Sains Malaysiana 45(7)(2016): 1063–1071

Initial Screening of Mangrove Endophytic Fungi for Antimicrobial Compounds and Heavy Metal Biosorption Potential

(Saringan Awal Kulat Bakau Endofit untuk Potensi Sebatian Antimikrob dan Bioserapan Logam Berat)

ONN, M. LING*, LIM, P. TEEN, AAZANI MUJAHID, PETER PROKSCH & MORITZ MÜLLER

ABSTRACT

Endophytic fungi provide protection to their host plant and the fungi often produce antimicrobial compounds to aid the host fighting off pathogens. These bioactive compounds were secondary metabolites which were often produced as waste- or by-products. In the present study, endophytic fungi isolated from mangrove plants and soils were characterized and their antimicrobial production and bioremediation potential of heavy metals copper (Cu) and zinc (Zn) were assessed. Twelve (12) isolated and identified endophytic fungi belonged to seven species; Penicillium, Curvularia, Diaporthe, Aspergillus, Guignardia, Neusartorya *and* Eupenicillium. *Antimicrobial activities of these 12 fungal endophytes were tested against Gram negative bacteria;* Bacillus subtilis, Staphylococcus aureus, *Gram positive bacteria;* Escherichia coli *and fungi;* Candida albicans *and* Aspergillus niger *among others. Two isolates (related to* Guignardia sp. *and* Neusartoya sp.*) showed strong antimicrobial (and antifungal) activity whereas the rest showed no activity. Compounds were isolated from both isolates and screened using HPLC. Both isolates displayed chemically very interesting chromatograms as they possessed a high diversity of basic chemical structures and peaks over a wide range of polarities, with structures similar to Trimeric catechin and Helenalin among others. For bioremediation assessment, the results showed maximum biosorption capacity for two isolates related to* Curvularia sp. *and* Neusartorya sp., *with the former removing 25 mg Cu/g biomass and the latter removing 24 mg Zn/g biomass. Our results indicated the potential of mangrove endophytic fungi in producing bioactive compounds and also highlighted their potential for the treatment of heavy metal-contaminated wastewater.*

Keywords: Antimicrobial; bioactive compounds; biosorption; endophytic fungi; heavy metals; mangroves

ABSTRAK

Kulat endofit memberi perlindungan kepada perumah mereka dan seringkali menghasilkan sebatian antimikrob untuk membantu perumah melawan patogen. Sebatian bioaktif ini adalah metabolit sekunder yang sering dihasilkan sebagai bahan buangan atau keluaran sampingan. Dalam kajian ini, kulat endofit yang diasingkan daripada tumbuhan bakau dan tanah telah dikelaskan dan pengeluaran serta potensi bioremediasi logam berat tembaga (Cu) dan zink (Zn) telah dinilai. Duabelas (12) kulat endofit telah dipencilkan dan dikenal pasti terdiri daripada tujuh spesies; Penicillium, Curvularia, Diaporthe, Aspergillus, Guignardia, Neusartorya dan Eupenicillium. *Aktiviti antimikrob daripada 12 kulat endofit ini telah diuji terhadap Gram bakteria negatif;* Bacillus subtilis, Staphylococcus aureus, *Gram bakteria positif;* Escherichia coli *dan kulat;* Candida albicans *dan* Aspergillus niger. *Dua pencilan (daripada* Guignardia sp. *dan* Neusartoya sp.*) telah menunjukkan aktiviti antimikrob yang kuat (dan anti-kulat) sedangkan yang lain tidak menunjukkan sebarang aktiviti. Sebatian telah diasingkan daripada kedua-dua pencilan diasing dan disaring menggunakan HPLC. Kedua-dua pencilan menunjukkan kromatogram yang sangat menarik kerana mereka mempunyai kepelbagaian yang tinggi dalam struktur kimia asas dan punca kepelbagai polariti, dengan struktur yang sama dengan Trimeric catechin dan Helenalin antara lainnya. Bagi penilaian potensi bioremediasi, keputusan menunjukkan keupayaan bioserapan maksimum pada dua pencilan yang berkaitan dengan* Curvularia sp. *dan* Neusartorya sp.*, dengan* Curvularia sp. *mengeluarkan 25 mg Cu/g biojisim dan* Neusartorya sp. *mengeluarkan 24 mg Zn/g biojisim. Keputusan kami menunjukkan potensi kulat endofit bakau dalam menghasilkan sebatian bioaktif dan juga menyerlahkan potensi mereka untuk rawatan air yang tercemar dengan sisa logam berat.*

Kata kunci: Antimikrob; bakau; bioserapan; kompaun bioaktif; kulat endofit; logam berat

INTRODUCTION

Mangrove forests in Malaysia cover an estimated total acreage of 5650 km^2, constituting of about 4% of the world's mangroves (FAO 2007). They are unique for their well-known adaptation towards their extreme environmental conditions of high salinity, changes in sea level, high temperatures and anaerobic soils (Shearer et al. 2007). As mangroves are situated at the interface between land and sea, they are directly affected by disturbances to both land and sea. Mangrove forests in Malaysia are for example threatened by heavy metal pollution, resulting from industrial waste water pollution and urbanization