Final Report

Marasmioid and Mycenoid Fungi in Thailand Phase I

By

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et al.

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1. Abstract

Marasmius and *Mycena* are the most diverse genera of saprotrophic mushrooms known in the world, with over 1600 species described in *Marasmius* and over 1200 species described in *Mycena*. The greatest species diversity in these genera occurs in the tropics, although hundreds of taxa are found in temperate regions of both the southern and northern hemispheres. Nearly all species are saprotrophic, serving important ecological roles in litter decomposition, nutrient recycling and retention, soil genesis, litter binding with its concomitant inhibition of erosion, and as food sources for innumerable species of arthropods, mollusks and small vertebrates. A few species are parasitic on economically important food crops such as coffee, cocoa, sugar cane, and on horticultural plants. In addition, a few species form antibiotics such as strobilurin. Many species are host-specific or substrate-specific which accounts for some of the high diversity seen in tropical forests. Many tropical regions of the world (such as Southeast Asia, China, west central Africa, most of Indonesia) which undoubtedly support a great diversity of *Marasmius*, *Mycena* and allied genera (i.e., marasmioid and mycenoid fungi) have had only limited mycological exploration. This is especially true in Thailand. To help fill the void in our knowledge of these ecologically and potentially biomedically important fungi, the objective of this project is to document the biodiversity, ecology and distribution of the genera *Marasmius* and *Mycena* in Thailand.

2. Executive Summary

The objectives of this project are to study the biodiversity and ecology and to provide preliminary information on Marasmioid and Mycenoid Fungi as a part of the overall effort to complete the taxonomy of Thai saprotrophic fungi.

Fungal samples were collected from the selected sites from the northern part through to the southern part of Thailand that would be representative of the different temperatures, forest types and humidity found in Thailand. Notes were taken with the fresh specimens and they were photographed or illustrated without using a microscope. Culture isolation was attempted with every specimen. All of the materials were dried by using a food drier, put into plastic boxes and labeled for standard preservation in the herbarium museum at BIOTEC. Microscopic characteristics of all samples were examined and illustrated by using microscopes at in the Mycology Lab at BIOTEC and any chemical tests required were also carried out there. Both of macromorphology and micromorphology descriptions were added in to the BIOTEC database.

In total, 461 samples (Table 11) were collected from the various parts of Thailand for the first phase of this project. The successful percentage of classification and identification from all of samples was 93% while 7% remained unidentified. Altogether 100 genera (Table 5) and 51 species (Table 6) were found. The 461 samples could be classified into three big groups of fungi, which were Marasmioid (Table 7), Mycenoid (Table 8), and other Macro Fungi (Table 9) by using distinguishing macroscopic and microscopic characters. The percentages for the three groups (Table 3) were about 25% for Marasmioid, 39% for Mycenoid and 35% for other Macro Fungi. With respect to cultures, 205 (Table 10) gave preliminary spore drops from the fresh samples, and these resulted in 126 pure cultures preserved at the BIOTEC Culture Collection while 79 cultures isolations are still in process. The percentages of cultures are about 28% for Marasmioid, 37% for Mycenoid and 35% other Macro Fungi.

Results from this preliminary work illustrate the high diversity of saprotrophic fungi in Thailand particularly in the Marasmioid and Mycenoid groups. A year of work has only barely touched the representative taxonomy of these fungi all over the country. All these specimens and data will be passed through to the second phase of the study and more exploration will be done to increase the database. Many of these fungi are new species or species that have not been previously cultured so they provide an excellent hunting ground for bioactive compounds. Because

the cultures are based on known and identified specimens or dried herbarium specimens they are more valuable than unknown cultures derived from unknown species for which there are no specimens. They should be given the highest priority in BIOTEC's screening program.

3. Tables index

4. Pictures index

5. Introduction

At BIOTEC one focus of attention is the Biodiversity of fungi. From 1992 -1999, Dr. Flegel and his colleagues spent several years examining the diversity of Macro Fungi in Thailand. Almost 3000 specimens (included duplicate specimens) were collected from the various parts of Thailand as a result of this work. One of the interesting groups collected was Basidiomycota which comprise the largest number of specimens in the collection. These are now included in the BIOTEC Macro Fungi database and Fugal Herbarium for preservation (Flegel, T.W. et. al 2000). This collection contains 1850 non-duplicate specimens and 60% belong to Phylum Basidiomycota. They include 171 genera and 392 species. The genus *Marasmius* and *Mycena* are are included but make up only 3% of specimens in the genus *Marasmius* and 1% specimens in the genus *Mycena*. Less than 10 of these species in the collection were identified to species or even to the sections of the genera to which they belong. This was mostly due to the paucity of literature available for their identification and the lack of a cooperating expert to help with the identifications.

In spite of the fact that they have been poorly represented in all early Thai collections, *Marasmius* and *Mycena* are the most diverse genera of saprotrophic mushrooms known in the world, with over 1600 species described in *Marasmius* and over 1200 species described in *Mycena*. The greatest species diversity in these genera occurs in the tropics, although hundreds of taxa are found in temperate regions of both the southern and northern hemispheres. Nearly all species are saprotrophic, serving important ecological roles in litter decomposition, nutrient recycling and retention, soil genesis, litter binding with its concomitant inhibition of erosion, and as food sources for innumerable species of arthropods, mollusks and small vertebrates. A few species are parasitic on economically important food crops such as coffee, cocoa, sugar cane, and on horticultural plants. In addition, a few species form antibiotics such as strobilurin. Many species are host-specific or substrate-specific which accounts for some of the high diversity seen in tropical forests.

Many tropical regions of the world (such as Southeast Asia, China, west central Africa, most of Indonesia) which undoubtedly support a great diversity of *Marasmius*, *Mycena* and allied genera (i.e., marasmioid and mycenoid fungi) have had only limited mycological exploration. This is especially true in Thailand as the current collection data indicate. To help fill the void in our knowledge of these ecologically and potentially biomedically important fungi, the objective of this project is to document the biodiversity, ecology and distribution of the genera *Marasmius* and *Mycena* in Thailand.

6. Research Objectives

6.1. To study Marasmioid and Mycenoid Fungi in Thailand

- 6.1.1. To study their micromorphological, macromorphological characters and their physiology to aid in identification and classification
- 6.1.2. To study their ecology at the research sites

6.2. To isolate cultures for fermentation and screening at BIOTEC

6.3. To generate quality specimens for preservation in the Thailand Fungal Herbarium

6.4. To add to the developing database of Thai fungal diversity

6.5. To provide preliminary data for a future grant application to be made of the United State National Science Foundation (NSF)

7. Research Methodology

7.1. Study Areas

Eight sites will be studied twice over a two years period from June 2000 to July 2001. The sites are selected throughout Thailand to represent a diversity of forest types. The name and detail of each site is shown in Table 1.

Table 1. Collection sites of Marasmioid and Mycenoid Fungi in Thailand

	Collection sites	Approx. Elevation (m.)
1.	Doi Inthanon National Park and Queen Sirikit Botanical Garden; Chiang Mai	600-2,500
2.	Doi Phuka National Park; Nan	800-1,980
3.	Sakarat MBA reserve; Chachongsao	600-1,000
4.	Khao Yai National Park; Nakhon Nayok	600-1,400
5.	Khao Soi Dao Wildlife Sanctuary; Chanthaburi	600-2,000
6.	Kaeng Krachan National Park; Phetchaburi	250-900
7.	Khao Luang National Park; Nakhon Sri Thammarat	10-400
8.	Hala-Bala Wildlife Sanctualy; Sungai Kolok	400-1,500

7.2. Materials

Fresh specimens of marasmioid and mycenoid fungi were collected from the research sites indicated in Table 1. Dried specimens were deposited in the BIOTEC Bangkok Herbarium (BBH). Axenic cultures were isolated from each specimen collected and deposited in the culture collection at BIOTEC. The genera *Marasmius* and *Mycena*, which are the focus of the proposed project, are often indistinguishable in the field from a number of allied genera (viz., *Marasmiellus*, *Hemimycena*, *Crinipellis*, *Trogia*, and others). Their generic identity can be confirmed only after micromorphological analyses. Hence, although we propose to monograph only *Marasmius* and *Mycena* from Thailand, other products of the project will be numerous specimens and cultures of allied genera, i.e., materials for future research projects.

