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CILIATED PROTOZOA FROM OXYGEN DEPLETED WATERS FROM CASSAFFOUSTH RESERVOIR (CORDOBA, ARGENTINA)

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RESUMEN. Protozoos ciliados oligoaerófilos del embalse Cassaffousth (Córdoba, Argentina).
Cinco especies de protozoos ciliados fueron encontradas en muestras de plancton del embalse Cassaffousth, en profundidades por debajo de los 10-14 m, en condiciones de bajo tenor de oxígeno: *Plagiophyla nasuta, Saprodinium dentatum, Brachonella spiralis, Caeonomorpha medusula* (citados por primera vez para la Argentina) y *Metopus es* (previamente mencionado como *M. sigmoides*). Se presentan descripciones e ilustraciones de estos ciliados.

ABSTRACT. Five species of ciliated protozoa were recorded in plankton samples collected during the summer in Cassaffousth reservoir (Córdoba province, Argentina), at depths below 10-14 m, in oxygen depleted waters below the epilimnetic layer. The species in question are: *Plagiophyla nasuta, Saprodinium dentatum, Brachonella spiralis, Caeonomorpha medusula* (first records for Argentina), and *Metopus es* (previously registered as *M. sigmoides*). Descriptions and illustrations of these ciliates are presented.

INTRODUCTION

The ciliates *Plagiophyla nasuta, Saprodinium dentatum, Metopus es, Brachonella spiralis* and *Caeonomorpha medusula* were found in plankton samples from Cassaffousth reservoir. With the exception of *Metopus es*, all are new records for Argentina. *M. es* was formerly cited under a different name.

Cassaffousth reservoir (Córdoba, Central Argentina, 32º 10' S, 64º 25' W) is a small subtropical monomictic water body located 1 km downstream from the larger Río Tercero Reservoir. Its area is 88 hm, maximum volume 10.5 hm^3, maximum depth 28.7, mean depth 11.9 m, and retention time 0.01 year (Boltovskoy &

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Foggetta, 1985). During the sampling period surface water temperature ranged between 10º and 24º C. Secchi-disk readings varied between 3.5 (July) and 1.4 m (March). The taxa here described were found only during the summer (January and March, 1981), at depths below 10 to 14 m. Temperature decreases from these depths to ca. 20 m are approximately 7º-8º C (from 22º C to 14º-15º C), which points at a stable thermocline, with restricted water exchange between deep waters and superficial, more oxygenated layers (Boltovskoy & Foggetta, 1985). During the summer, below 16 to 19 m (January and March, respectively), the water has a strong hydrogen sulfide (H_2S) odor, characteristic of oxygen depleted environments.

During the studied period this productive reservoir was characterized by blooms of chlorophytes (*Closterium aciculare* and *Sphaerocystis schroeteri*), diatoms (*Aulacoseira granulata*) and dinoflagellates (*Peridinium gatunense*), the latter being dominant during the stagnant phase.

MATERIAL AND METHODS

The studied material was collected bimonthly, at depths from 0 m to 20 m, between July, 1980, and September, 1981. 40 liters samples were taken at one meter intervals at between 0 and 10 m and every 2 m between 10 and 20 m, by means of a submersible centrifugal pump and filtered through a 33 µm mesh plankton net. Samples were fixed with 1% formaldehyde solution, retaining aliquots for observations *in vivo*. For line-drawings and photographs the ciliates were stained by adding 1% solution of methyl green in 1-2% acetic acid, to a drop of freshly colected material.

The classification system adopted is that proposed by de Puytorac *et al.* (1974) and, more recently, by The Commitee on Systematics and Evolution of the Society of Protozoologists (Levine *et al.*, 1980).

