

PLANKTONIC CILIATES CHOREOTRICHIDA AND STROMBIDIIDA FROM THE INNER ZONE OF BAHÍA BLANCA ESTUARY, ARGENTINA

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ABSTRACT

Seven species of aloricate planktonic ciliates were identified using protargol staining. Choreotrichida: Strombidinopsidae, *Strombidinopsis elongata* Song & Bradbury, 1998; Strobiliidae, *Strobilidium epacrum* Lynn & Montagnes, 1988 and Strombidiida: Strombidiidae, *Strombidium capitatum* (Leegaard, 1915) Kahl, 1932; *S. emergens* (Leegaard, 1915) Kahl, 1932; *S. acutum* Leegaard, 1915; *S. dalum* Lynn, Montagnes & Small, 1988 and *Cyrtostrombidium longisomum* Lynn & Gilron, 1993; they were collected from the inner zone of the Bahía Blanca estuary in the southern region of the Buenos Aires province, Argentina. These species represent new records to South America (Argentina).

KEYWORDS. Planktonic ciliates, estuary, distribution.

INTRODUCTION

In last decades the importance of ecological function of micro-organisms in pelagic food webs has been recognized and many studies have been carried out, principally in Europe and North America. Planktonic ciliates constitute a diverse group in a trophic and taxonomic point of view. They are often the dominants of the heterotrophic planktonic protists, representing a link between phytoplankton and higher trophic levels. Investigations show that aloricate ciliates occur in high numbers and consume significant quantities of autotrophic and heterotrophic microbial production (AZAM *et al.*, 1983; FENCHEL, 1987; MONTAGNES & LYNN, 1991). They are eaten in turn by other protozoans, many metazoans and fish larvae (JONSSON, 1986; PIERCE & TURNER, 1992; LONSDALE *et al.*, 1996; PETZ, 1999). The taxonomic composition and ecological characteristics of the aloricated planktonic ciliates from South Atlantic Ocean and coastal zone of Argentina are poorly known.

The aim is to report the assessment of the composition of the aloricate ciliates community in the inner zone from Bahía Blanca estuary, Argentina.

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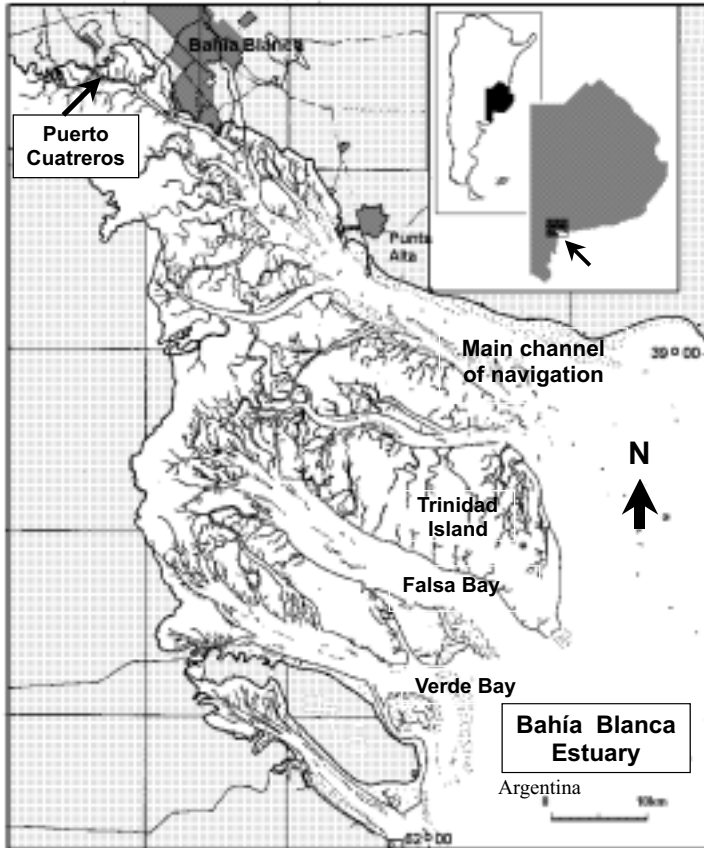


Fig. 1. The Bahía Blanca estuary, Argentina, showing the location of Puerto Cuatros.