7.3. Methods

Two assistant researchers were the primary collectors for the project and each researcher focused on a separate fungal group. Mr. Poramate Ruksawong was responsible for the taxonomy of *Marasmius*, while Ms. Thitiya Boonpratuang was responsible for the taxonomy of *Mycena*. Because these genera are very difficult to distinguish from each other and from allied genera in the field, it is most efficient if both assistant researchers collect and isolate into culture all marasmioid and mycenoid fungi encountered in the field. The researchers focus on their specific genus once the specimens have been determined to genus back in the laboratory.

In the field, 3-10 fruiting bodies of each species encountered were collected. Notes on the macromorphological features of each specimen were made soon after collection. These included data on size, shape, color, odor, taste, surface ornamentation, substrate specificity, and habitat. After the notes had been made and the fruitbodies illustrated, hyphal tissues from each specimen were isolated into axenic culture and then the specimens were dried for preservation. Micromorphological analyses were conducted on dried material in the mycological laboratory at BIOTEC. All morphological data were compared with published accounts and with data from pertinent herbarium specimens (type collections, representative material, etc.) in an

attempt to identify the specimens. Dried specimens were stored in the BIOTEC Bangkok Herbarium (BBH) and living cultures were stored in the fungal culture collection at BIOTEC Culture Collection. Specimen and culture accession data were added to the developing fungal database at BIOTEC.

8. Out put

The fungal samples were collected from selected sites that represented the range of temperatures, types of forest and range of humidity found from the northern through to the southern part of Thailand. In total, 461 samples (Table 11) were collected from the various parts of Thailand for the first phase of this project. The successful percentage of classification and identification from all of samples was 93% while 7% remained unidentified. Altogether 100 genera (Table 5) and 51 species (Table 6) were found. The 461 samples could be classified into three big groups of fungi, which were Marasmioid (Table 7), Mycenoid (Table8), and other Macro Fungi (Table 9) by using distinguishing macroscopic and microscopic characters. The percentages for the three groups (Table 3) were about 25% for Marasmioid, 39% for Mycenoid and 35% for other Macro Fungi. With respect to cultures, 205 (Table 10) gave preliminary spore drops from the fresh samples, and these resulted in 126 pure cultures preserved at the BIOTEC Culture Collection while 79 cultures isolations are still in process. The percentages of cultures are about 28% for Marasmioid, 37% for Mycenoid and 35% other Macro Fungi.

Notes were taken from the fresh materials and they were photographed or illustrated without using microscope. Culture isolation was attempted as soon as possible after collecting from the sites. The remainder of the specimens were dried using food drier at the lowest temperature setting until thoroughly dried. All of herbarium specimens were preserved in plastic boxes to protect against breagage. Each Herbarium box was sealed, labeled and deposited into the BBH at Yothi-Research Unit. The total number of non-duplicate Macro Fungi in the BBH increased to 2,311 (as of September 4, 2001).

The Microscopic characteristics of all samples were described and illustrated using microscopes at the BIOTEC Mycology Laboratory where any required chemical tests were also carried out. Their macroscopic and microscopic descriptions were added in to the BIOTEC database.

Altogether, 205 pure cultures (Table 10) were obtained from 461 fresh specimens, which is a 44% success rate. These isolations were subcultured until purified and were duplicated into two groups. The first set of pure cultures (126 cultures) have been added to the permanent culture collection at BIOTEC for screening of bioactive compounds while the remaining 79 isolations were still in process at the time of report preparation. Duplicate cultures (205 cultures) have been preserved at the Mycology Laboratory at BIOTEC for observation and study of their morphology and physiology for phylogenic and taxonomic purposes. The percentages of these cultures are Marasmioid 28%, Mycenoid 37% and other macro fungi 35%.

9. Problems and Recommendations

There has been some difficulty working at some sites because of lack of collaboration between BIOTEC or BRT/TRF and the Forestry department. It would be useful if BRT/TRF could arrange for some sort of coordinator to act as a liaison between approved project staff and the Forestry Department in order to arrangie for collecting and working permission in the field around the country. This would facilitate more efficient project work.

10. Conclusions

The genera *Marasmius* and *Mycena* are mostly litter- and wood- decomposers. Many of them could not identified because of the lack of monographic treatments of Marasmioid and Mycenoid Agarics in Asia for comparison. There is only one work in Malesia from E.J.H. Corner, in 1994 (Agarics in Malesia) but the few numbers of species included does not match the wealth of specimens found in the field. Accordingly, the success rate of species identification was only 16% (74 samples) while 77% (357 samples) could be identified only to genus. Hence, the study will continue on these two genera and their allied genera to build a broader taxonomic foundation to support biodiversity studies and to provide screening cultures of saprotrophic Agarics from Thailand.

Table 2: Financial Reprt

Marasmioid and Mycenoid Fungi in Thailand (Phase I) (Grant BRT 144010)

From June1, 2000 to May 31, 2001 (12 months)

Description	Year
1 Salary of researcher assistance	
1.1 Ms. Thitiya Boonpratuang	156,000 .00
1.2 Mr. Poramate Ruksawong	96,000.00
2 Supplies (Chemical and Glassware)	
2.1 Consumable	12,537.61
2.2 Miscellaneous	14,708.90
3 Traveling expenses	
Surveying and Collecting Material in Country	51,989.95
4 Maintenance	
4.1 Equipment	9,787.00
5 Research data or information	
5.1 Books, journals, documentation, and etc	26,773.67
6 Report preparation	
6.1 Paper, copying, printing, etc	8,222.80
7 Sample Analysis	
7.1 Sample analysis and parcel service	1,198.40
Total Expenses	**377,218.33**

(Ms.Thitiya Boonpratuang)
Research Assistant
(June 1, 2001)

(Prof. T.W. Flegel)
Principle Investigator
(June 1, 2001)

Appendix

The Collection Conclusions

Table 3: Three Group of Fungi

	Specimen Numbers
Mycenoid Fungi	181
Marasmioid Fungi	116
Other Macro Fungi	164
Total Specimen	**461**

The Percentage of Three Group of Fungi

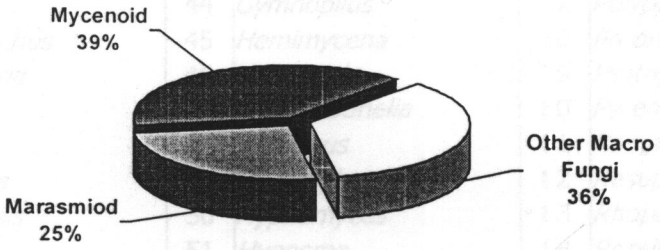


Table 4: Identification Status

	Specimen Numbers
Identified to spp.	74
Identified to Genera	357
Unidentified	30
Total Specimen	**461**

