

The Distribution of Macrofungi in the Sakaerat, Man and Biosphere Reserve with a Checklist of Species

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ABSTRACT: Mushrooms (the epigeous sporocarp of macrofungi) were collected from 2002 to 2004 in the diverse landscapes of the Sakaerat, Man and Biosphere Reserve. The habitats were: dry evergreen forest, dry dipterocarp forest, grassland, bamboo patches and reforested areas. Three hundred and fifteen species belonging to four classes and 44 families were recorded. The species checklist provided here includes 105 taxa. The number of species found in evergreen forest was greater than the number in dry dipterocarp forest: 97 and 27 species respectively.

KEY WORDS: epigeous, sporocarp, macrofungi, checklist, Sakaerat, Man and Biosphere Reserve.

INTRODUCTION

Edible mushrooms have been widely collected from forests of centuries, and systematic studies of fungi in Thailand have been conducted for more than two decades. One hundred and sixty taxa of both edible and poisonous mushrooms were recognized by Chandrasrikul (2001) and by the Royal Institute (1991b). Since 1997 many studies have been conducted by many researchers to determine the existing mushroom diversity in habitats throughout the country, to set up a database of information to facilitate management and development. Of interest are: fungal plant pathology, ectomycor-

rhizal fungi and fungi that may have medicinal properties and be of commercial potential. Studies include those of: Buntaweekun *et al.* 2005; Cheiklien and Thitapichit, 1999; Petcharat *et al.* 1999; Pongpajit *et al.* 1999; Chalermpongse, 1997; and Chalermpongse and Ramanwong, 1997. In spite of these efforts there are many fungi for which we have very little information, due to the very great diversity of species. Worldwide only 5-10 % have been described and named (Hawksworth, 1991). This study has significantly contributed to the records of the species of macro fungi occurring in the northeastern parts of Thailand.

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The Sakaerat Man and Biosphere Reserve, forms part of the northeastern forest group, and was set aside for environmental study in 1968 by the Advanced Research Project Agency of USA, in close co-operation with the National Research Council of Thailand. It is now administered by the Thailand Institute of Scientific and Technological Research (TISTR) of the Ministry of Science and Technology. The area is covered mainly with two forest types, dry evergreen forest (59.96%) and dry dipterocarp forest (18.58%). The remaining percentage is classified as reforested areas (18.52%), grassland (1.19 %) and bamboo forest (1.43%). The elevation ranges from 200 m to 762 m above mean sea level. The entire area is covered with the sandstone of the Korat Plateau. The climate is influenced by the tropical monsoon. The average annual rainfall is 973.4 mm, with 75% mean humidity, and a mean temperature of 26 °C. (TISTR, 2002).

MATERIALS AND METHODS

This study conducted from 2002 to 2005 was set up to determine the macrofungal diversity within the Sakaerat, Man and Biosphere Reserve forests, in particular in the dry evergreen forests and in the dry dipterocarp forests. At the same time, the diversity in the smaller areas of bamboo, in reforestation areas, and in grasslands was investigated. The material was collected in the late summer through into the rainy season, when the

climate is most suitable for the emergence of fungal fruiting bodies. Information on location and habitat was recorded. Species diversity data was collected along trails and the station road. At the end of each field day, new observations were recorded and the fungi collected were identified as far as possible without the use of a compound microscope. For identification to species level, spore characteristics were studied in the laboratory using Melzer's reagent test together with the microscopic structure characteristics of the grill trama and hymenium. The textbooks used for collection identifications were:

1. The Dictionary of Fungi (Kirk *et al.*, 2001)
2. How to Identify Mushrooms to Genus III (Largent *et al.*, 1977)
3. Mushrooms Demystified (Arora, 1986)
4. Texas Mushrooms (Metzler and Metzler, 1992)
5. Edible and Poisonous Mushrooms in Thailand (Royal Institute, 1996)
6. Mushrooms of Thailand and Cultivation Techniques (Chandrasrikul, 2001)
7. Thai Mushrooms and Other Fungi (Ruksawong and Flegel, 2001)

Local names and consumption data were obtained by interviewing local staff and surveying the local market.

