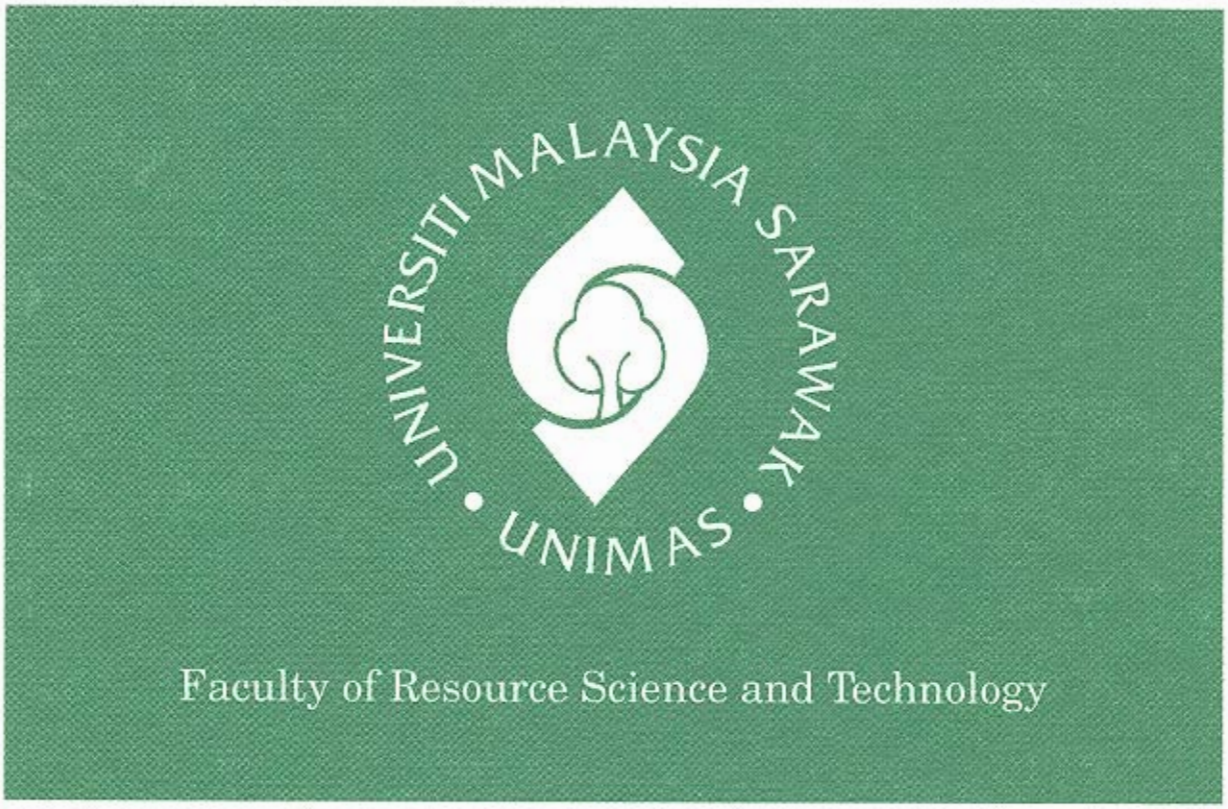

THE OCCURENCES OF POROID MUSHROOMS IN SECONDARY FOREST AT UNIMAS

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Bachelor of Science with Honours
(Plant Resource Science and Management)
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The Occurrences of Poroid Mushrooms in Secondary Forest at UNIMAS

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ABSTRACT

Poroid mushrooms, refering to fungi with pores hymenophore, were collected from a secondary forest at University Malaysia Sarawak (UNIMAS). The macromorphology and micromorphology of the poroids mushroom were examined. The poroid mushrooms in the secondary forest at UNIMAS were dominated by *Microporus* sp., *Trametes* sp. and also *Hexagonia* sp. There were also *Amauroderma* sp., *Coriolopsis* sp., *Flaviporus* sp., *Fomitopsis* sp., *Ganoderma* sp., *Heterobasidion* sp., *Hymenochaete* sp., *Phylloporia* sp., *Polyporus* sp., *Pycnoporus* sp., *Rigidoporus* sp. and *Tyromyces* sp. Pure cultures of some of the poroids were prepared from tissue of the fruit body. Effects of media on growth of *Pycnoporus* sp., *Rigidiporus* sp., *Hexagonia* sp. 2 and Polyporacea 1 were examined. The isolates that were grown on Potato Dextrose Agar (PDA), Potato Carrot Agar (PCA) and Malt Extract Agar (MEA) at room temperature showed no significant difference at P=0.05 in the colony growth rate. Seven isolates were selected for amylase qualitative assays on PDA + 1 % starch media. The clearing zone that indicating the amylase activity was formed only on plates inoculated with *Coriolopsis* sp. 1 and *Tyromyces* sp., after 4 days of inoculation and incubated at 30°C in dark condition.