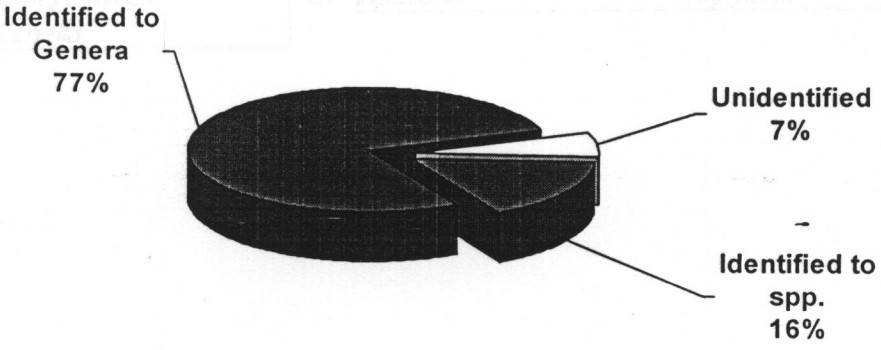


Table 5: Genus List

	Genus		Genus		Genus
1	*Agaricus*	35	*Eutypa*	68	*Neocordyceps*
2	*Agrocybe*	36	*Exidia*	69	*Omphalina*
3	*Amanita*	37	*Favolaschia*	70	*Orbilia*
4	*Auricularia*	38	*Filoboletus*	71	*Oudemansiella*
5	*Biscogniauxia*	39	*Flavodon*	72	*Panellus*
6	*Calyptella*	40	*Ganoderma*	73	*Peziza*
7	*Camarophyllus*	41	*Geupiniopsis*	74	*Phillipsia*
8	*Campanella*	42	*Gloiocephala*	75	*Philosibe*
9	*Cantharellus*	43	*Gomphus*	76	*Pleurotus*
10	*Cerrena*	44	*Gymnopilus*	77	*Polyporus*
11	*Chaetocalathus*	45	*Hemimycena*	78	*Poromycena*
12	*Chlorociboria*	46	*Hexagonia*	79	*Psathyrella*
13	*Cladopus*	47	*Hohenbouhelia*	80	*Pyrenomycetes*
14	*Clavaria*	48	*Hydropus*	81	*Ramaria*
15	*Clavicorona*	49	*Hygrocybe*	82	*Resupinatus*
16	*Clavulinopsis*	50	*Hyphomyces*	83	*Rhopalostoma*
17	*Clitocybe*	51	*Hypocrea*	84	*Rossilinia*
18	*Collybia*	52	*Hypoxylon*	85	*Russula*
19	*Coltricia*	53	*Incrustocalyptella*	86	*Scleroderma*
20	*Coprinus*	54	*Irpex*	87	*Scutellinia*
21	*Crepidotus*	55	*Laccaria*	88	*Sirobasidium*
22	*Crinipellis*	56	*Lecanocybe*	89	*Steccherícium*
23	*Cyclomyces*	57	*Lentinus*	90	*Stereum*
24	*Cymatoderma*	58	*Lenzites*	91	*Steriopsis*
25	*Cyphella*	59	*Leotia*	92	*Stictis*
26	*Dacryopinax*	60	*Lepiota*	93	*Termitomyces*
27	*Daedalia*	61	*Lycoperdon*	94	*Tetrapyrgos*
28	*Daldinia*	62	*Marasmiellus*	95	*Thelephora*
29	*Datronia*	63	*Marasmius*	96	*Tremella*
30	*Decrymyces*	64	*Melanotus*	97	*Trichaptum*
31	*Decryopinax*	65	*Microporus*	98	*Trogia*
32	*Dictyopanus*	66	*Mycena*	99	*Typhura*
33	*Dracyomyces*	67	*Naucoria*	100	*Xylaria*
34	*Eariella*				

Table 6: Species List

	Species		Species
1	*Calyptella cf.cappula*	27	*Marasmiellus paspali*
2	*Campanella junghuhnia*	28	*Marasmius brunneolus*
3	*Clavaria filiola*	29	*Marasmius caliensis*
4	*Crepidotus sulfurinus*	30	*Marasmius cf. aurantiobasalis*
5	*Cyclomyces fuscus*	31	*Marasmius cf. conicopapilata*
6	*Cyphella cupula*	32	*Marasmius conicopapilata*
7	*Daldinia concentrica*	33	*Marasmius maniripiensis*
8	*Decrymyces palmatus*	34	*Marasmius pellucidus*
9	*Decryopinax martinii*	35	*Marasmius purpureisetosus*
10	*Eutypa bambusina*	36	*Marasmius purpureosetulosus*
11	*Favolaschia thwaitsii*	37	*Marasmius tageticolor*
12	*Favolaschia tonkinensis*	38	*Mycena cf ariel*
13	*Favolashia pustulosa*	39	*Mycena cf brevisetosa**prob sp nov**
14	*Filoboletus manipularis*	40	*Mycena cf brunneiratifera*
15	*Flavodon flavus*	41	*Mycena cf sotae*
16	*Geupiniopsis buceina*	42	*Mycena chlarophose*
17	*Gloiocephala epiphylum*	43	*Naucoria christinae*
18	*Gloiocephala sp nov*	44	*Peziza cf domiciliana*
19	*Hypocrea pesisoides*	45	*Philosibe cubeensis*
20	*Incrustocalyptella orientalis*	46	*Polyporous sulphrinus*
21	*Laccaria laccata*	47	*Polyporus tricholoma*
22	*Lentinus brunneofloccosus*	48	*Poromycena cf decipiens*
23	*Lentinus connatus*	49	*Pyrenomycetes*
24	*Lentinus subnudus*	50	*Tremella fusiformis*
25	*Lepiota felina*	51	*Xylaria fokerii*
26	*Marasmiellus candidus*		

Table 7: Marasmiod Fungi (*Marasmius* and Allied Genera)

Marasmioid
Chaetocalathus sp
Crepidotus sp
Crepidotus sulfurinus
Crinipellis sp
Gloiocephala epiphylum
Gloiocephala sp nov
Hohenbouhelia sp
Incrustocalyptella orientalis
Marasmius brunneolus
Marasmius caliensis
Marasmius cf. aurantiobasalis
Marasmius cf. conicopapilata
Marasmius conicopapilata
Marasmius maniripiensis
Marasmius pellucidus
Marasmius purpureisetosus
Marasmius purpureosetulosus
Marasmius sp
Marasmius tageticolor
Oudemansiella sp
Tetrapyrgos sp
Trogia sp

Marasmius
Marasmius brunneolus
Marasmius caliensis
Marasmius cf. aurantiobasalis
Marasmius cf. conicopapilata
Marasmius conicopapilata
Marasmius maniripiensis
Marasmius pellucidus
Marasmius purpureisetosus
Marasmius purpureosetulosus
Marasmius sp
Marasmius tageticolor

Allied Genera
Chaetocalathus sp
Crepidotus sp
Crepidotus sulfurinus
Crinipellis sp
Gloiocephala epiphylum
Gloiocephala sp nov
Hohenbouhelia sp
Incrustocalyptella orientalis
Oudemansiella sp
Tetrapyrgos sp
Trogia sp