MATERIAL AND METHODS

Bahía Blanca estuary is located on the Atlantic coast at $38^{\circ}42' - 39^{\circ}25'S$, $61^{\circ}50' - 62^{\circ}22'W$. It has a total length of 68 km, being 200 m and 3 to 4 km wide near its head and mouth, respectively. It is a semienclosed body of water characterized as shallow, well mixed and with high turbidity due to a great amount of organic and inorganic suspended material. Strong winds and tidal waves dominate the general circulation (PICCOLO & PERILLO, 1990).

Sampling was done in Puerto Cuatros located in the inner part of the estuary, near its head (fig. 1), from February 1st, 1994 to February 22nd, 1995. This part has variable temperature and salinity. The Sauce Chico River, the Napostá Grande stream and other minor creeks, that discharge in the estuary only during rainfall periods, carry most of the freshwater inflow and in dry summers it becomes hypersaline (FREIJE *et al.*, 1981). Water samples were taken out at weekly intervals during daylight hours and high tide from the subsurface (0.50-1 m), using a 3 L Van Dorn bottle. Data of temperature and salinity were also registered. Protargol staining, according to TUFFRAU (1967); LEE *et al.* (1985) and FOISSNER (1991) was used to estimate the taxonomic composition. Protargol stained species were deposited in the collection of the Laboratorio de Ecología General, Departamento de Biología, Bioquímica y Farmacia, Universidad Nacional del Sur, Bahía Blanca, Argentina.

RESULTS AND DISCUSSION

The seven species reported in Puerto Cuatrerros belong to the orders Choreotrichida and Strombidiida. They are commonly found in other coastal areas of the world (LYNN *et al.*, 1988; MONTAGNES *et al.*, 1988; LYNN & GILRON, 1993; LEAKEY *et al.*, 1994; PETZ *et al.*, 1995; SONG & BRADBURY, 1998). Some differences in cell size and in numbers of several structures from Puerto Cuatrerros populations were observed. MONTAGNES *et al.* (1988) have demonstrated that spirotrichs show marked size variation in response to environmental influences and regulate numbers of structures in proportion to cell size.

Free-living phagotrophic protozoans are usually believed to have a cosmopolitan distribution and it seems that in environments with similar characteristics the same species could be present (FENCHEL, 1987). The taxonomy and ecology of marine aloricate planktonic ciliates have only recently been described with some frequency using modern cytological techniques thus, little is known about their global distribution and it is difficult to know which species have truly restricted geographic ranges (PIERCE & TURNER, 1992; PETZ, 1999).

Temperature and salinity values registered in Puerto Cuatrerros during the study were similar to those encountered in other parts of the world where the same species of aloricate ciliates were also found. These observations would confirm the hypothesis that protozoan species in coastal areas are widely distributed (FENCHEL, 1987). However, *Strombidium emergens* was recorded at geographically different sites (Weddell Sea; Gulf of Maine, USA and Puerto Cuatrerros) and in water temperature quite different. Thus, it is possible that species from different geographical regions have different temperature tolerances (LYNN *et al.*, 1991).

Spirotrichea, Choreotrichida, Strombidinopsidae *Strombidinopsis elongata* Song & Bradbury, 1998

(Figs. 2, 3)

Strombidinopsis elongata SONG & BRADBURY, 1998:785, fig. 6.