Keywords: Poroid mushroom, macromorphology and micromorphology, growth media, amylase qualitative assays

ABSTRAK

Cendawan berliang, merujuk kepada cendawan yang mempunyai liang pada jasad berbuah telah diperolehi daripada hutan sekunder Universiti Malaysia Sarawak (UNIMAS). Cendawan berliang yang diperolehi telah dikaji dari segi makromorfologi dan mikromorfologi. Taburan cendawan berliang di hutan sekunder UNIMAS didominasi oleh Microporus sp., Trametes sp. dan Hexagonia sp. Selain itu terdapat juga Amauroderma sp., Coriolopsis sp., Flaviporus sp., Fomitopsis sp., Ganoderma sp., Heterobasidion sp., Hymenochaete sp., Phylloporia sp., Polyporus sp., Pycnoporus sp., Rigidoporus sp. dan Tyromyces sp. Kultur tulen bagi cendawan berliang telah diperolehi daripada tisu jasad berbuah. Kesan media terhadap pertumbuhan cendawan berliang turut dikaji menggunakan pencilan Pycnoporus sp., Rigidiporus sp., Hexagonia sp. 2 dan Polyporacea 1. Pencilan tersebut telah ditumbuhkan pada PDA, PCA dan MEA pada suhu bilik dan menunjukkan tiada perbezaan ketara bagi kadar pertumbuhan koloni pada P=0.05. Tujuh pencilan telah dipilih untuk pencerakinan enzim amilase pada PDA + 1 % kanji. Zon cerah yang menunjukkan aktiviti amilase hanya terbentuk pada piring yang diinokulat dengan Coriolopsis sp. 1 dan Tyromyces sp., selepas 4 hari tempoh pengeraman pada suhu 30°C dalam keadaan gelap.

Kata Kunci: Cendawan berliang, makromorfologi dan mikromorfologi, media pertumbuhan, pencerakinan enzim amilase

1.0 INTRODUCTION

According to Sharma (1989), fungi (L. *fungus*, mushroom) are achlorophyllus, heterotrophic (saprophytic, parasitic, symbiotic or hyper parasitic), eukaryotic and spore-bearing organisms. The cell walls are made up of chitin, with or without fungal cellulose, along with many other complex organic molecules. The fungi vary widely in their minimum requirement for sources of carbon, nitrogen, phosphorus and other minerals, vitamins and other growth factors (Cooke and Whipps, 1992). Addition to that, the essential conditions for fungi to grow are adequate moisture, suitable temperature and oxygen supplies (Zabell and Morell, 1992). The most limiting factor among them is the moisture (Annon, 1989). Fungi usually obtain food by absorption, except a few lower groups where they take in food by ingestion.

The identification of fungi is still the main problem in the study of species determination and classification. In Borneo, the mycota has much in common with the mycotas found throughout Southeast Asia and Australasia, and much less with that of Europe (Pegler, 1997).

The true fungi form a separate kingdom, which include three phyla, Ascomycota (Cup Fungi and allies), Basidiomycota (Mushrooms and allies), and Zygomycota (Pin-moulds and allies) (Pegler, 1997).

Estimates have been made to suggest that there may be as many as 1,600,000 species of fungi on the planet, of which as few as five per cent has so far been given names and scientific descriptions (Pegler, 1997).

The fungi play important roles in many aspects of our daily lives. Apart from being parasitic species on our principal food plants, fungi have a profound influence on human affairs. For example, the most basic roles of fungi are recycling of carbon. Microbial degradation of cellulose has been estimated to return carbon to the atmosphere in the magnitude of 85 billion tons per year.

Fungi are also an ideal food because it crude proteins typically represent 20 – 30% of fungal dry matter (Moore and Chiu, 2001). It contains all of the amino acids, which are essential to human and animal nutrition. In China, mushrooms are used as food and also considered to provide a healthy and balanced diet. According to Horst, (1998) the fungus *Rhizopus oligosporus*, producer of the delicious tempeh food, is a prolific amylase enzyme producer and is known to be free of mycotoxin production, such as aflatoxin. A genus of *Lentinus* is also collected in many tropical areas for consumption and sale (Chang and Quimio, 1982; Morris 1987).

On the other hand, fungi were used widely for medicinal purposes. For example, species of hard polypores including *Ganoderma* were used in such problems of sickness such as toothaches, coughs and animal diseases. Harkonen, (2001) reported that modern Chinese pharmacological research has discovered more and more substances in fungi, which promote health and cure diseases such as sarcoma,

carcinoma and hepatitis. Considered best of all medical fungi in China is *Ganoderma lucidum.* It has been said the fungus can cure almost every ailment; for example headache, sleeplessness, poor appetite and depression. It is used by diluting the fungus in the water like tea or with alcohol. In addition, it was believed to bring good luck.