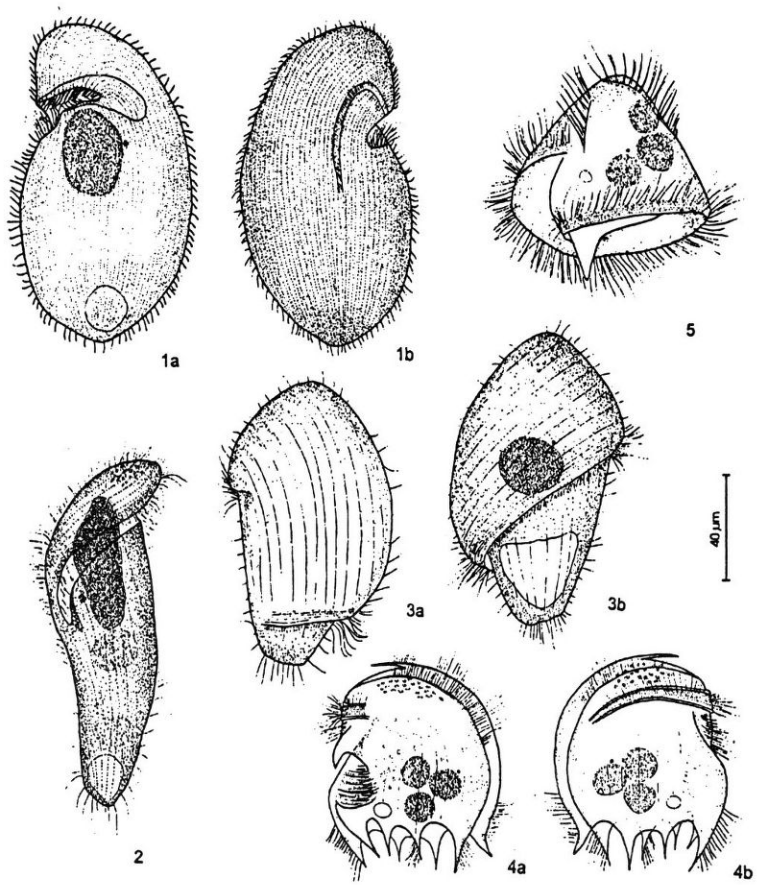
TAXONOMY

1. ***Plagiophyla nasuta*** Stein, 1860 (Fig. 1).

1860 *P.n.* Stein, *Sitz. Ber. Böhm. Ges. Wiss.* : 58, sec. Levander, 1894, *Acta Soc. Fauna Flora fenn.*, 12 : 76.

Body shape ovoid, laterally compressed, with slender anterior region. A slit-like buccal overture on the left side (ventral surface) of the body, distant from the apex by 1/4 of the total body length, and open towards the transverse vestibular area. This area is a deep ciliated canal, extending from the right margin to almost the midline of the body and ending in a short cytopharynx. A beak-like elevation is present on the right margin and over the canal. The dorsal side presents a transversely striated structure, starting from the anterior margin of the vestibular canal, and reaching, after a pronounced turn, the posterior utmost end of the canal. The function of this structure is unknown. The somatic ciliature is uniform, arranged in longitudinal kineties extending from the vestibular canal. Macronucleus spherical or oval, located cose to the centre of the body. A single terminal contractile vacuole.

Body length: 98 - 140 µm ($\bar{x}$=114.8 µm; n=4).



Figuras 1-5.- Ciliated protozoa from Cassaffousth reservoir. 1: *Plagiophyla nasuta* in ventral (a) and dorsal (b) views. 2: *Metopus es* in ventral view. 3a: *Brachonella spiralis* in dorsal (a) and ventral (b) views. 4: *Saprodinium dentatum* in dorsal (a) and ventral (b) views.

2. ***Saprodinium dentatum*** Lauterborn, 1901 (Fig.4, 7)

1901 *Discomorpha dentata* Lauterborn, *Zool. Anz.*, 24 : 54.
1908 *S. d.* Lauterborn, *Zeitschr. Wiss. Zool.*, 90 : 662, pl. 12, figs. 23-24.

Hyaline and small laterally compressed ciliates. Body shape spherical, covered by an armour-like rigid pellicle, sculptured with longitudinal ridges. The body is furnished with several spines: an apical spine (dorsal keel), a ventral one, located on the anterior margin of the buccal cavity, and eight spines around an inferior large invagination.

