Antarctic Science 5 (3): 279–280 (1993)

Short note
Thraustochytrid protists in Antarctic fast ice?

FRANZ RIEMANN and KARSTEN SCHAUMANN

Alfred-Wegener-Institut für Polar- und Meeresforschung, D-27515 Bremerhaven 1, Germany

Accepted 18 March 1993

Introduction

Sea ice provides a habitat for a conspicuous and productive assemblage of autotrophic microalgae and for heterotrophs ranging from bacteria to vertebrates (Horner 1990, Garrison 1991). With the exception of a reference to chytridiaceous fungi that were found infecting Arctic ice diatoms (Horner 1977) and a note in a cruise report (Schnack-Schiel 1987, p. 153), it appears that fungi and similar organisms have until now not been mentioned as members of the heterotrophic sea ice community. In the present short note we report on the abundant occurrence of apparently thraustochytrid fungus-like protists associated with mucilage tubes of pennate diatoms, encountered in the lower section of a fast ice core drilled close to the southern shelf ice margin of the Weddell Sea.

Material and methods

During cruise ANT IX-3 of the German RV *Polarstern* one 231 cm long ice core (7.6 cm diameter), reaching the ice bottom with attached ice platelets, was drilled (20 January 1991) on the small fast ice area close to the landing site of the British Antarctic Survey station at Halley, Weddell Sea (75°28'S, 26°43'W). The core was cut into 10 cm sections which were melted in 3 l of membrane-filtered (0.2 μm pores) sea water. From the undersurface of the ice a 3 cm thick layer of attached ice platelets could be retrieved together with some loose platelet material which filled the drilling hole. For comparison, eight samples from various parts of floating pack ice near Halley were investigated. After melting of the ice core sections the organisms were concentrated by using a 10 μm mesh sieve; in other cases subsamples were taken from bottom deposits in the vessels. Protists were fixed in 4% formaldehyde solution; subsamples were stained with Rose Bengal and processed for glycerine mounts. Other aliquots were stained with Acriflavine to test for the presence of sulphated mucopolysaccharides, cell wall compounds of thraustochytrids. In this context, it must be kept in mind that these compounds can also occur in the mucilaginous sheaths of other marine protists (Raghukumar & Schaumann 1993).

Observations and discussion

After melting, the lowest core section (218–228 cm depth) just above the platelet layer showed a coherent, viscous, large flake, the volume of which was estimated at 250 μl. The flake consisted mainly of the mucilage tubes of the pennate diatom *Berkeleya adeliensis* Medlin, 1990. Some ovoid aggregates of living *B. adeliensis* and *Nitzschia* sp. cells were interspersed with greyish portions of mucous tube material, which contained strongly degraded cells or empty frustules of *B. adeliensis*. The mucilage material was colonized by large numbers of rod-shaped bacteria, as observed by McConville & Wetherbee (1983). In addition, morula-like clusters of globular cells and loose aggregations of single spherical cells were attached to the mucilage (Fig. 1). The cells gave a positive staining reaction with Acriflavine and stained intensely with Rose Bengal. We tentatively identify the cells as sporangia or thalli of Thraustochytriaceae, a group of fungus-like protists with unresolved phylogenetic affinities (see Moss 1986, Chamberlain & Moss 1988). The present organisms show similarities to species of *Schizochytrium* (Goldstein & Belsky 1964) and *Labyrinthuloides* (Perkins 1973). A more definite identification is not possible because no cultures are available. The presence of ectoplasmatic net elements, which could only be identified indistinctly by our methods, remains questionable. Owing to the variety of cleavage patterns in thraustochytrids and the ability of cells of all sizes to divide (Bahnweg & Sparrow 1974, Quick 1974) there are great differences in the sizes of cells and cell clusters. The sizes of individual cells in the present material ranged from c. 2.5–10 μm and the clusters, which were

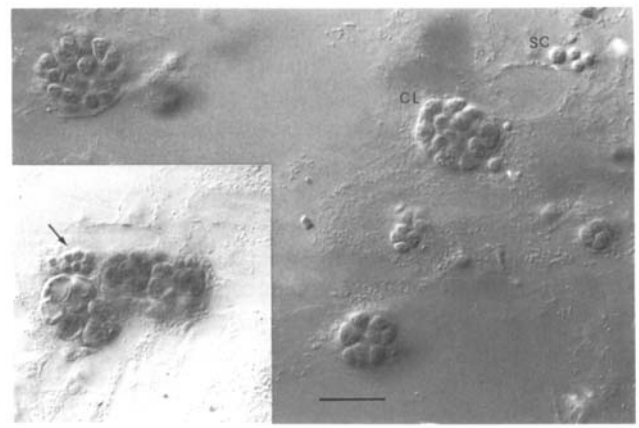


Fig. 1 Clusters (CL) and single cells (SC) of probable thraustochytrids on bacteria-rich mucilaginous tubes of diatoms; insert shows clusters of large and (arrow) small cells. Glycerine mount, Nomarski microscopy; scale bar = 20 μm.

https://doi.org/10.1017/S0954102093000379 Published online by Cambridge University Press

composed of up to 30 cells, reached a diameter of up to 40 μm. An estimate of all thraustochytrid cells within a 30 μl drop of diatom mucilage gave *c.* 2500 cells, or in the total 250 μl of the original sample from the melted ice core section (441 ml) *c.* 21000 cells of thraustochytrid protists.