In the meantime, not much reports on poroid mushroom in the tropics. Distributions of many poroid mushrooms have still poorly known. A complete knowledge of the fungi for any locality would require continuous observation and collecting over many years, and this has never been achieved in tropical conditions (Pegler, 1997).

The present study was undertaken to describe and identified the poroid mushrooms from secondary forest at University Malaysia Sarawak (UNIMAS). Investigation on capability of some poroid mushroom in production of amylase and the effect of media on the growth were also done.

2.0 LITERATURE REVIEW

The poroid mushrooms refer to all fungi with a poroid hymenophore except the members of Boletales and a few fleshy members of Agaricales such as *Favolaschia* sp., *Poromycena* sp. and similar genera (Ryvarden, 1992). The poroid mushrooms are protected against the environment in a different way from that of higher plants, and are less susceptible to short-term changes. As a result, the poroid mushrooms tends to have much wider distributions than higher plants.

Many of the poroids are commonly considered as harmful organisms that cause economic losses of the wood. It is well known that termites have close relationship with wood-rotting fungi; especially poroids (Ryvarden, 1992). In many cases, the termites were strongly attracted to wood attacked by polypores, especially brown rot fungi. Ecologically they are very important organisms that have many others important role to the ecosystem. Although most polypores cause wood decay, several genera of poroids have members that are mycorrhizal, forming mutualistically beneficial relationships with the root of trees (Tom, 2000). In addition, some of these fungi are highly valued by biotechnologists because of their wood-degrading (especially lignin-degrading) abilities.

Most Polyporaceae are wood decay fungi (Tom, 2000). There are two fundamentally different ways in which wood can be rotted. Wood is composed mostly of two substances: cellulose (white) and lignin (brown). Cellulose forms the primary wall of all plant cells. Many plants add a second wall of lignin inside the primary wall, especially in wood.

Brown rot fungi can degrade only the white cellulose and leave the brown lignin behind. In their simplest form, white rot fungi degrade the lignin and leave the white cellulose behind. Brown rot fungi degrade the primary walls and leave the secondary lignin walls behind.

White rot fungi leave the stringy cellulose of the primary walls behind. There are often enclose genera in the polypores, with seemingly identical characters, except that one causes a white rot and one causes a brown rot. A good example of this

is *Tyromyces*, which causes a white rot and *Oligoporus*, which causes a brown rot. This distinction is also used in the Agaricales, where, for example, *Pleurotus* causes a white rot and the closely related *Hypsizygus* causes a brown rot (Tom, 2000).

There are a couple potential biotechnology uses for these white rot fungi. The most promising application is bio pulping. One of the biggest energy expenditures in papermaking comes from removal of the brown lignin from the wood so that only the white cellulose is left to make paper. Usually this is done with chemical bleaches that are often contaminated with dioxins. There are ecological problems with disposal of these chemical. The paper companies could use the enzymes of a white rot fungus to remove the lignin. This could result in a savings of both energy and time and avoid pollutive wastes being dumped out of the mills. The ideal fungus for this endeavor would be fast growing, able to tolerate the high temperatures of composting, and leave the cellulose virtually untouched. This ideal fungus would have the exact characteristics of *Phanerochaete chrysosporium*, a corticioid fungus, or *Ceriporiopsis subvermispora*, a resupinate polypore (Tom, 2000). The fungus works very well on the laboratory bench, but, as with many industrial bioprocesses, there have been still problems with scaling up the process to an industrial level.

On the other hand, the poroid mushrooms are also can be applied for bioremediation. Tom, (2000) reported that some of the lignin-degrading enzymes of white rot fungi will also degrade some toxic wastes that have the same general chemical configuration. There is enormous potential to use these fungi to clean up even Superfund sites.

Again, this works very well on a small scale, but there are many of the same problems in scaling up the process.

Most of the poroid mushrooms can be found during dry weather since many of them are tough or perennial. Addition to that, the poroids are also produce basidiocarps only beneath the surface of logs lying on the forest floor, where it remains wet most of the year (Tom, 2000).

It is well known that some of the poroids mushrooms are quite aggressive and attack the wood of living trees or newly dead trees, while others are secondary invaders establishing themselves only on partially or well decayed wood (Ryvarden, 1992). The germinating spores usually cause penetration of poroids mushrooms within the host, although entry may also be caused by vegetative propagules in certain cases. Within the host, the poroid mushrooms produce various enzymes to attack cell walls and degrading them to the simplest compound. The mechanism of degradation is different in different groups. For example, the white rot fungi exude hydrolytic enzymes cellulase, which acts principally on cellulose.

The poroid mushrooms have elevated themselves on the trunks, exposed roots, branches or twigs, whilst others will only grow on the wood of dead trees and on the soil (Pegler, 1997). These mushrooms can be found at any time of the year and some of them able to survive for several years, producing a new layer of tubes each year.