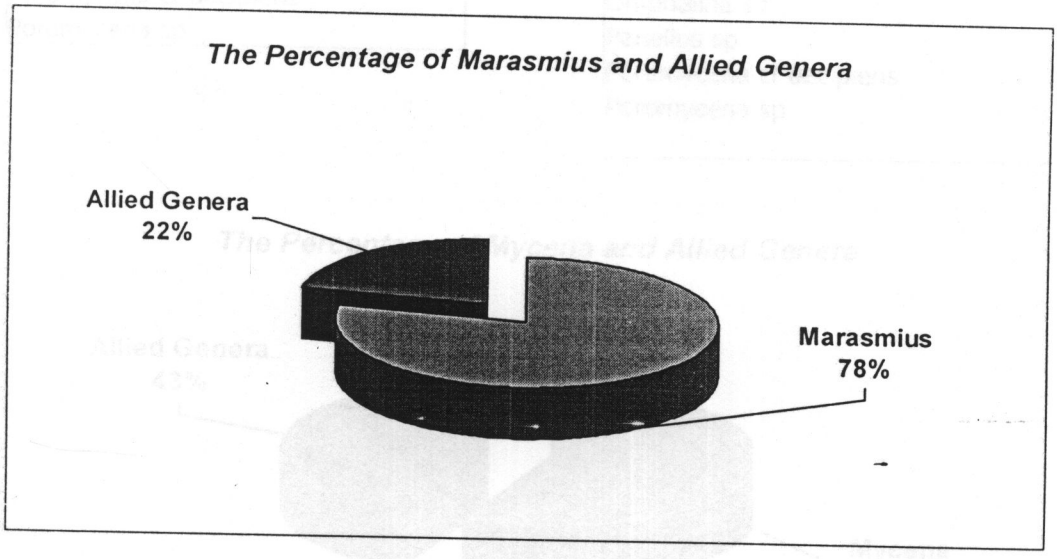


Table 8: Myceniod Fungi (*Mycena* and Allied Genera)

Mycenoid Fungi
Calyptella cf.cappula
Campanella junghuhnia
Campanella sp
Cyphella cupula
Cyphella sp
Favolaschia sp
Favolaschia thwaitsii
Favolaschia tonkinensis
Favolashia pustulosa
Filoboletus manipularis
Hemimycena sp
Hydropus sp
Hygrocybe sp
Lecanocybe sp
Marasmiellus candidus
Marasmiellus paspali
Marasmiellus sp
Mycena cf ariel
Mycena cf brevisetosa**prob sp nov*
Mycena cf brunneiratifera
Mycena cf sotae
Mycena chlarophose
Mycena sp
Omphalina sp
Panellus sp
Poromycena cf decipiens
Poromycena sp

Mycena
Mycena cf ariel
Mycena cf brevisetosa**prob sp nov*
Mycena cf brunneiratifera
Mycena cf sotae
Mycena chlarophose
Mycena sp

Allied Genera
Calyptella cf.cappula
Campanella junghuhnia
Campanella sp
Cyphella cupula
Cyphella sp
Favolaschia sp
Favolaschia thwaitsii
Favolaschia tonkinensis
Favolashia pustulosa
Filoboletus manipularis
Hemimycena sp
Hydropus sp
Hygrocybe sp
Lecanocybe sp
Marasmiellus candidus
Marasmiellus paspali
Marasmiellus sp
Omphalina sp
Panellus sp
Poromycena cf decipiens
Poromycena sp

The Percentage of Mycena and Allied Genera

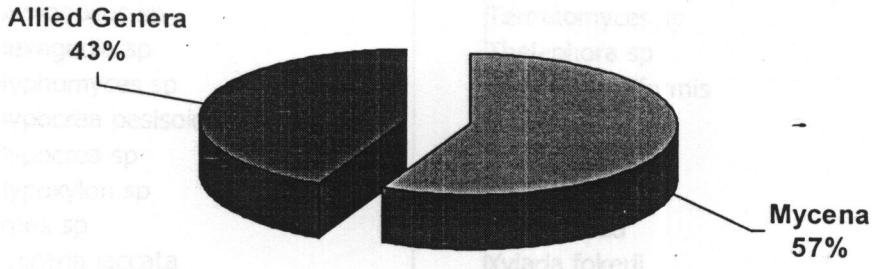


Table 9: Other Macro Fungi List

Scientific Name
Agaricus sp
Agrocybe sp
Amanita sp
Auricularia sp
Biscogniauxia sp
Camarophyllus sp
Cantharellus sp
Cerrena sp
Chlorociboria sp
Cladopus sp
Clavaria filiola
Clavaria sp
Clavicorona sp
Clavulinopsis sp
Clitocybe sp
Collybia sp
Coltricia sp
Coprinus sp
Cyclomyces fuscus
Cymatoderma sp
Dacryopinax sp
Daedalia sp
Daldinia concentrica
Datronia sp
Decrymyces palmatus
Decryopinax martinii
Dictyopannus sp
Dictyopanus sp
Discomycetes
Dracyomyces sp
Eariella sp
Eutypa bambusina
Exidia sp
Flavodon flavus
Ganoderma sp
Geupiniopsis buceina
Geupiniopsis sp
Gomphus sp
Gymnopilus sp
Hexagonia sp
Hyphomyces sp
Hypocrea pesisoides
Hypocrea sp
Hypoxylon sp
Irpex sp
Laccaria laccata
Laccaria sp
Lentinus brunneofloccosus

Scientific Name
Lentinus connatus
Lentinus sp
Lentinus subnudus
Lenzites sp
Leotia sp
Lepiota felina
Lepiota sp
Lycoperdon sp
Melanotus sp
Microporus sp
Naucoria christinae
Neocordyceps sp
Obelia sp
Orbilia sp
Peziza cf domiciliana
Peziza sp
Phellinus sp
Phillipsia sp
Philosibe cubeensis
Pleurotus sp
Polyporous sulphrinus
Polyporus tricholoma
Psathyrella sp
Pyrenomycetes
Ramaria sp
Resupinatus sp
Rhopalostoma sp
Rhopalostroma sp
Rossilinia sp
Russula sp
Scleroderma sp
Scutellinia sp
Sirobasidium sp
Soothing mold
Steccherícium sp
Stereum spectabile
Steriopsis sp
Stictis sp
Termitomyces sp
Thelephora sp
Tremella fusiformis
Tremella sp
Trichaptum sp
Typhura sp
Unidentified
Xylaria fokerii
Xylaria sp

Table 10: Cultures

Mycenoid	Cultures
Campanella	6
Cyphila	3
Favolaschia	6
Filoboletus	3
Hemimycena	1
Hygrocybe	2
Marasmiellus	11
Mycena	44
Total	76

Marasmioid	Cultures
Chaetocalathus	2
Cripidotus	1
Gloiocephala	3
Hohenbuehelia	1
Marasmius	49
Oudemansiella	1
Total	57

	Cultures
Mycenoid	76
Marasmioid	57
Other	72
Total Cultures	205

Other Macro Fungi	Cultures
Basidiobolus	1
Bionectria	1
Chaetotyphula	1
Chlorociboria	1
Clavicorona	2
Cymatoderma	2
Dacrymyces	1
Dacryopinax	4
Dictyopanus	3
Hexagonia	1
Holtermannia	1
Lentinus	2
Macrolepiota	1
Melanotus	1
Microporus	5
Odontia	1
Peziza	2
Phillipsia	1
Pholiota	1
Plulotus	6
Polyporus	1
Ramaria	1
Resupinatus	2
Steccherícium	1
Stereum	1
Tremella	1
Typhula	1
Unidentified	26
Total	72