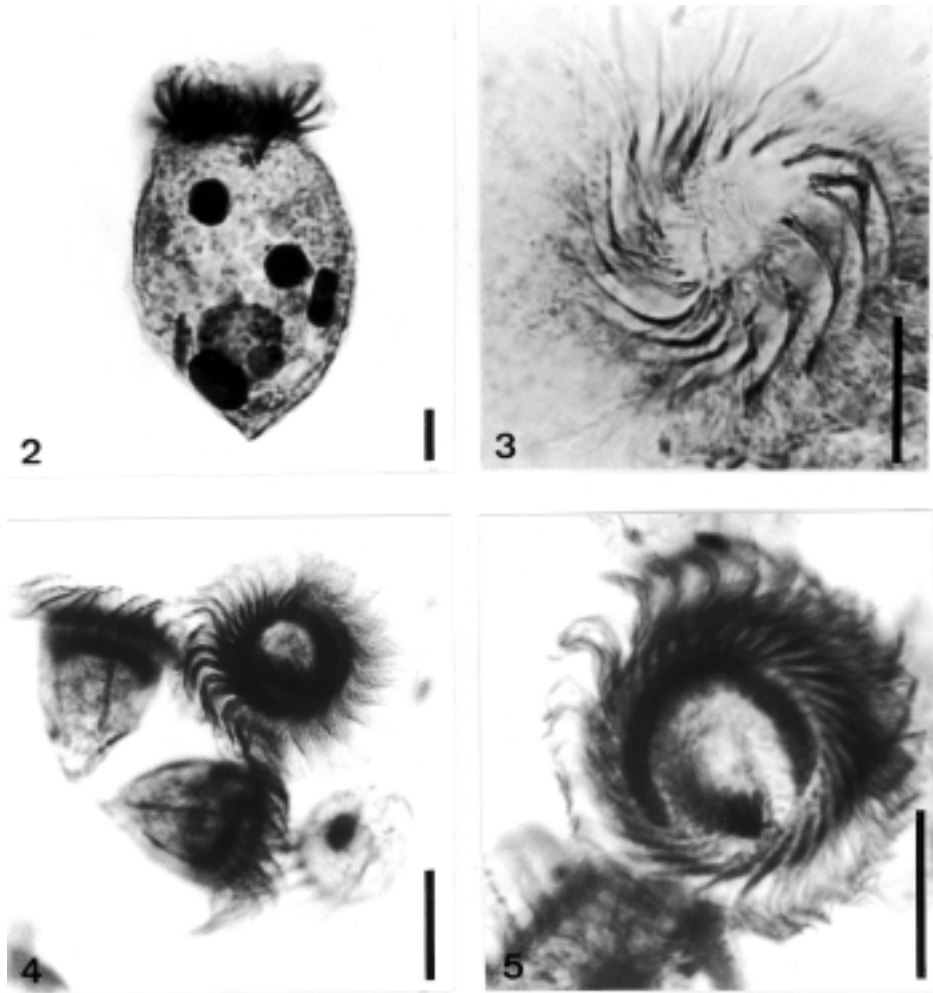
Description. Large cell, 97.5-128.7 length, 74-82 width (n=13). Cylindrical body shape with a pointed posterior end; 14-18 longitudinal somatic kineties evenly distributed around the cell. Two spherical to ovoid macronucleus 12-17.6 length to 12-15.6 width positioned in centre of the cell (fig. 2). Diameter of adoral zone 39-51. External oral polykinetid zone composed of 17-20 polikinetids. Inner oral polykinetid zone with 4-6 polikinetids, which three of them are independent and located in an oral depression (fig. 3). Micronucleus not observed.

Occurrence. The species was present in Puerto Cuatrerros mainly in winter months when the diatom bloom occurs; salinity 29.6-35.7 ‰, temperature 8.8-11°C.

Distribution. Yellow Sea, northeastern of China (SONG & BRADBURY, 1998); Puerto Cuatrerros, Bahía Blanca estuary, Argentina.

Environmental parameters. Oligo to mesosaprobic coastal waters, salinity 30-32 ‰, temperature 5-24°C.

Taxonomical remarks. The population of *Strombidinopsis elongata* from Puerto Cuatrerros differs from the population described in north of China (SONG & BRADBURY, 1998) by having larger cell and macronucleous, but the similarities in body shape, number of external oral polikinetids and somatic kineties justify the assignment of these specimens to *S. elongata*.



