New records of two soil and one marine ciliate species (Ciliophora: Intramacronucleata) from Korea

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Three ciliate species, *Australocirrus australis* (Foissner, 1995) Kumar and Foissner, 2015, *Rimaleptus longitrichus* (Vd’ačný and Foissner, 2008) Vd’ačný and Foissner, 2012, and *Frontonia subtropica* Pan et al., 2013, that were previously unreported in Korea were collected from terrestrial and marine habitats in Korea. Using live observation and protargol impregnation, the three species were identified using a combination of the following characteristics: *Australocirrus australis*, the distance between the anterior pretransverse cirrus and the anteriormost transverse cirrus (0.6–2.1% of body length) and the arrangement of the transverse cirri (oblique row); *Rimaleptus longitrichus*, the arrange of contractile vacuoles and longitudinal ciliary rows anteriorly spaced; *Frontonia subtropica*, number of somatic kineties (approximately 115 rows) and vestibular kineties (5 rows).

Keywords: *Australocirrus*, *Frontonia*, Korea, morphology, *Rimaleptus*

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Fig. 1. Photomicrographs of three ciliates after protargol impregnation (A-C) and in vivo (D-K). A-C, Australocirrus australis, ventral views (A, B) and dorsal view (C), arrows indicate pretransverse cirrus in (A), micronuclei in (B), and caudal cirri in (C); D-G, Rimaleptus longitrichus, right side view, showing longitudinal dorsal brush (F) and cortical granules on cell surface (G); H-K, Frontonia subtropica, left side view of representative specimens, arrows in (H) denote blue granules, arrow in (I) indicates a contractile vacuole, macronucleus (J), buccal apparatus and extrusomes (K). Ma, macronuclear nodule. Scale bars = 100 μm (A, D, E), 150 μm (H).
Diagnosis. Size about 160-195 × 55-95 μm from protargol impregnated specimens; body shape elongate ellipsoid or slightly obovate; contractile vacuole slightly above mid-body at left margin of cell, with two long collecting canals; two macronuclear nodules ellipsoidal; two to six micronuclei; anterior pretransverse cirrus and the anteriormost transverse cirrus relative to body length (5-8% vs. 0.6-2.1%), and the number of adoral membranelles, number of cirri in right and left marginal rows, and number of dorsal kineties. However, they can be distinguished from congeners by the presence of a row of contractile vacuoles on either margin of ventral and dorsal sides (Vd’ačný and Foissner, 2008; 2012).

Material examined. From soil at Ichulam, Pohang-si, Nam-gu, Gyeongsangbuk-do, Korea (35°53’48.26”N, 129°31’33.12”E), February 23, 2016. Voucher slides. A slide of protargol-impregnated specimens was deposited at the National Institute of Biological Resources, Korea (NIBRPR0000107957).

Remarks. Rimaleptus longitrichus was originally described by Vd’ačný and Foissner (2008). It can be distinguished from congeners by the presence of a row of contractile vacuoles on either margin of ventral and dorsal sides (Vd’ačný and Foissner, 2008; 2012).

Class Oligohymenophorea de Puytorac, 1857

1. Australocirrus australis (Foissner, 1995) Kumar and Foissner, 2015 (Figs. 1A-C)

Diagnosis. Size about 155 × 100 μm from protargol impregnated specimens; ellipsoidal body shape, dorsoventrally slightly flattened, anterior end broad and posterior end slightly narrowed; cytoplasm containing blue granules and algae; extrusomes spindle-shaped, densely arranged alongside somatic kinety rows; somatic kineties composed of about 115 rows; peniculi 1-3 each with four kineties; five vestibular and five postoral kineties; one elongate elliptical macronucleus; one micronucleus attached to macronucleus.

Material examined. From Seawater at Aam-do Waterfront Park (salinity, 28 psu), Incheon-si, Jung-gu, Korea (37°26’43.30”N, 126°34’18.50”E), May 28, 2017. Voucher slides. A slide of protargol-impregnated specimens was deposited at the National Institute of Biological Resources, Korea (NIBRPR0000107959).

Remarks. Australocirrus australis is very similar to A. shii in body size, number of adoral membranelles, number of cirri in right and left marginal rows, and number of dorsal kineties. However, they can be distinguished from the percentage of the distance between the anterior pretransverse cirrus and the anteriormost transverse cirrus relative to body length (5.8% vs. 0.6-2.1%), and the arrangement of the transverse cirri (3+2 vs. an oblique row) (Foissner, 1995; Kumar and Foissner, 2015).

3. Frontonia subtropica Pan et al., 2013 (Figs. 1H-K)

Diagnosis. Size about 155 × 100 μm from protargol impregnated specimens; ellipsoidal body shape, dorsoventrally slightly flattened, anterior end broad and posterior end slightly narrowed; cytoplasm containing blue granules and algae; extrusomes spindle-shaped, densely arranged alongside somatic kinety rows; somatic kineties composed of about 115 rows; peniculi 1-3 each with four kineties; five vestibular and five postoral kineties; one elongate elliptical macronucleus; one micronucleus attached to macronucleus.

Material examined. From Seawater at Aam-do Waterfront Park (salinity, 28 psu), Incheon-si, Jung-gu, Korea (37°26’43.30”N, 126°37’54.14”E), December 16, 2014. Voucher slides. A slide of protargol-impregnated specimens was deposited at the National Institute of Biological Resources, Korea (NIBRPR0000107958).

Remarks. Frontonia subtropica differed from its congeners by cell size (155 × 100 μm), number of somatic kineties (approximately 115 rows) and vestibular kineties (5 rows) (Pan et al., 2013).

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including a new species of *Anigsteinia*. European Journal of Protistology In press.


