

# TAXONOMY & ECOLOGY

*Beyond Classical Approaches*

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## CONSTITUENTS OF ESSENTIAL OILS FROM RESIN, BARK AND HEARTWOOD OF *AGATHIS BORNEENSIS*

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### ABSTRACT

The chemical constituents of essential oils obtained by the exhaustive hydrodistillation of resin, bark and heartwood of *Agathis borneensis* were studied. Gas chromatography/flame ionization detector (GC/FID) and gas chromatography/mass spectrometer (GC/MS) analyses revealed that distribution profile of the heartwood oil was simple compared to resin and bark oils. The major components in the resin oil to be dominated by  $\alpha$ -pinene (31.15 %),  $\delta$ -limonene (17.92 %),  $\beta$ -pinene (11.36 %) and terpinen-4-ol (8.41 %).  $\beta$ -pinene (9.14 %), terpinen-4-ol (8.99 %),  $\alpha$ -pinene (8.95 %) and  $\alpha$ -terpineol (8.93 %) were identified as the major constituents in the bark oil. Hexadecanoic acid (66.85 %) was identified as the major heartwood oil constituent, while monoterpenes such as  $\gamma$ -terpinene and terpinen-4-ol were detected in trace amounts.

**Keywords:** Essential oil, *Agathis borneensis*, resin, bark, heartwood

### INTRODUCTION

*Agathis* species are belongs to the Araucariaceae family. Araucariaceae comprises of three genera which are *Agathis*, *Araucaria* and *Wollemia* with over 40 species. Araucariaceae are evergreen conifers that can be found in warm temperate regions of the southern hemisphere, with the exception of Southern Africa (Brophy *et al.*, 2000). *Agathis* species can be found in Philippines, Moluccas, Celebes, Borneo and Peninsular Malaysia. This genus is very important as high value timber and has a valuable resin which is used as varnishes and lacquers (Appanah and Weinland, 1993). The resin acid derivatives from this genus have some bioactivities such as antifungal and antibacterial (Savluchinske-Feio *et al.*, 2006). *Agathis borneensis* also known by several vernacular names such as "Bindang" in Sarawak, "Damar Minyak" in Peninsular Malaysia, "Manggilan" in Sabah and "Tulong" in Brunei. In Sarawak, it found in mixed dipterocarp and kerangas forest in areas above 610 meter. The timber is classified as softwood (belongs to a taxonomic group of gymnosperm) and is light in weight (Ismail *et al.*, 1999). The purpose of this study was to investigate and compare the chemical compositions of essential oils from resin, bark and heartwood of *Agathis borneensis*. To the best of our knowledge, an investigation of the

essential oil of *A. borneensis* has not been reported to date.

### EXPERIMENTAL

#### *Plant material*

The resin, bark and heartwood of *A. borneensis* were collected from Bario, Sarawak in August 2008. The resin was ground into powder by using mortar and pestle, while the bark and heartwood were cut into small meals.

#### *Isolation of Oils*

The extraction of the oil was carried out according to the procedure outlined by Datta (1987). The samples were extracted using a Clavenger-type hydrodistillation apparatus. Exactly 30 g of ground resin, 300 g of bark and 200 g of heartwood meals of *A. borneensis* were weighted, transferred to 2 liter flat round bottom flask and mixed with 1.5 liter of distilled water. The flask was assembled to the clavenger trap, connected to the condenser and heated. The hydrodistillation process was carried out for eight hours. After eight hours, the oil trap in the clavenger was cooled at room temperature. The oily layer obtained was separated and dried over anhydrous sodium sulphate. The percentage of the oil was