



Molecular identification of the exotic lineage of *Kappaphycus alvarezii* (Rhodophyta, Solieriaceae) cultivated in the tropical region of Brazil

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Abstract

Kappa carrageenan is an important phycocolloid extracted from the red seaweed *Kappaphycus alvarezii*. This species has been introduced into several regions, most recently in Brazil. The remote invasive potential of this seaweed in both south and southeast waters of Brazil (subtropical regions) has been established, but introduction in the northeastern tropical area is contested due to the absence of biological information. An unknown exotic lineage of *K. alvarezii* has been illegally introduced and cultivated in an area characterized by the presence of coral reefs in Paraíba, the northeastern Brazilian coast, since the beginning of the last decade. This work focuses on the molecular identification of these samples in comparison with sequences of other strains of *K. alvarezii* and congeners available in Genbank. Maximum likelihood (ML) and Bayesian inference (BI) analyses showed strong similarities between *K. alvarezii* cultivated in the tropical waters in Brazil and those lineages cultivated in Hawaii, Venezuela, Malaysia and Tanzania that have never shown invasive behavior. However, more detailed investigations and use of environmental monitoring are recommended before commercial cultivation of this species can be authorized in tropical region of Brazil.

Key words: bioinvasive potential, carrageenophyte, *cox2-3* spacer, cultivation

Introduction

Seaweed farming has an important role in the development of sustainable mariculture and represents an alternative livelihood for fishers (Ask & Azanza 2002, Oliveira & Paula 2003, Bindu & Levine 2011, Bixer & Porse 2011). The worldwide production of economically important macroalgae has increased significantly in recent decades, from 3.8 million tons in 1990 to 19 million tons in 2010; however, in 2008, the total value of farmed algae was ca. of US\$ 4.4 billion, and its value increased to US\$ 5.7 billion in 2010 (FAO 2012). Among these seaweeds, the genera *Kappaphycus* M.S.Doty in Abbott (1988: 171) and *Euclidean* J. Agardh (1847: 16) (Rhodophyta, Solieriaceae), which are also known as euclideanoid algae, have been cultivated worldwide as the primary source of carrageenan (Doty 1985, Areces 1995, Ask *et al.* 2003, Hayashi *et al.* 2010). *Kappaphycus alvarezii* (M.S. Doty 1985: 37) M.S. Doty ex P.C. Silva in Silva *et al.* (1996: 333) is the most cultivated seaweed in the world (Ask & Azanza 2002, Aguilan *et al.* 2003, Hayashi *et al.* 2007a, 2010, Bindu & Levine 2011, Bixler & Porse 2011). The cultivation of *K. alvarezii* began in the 1970s in the Philippines, and currently it has been introduced to more than 20 countries for mariculture purposes (Doty & Alvarez 1975, Doty 1985, Areces 1995, Ask & Azanza 2002, Ask *et al.* 2003).