Figs. 2-5. Protargol impregnated ciliate species from Puerto Cuaterros: 2, *Strombidinopsis elongata* Song & Bradbury, 1998, general view; 3, anterior oral polykinetid zone; 4, *Strobilidium epacrum* Lynn & Montagnes, 1988, general view; 5, anterior oral polykinetid zone. Scale bars, 20 μ m: figs. 2,3; 4,5, respectively in the same scale.

Strobilidiina, Strobiliidae

***Strobilidium epacrum* Lynn & Montagnes, 1988**

(Figs. 4, 5)

Strobilidium epacrum LYNN & MONTAGNES, 1988:643, fig. 2.

Description. Conical cell shape with pointed posterior end, 35-55 length, 31-47 width (fig. 4) (n=3). Five somatic kineties of various lengths covered with cytoplasmic

flaps. On dorsal region, kinety 2 spiralled, extending from posterior to anterior, kinety 3 short, in the middle of the body and kinety 4 longitudinally, longer than kinety 3. On ventral region found kinety 1, halfway down cell and kinety 5 extended longitudinally. Macronucleous C-shaped with ventral opening. External oral polykinetid zone composed of 30-31 polykinetids. Inner oral polykinetid zone composed of 6-8 polykinetids, six of them continuous with the external polykinetids and two independent. The internal polykinetids are situated in the oral depression (fig. 5).

Occurrence. In Puerto Cuatros this species was frequent in spring; salinity 30-38 ‰, temperature 12-18°C.

Distribution. Neritic waters near the Isles of Shoals, Gulf of Maine, USA (LYNN & MONTAGNES, 1988); Puerto Cuatros, Bahía Blanca estuary, Argentina.

Taxonomical remarks. Except for the cell size, the specimens from Puerto Cuatros (35-55 length) match well with the population described by LYNN & MONTAGNES (1988) (60-95 length).

Strombidiida, Strombidiidae

***Strombidium capitatum* (Leegaard, 1915) Kahl, 1932**

(Figs. 6, 7)

Laboea capitata LEEGAARD, 1915:16, fig. 6.

Strombidium capitatum; KAHL, 1932:503, fig. 20; MAEDA & CAREY, 1985:51, fig. 88; MONTAGNES *et al.*, 1988:192, fig. 2.

Description. Cylindrical body shape, 23-51 length, 39-55 width (n=11) (fig. 6). A conspicuous peristomial collar and a large, wide and deep oral groove at the anterior part of the cell. Trichites in radial arrangement inserting at the posterior end. Subequatorial kinety surrounds the cell. Anterior polykinetid zone and ventral polykinetid zone separated. Anterior polykinetid zone composed of 16-18 polykinetids. Ventral polykinetid zone composed of 18-20 polykinetids. A paroral membranell in the inner part of the oral groove. One macronucleous elongated (fig. 7).

Occurrence. In Puerto Cuatros *S. capitatum* was frequent in October and December; salinity 29-30 ‰, temperature 12-21 °C.

Distribution. Great Harbor, Woods Hole, Massachusetts, USA (MONTAGNES *et al.*, 1988); Puerto Cuatros, Bahía Blanca estuary, Argentina.

Environmental parameters. Salinity 31-32 ‰, temperature 5-24°C; eurythermal.

Food. Mixotrophic, nanoflagellates.