The Percentage of Culture

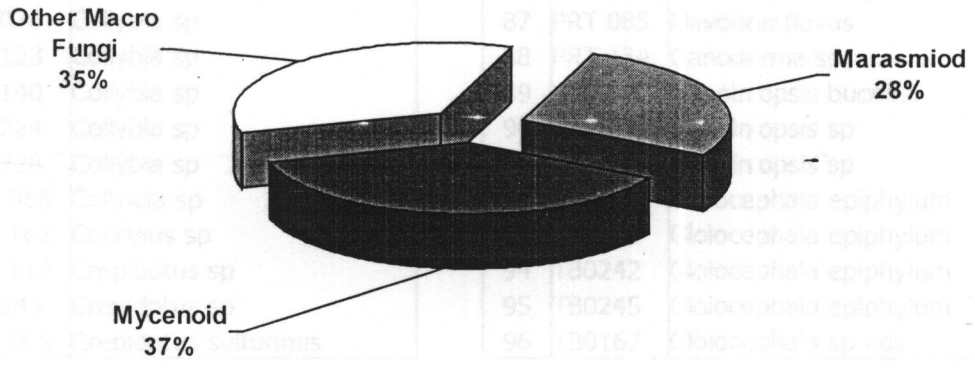


Table 11: Specimen list

BBH	Number	Scientific Name
1	PRT 115	Agaricus sp
2	TB0042	Agaricus sp
3	TB0052	Agaricus sp
4	TB0122	Agaricus sp
5	TB0137	Agaricus sp
6	TB0229	Agaricus sp
7	TB0065	Agrocybe sp
8	PRT 068	Amanita sp
9	PRT 148	Amanita sp
10	PRT 160	Amanita sp
11	TB0067	Auricularia sp
12	PRT 090	Biscogniauxia sp
13	TB0113	Calyptella cf.cappula
14	PRT 077	Camarophyllus sp
15	PRT 049	Campanella junghuhnia
16	TB0039	Campanella sp
17	TB0078	Campanella sp
18	TB0147	Campanella sp
19	TB0210	Campanella sp
20	TB0213	Campanella sp
21	PRT 098	Cantharellus sp
22	PRT 111	Cantharellus sp
23	TB0064	Cerrena sp
24	TB0041	Chaetocalathus sp
25	TB0032	Chlorociboria sp
26	TB0077	Cladopus sp
27	PRT 112	Clavaria filiola
28	PRT 150	Clavaria sp
29	PRT 045	Clavicorona sp
30	TB0023	Clavicorona sp
31	PRT 053	Clavulinopsis sp
32	TB0029	Clavulinopsis sp
33	PRT 074	Clitocybe sp
34	TB0116	Clitocybe sp
35	PRT 008	Collybia sp
36	PRT 107	Collybia sp
37	PRT 142	Collybia sp
38	TB0062	Collybia sp
39	TB0070	Collybia sp
40	TB0123	Collybia sp
41	TB0140	Collybia sp
42	TB0224	Collybia sp
43	TB0228	Collybia sp
44	PRT 088	Coltricia sp
45	PRT 162	Coprinus sp
46	PRT 118	Crepidotus sp
47	TB0243	Crepidotus sp
48	PRT 065	Crepidotus sulfurinus

BBH	Number	Scientific Name
49	PRT 036	Crinipellis sp
50	TB0057	Crinipellis sp
51	PRT 063	Cyclomyces fuscus
52	PRT 046	Cymatoderma sp
53	PRT 047	Cyphella cupula
54	TB0273	Cyphella sp
55	TB0274	Cyphella sp
56	TB0054	Dacryopinax sp
57	PRT 133	Daedalia sp
58	PRT 091	Daldinia concentrica
59	TB0187	Datronia sp
60	PRT 057	Decrymyces palmatus
61	PRT 113	Decryopinax martinii
62	TB0241	Dictyopannus sp
63	PRT 154	Dictyopanus sp
64	TB0053	Discomycetes
65	TB0283	Dracyomyces sp
66	PRT 128	Eariella sp
67	PRT 093	Eutypa bambusina
68	TB0019	Exidia sp
69	PRT 019	Favolaschia sp
70	PRT 048	Favolaschia sp
71	PRT 080	Favolaschia sp
72	PRT 082	Favolaschia sp
73	PRT 108	Favolaschia sp
74	TB0076	Favolaschia sp
75	TB0087	Favolaschia sp
76	TB0114	Favolaschia sp
77	TB0286	Favolaschia sp
78	TB0037	Favolaschia thwaitsii
79	TB0142	Favolaschia thwaitsii
80	TB0255	Favolaschia thwaitsii
81	TB0259	Favolaschia tonkinensis
82	PRT 095	Favolashia pustulosa
83	PRT 129	Filoboletus manipularis
84	TB0082	Filoboletus manipularis
85	TB0134	Filoboletus manipularis
86	TB0239	Filoboletus manipularis
87	PRT 085	Flavodon flavus
88	PRT 134	Ganoderma sp
89	TB0028	Geupiniopsis buceina
90	PRT 059	Geupiniopsis sp
91	TB0079	Geupiniopsis sp
92	TB0046	Gloiocephala epiphylum
93	TB0240	Gloiocephala epiphylum
94	TB0242	Gloiocephala epiphylum
95	TB0245	Gloiocephala epiphylum
96	TB0167	Gloiocephala sp nov

Table 11: Specimen list (cont.)

BBH	Number	Scientific Name
97	PRT 102	Gomphus sp
98	PRT 071	Gymnopilus sp
99	PRT 101	Gymnopilus sp
100	TB0095	Hemimycena sp
102	TB0104	Hemimycena sp
103	TB0124	Hemimycena sp
104	TB0128	Hemimycena sp
105	TB0151	Hemimycena sp
106	TB0257	Hemimycena sp
107	PRT 127	Hexagonia sp
108	PRT 023	Hohenbouhelia sp
109	PRT 110	Hydropus sp
110	TB0110	Hydropus sp
111	PRT 009	Hydropus sp
112	TB0216	Hygrocybe sp
113	PRT 078	Hyphomyces sp
114	PRT 078	Hypocrea pesisoides
115	PRT 077	Hypocrea sp
116	PRT 151	Hypocrea sp
117	PRT 084	Hypoxylon sp
118	PRT 029	Incrustocalyptella orientalis
119	TB0047	Incrustocalyptella orientalis
120	TB0089	Irpex sp
121	PRT 146	Laccaria laccata
122	TB0063	Laccaria sp
123	TB0211	Lecanocybe sp
124	TB0034	Lentinus brunneofloccosus
125	TB0040	Lentinus brunneofloccosus
126	PRT 055	Lentinus connatus
127	TB0035	Lentinus sp
128	TB0069	Lentinus sp
129	PRT 097	Lentinus subnudus
130	PRT 086	Lenzites sp
131	PRT 147	Leotia sp
132	PRT 163	Lepiota felina
133	TB0068	Lepiota sp
134	PRT 072	Lycoperdon sp
135	PRT 152	Marasmiellus candidus
136	TB0012	Marasmiellus paspali
137	PRT 002	Marasmiellus sp
138	PRT 004	Marasmiellus sp
139	PRT 005	Marasmiellus sp
140	PRT 013	Marasmiellus sp
141	PRT 014	Marasmiellus sp
142	PRT 018	Marasmiellus sp
143	PRT 028	Marasmiellus sp
144	PRT 044	Marasmiellus sp

BBH	Number	Scientific Name
145	PRT 062	Marasmiellus sp
146	PRT 096	Marasmiellus sp.
147	TB0015	Marasmiellus sp
148	TB0075	Marasmiellus sp
149	TB0133	Marasmiellus sp
150	TB0135	Marasmiellus sp
151	TB0136	Marasmiellus sp
152	TB0143	Marasmiellus sp
153	TB0148	Marasmiellus sp
154	TB0162	Marasmiellus sp
155	TB0163	Marasmiellus sp
156	TB0165	Marasmiellus sp
157	TB0207	Marasmiellus sp
158	TB0208	Marasmiellus sp
159	TB0214	Marasmiellus sp
160	TB0230	Marasmiellus sp
161	TB0249	Marasmiellus sp
162	TB0252	Marasmiellus sp
163	TB0275	Marasmiellus sp
164	TB0276	Marasmiellus sp
165	TB0013	Marasmius brunneolus
166	PRT 024	Marasmius caliensis
167	TB0003	Marasmius cf. aurantiobasalis
168	TB0071	Marasmius cf. aurantiobasalis
169	TB0226	Marasmius cf. aurantiobasalis
170	TB0004	Marasmius cf. conicopapilata
171	TB0218	Marasmius conicopapilata
172	TB0045	Marasmius maniripiensis
173	PRT 105	Marasmius pellucidus
174	PRT 020	Marasmius purpureisetosus
175	PRT 033	Marasmius purpureosetulosus
176	PRT 031	Marasmius sp
177	PRT 039	Marasmius sp
178	PRT 006	Marasmius sp
179	PRT 011	Marasmius sp
180	PRT 032	Marasmius sp
181	PRT 016	Marasmius sp
182	PRT 027	Marasmius sp
183	PRT 030	Marasmius sp
184	PRT 035	Marasmius sp
185	PRT 003	Marasmius sp
186	PRT 043	Marasmius sp
187	PRT 040	Marasmius sp
188	PRT 026	Marasmius sp
189	PRT 025	Marasmius sp
190	PRT 001	Marasmius sp
191	PRT 034	Marasmius sp

Table 11: Specimen list (cont.)