Growths of poroid mushrooms are much slower, and there is no overnight 'mushroom growth'. Addition to that, some of the fruit bodies of the poroids mushrooms are long-lived.

In general, the poroid mushroom form fruit bodies with a layer of closely compacted, vertical tubes under the cap surface, which comprise various sizes of hymenophore; spore-producing surface (Ryvarden, 1992). These fruit bodies are often perennial. The sterile upper surface comprises a thick, hard, impervious crust, which is often wax impregnated and appears highly varnished, as in *Ganoderma tropicum*.

Commonly, the poroid mushrooms has developed hyphae, which are thick-walled, together with other specialized hyphae, which are highly branched and able to bind the individual hyphae together into a strong tissue. The septation of the generative hyphae is accepted as a basic character for generic delimitation the polypores (Ryvarden, 1992).

There are a number of essential phases in the life of the poroid mushroom. These are spore germination, vegetative growth of the mycelium, development of the spore-bearing apparatus, production of the spores and finally their liberation and dispersal (Ingold and Hudson, 1993).

Morphological data are important for identification of species group (Raper and Fennell, 1965). There are several characteristics that can be used to identify the poroid mushrooms. The common characteristics that usually used are; the form of the

fruiting body, form of the hymenophore, hyphal system, type of cystidia and spores characteristic.

Poroids can take various forms of fruiting body. They may be pileate; having a pileus or distinguishable cap. Some may be stipitate; having a stalk. Or they may be resupinate; (effused), lying flat on the substrate. Some may be effused-reflexed, which mean they lie flat on a flat (i.e. parallel to the ground) substrate, but form shelves where the substrate surface is not parallel to the ground.

Most poroids have pores, small holes on the underside of the fruiting body that increase the surface area for bearing basidia with their spores (Ryvarden, 1992). However, some genera have enlarged pores that may be mazelike or gill-like. Even some may become hydnoid, with downward pointing teeth or spines. The form of the hymenophore may even change depending on which side of the substrate the fungus is fruiting, especially if the substrate suddenly changes to be perpendicular to the ground.

The hyphal system of the poroids can be monomitic, dimitic, or trimitic (Tom, 2000). Some poroids are very soft and last for only one season, while others are very hard and often perennial. This is usually a direct result of the hyphal type found within the polypore fruiting body. Monomitic species have only septate generative hyphae, which are responsible for growth and transport of food and other materials through the fruiting body. These may be thin-walled or thick-walled, clamped or unclamped. Most of these species have fruiting bodies that are soft.

Dimitic-skeletal species have septate generative hyphae and thick-walled non-septate skeletal hyphae, which provide the hard structure found in many poroids for example, *Ganoderma applanatum*. Dimitic-binding species have septate generative hyphae and thin often-branching binding hyphae, which are responsible for holding the other hyphae together.

Trimitic species have septate generative hyphae and thick-walled, non-septate skeletal hyphae and thin often branching binding hyphae.

General spore size and shape are important characters. There are three common shapes that found in the tropic; globose, ellipsoid and cylindrical. The ellipsoid and globose spores are common in tropical and it tends to have larger size compare to the temperate species (Ryvarden, 1992).

Cystidia are actually found in very few genera of poroids, but when present they are a diagnostic feature (Tom, 2000). Some characteristics to look for are the shape, size, thickness, and any crystals that are found at or near the ends.

Besides all of the characteristics that were described, the pure culture studies have also been used in the identification of fungi species. Thus, for small collection, or for relatively short-term preservation, sub-culturing is an effective method of culture maintenance (Smith and Onions, 1994). However, the successful maintenance is dependent upon transfer from well-developed parts of the culture, taking care to ensure that contaminants or genetic variants do not replace the origin strain.

3.0 MATERIALS AND METHODS

3.1 Source of organisms

The poroid mushrooms were collected from a secondary forest at University Malaysia Sarawak (UNIMAS) campus. Collections of samples were done four times during the study period. Fruiting body of the mushrooms was collected along the trail; from the trunks, branches, exposed roots and the fallen, decaying leaves of the forest trees and also on the soil.

3.2 Specimen's identification

Macromorphology

The newly collected specimens of poroid mushroom were brought back into laboratory for identification, which was based on morphological structures. The basidiomata; including the pileus, margin, pore surface, pore tubes, context, stipe size of the fungus was measured and colour and other related characteristics of these structures were observed and recorded. Small pieces of tissues from the fruiting body were soaked in 5% KOH and the colour changes were recorded.

Micromorphology

The tissues from the various part of freshly collected fruiting body were partially digested on a glass slide with 10 % solution potassium hydroxide. The tissues were then left to be sufficiently soft for 15 minutes and these tissues were washed with water. The access water was removed with blotting paper. The tissues were then, teased by fine needle under light microscope. For clear examination, these tissues were mounted with 5 % KOH. After that, the tissues were stained with cotton blue.

