



Production of Volatile Compounds by a Variety of Fungi in Artificially Inoculated and Naturally Infected *Aquilaria malaccensis*

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Abstract

Aquilaria malaccensis, the resinous agarwood, is highly valued in the perfumery and medicinal industry. The formation of fragrant agarwood resin inconsistently by various fungi is still not clearly understood. The current study investigated the agarwood quality and fungal diversity in artificially inoculated and naturally infected *A. malaccensis*. The chemical analysis of volatile compounds of agarwood was performed using the Solid Phase Micro Extraction (SPME) method, and the identification of fungi was made through a morphological observation using a light microscope. Gas chromatography analysis revealed the presence of essential compounds related to high-quality agarwood, such as 4-phenyl-2-butanone, β -selinene, α -bulnesene, and agarospirol in both artificially inoculated and naturally infected agarwood but with some differences in the abundance. Further studies on the fungi associated with agarwood volatile compounds formation showed a total of ten fungal group isolates, which were identified based on morphological and molecular studies. The study revealed that agarwood from both artificial and natural sources were naturally infected with *Fusarium*, *Botryosphaeria*, *Aspergillus*, *Schizophyllum*, *Phanerochaete*, *Lasiodiplodia*, *Polyporales*, and *Ceriporia* species. This study has offered a potential opportunity to research further the promising development of fungal strains for artificial inducement of high-quality agarwood formation from *A. malaccensis* trees.

Introduction

In the world market, industries are willing to pay for any given price to get the supply, nevertheless of synthetic sources available with cheaper price. Either of its limited sources or artificial production, *Aquilaria* spp. is also amongst the most expensive agarwood species [1–3]. The species itself would not be valuable unless it contains a resinous strip usually found along the inner part of the trunk. Some still unknown mechanism contributes to resin

production in agarwood species. Regardless of the fact, countries with available agarwood species seedling have been practising agarwood plantation. Whilst researchers worldwide compete to investigate agarwood species formation, the species keep declining each new year [4–6].

Agarwood (*Aquilaria malaccensis*) is the resinous fragrant infused wood species growing in tropical rainforests in South and Southeast Asian countries [7]. *A. malaccensis* is the most popular source amongst the *Aquilaria* species. It is known by various names such as agar, agarwood/sandalwood, aloeswood, eaglewood, gaharu, and kalamabak [7]. It has high commercial demand for its medicines, perfumes, incense, and religious rituals in Asia and the middle east. Resinous agarwood emits a unique soft fragrance when burnt, but its scent is easily detected in super quality agarwood. Distributed in different countries, agarwood is called with a different language and usages relevant to local culture. It is called ‘gaharu’ or ‘karas’ in Malaysia and Indonesia. Whilst vernacular names sound confusing sometimes, their commercial name is widely known as agarwood, aloeswood, and eaglewood [8].

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