Terpenoids from the Deep-Sea-Derived Fungus Penicillium thomii YPGA3 and Their Bioactivities

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Abstract: A chemical study of the ethyl acetate (EtOAc) extract from the deep-sea-derived fungus Penicillium thomii YPGA3 led to the isolation of a new austalide meroterpenoid (1) and seven known analogues (2–8), two new labdane-type diterpenoids (9 and 10) and a known derivative (11). The structures of new compounds 1, 9, and 10 were determined by comprehensive analyses via nuclear magnetic resonance (NMR) and mass spectroscopy (MS) data. The absolute configurations of 1, 9, and 10 were determined by comparisons of experimental electronic circular dichroism (ECD) with the calculated ECD spectra. Compound 1 represented the third example of austalides bearing a hydroxyl group at C-5 instead of the conserved methoxy in other known analogues. To our knowledge, diterpenoids belonging to the labdane-type were discovered from species of Penicillium for the first time. Compound 1 showed cytotoxicity toward MDA-MB-468 cells with an IC50 value of 38.9 μM. Compounds 2 and 11 exhibited inhibition against α-glucosidase with IC50 values of 910 and 525 μM, respectively, being more active than the positive control acarbose (1.33 mM).

Keywords: Penicillium thomii YPGA3; deep-sea-derived fungus; austalide meroterpenoid; labdane-type diterpenoid; bioactivities

1. Introduction

Austalides are a class of natural meroterpenoids with attractive scaffolds. Previous biosynthetic studies revealed that they are biosynthesized by cyclization and oxidative modification of 6-[(2E, 6E)farnesyl]-5,7-dihydroxy-4-methylphthalide [1]. These meroterpenoids were mainly produced by the species of the fungal genera Aspergillus and Penicillium, especially those from marine environments. Since austalides A–E were first reported in 1981, a total of 36 analogues have been identified [2–11]. The structural variations of austalides are attributed to oxidation occurring at C-13, C-14, C-17, and the isopropyl (C-15, C-25, C-26) to generate alcohol, isopropenyl, lactone, ester,