Observations on the hyphae and basidiospore were also done by staining the tissue with Congo Red. Types of hyphae, generative, skeletal and binding hyphae and basidiospores forms were identified.

3.3 Pure Culture Preparation

Pure culture was prepared by using fungal tissue from the fruit body and inoculated on PDA. The tissue of basidiocarp was cut to about 3 mm^2 and transferred carefully onto a small plate. These cut tissues were washed with 10 % Clorox for 5 minutes. Then, they were washed with sterilized distilled water 2 to 3 times, dried on filter paper and then inoculated on PDA. The pure cultures were obtained after at least 3 times of sub culturing and until there were no changes in the form of the culture. The new culture was prepared on a new PDA plate for the different studies on colony growth of the mushrooms.

3.4 Effect of media on growth of selected poroid mushrooms

Three different media were used. The media were PDA, Potato Carrot Agar (PCA) and Malt Extract Agar (MEA). Agar block 3 mm diameter, containing mycelia of the selected poroid mushrooms cut from 7 – day – old pure culture were inoculated on each prepared media. The fungus was inoculated at the center of 9 cm diameter Petri dishes containing the test media. Three replicates were prepared for each media. The inoculated plates were incubated at room temperature, 22 - 25°C. Growth of the fungus on media PDA, PCA and MEA were determined by measuring colony diameter.

Diameter on the agar plates was measured everyday until the mycelium covered the whole surface of agar in the plate or after 7 days. Average diameter of the colony in each plate was taken from the two diameters, which were perpendicular to each other. The average growth rate for each media was calculated as below.

$$\text{Average colony diameter, (D); } = \frac{d1+d2}{2}$$

Average growth rate;

$$= \frac{(D2-D1) + (D3-D2) + (D4-D3) + (D5-D4) + (D6-D5) + (D7-D6)}{N-1}$$

Where;

d = Diameter of colony

D = Average colony diameter (cm)

N = Total number of days

3.5 Amylase Qualitative Assay

Agar blocks, 5 mm in diameter, containing mycelia of selected poroid mushrooms were cut from 7-day-old pure culture then inoculated on Petri dishes containing Potato Dextrose Agar + 1 % starch media. These cultures were then incubated at 30°C in dark condition. After 4 days, the clear zone was visualized by flooding the plates with 10 ml of iodine 5M. The clear hydrolyzed zone around the cultures indicates that the cultures are producing amylase. The average diameter of clearing zone was determined.

4.0 RESULTS

The collection of poroid mushrooms in the secondary forest at UNIMAS campus was done in July 2004 to January 2005. Within the period of time, four times of sample collections were done at different location in the peat swamp forest area. Most of the poroids were collected from dead or decay wood, on branches and trunks of both fallen and standing tree. From the collections, it was found that there were three common Order of poroid mushrooms in the peat swamp area, which were Hymenochaetales, Polyporales and Russulales. The most common genus was *Microporus* followed by *Hexagonia* and *Trametes* from Order Polyporales. Besides these three most common genera, there were also *Amauroderma, Coriolopsis, Flaviporus, Fomitopsis, Ganoderma, Heterobasidion, Hymenochaete, Phylloporia, Polyporus, Pycnoporus, Rigidoporus* and *Tyromyces*. The genus and expected numbers of species of the poroids collected from the forest were shown in Table 1.

Table 1. The poroid mushrooms collected in a secondary forest at UNIMAS

Order	Family	Genus	Number of expected species
Hymenochaetales	Hymenochataceae	*Hymenochaete*	2
		Phylloporia	4
Polyporales	Fomitopsidaceae	*Fomitopsis*	3
	Ganodermataceae	*Amauroderma*	2
		Ganoderma	3
	Meripilaceae	*Rigidoporus*	2
	Polyporaceae	*Coriolopsis*	6
		Hexagonia	9
		Microporus	10
		Polyporus	4
		Pycnoporus	3
		Trametes	7
		Tyromyces	2
		Polyporacea	6
	Steccherinaceae	*Flaviporus*	3
Russulales	Bondarzewiaceae	*Heterobasidion*	2

4.1 Descriptions of Poroid Mushrooms

The descriptions of each sample are as following:

Sample No : 01
Order : Polyporales
Family : Ganodermataceae
Species : *Amauroderma* sp. (Figure 1.a)

Habitat and growth habit

Fruiting body was perennial, found on decay wood in soil. Rarely found in UNIMAS peat swamp forest.

Macroscopic features

Fruiting body was circular to dimidiate, laterally stipitate. Pileus was hard and smooth on fresh specimen. Individual pileus was up to 4.0 cm in diameter, 1.0 – 1.5 cm thick in center; untomentose; margin entire; pileus upper surface date brown. Pore surface fawn; pores rounded to angular, 6 – 7 pores per mm. Pore tube umber, up to 1.0 cm. Context was 0.5 – 1.0 cm thick; fuscous black. Stipe was hard, solid, fuscous black up to 12.0 cm long, 7 mm diameter. Odor and taste none. KOH colour changed to rusty tawny.