BBH	Number	Scientific Name
192	PRT 038	Marasmius sp
193	PRT 041	Marasmius sp
194	PRT 042	Marasmius sp
195	PRT 104	Marasmius sp
196	PRT 012	Marasmius sp
197	PRT 021	Marasmius sp
198	PRT 022	Marasmius sp
199	PRT 037	Marasmius sp
200	PRT 106	Marasmius sp
201	PRT 117	Marasmius sp
202	PRT 119	Marasmius sp
203	PRT 120	Marasmius sp
204	PRT 121	Marasmius sp
205	PRT 122	Marasmius sp
206	PRT 123	Marasmius sp
207	PRT 131	Marasmius sp
208	PRT 135	Marasmius sp
209	PRT 136	Marasmius sp
210	PRT 137	Marasmius sp
211	PRT 138	Marasmius sp
212	PRT 139	Marasmius sp
213	PRT 140	Marasmius sp
214	PRT 141	Marasmius sp
215	PRT 142	Marasmius sp
216	PRT 144	Marasmius sp
217	PRT 145	Marasmius sp
218	PRT 149	Marasmius sp
219	PRT 156	Marasmius sp
220	PRT 161	Marasmius sp
221	TB0038	Marasmius sp
222	TB0044	Marasmius sp
223	TB0048	Marasmius sp
224	TB0049	Marasmius sp
225	TB0050	Marasmius sp
226	TB0055	Marasmius sp
227	TB0056	Marasmius sp
228	TB0058	Marasmius sp
229	TB0059	Marasmius sp
230	TB0060	Marasmius sp
231	TB0061	Marasmius sp
232	TB0073	Marasmius sp
233	TB0083	Marasmius sp
234	TB0084	Marasmius sp
235	TB0111	Marasmius sp
236	TB0164	Marasmius sp
237	TB0166	Marasmius sp
238	TB0178	Marasmius sp
239	TB0212	Marasmius sp

BBH	Number	Scientific Name
241	TB0222	Marasmius sp
242	TB0223	Marasmius sp
243	TB0244	Marasmius sp
244	TB0001	Marasmius sp
245	TB0002	Marasmius sp
246	TB0007	Marasmius sp
247	TB0005	Marasmius sp
248	TB0006	Marasmius sp
249	TB0009	Marasmius sp
250	TB0008	Marasmius sp
251	TB0010	Marasmius sp
252	TB0014	Marasmius sp
253	TB0033	Marasmius sp
254	TB0036	Marasmius sp
255	PRT 015	Marasmius tageticolor
256	PRT 100	Melanotus sp
257	PRT 114	Melanotus sp
258	TB0186	Microporus sp
259	TB0190	Microporus sp
260	TB0198	Microporus sp
261	TB0236	Mycena cf ariel
262	TB0254	Mycena cf brevisetosa
263	TB0088	Mycena cf brunneiratifera
264	TB0093	Mycena cf brunneiratifera
265	TB0099	Mycena cf brunneiratifera
266	TB0100	Mycena cf brunneiratifera
267	TB0159	Mycena cf brunneiratifera
268	TB0180	Mycena cf brunneiratifera
269	TB0225	Mycena cf brunneiratifera
270	TB0233	Mycena cf brunneiratifera
271	TB0247	Mycena cf brunneiratifera
272	TB0262	Mycena cf brunneiratifera
273	TB0261	Mycena cf sotae
274	TB0018	Mycena chlarophose
275	PRT 109	Mycena sp
276	PRT 124	Mycena sp
277	PRT 132	Mycena sp
278	TB0132	Mycena sp
279	TB0138	Mycena sp
280	TB0139	Mycena sp
281	TB0144	Mycena sp
282	TB0145	Mycena sp
283	TB0146	Mycena sp
284	TB0149	Mycena sp
285	TB0150	Mycena sp
286	TB0152	Mycena sp
287	TB0153	Mycena sp
288	TB0154	Mycena sp

Table 11: Specimen list (cont.)

BBH	Number	Scientific Name
290	TB0156	Mycena sp
291	TB0158	Mycena sp
292	TB0160	Mycena sp
293	TB0161	Mycena sp
294	TB0168	Mycena sp
295	TB0169	Mycena sp
296	TB0171	Mycena sp
297	TB0172	Mycena sp
298	TB0173	Mycena sp
299	TB0174	Mycena sp
300	TB0175	Mycena sp
301	TB0176	Mycena sp
302	TB0179	Mycena sp
303	TB0181	Mycena sp
304	TB0201	Mycena sp
305	TB0204	Mycena sp
306	TB0206	Mycena sp
307	TB0215	Mycena sp
308	TB0219	Mycena sp
309	TB0221	Mycena sp
310	TB0227	Mycena sp
311	TB0231	Mycena sp
312	TB0234	Mycena sp
313	TB0235	Mycena sp
314	TB0246	Mycena sp
315	TB0248	Mycena sp
316	TB0250	Mycena sp
317	TB0256	Mycena sp
318	TB0258	Mycena sp
319	TB0263	Mycena sp
320	TB0264	Mycena sp
321	TB0265	Mycena sp
322	TB0267	Mycena sp
323	TB0268	Mycena sp
324	TB0270	Mycena sp
325	TB0271	Mycena sp
326	TB0272	Mycena sp
327	TB0277	Mycena sp
328	TB0281	Mycena sp
329	TB0287	Mycena sp
330	TB0011	Mycena sp
331	TB0017	Mycena sp
332	TB0043	Mycena sp
333	TB0051	Mycena sp
334	TB0072	Mycena sp
335	TB0080	Mycena sp
336	TB0085	Mycena sp
337	TB0090	Mycena sp
338	TB0092	Mycena sp
339	TB0118	Mycena sp
340	TB0120	Mycena sp
341	TB0094	Mycena sp
342	TB0108	Mycena sp
343	TB0170	Mycena sp
344	TB0096	Mycena sp
345	TB0097	Mycena sp
346	TB0098	Mycena sp
347	TB0109	Mycena sp
348	TB0101	Mycena sp
349	TB0115	Mycena sp
350	TB0102	Mycena sp
351	TB0119	Mycena sp
352	TB0105	Mycena sp
353	TB0117	Mycena sp
354	TB0121	Mycena sp
355	TB0125	Mycena sp
356	TB0126	Mycena sp
357	TB0260	Mycena sp
358	TB0282	Mycena sp
359	TB0127	Mycena sp
360	TB0129	Mycena sp
361	TB0130	Mycena sp
362	TB0131	Mycena sp
363	TB0269	Mycena sp
364	PRT 155	Naucoria christinae
365	PRT 070	Neocordyceps sp
366	PRT 061	Obelia sp
367	PRT 073	Omphalina sp
368	TB0157	Omphalina sp
369	TB0220	Omphalina sp
370	TB0253	Omphalina sp
371	PRT 116	Orbilia sp
372	TB0021	Oudemansiella sp
373	TB0066	Oudemansiella sp
374	TB0081	Oudemansiella sp
375	TB0203	Oudemansiella sp
376	PRT 007	Oudermansiella sp
377	PRT 079	Panellus sp
378	TB0182	Peziza cf domiciliana
379	TB0030	Peziza sp
380	PRT 066	Phellinus sp
381	PRT 089	Phillipsia sp
382	TB0288	Philosibe cubeensis
383	TB0278	Pleurotus sp
384	TB0279	Pleurotus sp
385	TB0280	Pleurotus sp

Table 11: Specimen list (cont.)

