Clin Exp Pharmacol 2018, Volume: 8
DOI: 10.4172/2161-1459-C1-029

11th International Conference and Exhibition on
Pharmacology and Ethnopharmacology
&
International Conference on Pharmaceutical Oncology
July 18-19, 2018 | Atlanta, USA

Isolation and identification of antifungal compounds from turmeric (Ryudai gold) and their activities against *Fusarium solani*

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Recently, synthetic fungicide is gradually restricted due to its undesirable impacts on the environment and human health. Turmeric (*Curcuma* spp.) has numerous biological activities including anticancer, antibacterial, antifungal and insecticidal properties. There are more than 80 species of turmeric and 70 strains/varieties of *Curcuma longa* with different chemical properties which may possess different activities. *Fusarium solani sensu lato* (FSSL), pathogenic fungal species, causes several diseases in human, animals, and plants. To date, there has been no report that addresses the effect of turmeric on F. solani. Therefore, we evaluated antifungal activities of 3 *Curcuma* longa strains (Ryudai gold: RD, Okinawa ukon, and BK2), *C. xanthorrhiza, C. aromatica, C. amada and C. zedoaria* on 4 isolates of FSSL derived from American manatees (Trichechus manatus) with 3 different genotypes. The methanol extract of all turmeric inhibited fungal growth concentration-dependently. Among different species and varieties of turmeric, *Curcuma longa* (Ryudai gold) had a highest inhibitory effect on fungal growth. For this, Ryudai gold was chosen for isolation of antifungal compounds using silica gel column and high-performance liquid chromatography. Structural identification of the antifungal compounds was conducted using ^{1}H NMR, ^{13}C NMR, and liquid chromatography-tandem mass spectrometry. The purified antifungal compounds were curcumin (1), demethoxycurcumin (2), bisdemethoxycurcumin (3) and (*E*)-α-atlantone (4). The order of the IC_{50} against *F. solani* was curcumin (65-76 μM) > demethoxycurcumin (76-88 μM) > (E)-α-atlantone (91-118 μM) >bisdemethoxycurcumin (711-746 μM). The results suggested that turmeric strain Ryudai gold developed by the University of the Ryukyus showed excellent antifungal activities against FSSL and could be used for an antifungal agent.

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