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Review

# Biogeography of polypores in Malesia, Southeast Asia

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ABSTRACT

Biogeography of polypores distributed in the Malesian region is reviewed. Some of the species reported from this region are pantropical or paleotropical and widely distributed along the equator. Several species are restricted to lowland areas of Malesia and adjacent regions, and can be classified as Asian or Asian-Oceanian tropical species. Some species have only been recorded from lowland areas of Malesia at present, but detailed distributions are unclear for many of them. Some lowland Malesian species are also distributed in temperate areas of East Asia; among them, few species are circumglobal in the Northern Hemisphere, whereas many others are tropical species showing continuous distributions up to the warm temperate areas of East Asia. Species recorded from highland areas of Malesia include tropical species common to lowland Malesia, temperate species common to temperate Asia, and endemic species in highland areas of Malesia and adjacent regions. Regarding the factors that delimitate distribution of the Malesian polypores, I discuss polypore host preference, response to physical environmental factors, and dispersal ability. Systematics and ecological characteristics are briefly discussed for selected Malesian polypores: *Corneroporus subcitrinus*, *Paratrichaptum accuratum*, *Postia stellifera* and *Roseofavolus eos*.

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## 1. Introduction

"The Malesian region" refers to a biogeographic region that includes the Malay Peninsula, Java, Sumatra, Borneo, the Philippines, and their surrounding islands, and that is categorized under the Indo-Malesian Subkingdom in the Paleotropical Kingdom (Takhtajan 1961; Fig. 1). Tree species richness in this region is extremely high. The numbers of the tree species recorded in a 52-ha plot in Lambir Hills National Park (Northern Borneo) and in a 50-ha plot in Pasoh Forest Reserve (the Malay Peninsula), both of which are primary lowland rainforest, are 1175 and 818, respectively, whereas only 1166 species are collectively known from all temperate forests in the Northern Hemisphere (Wright 2002; Davies et al. 2003). Many trees are endemic to this region, and areas including the Malay Peninsula, Northern Borneo, and the Philippines are considered biodiversity hotspots in need of biodiversity conservation (Myers 1988).

Polypores are a group of fungi that includes important wood decomposers in forest ecosystems. Their species

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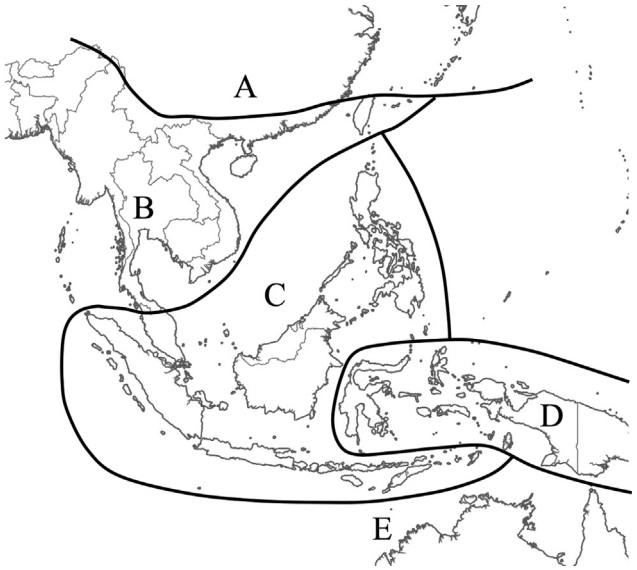


**Fig. 1 – Map of the floristic regions of Southeast Asia modified from Takhtajan (1961). A: The Eastern Asian region. B: The Indo-Chinese region. C: The Malesian region. D: The Papuan region. E: The North and East Australian region.**

richness and composition are often influenced by tree species composition in forests, because many show host specificity or preference for certain trees. High species diversity of forest trees in this region may result in high polypore species richness.