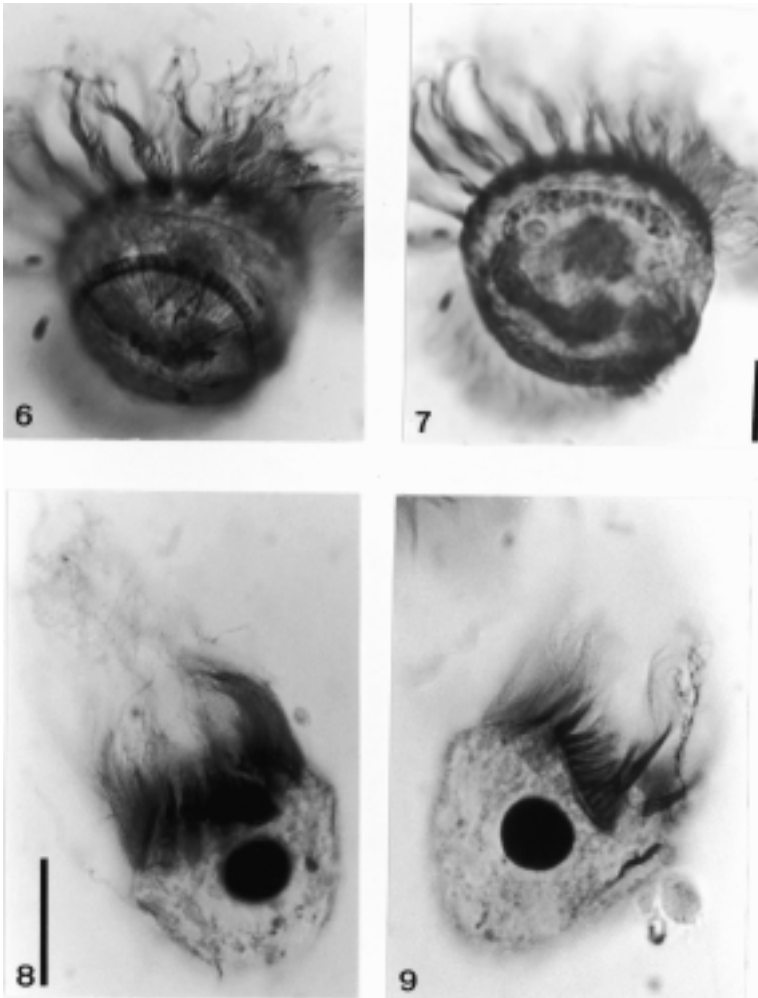
Taxonomical remarks. Cellular features of *S. capitatum* from Puerto Cuatros are similar to those described by MONTAGNES *et al.* (1988).

***Strombidium acutum* Leegaard, 1915**

(Figs. 8, 9)

Strombidium acutum LEEGAARD, 1915:31, fig. 21; MAEDA & CAREY, 1985:56, fig. 97; MONTAGNES *et al.*, 1988:192, fig. 6; LYNN *et al.*, 1988:262, fig. E.

Description. Conical shape 27-33 in length, 27-35 in width (n=10) (fig. 8). Anterior polykinetid zone distinctly separated from ventral polykinetid zone. Anterior polykinetid zone composed of 12-16 polykinetids. Ventral polykinetid zone composed of 10-12

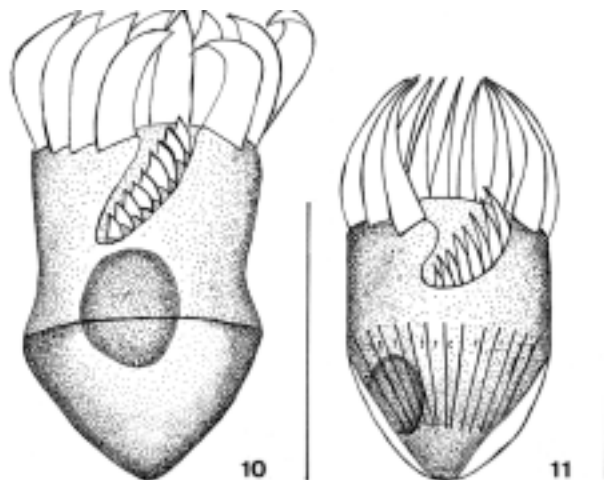


Figs. 6-9. Protargol impregnated ciliate species from Puerto Cuatreros: 6, *Strombidium capitatum* (Leegaard, 1915) Kahl, 1932, general view; 7, nuclear detail; 8, *Strombidium acutum* Leegaard, 1915, general view showing filamentous material belonging to the trichites; 9, ventral view. Scale bars, 20 μ m: figs.6,7; 8,9, respectively in the same scale.

polykinetids located in a shallow ventral groove. Girdle kinety supraequatorial surrounding the cell. One spherical macronucleus 8-19 in diameter centrally positioned. Large trichites inserted near girdle. Filamentous material belonging to the extruding trichites interlaced with anterior cilia characterizes this species (fig. 9).

