon, Goseong-gun, Gangwon-do, Korea (N38°20'11", E128°30'58") on April 28, 2017.

Diagnosis. Body size 190–230 \times 55–60 μ m in vivo; elon-

gated elliptical to lanceolate shape; two macronuclear nodules, a single micronucleus positioned between two macronuclei; 9 or 10 left somatic kineties; 16–19 right somatic kineties; several contractile vacuoles along the ventral side of posterior part; extrusomes spindle shaped, arranged along anterior part of oral slit and scattered throughout cytoplasm.

Distribution. China, Korea (this study).

Remarks. The Korean population of *Amphileptus eignerii* Lin, Song and Li, 2007 shows minor differences to the original population in their arrangement of cytoplasmic extrusomes (scattered throughout the body vs. scattered along pharyngeal fiber) and the occupied ratio of oral extrusomes to length (1/3 vs. 1/4) (Lin *et al.*, 2007).

Voucher slides. Two slides, including protargol-impregnated specimens, were deposited at the National Institute of Biological Resources, Korea (NIBRPR0000107908, NIBRPR0000107909).

Class Phyllopharyngea de Puytorac *et al.*, 1974
Subclass Cyrtophoria Fauré-Fremiet in Corliss, 1956
Order Chlamyodontida Deroux, 1976
Family Chilodonellidae Deroux, 1970
Genus *Pseudochilodonopsis* Foissner, 1979



Fig. 9. *Pseudochilodonopsis fluviatilis* specimen in vivo (A) and a protargol impregnated specimen (B). A. Typical individual in vivo. B. Ventral view that shows the oral and ventral somatic ciliature. Scale bars: A and B = 30 μ m.

9. *Pseudochilodonopsis fluviatilis* Foissner, 1988 (Fig. 9)

Material examined. Brackish water (salinity 4‰) taken from the River Gyeongpocheon, Unjeong-dong, Gangneung-si, Gangwon-do, Korea (N37°47'20", E128°54'34") on December 8, 2016.

Diagnosis. Body size 70-85 \times 40-50 μ m in vivo; reniform; ventrally flattened; flexible; colorless; two contractile vacuoles obliquely located; postoral ventral kinety absent; 4 or 5 left somatic kineties; 4 or 5 right somatic kineties; dorsal bristles located subapical, about 3.6 μ m in length; 2 circumoral kineties; preoral kinety discontinued, composed of 4 segments on anterior left margin; macronucleus ellipsoidal, 7-9 μ m in diameter.

Distribution. Austria, Germany, Korea (study).

Remarks. *Pseudochilodonopsis fluviatilis* Foissner, 1988 can be separated from *P. algivora* (Kahl, 1931) Foissner, 1979 by the difference in the shape of the posterior end (indented vs. smooth) (Foissner *et al.*, 1991). *Pseudochilodonopsis fluviatilis* and *P. piscatoris* (Blochmann, 1895) Foissner, 1979 can be separated from each other by their body outline (reniform vs. slightly lanceolate) and the position of the dorsal brush (apical vs. subapical) (Foissner *et al.*, 1991).

Voucher slides. Two slides, including protargol-impregnated specimens, were deposited at the National Institute of Biological Resources, Korea (NIBRPR0000107910, NIBRPR0000107911).

Class Prostomatea Schewiakoff, 1896
Order Prorodontida Corliss, 1974
Family Holophryidae Perty, 1852
Genus *Holophrya* Ehrenberg, 1831

10. *Holophrya teres* (Ehrenberg, 1833) Foissner, Berger and Kohmann, 1994 (Fig. 10)

Material examined. Brackish water (salinity 2.7‰) taken from the River Gyeongpocheon, Unjeong-dong, Gangneung-si, Gangwon-do, Korea (N37°47'20", E128°54'34") on March 23, 2017.

Diagnosis. Body size 105-145 \times 60-70 μ m in vivo; ob-conical shape; oral opening apically located; colorless; flexible; dark granules on posterior portion; oral basket conspicuous, pharyngeal rod about 70 μ m in length; single contractile vacuole terminally located; excretory pores about 10 in number; caudal cilia about 10 in number and around 20 μ m in length; 87-97 somatic kineties; 3 dorsal brush rows; single ellipsoidal macronucleus, size about 35 \times 27 μ m; single ellipsoidal micronucleus attached to macronucleus, size about 10 \times 5 μ m.

Distribution. Cosmopolitan (Alaska, Austria, Czech, England, Germany, India, Italy, Poland, Korea (this study)).

Remarks. *Holophrya teres* (Ehrenberg, 1833) Foissner, Berger and Kohmann, 1994 can be separated from *H. discolor* Ehrenberg, 1833 by the number of somatic kineties (87-97 vs. 35-64).

