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Internal mycobiota of marine macroalgae from the Tamilnadu coast: distribution, diversity and biotechnological potential

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Abstract

Eleven brown algae, six green algae and eight red algae occurring along the coast of Tamilnadu state, southern India were screened for their fungal endophyte assemblages. The green algae had a low diversity of endophytes but were more densely colonized. The brown algae supported a higher diversity of endophytes. There were a few dominant endophyte species with a wide host range and several with low colonization frequency that were restricted to a few algal species. The endophytes produced bioactive compounds that inhibited bacteria, an alga and a fungus. They also produced antioxidants and insecticidal metabolites.

Keywords: diversity; endophytes; fungal metabolites; macroalgae; marine algae.

Introduction

There are many reports on the association of parasitic and saprobic fungi with marine algae (Kohlmeyer 1968, Kohlmeyer and Volkmann-Kohlmeyer 2003, Zuccaro and Mitchell 2005), but very few on asymptomatic fungal symbionts of seaweeds (Jones et al. 2008). The few reports on these fungi include those of Zuccaro et al. (2003, 2008), Tsuda et al. (2004), Schulz et al. (2008). Although not all seaweeds are plants (brown algae are not members of the plant kingdom, but green and red algae are), we use the term ''endophytes'' in this study to denote the symptomless fungal endosymbionts present in the marine macroalgae. Marine fungal endophytes of seaweeds (especially the marine-derived forms) have received increasing attention as sources of novel natural products (Bugni and Ireland 2004, Zhang et al. 2006, Jones et al. 2008, Raghukumar 2008, Schulz et al. 2008, Kjer et al. 2010). For example, the marine algal endophyte *Drechslera dematioidea* (Bubák *et* Wróblewski) Subram. *et* Jain produces several bioactive compounds including ten new sesquiterpenes (Bugni and Ireland 2004). Jones et al. (2008) stress the need for studying tropical marine algae for their endophytes as few of these seaweeds have been screened. An understanding of the distribution and diversity of endophytes of marine algae is essential for making prudent bioprospecting decisions.

The aim of the present study was to determine the diversity of fungal endophytes of some of the marine macroalgae off the Tamilnadu coast and to conduct a preliminary evaluation of their potential for production of antialgal, antifungal, antibacterial, antiinsect and antioxidant metabolites.

Materials and methods

Collection sites

The 25 seaweed species (11 brown algae, six green algae and eight red algae) were collected from Mandapam (Palk Bay, 9°16′N, 79°7′E), Keezhakarai (Palk Bay, 9°13′N, 78°46′E), Kodiyakkarai (Palk Strait, 10°16′N, 9°49′E) and Kovalam (Bay of Bengal, 8°22′N, 76°59′E) along the coast of Tamilnadu state (Table 1). Fresh thalli without any disease symptoms were collected, brought to the laboratory in sterile polyethylene bags and processed within 24–36 h.

Isolation and identification of endophytes

The macroalgae were washed thoroughly in running tap water and cut into segments of approximately 0.5 cm^2. For each algal species, 100 segments were screened for the presence of endophytes. Initially, the thallus segments of *Sargassum wightii* were subjected to four different surface sterilization procedures to ascertain the most suitable method for isolating fungi from the algae.

Method A: the segments were dipped in 70% ethanol for 5 s followed by immersion in 4% NaOCl for 60 s and washed with sterile distilled water for 10 s (modified after Suryanarayanan et al. 1998).