



# Endophytic Fungi of Marine Alga From Konkan Coast, India—A Rich Source of Bioactive Material

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Endophytes are an unexploited source of pharmacologically relevant compounds owing to their species richness and diversity. In this study, a total of 26 endophytic fungi were isolated and identified from 10 marine algal samples collected from the Konkan coast, Goa, India. Eighteen of the fungal isolates belonged to phylum Ascomycota while one belonged to phylum Basidiomycota based on ITS sequencing. Further, the genus *Aspergillus* sp. was the most common and abundant endophyte found in the sampled algal species. A significant antibacterial activity against five pathogenic bacteria was exhibited by the extracts of fungal isolates AG1.1, AG1.1 (G) and VG2.6 (agar diffusion assay). The extracts of fungal endophytes VB1.1, PG1.2 and VG2.6 demonstrated good antioxidant activity (DPPH scavenging assay). Further, cytotoxicity of all the endophytic extracts on human cancer cell lines was determined by MTT and resazurin assay. The crude extract of *Aspergillus unguis* (AG 1.2) showed the highest cytotoxic potential on cervical cancer (HeLa), breast cancer (MCF-7), lung cancer (A549), and skin cancer (A431) cell lines in a concentration dependent manner. Moreover, Gas Chromatography-Mass Spectroscopy analysis of the extract of *A. unguis* (AG 1.2) confirmed the presence of several bioactive metabolites including azelaic acid, azetidine, and furofurans. The extract of *A. unguis* (AG 1.2) demonstrated G1 phase cell cycle arrest, reactive oxygen species (ROS)-dependent MMP loss and apoptosis-dependent cell death in A431 cells. The algae-derived fungal endophytes of Konkan coast are a rich source of novel pharmaceutically active compounds as indicated by this work.

**Keywords:** Konkan coast, fungal endophyte, diversity, cytotoxicity, apoptosis

## INTRODUCTION

For centuries treatment of a wide spectrum of maladies depended on natural sources (Mann, 2002; Marris, 2006). In the modern medicine, many effective lead molecules have come out of experimental research on natural products which include complex extracts or isolated compounds from plants, marine organisms, bacteria, and fungi (Lauritano et al., 2016). Due to the wide range of climatic and topological conditions, India offers a variety of flora and fauna, ranked to be one of the richest in the world (Nagarajan, 2014). The Indian coastline extends over 8,000 km with rich marine habitats, not just restricted to the sea but also in the intertidal rocky, sandy and muddy shores, mangroves, algae and coral reefs.

Marine natural products have been the focus of global research owing to their species richness and diversity (Calisto et al., 2019). Marine life is fundamentally robust and tolerant to extreme