Holophrya teres can also be distinguished from *H.*

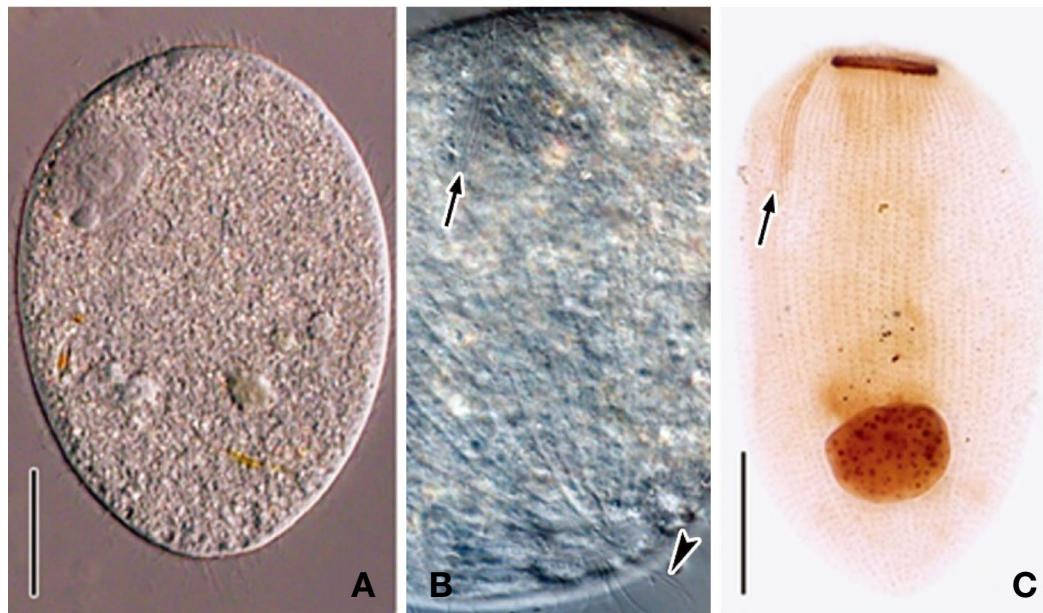


Fig. 10. *Holophrya teres* specimens in vivo (A, B) and a protargol impregnated specimen (C). A. Slightly squeezed individual in vivo. B. Lateral view that shows the dorsal brush, caudal cilia, and contractile vacuole (arrow indicates dorsal brush rows, arrowhead denotes caudal cilia). C. Lateral view that shows the somatic ciliature (arrow indicates dorsal brush rows). Scale bars: 30 μm .

ovum Ehrenberg, 1831 by the number of somatic kineties (87-97 vs. 52-80) and the presence of symbiotic algae (absent vs. present) (Foissner *et al.*, 1994).

Voucher slides. Two slides, including protargol-impregnated specimens, were deposited at the National Institute of Biological Resources, Korea (NIBRPR0000107912, NIBRPR0000107913).

Class Oligohymenophorea de Puytorac *et al.*, 1974
Order Urocentrida Jankowski, 1980
Family Urocentridae Claparède and Lachmann, 1858
Genus *Urocentrum* Nitzsch, 1827

11. *Urocentrum turbo* (Müller, 1786) Nitzsch, 1827 (Fig. 11)

Material examined. Freshwater taken from the Gasiyeonseupji wetland, Unjeong-dong, Gangneung-si, Gangwon-do, Korea (N37°47'15", E128°53'42") on October 7, 2016.

Diagnosis. Body size about 60-70 \times 45-50 μm in vivo; cork or dumbbell shaped; anterior half wider than posterior body with slightly narrowed mid-body; contractile vacuole terminally located; numerous spindle shaped extrusomes; frontal ciliary band composed of 17-26 rows of kinetids; equatorial ciliary band composed of 80-140 kineties; somatic kineties irregular arranged; 3 buccal membranes; tail cirrus conspicuous; macronucleus, horizontal C-shape in posterior half of body, a single spheri-

cal micronucleus attached near macronucleus.

Distribution. Cosmopolitan including Korea (this study).

Remarks. *Urocentrum* (Müller, 1786) is a monotypic genus. The body shape and somatic ciliature are unique and easy to recognize in this species at low magnification. *Urocentrum turbo* predominantly inhabits eutrophic waters (Foissner *et al.*, 1994).

Voucher slides. Two slides, including protargol-impregnated specimens, were deposited at the National Institute of Biological Resources, Korea (NIBRPR0000107914, NIBRPR0000107915).

Subclass Scuticociliatia Small, 1967
Order Philasterida Small, 1967
Family Uronematidae Thompson, 1964
Genus *Uronema* Dujardin, 1841

12. *Uronema marinum* Dujardin, 1841 (Fig. 12)

Material examined. Marine water taken from Hupo-hang port, Hupo-ri, Hupo-myeon, Uljin-gun, Gyeongsangbuk-do, Korea (N36°40'52", E129°27'23") on April 5, 2017.

