Communications

Allelopathic interactions between the red-tide causative dinoflagellate *Prorocentrum donghaiense* and the diatom *Phaeodactylum tricornutum**

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Abstract

The interactions between the red-tide causing dinoflagellate *Prorocentrum donghaiense* and the marine diatom *Phaeodactylum tricornutum* were investigated using a co-culture experiment and an enriched culture filtrate experiment. The results showed that when the two microalgae were cultured together with different initial cell densities, the growth of one species was basically suppressed by the other one. In addition, the enriched culture filtrates of one species had generally inhibitory effects on the other one. Our result inferred that *P. donghaiense* and *P. tricornutum* would interfere with each other mainly by releasing allelochemicals into the culture medium, and that the degree of allelopathic effects was dependent on the initial cell densities and growth phases. The allelopathic interactions between microalgal species may contribute to the formation and succession of red tides.

Marine microalgae act as the basis of the marine food chain and reduce carbon dioxide levels in the atmosphere during photosynthesis. Sometimes, however, some species of marine microalgae proliferate and assemble so quickly that they may lead to red tide events, which have been reported to increase in frequency, intensity and geographic distribution during recent decades and have brought about many negative environmental and economic consequences (Kremp et al. 2012). Hence, there is an urgent need to understand the mechanisms underlying the outbreak of red tides, which is significant in developing effective management strategies to control them.

However, the outbreak mechanisms of red tides are very complex and are not fully understood (Cai et al. 2013). In particular, no satisfactory explanations have been provided to explain why some microalgal species are replaced in a phytoplankton community. Recent studies have shown that the forming of red tides can be dependent on multiple physical, chemical, meteorological and biological factors, such as wind, water current, disturbance, temperature, salinity, nutrient availability, predation of zooplankton, and so on (Smayda 1997, Laanaia et al. 2013, Persson et al. 2013).

Allelopathy, a widely existing natural phenomenon, refers to any direct or indirect, inhibitory and stimulatory effects of plants or microorganisms on others, by producing chemical compounds that are released into the environment (Rice 1984, Meiners et al. 2012). It is believed to be a competitive strategy to adapt to the environment (Cummings et al. 2012). Allelopathy is not a contributory factor towards the formation of harmful algal blooms, but may be important in the maintenance of these blooms (Jonsson et al. 2009). For a long time, research on allelopathy concentrated on terrestrial higher plants (Feng et al. 2010, Khan et al. 2012). The existing published research work on allelopathy in marine microalgae is somewhat limited (Addisie & Medellin 2012). Understanding the allelopathic interactions in marine