BBH	Number	Scientific Name
386	TB0284	Pleurotus sp
387	TB0285	Pleurotus sp
388	PRT 159	Polyporous sulphrinus
389	PRT 058	Polyporus tricholoma
390	TB0107	Poromycena cf decipiens
391	TB0112	Poromycena cf decipiens
392	PRT 017	Poromycena sp
393	PRT 126	Psathyrella sp
394	PRT 158	Psathyrella sp
395	PRT 069	Pyrenomycetes
396	PRT 130	Ramaria sp
397	TB0251	Ramaria sp
398	TB0074	Resupinatus sp
399	TB0209	Resupinatus sp
400	PRT 052	Rhopalostoma sp
401	PRT 125	Rhopalostroma sp
402	PRT 087	Rossilinia sp
403	PRT 094	Russula sp
404	PRT 153	Russula sp
405	PRT 103	Scleroderma sp
406	PRT 064	Scutellinia sp
407	TB0020	Sirobasidium sp
408	PRT 083	Soothing mold
409	PRT 056	Steccherícium sp
410	PRT 050	Stereum spectabile
411	TB0200	Steriopsis sp
412	PRT 099	Stictis sp
413	PRT 081	Termitomyces sp
414	TB0026	Termitomyces sp
415	PRT 076	Tetrapyrgos sp
416	TB0091	Tetrapyrgos sp
417	TB0106	Tetrapyrgos sp
418	PRT 054	Thelephora sp
419	TB0025	Thelephora sp
420	TB0027	Thelephora sp
421	PRT 060	Tremella fusiformis
422	PRT 143	Tremella fusiformis
423	TB0016	Tremella sp

BBH	Number	Scientific Name
424	TB0086	Trichaptum sp
425	PRT 010	Trogia sp
426	PRT 075	Trogia sp
427	TB0024	Trogia sp
428	TB0022	Typhura sp
429	PRT 067	Unidentified
430	TB0031	Unidentified
431	TB0141	Unidentified
432	TB0177	Unidentified
433	TB0183	Unidentified
434	TB0184	Unidentified
435	TB0185	Unidentified
436	TB0188	Unidentified
437	TB0189	Unidentified
438	TB0191	Unidentified
439	TB0192	Unidentified
440	TB0193	Unidentified
441	TB0194	Unidentified
442	TB0195	Unidentified
443	TB0196	Unidentified
444	TB0197	Unidentified
445	TB0199	Unidentified
446	TB0202	Unidentified
447	TB0205	Unidentified
448	TB0232	Unidentified
449	TB0237	Unidentified
450	TB0238	Unidentified
451	TB0266	Unidentified
452	TB0289	Unidentified
453	TB0290	Unidentified
454	TB0291	Unidentified
455	TB0292	Unidentified
456	TB0293	Unidentified
457	TB0294	Unidentified
458	TB0295	Unidentified
459	PRT 157	Xylaria fokerii
460	PRT 051	Xylaria sp
461	PRT 092	Xylaria sp

Example of Specimens

Known Genus and known species

Picture 1: *Marasmiellus paspali*

Specimen Number: TB0012

Macroscopic Features:

Pileus: Cream color (yellow-orange forrow color) non marginate color 2.0-4.0 mm diam, plano-convex, reniform, centre depressed, undate marginate, forrow from center to marginate but not completed forrow

Lamellae: 6 gills, distant gills with 4 series, furcate, adnate gill, lamellae edge even or entire, same color as pileus

Stipe: eccentric, tapperin downwards, range color from whitish to raddish brown at the stem base, solid surface, non-insititious

Substrate: bamboo

Habitat: Bamboo Forest

Picture 2: *Marasmius aurantiobasalis*

Specimen Number: TB0003, 71, 226

Macroscopic Features:

Pileus: cream color (dark brown at the center) 3.0-7.0 diam, plano-convex to applanate, subumbilicate deflexed, crenulate marginate

Lamellae: 12-18 gills, subdistant gill with one series, no collarium, adnexed, furcate, even or entire lamellae edge, light brown to cream color at lamellae

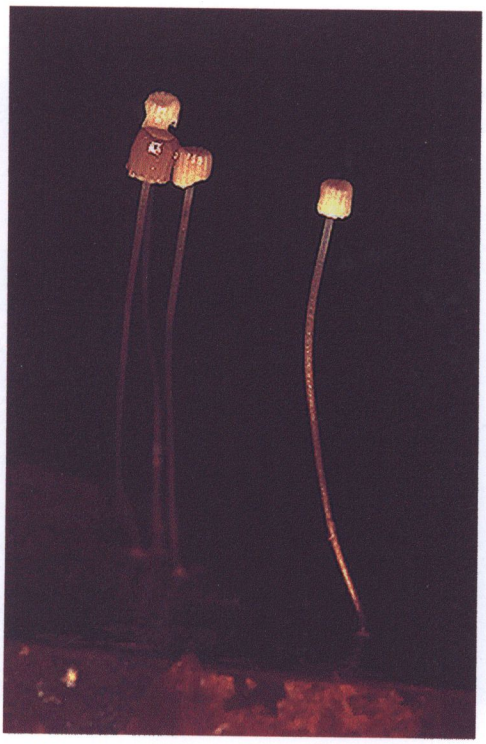
Stipe: 10.0-15.0 mm height x 0.1 mm diam. Range color from light yellow (gold color) at apex to orange color at the stem base, central, cylindrical, filiform, dry surface, insititious, golden rhizomorph

Substrate: leave litter

Habitat: tropical Forest, Khao Yai National Park

Picture 3: *Mycena brunneiratifera* Corner

Specimen Number: TB0088, 93, 99, 100,159, 180, 225, 233, 247



Macroscopic Features:

Pileus: color range from cream color at margin to black color at the top of pileus or cream color for whole pileus

2.0-5.0 mm width x 2.0-5.0 mm hight campanulate, umbilicate with or without papilla at the umbo, furrow from the top of pileus to margin, striate marginate

Lamellae: deeply decurent gill, distant gill without series, 6-12 gills, well developing gill

Stipe: 0.2-0.5 mm width x 5.0-70.0 mm height, central, cylindrical, color range from cream color to dark brown or black color, shiny surface, mycelium at base

Substrate: on leaves

Habitat: tropical forest, all around country

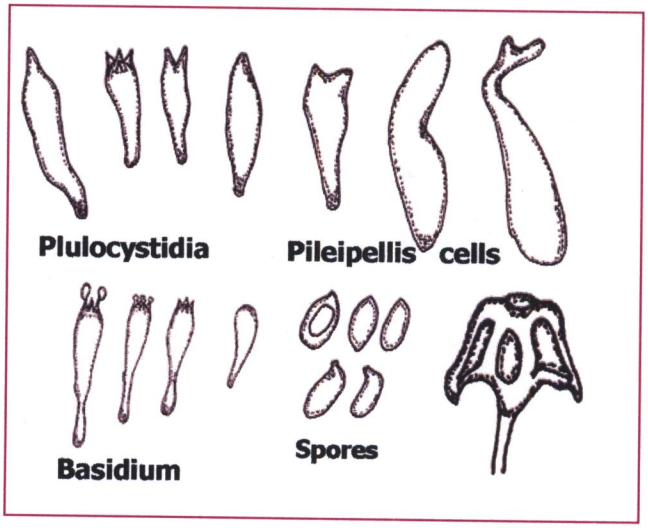
Microscopic Features:

Spore: 6.5-7.5 x 4.0-5.0 μm, white, smooth, pipe shape

Cheilocystidia absent, 4 basidia-sterigma,

Chemical Testing:

Dextrinoid tissue trama and amyloid spore with Melzer's Reagent.