Microscopic features

The hyphal system was trimitic (Figure 1.b), the generative hyphae septa with clamps 2 – 3 µm in diameter. Skeletal hyphae thick walled and binding hyphae thin walled and short-branched.

Sample No : 02
Order : Polyporales
Family : Polyporaceae
Species : *Coriolopsis* sp. 1 (Figure 2.a)

Habitat and growth habit

Fruiting body was perennial, found on dead or decay wood in soil. Rarely found in UNIMAS peat swamp forest.

Macroscopic features

Fruiting body semicircular, bracketlike, more rarely forming rosettes, effused resupinate. Pileus was glabrous and hard on dry specimen. Individual pilei up to

3.5 cm in diameter, 0.5 – 1.0 cm thick in center; untomentose; margin wavy; pileus upper surface undulating and with narrow concentric zones, rough, creamy to saffron. Pore surface orange to saffron, pores angular, small, 7 – 8 pores per mm. Pore tube saffron, up to 0.1 cm. Context was 0.1 – 0.3 cm thick; salmon. Odor and taste none. KOH colour changed to sulphur yellow.

Microscopic features

The hyphal system was trimitic (Figure 2.b), generative hyphae without clamps 5 – 6 µm in diameter, thick walled septa hyphae. Skeletal hyphae thick walled and binding hyphae thin-walled and short-branched.

Sample No : 03
Order : Polyporales
Family : Polyporaceae
Species : *Coriolopsis* sp. 2 (Figure 3.a)

Habitat and growth habit

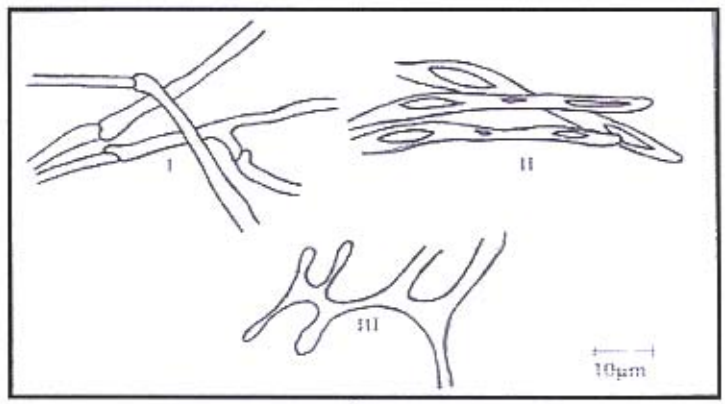
Fruiting body was perennial, found solitary on dead or decay wood, on branches and trunks of fallen tree. Rarely found in UNIMAS peat swamp forest.

Macroscopic features

Fruiting body was bracket like and dimidiate. Individual pilei up to 3.5 cm in diameter, 0.1 – 0.3 cm thick in center; untomentose; margin eroded; pileus upper surface with indistinct concentric zones, the outer layer of pileus white in colour, lemon yellow to orange near to substrate. Pore surface buff to light brown; pores rounded to angular, very small, 10 – 11 pores per mm. Pore tube sulphur yellow to buff, up to 10 mm. Context 1 – 10 mm thick; lemon yellow. Odor and taste none. KOH colour changed to light brown.

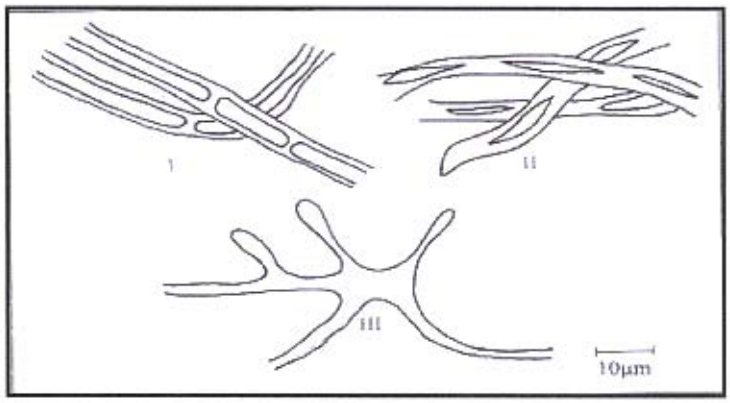
Microscopic features

The hyphal system was trimitic (Figure 3.b), generative hyphae septa with clamps 4 – 6 µm in diameter. Skeletal hyphae thin to thick walled and binding hyphae thick- walled and short-branched.