Somatic ciliature limited to a single row next to the frontal margin, extending along the left (ventral) side and almost reaching the middle of the body. Groups of cilia at the posterior body region and a perizonal ciliary stripe; the latter composed of five rows located along the pellicle ridge extending along most of the right (dorsal) side and over a short distance on the left one, and by two short rows located between the ridge and the buccal cavity.

Buccal area small. The cytostome opens ventrally towards the left side. Refringent granules towards the anterior end. One to three macronuclei and a single micronucleus. The single contractile vacuole is terminal and ventrally located.

Length: 60 - 75 μm ($\bar{x}$=67.3 μm; n=8).

3. ***Metopus es*** O. F. Müller, 1786 (Fig. 2)

1786 *M. es* Müller, Animacula infusoria fluvatilia et marina, sec. Kahl, 1930-1935: Utiere oder Protozoa. I: Wimpertiere oder Ciliata : 416.

1858 *M. sigmoides* Claparède et Lachmann, *Mem. Inst. nat. génev.*, 5 : 255, pl. XII, fig. 1.
1927 *M. sigmoides* var. *es* Kahl, *Arch. Protistenk*, 57 : 141, fig. 10.
1932 *M. es* Kahl, Utiere oder Protozoa. I: Wimpertiere oder Ciliata, : 416, fig.70, 1.

Elongate with sigmoid outline and asymmetrical shape due to the torsion of the anterior portion of the body. Posterior end somewhat truncated. Peristome oblique and slightly spiral, dividing the body into an anterior and a posterior sections.

Somatic cilia uniform and arranged in longitudinal kineties at the posterior portion; at the anterior one, the kineties form oblique rows outlining the peristome. A perizonal ciliary stripe along the anterior margin of the peristome, composed of five ciliary rows. An ample adoral zone of membranelles and a small undulating membrane. The cytostome opens equatorially or sub-equatorially. Ovoid macronucleus centrally located near the cytostome. Micronucleus single. Contractile vacuole terminal. Refringent granules at the anterior pole.

Body length: 116 - 138 μm ($\bar{x}$=117.3 μm; n=3).

This species has been reported for Argentina by Seckt (1924) as *M. sigmoides*. He included it in a species list from Córdoba and Buenos Aires provinces, without description or illustrations. De la Rúa (1911) also made reference to *M. sigmoides*, but his description does not totally agree with that of *Metopus es*.

4. ***Branchonella spiralis*** (Smith, 1897) Jankowski, 1964 (Fig. 3, 6a-b)

