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Endophytic Fungi as Potential Produces of Bioactive Metabolites

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COLUMN ARTICLE

Plants are a repository of fugal endophytes. Endophytes, are the chemical synthesizers inside the healthy tissues of plants typically causing no apparent symptoms of disease on the host [1]. A large number of secondary metabolites have been extracted, isolated and characterized from endophytic microbes from various types of plants throughout the world [2-6]. Many of these synthesized chemical compounds are bioactive, and the range includes alkaloids, steroids, terpenoids, peptides, polyketides, flavonoids, quinols and phenols as well as some halogenated compounds [2,3,7]. Therefore, the plant endophytic fungi have been recognized as an important and novel resource of natural bioactive products with potential application in medicine, agriculture and food industry [3,8,9]. Many valuable bioactive compounds with cytotoxic, antimicrobial, antidiabetic, insecticidal and anticancer activities have been fruitfully discovered from the endophytic fungi during the past two decades [10].

Only a handful of plants in the world have ever been completely studied relative to their endophytic biology [3]. It is not known whether all endophytes synthesize bioactive metabolites, but according to Strobel and coworkers (2004) those plants in distinctive environments that fight to compete with other living organisms or that seek for assistance to survive, are likely to host endophytes which can synthesize secondary metabolites that will eventually support the plant to overcome biotic and abiotic stress factors in their environments.

Many scientists have stipulated that plants growing in lush tropical rainforests, where competition for light and nutrients is high, are most likely to host the greatest number of bio-active endophytes. A recent study has reported that endophytes from tropical regions produced considerably more bioactive secondary metabolites than those from temperate parts of the world [11]. For example, a nonapeptidal fungal metabolite acting as an antidiabetic agent was isolated from an endophytic fungus collected from an African rainforest [12].

Mangrove plants have unique features in order to adapt to their habitat with muddy saline waters, brackish tidal activities, anaerobic soil and high faunal and microbial competition [13]. Marine mangrove fungi have proven to be an important source of bioactive compounds [13,14]. According to Bandaranayake (1998), leaves, stems, bark, roots and fruits of mangrove plants are a valuable resource for folk medicine used traditionally. It is highly likely that the biosynthetic abilities of the endophytic fungi within these plants contribute significantly to their medicinal properties [15].

Weeds and invasive plant species are usually aggressive growers, making them compete for water, light, space and nutrients. Therefore, they are frequently present in large quantities. They are adaptable, being able to easily invade

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a wide range of ecological niches [16]. Weeds and invasive plant species may be successful competitors due to resistance towards different pathogens. These plants species may therefore contain active biological compounds to resist various microbial attacks. At the same time these species are readily available in great quantities for use, and collection of them may protect indigenous plants and natural ecosystems.

Traditional and native medicinal plants also have been recognized as a source of fungal endophytes with novel metabolites of pharmaceutical significance [3,17,18]. According to Isaacs (2002), compounds isolated from the endophytic fungi found on leaves of the plant *Desmodium uncinatum* which was used by indigenous people of Papua New Guinea for healing wounds and body sores has exhibited anti-fungal, antibacterial effects and also shown to destroy cervical cancer cells [19].

Drug resistance bacteria, appearance of life-threatening viruses, tremendous increase of infectious diseases in humans, and agricultural crop damages due to pests, appeal novel approaches to manage these issues. There is a general call for new antibiotics, chemotherapeutic agents and agrochemicals that are effective, have low toxicity, and with minimum environmental impact. Accordingly, endophytic fungi are relatively unexplored producers of secondary metabolites with unprecedented carbon skeletons and great bioactivities, with an enormous potential for utilization in pharmaceutical and agricultural industries [20].

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