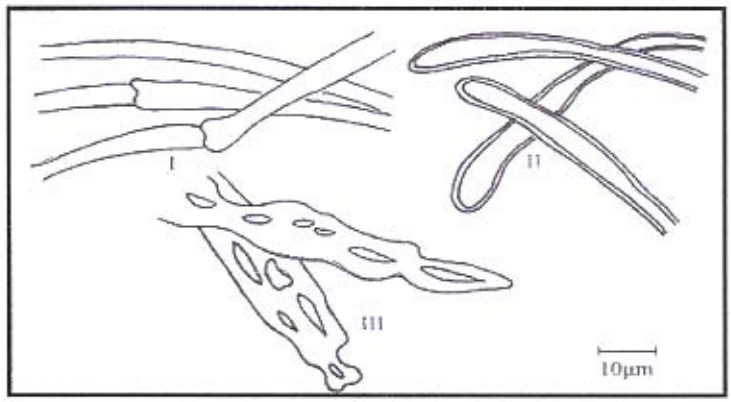
a b

Figure 1. *Amauroderma* sp. **a.** Fruiting body **b.** (I) Generative hyphae (II) Skeletal hyphae (III) Binding hyphae



a b

Figure 2. *Coriolopsis* sp. 1 **a.** Fruiting body **b.** (I) Generative hyphae (II) Skeletal hyphae (III) Binding hyphae



a b

Figure 3. *Coriolopsis* sp. 2 **a.** Fruiting body **b.** (I) Generative hyphae (II) Skeletal hyphae (III) Binding hyphae

Sample No : 04
Order : Polyporales
Family : Polyporaceae
Species : *Coriolopsis* sp. 3 (Figure 4.a)

Habitat and growth habit

Fruiting body was perennial, found grow in cluster on decay wood, branches and trunks of tree.

Macroscopic features

Fruiting body fully resupinate, attached tightly to substrate; 2 – 3 mm thick, untomentose; margin eroded; pileus upper surface grayish yellow; moist. Pore surface reddish yellow; pore angular to elongated, 8 – 9 pores per mm. Pore tube grayish yellow, up to 0.1 cm long. Context was 1 – 10 mm thick; dark yellow. Odor and taste are slightly acidic. KOH colour changed to greenish yellow.

Microscopic features

The hyphal system was trimitic (Figure 4.b), generative hyphae without clamps 8 – 9 µm in diameter, thick walled and septa hyphae. Skeletal hyphae thick walled and binding hyphae thin walled and short-branched.

Sample No : 05
Order : Polyporales
Family : Polyporaceae
Species : *Coriolopsis* sp. 4 (Figure 5.a)

Habitat and growth habit

Fruiting body was perennial, found on dead or decay wood, on branches and trunks of fallen tree.

Macroscopic features

Fruiting body bracket shape; flabelliform. Pileus was semicircular and black to date brown on dry specimen. Individual pilei up to 4.5 cm in diameter, 1.5 – 2.0 cm thick in center, untomentose; margin eroded; pileus upper surface olive yellow, glabrous

and moist. Pore surface olive brown; pores angular, very small, 10 – 11 pores per mm. Pore tube light yellow to slightly yellow, up to 1.5 cm long. Context was 10 – 15 mm thick; golden. Odor and taste are slightly acidic. KOH colour changed to yellow.

Microscopic features

The hyphal system was trimitic (Figure 5.b), generative hyphae without clamps 6 – 7 μm in diameter, thick walled septa hyphae. Skeletal hyphae thick walled and binding hyphae thin walled and long-branched.

Sample No : 06
Order : Polyporales
Family : Steccherinaceae
Species : *Flaviporus* sp. (Figure 6.a)

Habitat and growth habit

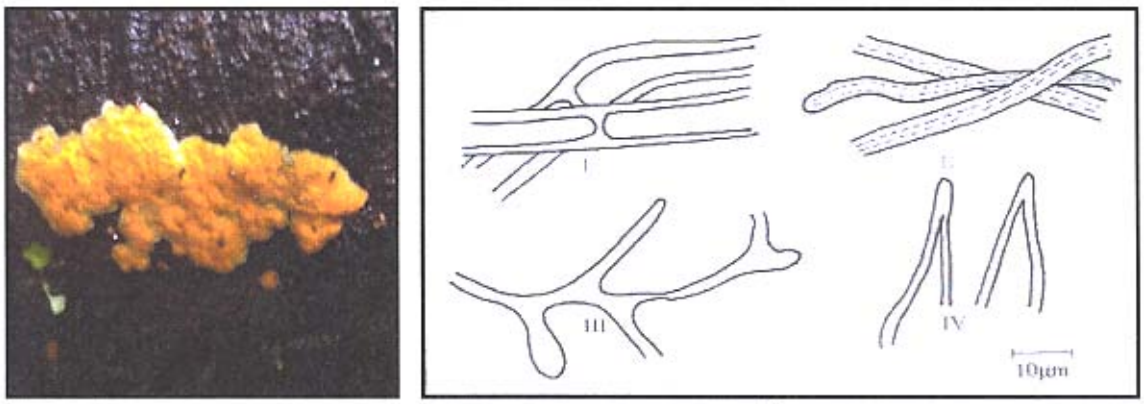
Fruiting body was perennial, found on dead or decay branches and trunks of fallen tree.