(Using Drawing tube with microscope)

Known Genus but unknown species

Picture 4: *Mycena* near *brevisetosa*

Specimen Number: TB0254

Macroscopic Features:

Pileus: cream color or white color, 0.5-10 mm width, conical to hemispherical, eroded marginate, pure white, granulose with small hairs

Lamellae: decurent gill, distant gill without series, 3-4 gills, eroded lamella-edge,

Stipe: 0.5-1.0 mm height, same color with pileus, central, cylindrical, mycelium at the stem-base

Substrate: on leaves of Licuala sp.

Habitat: tropical forest, Khao Yai National Park.

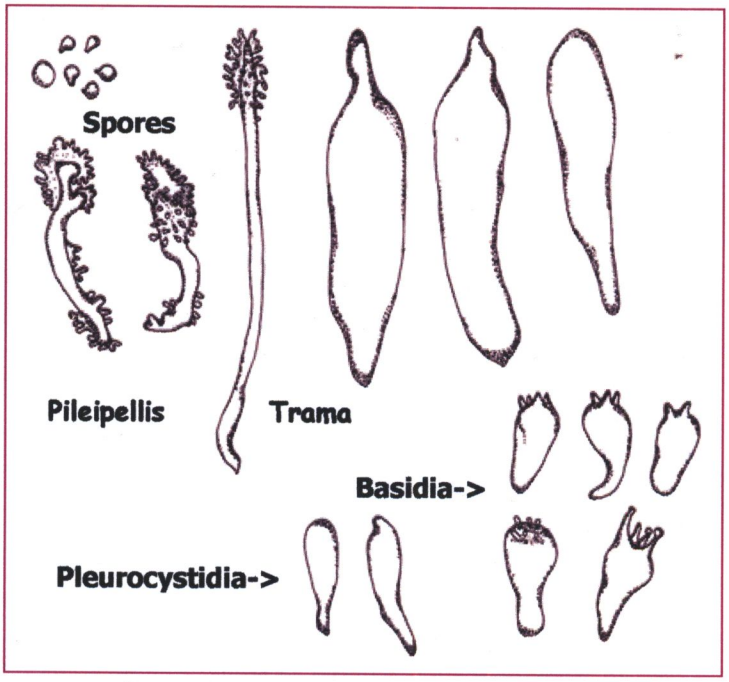
Microscopic Features:

Spore: 7-10 x 4.5-5.5 μm, white, smooth, ellipsoid, thin-walled, aguttate

Basidia: 18-25 x 8-10 μm., 2-4 sterigmata, Cheilocystidia absent, Pluelocystidia absent,

Chemical Testing:

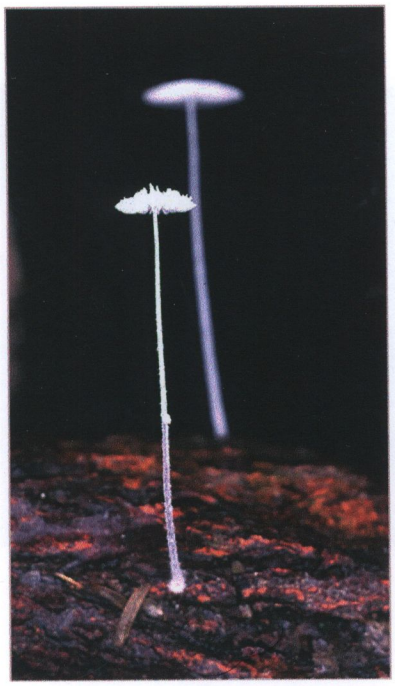
Dextrinoid tissue and amyloid spore with Melzer's Reagent.



(Using Drawing tube with microscope)

Picture 5: *Mycena* near *sotae*

Specimen Number: TB0261



Macroscopic Features:

Pileus: 1.0-1.5 mm diam, plano-convex to convex, translucent, short setae all over the pileus, lamella eroded

Lamellae:

Stipe: same color as pileus, setae all over stem, disc at the stem base,

Substrate: leaves litter

Habitat: tropical Forest

Picture 6: *Mycena* sp.

Specimen Number: TB0158, 231

Macroscopic Features:

Pileus: 3.0-15.0 mm diam, reddish brown, convex to plano-convex, some hemispherical, depressed at the top of pileus, thick margin, crenuate marginate, striate from the center to the margin

Lamellae: 11-13 gills, deeply decurent gill, distant gill with two series, thick lamella-edge, undulate lamella-edge, same color as pileus, the lamellae-edge has darker color than the pileus

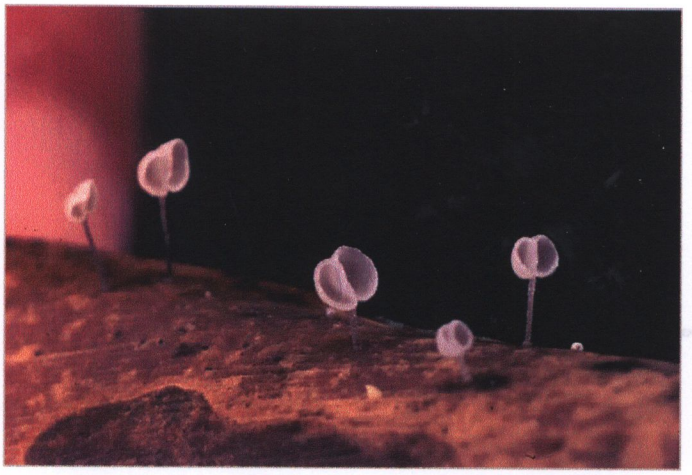
Stipe: same color as pileus, insititious, central, cylindrical, striate from apex to stem base, shinny surface

Substrate: leaves litter

Habitat: tropical Forest

Picture 7: *Lecynocybe* near *lateralis*

Specimen Number: TB211



Macroscopic Features:

Pileus: cream color or white or rarely pale pinkish, 0.5-1.5 mm width, convex to hemispherical, straight marginate, dry surface to granulose

Lamellae: one gill point of stipe atachment at one margin to the opposite margin, even and entire lamellaedge

Stipe: 0.1-0.5 mm height, lateral, attached at apex, cylindrical, dry surface to pruinose, insititious, granulose basal disc

Substrate: bamboo sheet

Habitat: Bamboo Forest, Khao Yai National Park

Unknown Genus and unknown species

Picture 8: Unidentified

Specimen Number: TB0185, 205, 238,266

Macroscopic Features:

Pileus: white color to brown color, 2.0-20.0 mm diam, applanate to plano-convex, concave sometime, pileus with or without papilla

Lamellae: no gills, no pore, hymenophore smooth

Stipe: 1.0-2.0 mm diam x 5.0-20.0 mm height, white or brown color, central, cylindrical, dry surface, insititious

Substrate: leave litter

Habitat: tropical Forest