Occurrence. In Puerto Cuatreros *S. acutum* was observed in spring and summer; salinity 30-35 ‰, temperature 12-19°C.

Distribution. Neritic waters near the Isles of Shoals, Gulf of Maine, USA (LYNN *et*



Figs. 10, 11. Protargol impregnated ciliate species from Puerto Cuatrerros: 10, *Strombidium emergens* (Leegaard, 1915) Kahl, 1932, general view; 11, *Strombidium dalum* Lynn, Montagnes & Small, 1988, general view. Scale bars, 20 μ m.

al., 1988); Perch Pond, Falmouth, Massachusetts, USA (MONTAGNES *et al.*, 1988); Puerto Cuatrerros, Bahía Blanca estuary, Argentina.

Environmental parameters. Salinity 24-32 ‰, temperature 7-20°C.

Food. Mixotrophic, autotrophic flagellates.

Taxonomical remarks. The specimens was determined according to the description of LYNN *et al.* (1988). The specimens from Puerto Cuatrerros have smaller cell than those described by these authors, but they have registered a great variability of this character among populations of this species.

***Strombidium emergens* (Leegaard, 1915) Kahl, 1932**

(Fig. 10)

Laboea emergens LEEGAARD, 1915:21, fig. 11.

Strombidium emergens; KAHL, 1932:501, fig. 13; MONTAGNES *et al.*, 1990:320, fig. Q; PETZ *et al.*, 1995:115-117, figs. 35 a-c.

Strombidium sulcatum; LYNN *et al.*, 1988:268, fig. E (*non* Claparéde & Lachmann, 1858).

Description. Anterior portion of the body cylindrical, posterior conical, 27-39 length, 19.5-29 wide (n=7). Subequatorial girdle kinety all around the cell. Anterior polykinetid zone and ventral polykinetid zone separated; the anterior composed of 12-14 polykinetids, ventral with 9-11 polykinetids located in a ventral groove. Macronucleous spherical to ovoid, 6-12 large, 6-16 wide positioned in centre of the cell (fig. 10).

Occurrence. In Puerto Cuatrerros was observed in winter, salinity 30-33 ‰, temperature 9-12°C.

Food. Mixotrophic, autotrophic flagellates.

Distribution. Neritic waters near the Isles of Shoals, Gulf of Maine, USA; ecological

parameters: salinity 26-32 ‰, temperature 10-20°C (LYNN *et al.*, 1988). Weddell Sea (69°46'-70°21'S, 08°53'-11°00'W).

Environmental parameters. Salinity *ca.* 50 ‰, temperature -2,6°C (PETZ *et al.*, 1995); Puerto Cuatreros, Bahía Blanca estuary, Argentina.

Taxonomical remarks. Puerto Cuatreros population of *Strombidium emergens* is similar to the population described by LYNN *et al.* (1988) as *Strombidium sulcatum*. This population was later determined as *Strombidium emergens* by MONTAGNES *et al.* (1990).

***Strombidium dalum* Lynn, Montagnes & Small, 1988**

(Fig. 11)

Strombidium dalum LYNN *et al.*, 1988:266, fig. 3 A.

Description. Conical shape, 12-37 length, 12 width (n=8). Anterior polykinetid zone distinctly separated from ventral polykinetid zone. Anterior polykinetid zone composed of 10-12 polykinetids. Ventral polykinetid zone with 8 polykinetids located in a ventral groove. Girdle kinety equatorial. Long trichites inserting anteriorly to girdle kinety and extending near to posterior end, in radial arrangement. One macronucleous 4-8 in diameter, conical to spherical, located at posterior end (fig. 11).

Occurrence. In Puerto Cuatreros was observed in spring; salinity 30-31 ‰, temperature 9-13°C.

