



## Original Article



## Description of two new species *Chattonella tenuiplastida* sp. nov. and *Chattonella malayana* sp. nov. (Raphidophyceae) from South China Sea, with a report of wild fish mortality

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## ABSTRACT

Fisheries damage caused by *Chattonella* red tide has been recorded in Southeast Asia. Molecular studies have clarified the presence of two species, *Chattonella marina* complex and *Chattonella subsalsa* in the region, unlike East Asia that had only *C. marina* complex. To elucidate the phylogeography of *Chattonella* in Asia, further phylogenetic and morphological examinations were carried out with 33 additional culture strains, including the strains isolated during a bloom of *Chattonella* sp. (up to 142 cells mL<sup>-1</sup>) that was associated with a wild fish mortality along the northeastern coast of Peninsular Malaysia in 2016, and those from Yellow Sea, where the *Chattonella* genotypes have not been determined. LSU rDNA and ITS2 trees showed five intrageneric clades in the genus *Chattonella*, which were clades I and II (*C. subsalsa*), clade III (*C. marina* complex) and two new clades, namely clade IV from Thailand and Malaysia, and clade V from Peninsular Malaysia. The positions of the two new clades were different in LSU rDNA and ITS2 trees. LSU rDNA divergences of clades IV and V from the other clades were  $\geq 4.01\%$  and  $\geq 5.70\%$ , while their ITS2 divergences were  $\geq 7.44\%$  and  $\geq 16.43\%$ , respectively. Three and five compensatory base changes (CBCs) were observed in the clades IV and V, respectively, when compared to each of their closest clade. Cells from clades IV and V showed similar morphology to *C. marina* complex and *C. subsalsa* clade II, including the presence of button-like granules on cell surface and oboe-shaped mucocysts. However, cell size, the number and shape of chloroplasts in *Chattonella* clades IV and V, and the non-stacked thylakoids penetrated the pyrenoid in *C. subsalsa* clade II, were distinctive. Based on the diagnostic chloroplast shape, we proposed the designation of clades IV and V to two new species, *Chattonella tenuiplastida* sp. nov. and *Chattonella malayana* sp. nov.

## 1. Introduction

The class Raphidophyceae Chadeffaud ex Silva is a group of naked flagellates consisting of species found in both marine and freshwater habitats (Demir-Hilton et al., 2012). Their cells are fragile, without protective covering, and possessing golden brown or green to yellowish

chloroplasts. Ten genera are currently recognized in the class, including the marine *Chattonella* Biecheler, *Chlorinimonas* Yamaguchi, Nakayama, Murakami et Inouye, *Fibrocapsa* Toriumi et Takano, *Haramonas* Horiguchi, *Heterosigma* Hada ex Hara et Chihara and *Psammamonas* Grant, Waller, Clementson et Wetherbee, and the freshwater *Gonyostomum* Diesing, *Merotricha* Mereschkowsky, *Vacuolaria* Cienkowski and

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