The Stunning, Glass-Covered Resting Cyst of *Maryna umbrellata* (Ciliophora, Colpodea)

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Summary. *Maryna umbrellata* (Gelei, 1950) Foissner, 1993 is a colpodid ciliate common in ephemeral water bodies. Pure cultures were established and the resting cyst studied by light and electron microscopy, protease digestion of thin sections, and various cytochemical reactions shown by colour micrographs. The cyst of *M. umbrellata* belongs to the kinetosome-resorbing (KR) type and has a conspicuous glass cover described by Foissner *et al.* (2009). It is 100 µm across and the about 13 µm thick wall, which amounts for half of the total cyst volume, consists of four distinct layers: (i) the about 6 µm thick pericyst, which is composed of glass granules embedded in mucoproteins, and of a basal layer consisting of glycogen tubules about 20 nm across; (ii) the about 140 nm thick, electron-dense ectocyst, which is not digested by protease; (iii) the about 6 µm thick mesocyst, which is distinctly laminated and made of proteins; and (iv) the thin, about 500 nm thick endocyst, which is structureless and consists of glycoproteins. The meso- and endocyst are highly elastic, reducing their diameter by 50% when the encysted ciliate is removed. The cyst contents is dominated by up to 7 µm-sized “spongy globules” consisting of an electron-dense, proteinaceous matrix burrowed by electron-lucent strands of glycogen, providing the cyst with a curious, white-spotted appearance in the electron microscope. The small lipid droplets have a proteinaceous centre. The cyst plasm contains proteins and unstructured mucosubstances, which stain with alcian blue, and thus possibly originate from the decomposed mucocysts. This study suggests that ciliate resting cysts are much more diverse than indicated by literature data.

Key words: Colpoda, cyst cytochemistry, comparative ultrastructure of colpodid resting cysts, function of cyst layers, silicon in ciliates.

INTRODUCTION

The ability to form a dormant stage, usually called cyst or spore, provides micro-organisms with an endless life, while specific properties of the cyst wall are very likely important for the biogeographic range a species or population can occur (Foissner 1987, 2006; Gutiérrez *et al.* 2001). Specific cyst properties must also strongly influence the occurrence or absence of a certain species under certain environmental conditions. It is thus surprising that current protistology shows only meagre interest in cyst research, although some progress has been made by ecologists (e.g., Jonsson 1994, Kim and Taniguchi 1997, Müller and Wünsch 1999, Müller *et al.* 2002, Endo and Taniguchi 2006, Weisse *et al.* 2008), biochemists (e.g., Nakamura and Matsusaka 1992, Wato *et al.* 2003, Tsutsumi *et al.* 2004, Yamasaki *et al.* 2004, Akematsu and Matsuoka 2005, Oda and Matsu- saka 2005), and molecular biologists (e.g., Gutiérrez *et al.* 2001).