Yamashita et al. (2015) surveyed a 2-ha plot survey in a lowland primary area of Pasoh Forest Reserve and estimated 188 species of polypores, which is much higher than in temperate areas. It is expected that the polypore species throughout the Malesian region should be much richer, because different species should be distributed in other forest types including hill forests, mountain and subalpine forests, young secondary forests, plantations, swamp forests, mangrove forests, and geographically isolated primary lowland forests.

Ryvarden (1991) reviewed polypore biogeography, mainly at the genus level. He mentioned that only the following five genera are endemic in tropical Asia, although some of them are now known to accommodate non-Asian species: *Elmerina* Bres., *Flabellophora* G. Cunn., *Hymenogramme* Mont. & Berk., *Paratrichaptum* Corner, and *Sparsitubus* Xu & Zhao. This number of genera is substantially less than 22, which is the number of pantropic polypore genera (Ryvarden 1991).

In contrast, polypore mycobiota in tropical Asia, including the Malesian region, is peculiar compared with other regions at the species level. E. J. H. Corner intensively collected in the Malesian and adjacent Papuan regions, and described nearly 280 new polypore species from these regions (Corner 1983, 1984, 1987, 1989a,b, 1991, 1992), although several are now considered synonyms of previously described or dubious species (Hattori 2000, 2001a,b, 2002, 2003a,b, 2005a; Dai and Li 2012; Hattori and Sotome 2013). Many of the species newly described by Corner are still unknown outside of these two regions. Hattori and Lee (2003) also concluded that many of the polypores recorded in Pasoh Forest Reserve are likely endemic to tropical Asia.

In addition, recent phylogenetic studies have revealed that several pantropic and paleotropic "species" actually represent species complexes that contain cryptic species restricted to tropical Asia. This indicates that more species are endemic in tropical Asia, including the Malesian and adjacent regions, than was once considered.

Although the polypore mycobiota in these regions is species-rich and peculiar, no discussion has been made regarding the factors that influence distribution of these polypores. As mentioned above, tree flora can be a primary factor that delimitates distribution of polypores with host specificity. Climate, including temperature and precipitation, is another factor that affects wood-decaying fungus distribution (Heilmann-Clausen and Boddy 2008). Changes in mycobiota along latitudinal and altitudinal gradients may be partially influenced by the response of each species to temperature. Dispersal ability may also influence the distribution of each species.

In this article, I review important mycologists and literature that described polypores from the Malesian region. Then, I discuss polypore distribution patterns in this region, and biological characteristics that might affect their distribution. Finally, I review some peculiar species of polypores reported from this region.

## 2. Important taxonomical studies on Malesian polypores

Polypores in general produce less watery and highly persistent basidiomata, and are more easily dried for keeping as specimens than agarics and many other macrofungi. This made it possible for mycologists to describe considerable new polypore species during the 19th and the early 20th centuries based on specimens collected during field expeditions to the Malesian and adjacent Papuan regions (Table 1).

Among these regions, the largest number of new species was described from the Philippines during this time, where significant contributions were made by W. A. Murrill and C. G. Lloyd. Murrill (1907, 1908a,b) described a total of 58 polypore species from the Philippines based on collections made by his coworkers including E. D. Merrill, R. S. Williams, and A. D. E. Elmer (Ryvarden 1985). Later, Lloyd described 41 new species based on specimens sent from his coworkers including E. D. Merrill (Ryvarden 1989, 1990, 1992). Graff (1916) summarized newly described fungi from the Philippines in the 19th and early 20th centuries. However, despite intensive reports during this time, only limited studies have been conducted on Philippine polypores after the late 20th century.

Java Island, Indonesia is another area from which many polypores were described. Most species from "Indonesia excluding Borneo, Celebes, and New Guinea", shown on Table 1, were actually described from Java, except for some limited species that were mainly from Sumatra. F. W. Junghuhn stayed for an extended amount of time in Java, and described 30 new polypore species from Java (Ryvarden 1981a). J-H. Léveillé is another mycologist who described various

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