



Two newly recorded invasive alien ascidians (Chordata, Tunicata, Ascidacea) based on morphological and molecular phylogenetic analysis in Korea*

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Abstract

We report five alien ascidians with some distinct features that were investigated from August 2009 to October 2011 in Korea, among which *Ascidella aspersa* (Müller, 1776) belonging to family Ascidiidae of order Phlebobranchia and *Molgula manhattensis* (De Kay, 1843) belonging to family Molgulidae of order Stolidobranchia are newly discovered invasive species. These ascidians were identified and their phylogenetic relationships were clarified through molecular analysis using about 680 bp of nuclear 18S rDNA and about 670 bp of mt-COI genes along with detailed morphological characteristics, and reported for the first time in Korea. It was discovered that *A. aspersa* was widespread three coastlines of Korea except Jeju Island, and *M. manhattensis* first found in Mokpo, Gunsan, and Incheon in June 2010 extended into Busan of Korea Strait in 2011.

Key words: Ascidians, *Ascidella aspersa*, *Molgula manhattensis*, invasive alien species, Korea, morphological characters, 18S rDNA, mt-COI, molecular phylogenetic analysis

Introduction

Ascidians consist of the largest and most diverse class Ascidacea belonging to subphylum Tunicata of phylum Chordata (Shenkar *et al.* 2012). They comprise approximately 3,000 described species found in all marine habitats from shallow water to the deep sea (Shenkar & Swalla 2011). All ascidians—commonly called sea squirts—are sessile organisms that live attached to submerged natural and artificial surfaces including rocks, pilings, ropes, and shells or carapaces of other species (Inglis *et al.* 2008). They exhibit large variations from small inconspicuous colonial forms to large and colorful solitary forms (Petersen 2007), and feed by pumping water into the body through an oral siphon. Food particles are filtered out of the water inside the body, and then expelled through an atrial siphon (Inglis *et al.* 2008). The transport of species on the hulls and in the ballast water of international shipping and the subsequent establishment of organisms in foreign ports are not new phenomena (Byrne *et al.* 1997). Ascidians are one of the key ecological groups because of their invasive potentials and abilities to thrive in eutrophic environments. For example, the solitary ascidians, *Styela clava* and *Ciona intestinalis*, have caused an adverse effect on aquaculture along Canada's east coast, mainly on mussel culture (Shenkar & Swalla 2011). Introductions of non-indigenous ascidians into harbors in both tropical and temperate waters are now commonplace, with the rate of introductions increasing, sometimes creating severe damage to natural fauna by overgrowth (Lambert & Lambert 1998; Coles *et al.* 1999; Lambert 2002; Cohen *et al.* 2005). The invasive ascidians can survive to compete with the native indigenous filter feeding organisms for food and space (Currie *et al.* 1998). They also cause huge problems for the growers in terms of costs and labors in relation to extra handling of the equipment, but potentially also with decreased bivalve production owing to the competition for foods (Petersen 2007).