

FORMULATED MICROBIAL CONSORTIUM AS INOCULANT FOR AGARWOOD INDUCTION

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Agarwood or gaharu is well known as the most valuable resinous heartwood that occurs in trees of *Aquilaria* species. Depletion of the wild resource from the jungle leads to the high price of agarwood. Thus, there is an urgent need to produce agarwood sustainably through agarwood cultivation to meet the global demand and induction. This research was conducted to formulate microbial consortia that can be used as fungal inoculants for agarwood induction in *Aquilaria* species. The effectiveness of formulated microbial consortia was observed based on the colour and mean length of infected zone formation after a three and six months inoculation periods in each wet and dry season, respectively. *Aquilaria* sp. was inoculated with three types of formulated fungal inoculants and negative control by using the bottle drip method. The findings showed that F3 inoculant (a combination of *Trichoderma* sp., *Lasiodiplodia* sp. and *Curvularia* sp.) was the most potential fungal inoculant for agarwood formation based on the darkest colour and largest mean length of the infected zone, after a three and six months inoculation periods for both wet and dry seasons. The formulated inoculant is recommended for further development as agarwood fungal inoculant to induce agarwood artificially for future sustainable supply of agarwood.

Keywords: *Aquilaria*, fungal inoculants, bottle drip method, infected zone, seasons

INTRODUCTION

Agarwood is the dark resinous heartwood that occurs in the trees from *Thymelaeaceae* family including *Aquilaria*, *Gonystulus* and *Gyrinops* spp. According to a study by Naef (2011), agarwood is the most valuable resinous fragrant wood in the world. Its price could go up to USD100,000 per kilogram in the market for superior quality and high purity material. Furthermore, agarwood is not only well-known for its traits as perfumery ingredients and as aroma enhancers in food products, but also used as traditional medicine for centuries (Lee et al. 2016). In terms of medicinal uses of agarwood, it has been recommended as an anti-inflammatory agent to treat rheumatism, arthritis, body pain, asthma and gout (Hashim et al. 2016).

The lengthy inoculation periods in nature, which may take approximately 75 to 80 years before the highest yield can be observed, has restrained the supply of agarwood in the market (Naef 2011, Liu et al. 2013). Therefore, the uncertain supply and production of the agarwood is the main concern that needs to be addressed by researchers to meet the global demand for

agarwood trading (Barden et al. 2000). In a natural forest, only 7–10% of the trees contain agarwood. The experienced specialist could only deduce the deposit of agarwood by mere observation on the intact stem. However, the trees still need to be fell and cut open to exactly determine the content and quality of the wood impregnated with resinoid. *Aquilaria malaccensis* has been listed as the most endangered species among all agarwood tree species, as stated in Appendix II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES); unsustainable harvesting of *Aquilaria* sp. in natural forests led to near extinction (CITES 2015). Thus, the agarwood needs to be artificially induced to maintain the diversity of *Aquilaria* sp., and for the production of a larger amount of resin.

The cultivation of *Aquilaria* trees has been widely practiced in many countries to meet the demand for agarwood. Wounding, chemicals and microbes inducing agents have been used for artificial inoculation (Pojanagaroon & Kaewrak 2005, Zhang et al. 2010). In 1952,