DINOFLAGELLATE CYST ASSEMBLAGES AS REPERTOIRE OF SPECIES DIVERSITY: MAIN RESULTS OF THE EU-SEED PROJECT RELATED TO MEDITERRANEAN SITES

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Abstract

Knowledge of phytoplankton species composition is important to understand bloom events in the coastal areas; it is also crucial to have information on the presence of novel and potentially introduced taxa and to confirm the recurrent events of a species. In the case of dinoflagellates, the alternation between the life stages (vegetative and resting stage) has profound implications for population dynamics. Cyst assemblages in surface sediments represent a temporally integrated repertoire of species diversity. Therefore, cyst "seedbed" maps provide baseline information for monitoring purposes, to depict geographic patterns of harmful species, and to detect the introduction of new species.

Keywords: Biodiversity, Biogeography, Life Cycles, Toxic Blooms, Dinoflagellates

Introduction

The predictability of harmful algal blooms (HABs) is one of the most complex subjects of study and one of the major setbacks is improving our knowledge of life strategies of the species and their links to the surrounding environment. Dormant cells are well-recognized stages of the life cycles of HA species. The duration of the dormant phase is often much greater than that of the multiplicative vegetative one. The dormant cells are non-motile hence, during the resting period, dispersion and concentration are determined by the same forcing functions that control the dynamic of passive particles in the water. Due to these features, the dormant stages contribute to the persistence and expansion of harmful species. In the EU SEED project, one of the objectives was focused in the mapping of cyst beds and seed populations in surface sediments to obtain information of species at several Mediterranean areas. The maps were produced in a range of locations and habitats. The focus of those surveys has been to asses the present or past biogeographic distribution of HA species.

Study areas

Sediment cores were taken by a scuba diver using cylindrical plastic corers (20 cm long with a diameter of 5 cm) in different target areas: Arenys harbour (Spain), Olbia and Siracusa bay (Italy) covering different number of stations. Samples were stored in the dark at 4°C until analysed. The sediments were processed for cyst concentration and separation from the sediment using a modified sodium polytungstate density gradient method [1] and analyzed by molecular PCR method using taxa specific primers [2].

Results and discussion

The results of the different areas analyzed showed that a tight linkage exists between pelagic and benthic domains but we also found species that were never recorded as motile stages in the water column and were present in sediments as resting cysts. This was the case of the following dinoflagellate species: *Pentapharsodinium* cf *tyrrhenicum*, *Scrippsiella crystallina*, *S. lachrymosa*, *S. precaria*, *S. trochoidea*, *Protoperidinium avellanum*, *P. claudicans*, *P. compressum*, *P. conicum*, *P.* cf *minutum*, *P. oblongum*, *P. pentagonum*, *P. subinerme*, *Zygabikodinium lenticulatum*, *Gyrodinium instriatum* and *Gymnodinium nolleri* (Figure 1).

We found that mapping the distribution of benthic stages of HA species (e.g. dinoflagellates) in superficial sediments it would allow the establishment of a baseline for the monitoring of spreading events, such as introduction of new species, and human-assisted dispersal. Embayments and hydrographically confined areas in the Mediterranean Sea act as reservoirs for planktonic dinoflagellates. During stagnant conditions, fluxes towards the sea bottom are favoured. Organic matter, cysts, and other substances accumulate in the uppermost layer of the sediments which is continually modified by addition of newly settled particles and by subsequent degradation of the accumulated material. Under these conditions, the formation of a cyst bank occurs [1, 3 and 4]. These seed banks have a high biodiversity, hosting more and/or different species of those that constitute the diversity of the vegetative population ecologically active in a present moment. Knowledge of the geographic distribution and density of cyst beds of harmful algae can help to identify risk areas under different ecological and hydrographical scenarios, providing useful information for the management of coastal
areas.

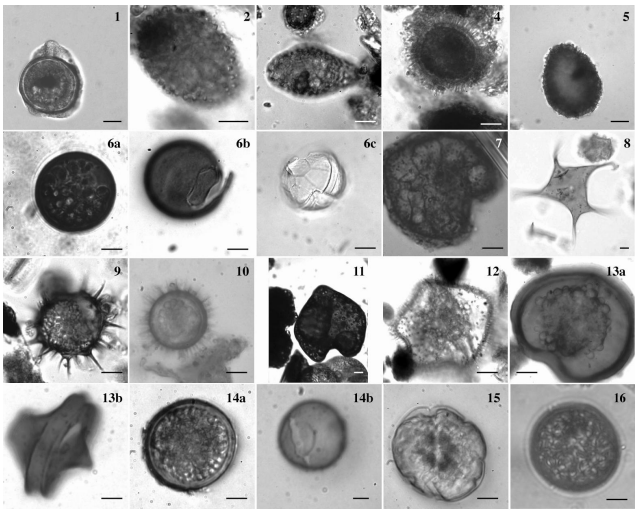

Fig. 1. *Pentapharsodinium* cf *tyrrhenicum*. (2) *Scrippsiella crystallina*. (3) *S. lachrymosa*. (4) *S. precaria*. (5) *S. trochoidea*. (6 a, b, c) *Protoperidinium avellana*: (6 a) viable cyst, (6b) empty cyst with the archeopyle, (6c) theca of the motile cell. (7) *P. claudicans*. (8) *P. compressum*. (9) *P. conicum*. (10) *P.* cf *minutum*. (11) *P. oblongum*. (12*) P. pentagonum*. (13 a, b) *P. subinerme*: (13a) viable cyst, apical view, (13 b) empty cyst, lateral view. (14 a,b) *Zygabikodinium lenticulatum*: (14 a) viable cyst, (14 b) empty cyst. (15) *Gyrodinium instriatum*. (16) *Gymnodinium nolleri*. All scale bars 10 µm

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