Diagnosis. Body size about 32-41 \times 11-20 μm in vivo; elongate elliptical shape; cytostome in anterior 1/2 to 2/5 of body; spherical single contractile vacuole terminally located; about 12 somatic kineties; 1 caudal cilium 11-16 μm long; M1 composed of 5-7 kinetosomes; M2

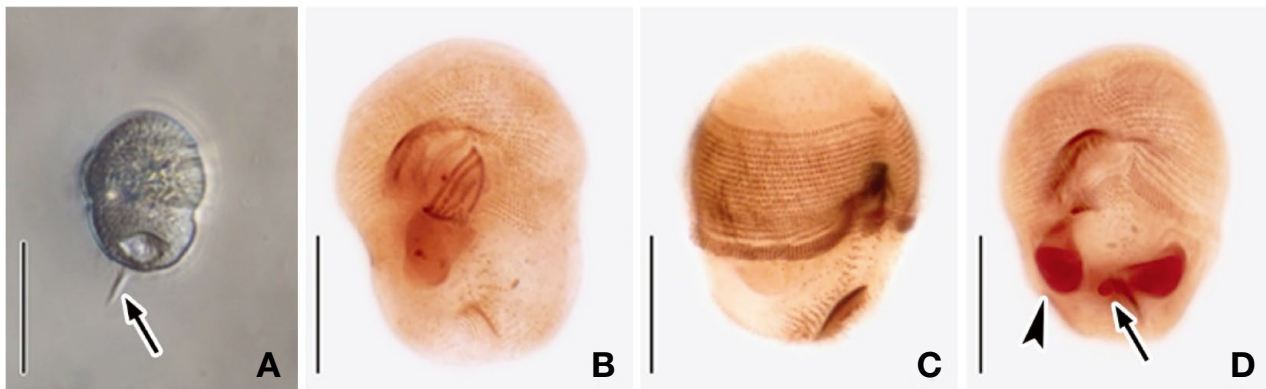


Fig. 11. *Urocentrum turbo* specimen in vivo (A) and protargol impregnated specimens (B-D). A. Typical individual in vivo (arrow indicates tail-like cirrus). B. Ventral view showing the three buccal membranes. C. Frontal and equatorial ciliary bands. D. Macronucleus (arrowhead) and micronucleus (arrow). Scale bars: A = 50 μm and B-D = 20 μm .

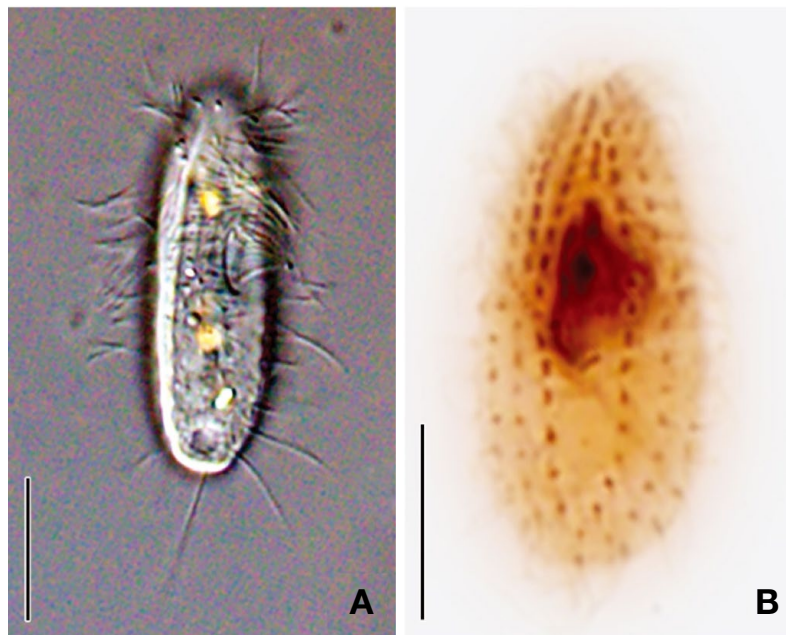


Fig. 12. *Uronema marinum* specimen in vivo (A) and a protargol impregnated specimen (B). A. Typical individual in vivo. B. Ventral view that shows the oral and ventral somatic ciliature. Scale bars: A and B = 10 μm .

slightly longer than M1; M3 short; scutica consisting of 4 or 5 dikinetids, arranged in Y or V-shapes; 1 globular macronucleus, size about $7 \times 6 \mu\text{m}$; single spherical micronucleus 1.5 μm in diameter.

Distribution. Cosmopolitan (Antarctica, Benin, China, Germany, Russia, U.S.A., Korea (this study)).

Remarks. The Korean population of *U. marinum* Dujardin, 1841 can be separated from the Chinese population by the arrangement of scutica (Y or V-shaped vs. always Y-shaped), and the number of scutica dikinetids (4 or 5 vs. 3) (Wang *et al.*, 2009).

Voucher slides. Two slides, including protargol-impreg-

nated specimens, were deposited at the National Institute of Biological Resources, Korea (NIBRPR0000107916, NIBRPR0000107917).

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