In the platelet ice layer beneath the fast ice the dominant diatoms were *Entomoneis* sp. forming ribbon-shaped colonies. Thraustochytrid clusters were rare in this material. In the samples from drifting pack ice, dominated by large amounts of the prymnesiophyte *Phaeocystis* sp., no thraustochytrids could be detected. Bahnweg & Sparrow (1974) and Riemann & Schrage (1983) found thraustochytrids in Antarctic water and sediment samples.

In the present material the majority of thraustochytrids was obviously attached to *Berkeleya adeliensis* mucilage tubes. Thraustochytrids are mostly saprotrophic, but cases of parasitism have been recorded (Moss 1986). It is, therefore, not known whether the degradation of the diatom cells within the tubes is due to deterioration of physical environmental factors, parasitism, or a combination of both factors. McConville & Wetherbee (1983) noted conspicuous signs of degradation of the tube-forming diatom they identified as *Amphipleura* sp. (syn. of *Berkeleya adeliensis*, see Medlin 1990) towards the end of December in an Antarctic bottom-ice microalgal community. Reasons for the decline were not clear although osmotic stress in conjunction with seasonal ice melting processes was suggested. It is possible that algae afflicted in this way become substrata for thraustochytrids.

Acknowledgements

We thank R. Gradinger for collecting the material and calling our attention to the diatom tubes, and R. Scharek and R.M. Crawford for advice with the identification of diatoms. S. Raghu Kumar helped with the identification of thraustochytrids. Drs S.T. Moss and A.H.L. Chamberlain provided useful critical comments. This is publication No. 627 of the Alfred-Wegener-Institut für Polar- und Meeresforschung, Bremerhaven.

References

BAHNWEG, G. & SPARROW, F.K. 1974. Four new species of *Thraustochytrium* from Antarctic regions, with notes on the distribution of zoosporic fungi in the Antarctic marine ecosystems. *American Journal of Botany*, **61**, 754-766.

CHAMBERLAIN, A.H.L. & MOSS, S.T. 1988. The thraustochytrids: a protist group with mixed affinities. *BioSystems*, **21**, 341-349.

GARRISON, D.L. 1991. Antarctic sea ice biota. *American Zoologist*, **31**, 17-33.

GOLDSTEIN, S. & BELSKY, M. 1964. Axenic culture studies of a new marine phycomycete possessing an unusual type of asexual reproduction. *American Journal of Botany*, **51**, 72-78.

HORNER, R.A. 1977. History and recent advances in the study of ice biota. *In* DUNBAR, M.J., *ed. Polar Oceans.* Calgary, Alberta: Arctic Institute of North America, 269-283.

HORNER, R.A. 1990. Ice-associated ecosystems. *In* PRIDDLE, J. & MEDLIN, L.K., *eds. Polar marine diatoms.* Cambridge: British Antarctic Survey, 9-14.

MCCONVILLE, M.J. & WETHERBEE, R. 1983. The bottom-ice microalgal community from annual ice in the inshore waters of east Antarctica. *Journal of Phycology*, **19**, 431-439.

MEDLIN, L.K. 1990. *Berkeleya* spp. from Antarctic waters, including *Berkeleya adeliensis*, sp. nov., a new tube dwelling diatom from the undersurface of sea-ice. *Beihefte zur Nova Hedwigia*, **100**, 77-89.

MOSS, S.T. 1986. Biology and phylogeny of the Labyrinthulales and Thraustochytriales. *In* MOSS, S.T., *ed. The biology of marine fungi.* Cambridge: Cambridge University Press, 105-129.

PERKINS, F.O. 1973. A new species of marine labyrinthulid, *Labyrinthuloides yorkensis* gen. nov., spec. nov. Cytology and fine structure. *Archiv für Mikrobiologie*, **90**, 1-17.

QUICK, J.A. 1974. *Labyrinthuloides schizochytrops* n. sp., a new marine *Labyrinthula* with spheroid "spindle" cells. *Transactions of the American Microscopical Society*, **93**, 344-365.

RAGHUKUMAR, S. & SCHAUMANN, K. 1993. An epifluorescence microscopy method for direct detection and enumeration of the fungus-like marine protists, the thraustochytrids. *Limnology and Oceanography*, **38**, 182-187.

RIEMANN, F. & SCHRAGE, M. 1983. On a mass occurrence of a thraustochytrioid protist (fungi or rhizopodan Protozoa) in an Antarctic anaerobic marine sediment. *Veröffentlichungen des Instituts für Meeresforschung in Bremerhaven*, **19**, 191-202.

SCHNACK-SCHIEL, S. (*ed.*) 1987. Die Winter-Expedition mit FS "Polarstern" in die Antarktis (ANT V/1-3). *Berichte zur Polarforschung*, **39**, 1-258.

https://doi.org/10.1017/S0954102093000379 Published online by Cambridge University Press