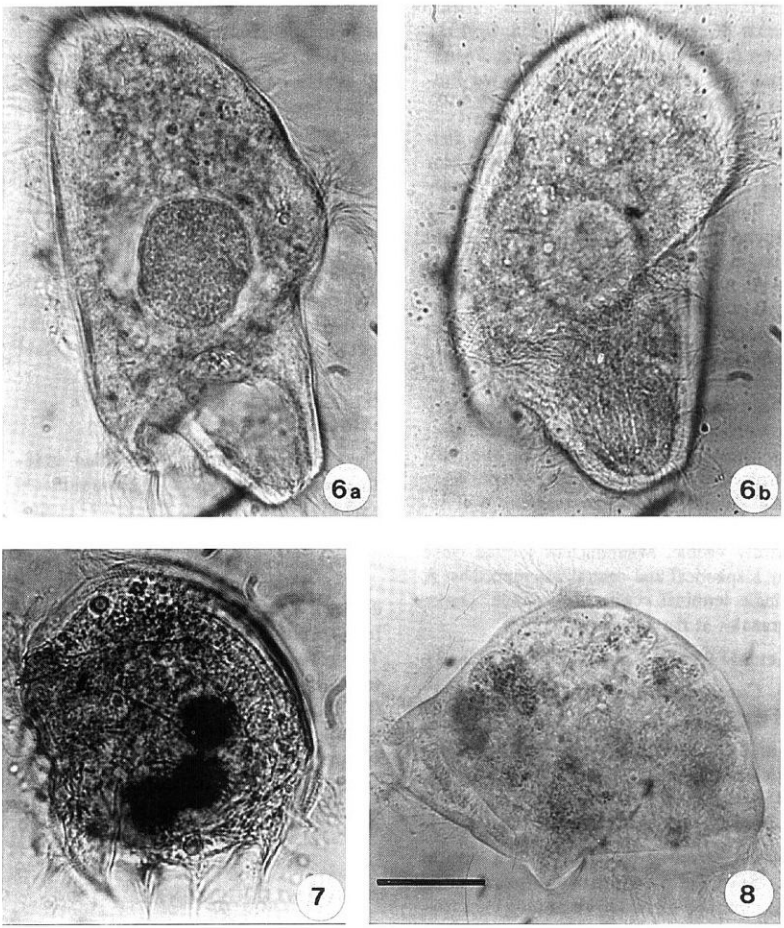


Fig. 6-8. - Ciliated protozoa from Cassaffousth reservoir. 6 a-b: *Brachonella spiralis*. 7: *Saprodinium dentatum*. 8: *Caenomorpha medusula*. Scale = 20 µm.

1897 *Metopus spiralis* Smith, *Trans. Amer. Micr. Soc. 19 :* 62, pl. I, fig.13. 1964 *B. spiralis* Jankowski, *Arch. Protistenk.* 107, sec. Bick, 1972, Ciliated Protozoa : 148, fig. 76.

General shape ovoid, dorsoventrally flattened. Anterior end spherical, posterior end slender and truncated with a bundle of longer cilia. The peristome spiralling around the body, starting at the left dorsal margin and ending on the dorsal side next to the posterior end of the left dorsal margin, dividing the body entirely into two regions, crossing obliquely the ventral face. Somatic cilia uniform, longitudinally distributed, with the exception of the area ahead of the peristome, where the ciliary rows are parallel to the former; the most proximate ones form the perizonal ciliary stripe. Buccal overture at the posterior body half. Adoral zone of membranelles well developed, and a tiny undulating membrane is hardly visible. Micronucleus located close by a spherical and central macronucleus. A single terminal contractile vacuole. Dusky granules at the anterior pole.

Length: 97 - 118 μm ($\bar{x}$=104.5 μm; n=8).

5. ***Caenomorpha medusula*** Perty, 1852 (Fig. 5, 8)

1852 *C. medusula* Perty, Zur Kenntniss kleinster Lebensformen : 140, pl. III, fig. 4, sec. Levander, 1894, Materialen zur Kenntniss der Wasserfauna : 84.

Small spinning-top-like, with a central spine at the posterior end. Somatic ciliature formed by two rows of long cilia (flexible cirri) at the anterior region of the body, two short kineties at the base of the spine and one perizonal ciliary stripe along the external peristomal edge composed of several ciliary rows. According to Fernández-Galiano & Fernández-Leborans (1980) the ciliary stripe consists of about 20 double rows of kinetosomes. Peristome spiral, bending around the body by somewhat more than 360º, bordered by a long stripe of adoral membranelles. Posteriorly located cytostome. Two or three spherical macronuclei and one micronucleus. Single contractile vacuole.

Length: 45 - 67 μm ($\bar{x}$=55 μm; n=6).

Both the body size and the spine length of the specimens are in agreement with those of the dwarf form reported by Kahl (1927) as dubious.

CONCLUSIONS

The species described are regarded as indicators of polysaprobic environments with high levels of H_2S (Bick, 1972). Our results confirm this characterization insofar as all of them were recorded in association with strongly stratified, oxygen depleted waters. These species were not found at the neighboring Embalse Río Tercero reservoir, connected with Cassaffousth by a 1 km long stretch of the river Río III, where the plankton composition is quite similar to that of the former, but summer stratification is less stable and the O_2 depleted waters are restricted to a small area (Boltovskoy & Foggetta, 1985).

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