Macroscopic features

Fruiting body semipiliate, more rarely resupinate to effuse reflexed. Pileus was smooth, otherwise uneven and hard on dry specimen. Individual pilei up to 4.0 cm in diameter, 0.1 – 0.3 cm thick in center; untomentose; margin eroded; pileus upper surface saffron to sulphur yellow. Pore surface saffron; pores angular, 7 – 8 pores per mm. Pore tube buff, up to 1.0 mm. Context 0.1 – 1.0 mm thick; saffron. Odor and taste none. KOH colour changed to sulphur yellow.

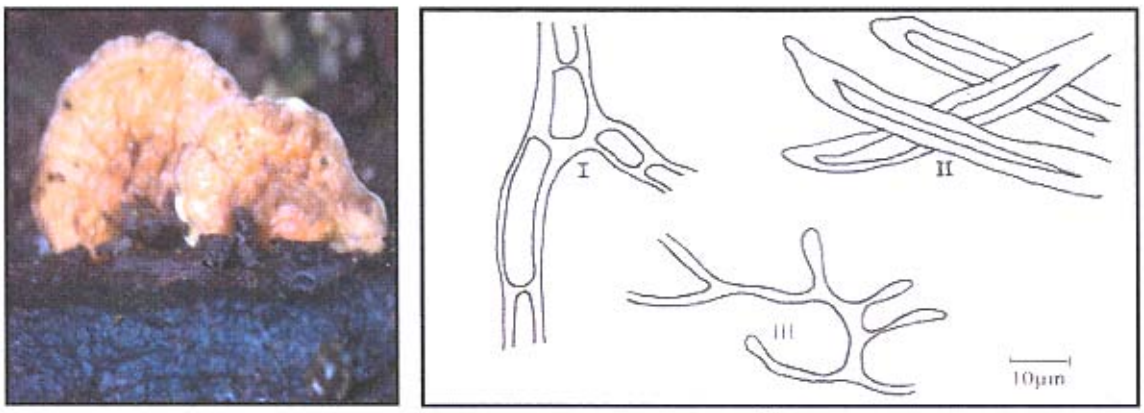
Microscopic features

The hyphal system was trimitic (Figure 6.b), generative hyphae with clamps, 3 – 4 μm in diameter, thin-walled clamped hyphae. Skeletal hyphae thick walled and binding hyphae long branched.



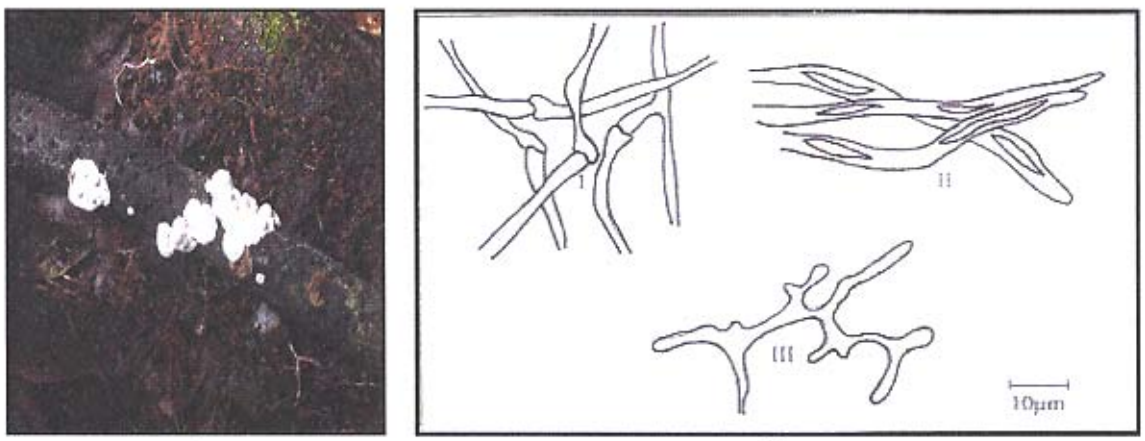
a b

Figure 4. *Coriolopsis* sp. 3 **a.** Fruiting body **b.** (I) Generative hyphae (II) Skeletal hyphae (III) Binding hyphae (IV) Part of hymenium



a b

Figure 5. *Coriolopsis* sp. 4 **a.** Fruiting body **b.** (I) Generative hyphae (II) Skeletal hyphae (III) Binding hyphae



a b

Figure 6. *Flaviporus* sp. **a.** Fruiting body **b.** (I) Generative hyphae (II) Skeletal hyphae (III) Binding hyphae