Distribution. Neritic waters near the Isles of Shoals, Gulf of Maine, USA (LYNN *et al.*, 1988). Coastal waters near Kingston Harbour, Jamaica (LYNN & GILRON, 1993); Puerto Cuatreros, Bahía Blanca estuary, Argentina.

Environmental parameters. Salinity 26-36 ‰, temperature 5-20°C.

Taxonomical remarks. The population of Puerto Cuatreros is similar in size to those of the Gulf of Maine and Jamaican coast described by LYNN *et al.* (1988) and LYNN & GILRON (1993). It has a similar number of anterior and ventral oral polykinetids and it has a similar macronucleous spherical to conical shape. The specimens of *S. dalum* recorded in Puerto Cuatreros do not show either the ventral kinety, present only in the Jamaican one (LYNN & GILRON, 1993) nor the "torch-like" shape of the cilia of the anterior polikinetid zone present only in the Gulf of Maine population (LYNN *et al.*, 1988). Ventral kinety was a characteristic apparently overlooked in the Gulf of Maine population and the torch-like shape of the cilia was considered an artefact of fixing and staining in the Jamaican population.

***Cyrtostrombidium longisomum* Lynn & Gilron, 1993**

(Fig. 12)

Cyrtostrombidium longisomum LYNN & GILRON, 1993:61, figs. 6 A-C.

Description. Conical shape, 47-74 length, 19.5-31 width (n=4). Anterior polykinetid zone composed of 10 polykinetids, surrounding the anterior end that bears a spherical protuberance. No ventral polykinetid zone. Ventral kinety composed of dikinetids, with one kinetosome ciliated. Basquet of fibres around the cytopharynx. One large elongate macronucleous 17.5-25 length, 4-6 width. Micronucleous not impregnated. Cytoplasm filled with inclusions, probably pigments of green algae. Cell covered with polysaccharid

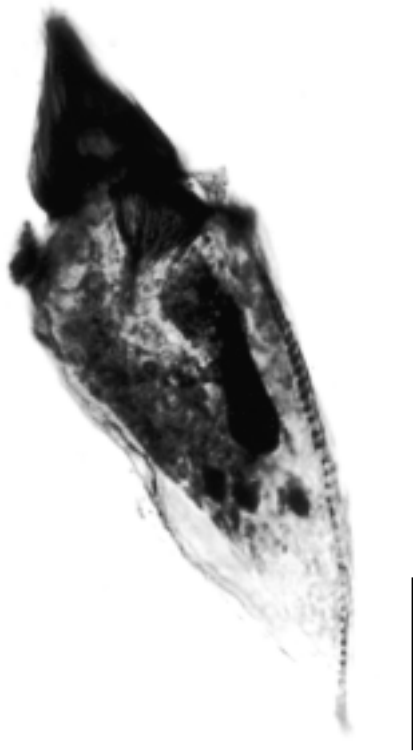


Fig. 12. Protargol impregnated ciliate species from Puerto Cuatrerros: *Cyrtostrombidium longisomum* Lynn & Gilron, 1993, right lateral and internal view. Scale bar, 20 μ m.

plates. Distended cell surface present (fig. 12).

Occurrence. In Puerto Cuatrerros was recorded in spring; salinity 29-35.5 ‰, temperature 11-22°C.

Distribution. Coastal waters near Kingston Harbour, Jamaica (LYNN & GILRON, 1993), Plymouth Sound, Southampton waters (LEAKEY *et al.*, 1994); Puerto Cuatrerros, Bahía Blanca estuary, Argentina.

Environmental parameters. Salinity 34.8 ‰, temperature 14.4°C.

Taxonomical remarks. *Cyrtostrombidium longisomum* from Puerto Cuatrerros is similar to the Jamaican population (LYNN & GILRON, 1993) in the body shape, by the presence of a protuberance, a ventral kinety and in the shape and size of the macronucleus. The cell of the Puerto Cuatrerros population is larger and shows polysaccharid plates not reported for the Jamaican population. This last feature could be considered a characteristic of the environment.

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