

## Phylogenetic relationship of *Alexandrium tamiyavanichii* (Dinophyceae) to other *Alexandrium* species based on ribosomal RNA gene sequences

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### Abstract

The phylogenetic relationship of the thecate PSP-toxin producing dinoflagellate *Alexandrium tamiyavanichii* Balech to other species of *Alexandrium* was studied based on nucleotide sequences of the ITS1, ITS2, 5.8S, 18S and 28S subunits of the ribosomal RNA gene. These are the first such sequences available for *A. tamiyavanichii*, which is one of the producers of paralytic shellfish poisoning toxins in tropical waters. Based on the nucleotide sequences of the 28S, 18S and 5.8S subunits of the rRNA gene, *A. tamiyavanichii* grouped together with *A. tamarense*, *A. catenella* and *A. fundyense*. More interestingly, *A. tamiyavanichii* was most closely affiliated to *A. tamarense* isolates from Thailand. This result reaffirmed conclusions from previous studies that, for the *A. tamarense/fundyense/catenella* species complex, geographical origin rather than morphology seems to determine genetic relatedness. Results of this study also suggest that *A. tamiyavanichii* most probably belongs to the same species complex. Ribosomal RNA gene sequences do not separate the PSP toxin producing from the non-producing species of *Alexandrium*. © 2002 Elsevier Science B.V. All rights reserved.

**Keywords:** *Alexandrium tamiyavanichii*; Phylogenetic relationship; Ribosomal RNA gene; Paralytic shellfish poisoning

### 1. Introduction

Several marine dinoflagellate species are known to produce toxins that cause paralytic shellfish poisoning (PSP). Most of these species belong to the thecate genus *Alexandrium* Halim. *Pyrodinium bahamense* Plate var. *compressum* Böhm is currently the only other thecate genus known to produce PSP

toxins, while of the athecate dinoflagellates only *Gymnodinium catenatum* Graham is currently known to cause PSP. In Malaysia and several other tropical Pacific countries, the most important PSP-toxin producing species is *Pyrodinium bahamense* var. *compressum* (Usup and Azanza, 1998). In the Straits of Malacca, however, there is evidence that PSP events there are due primarily to *A. tamiyavanichii*. Kodama et al. (1988) also previously reported the presence of *A. tamiyavanichii* in Thailand waters.

*Alexandrium* is arguably the most important harmful algal bloom (HAB) species, based on the number of species involved and their extensive geographical distribution. It is, thus, not surprising that many studies

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