RESULTS

Species diversity

During the course of the study, a total of 315 genera of epigeous sporocarp in 44 families were found among the

in 44 families were found among the more than 2,000 specimens collected. Identification to the species level is provided here in the checklist below for 105 species from 27 families. The greatest number of species collected belonged to the families, *Tricholomataceae*, *Amanitaceae* and *Russulaceae* (14, 8, and 7 species respectively). The greatest number of species (95) was found in dry evergreen forests. Fifteen species

were found in dry deciduous forest, five species in grassland, three species in bamboo patches, and six species in reforested station areas (Fig.1). The greatest numbers of species were found in dry evergreen forest due to the environmental conditions. The temperature, relative humidity and varieties of substrates are more suitable for mushrooms in these areas than in the dry dipterocarp forests.

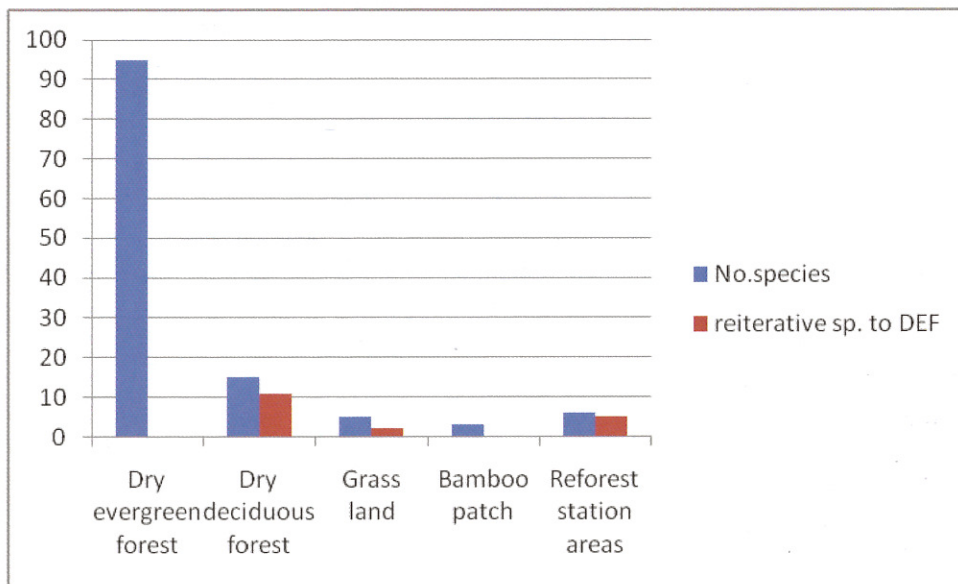


Figure 1. Species richness of mushrooms in different forest types at Sakaerat, Man and Biosphere Reserve. Red column indicated reiterative species to dry evergreen forest.

Wild mushrooms have been eaten by Thai people for a long time. In addition to the food resource, they are also of significant economic value. More than 50 species of edible mushrooms have been reported from Thailand, most are in the genera *Termitomyces*, *Russula*, *Agaricus*, *Amanita*, *Cantharellus*, and *Auricularia*. There are some poisonous lookalike mushrooms that

cause discomfort when eaten, and which may prove to be fatal, especially in the genera *Russula* and *Amanita*. There were more than 44 species of edible mushrooms recorded in this survey, including termite mushrooms with more than ten species. Five species of mushrooms were found that are recognized as being toxic.

The Checklist

The checklist in the table below contains only those taxa for which a reasonably confident identification could be made. Checklist of mushrooms in the Sakaerat, Man and Biosphere Reserve 2001-2004. Advice on the edibility of species was obtained mainly from Chandrasrikul (1996, 2001), and the Royal Institute (1996).

Family	Scientific name	Forest Type	Role/Edibility	Substrate
Phylum Basidiomycota Class Basidiomycetes				
Agaricaceae	<i>Agaricus silvaticus</i> Schaeff.	DEF	E	Soil
	<i>Agaricus trisulphuratus</i> Berk.	DEF,DDF	Unk	soil
	<i>Chlorophyllum molybdites</i> (Meyer ex Fr.) Mass	G	P	soil
	<i>Leucocoprinus birnbaumii</i> (Corda) Sing.	G	Unk	soil
	<i>Leucocoprinus cepaestipes</i> (Sow. ex Fr.) Pat.	DEF	Unk	soil
	<i>Leucocoprinus fragilissimus</i> (Rav.) Pat.	DEF	Unk	soil
	<i>Macrolepiota gracilentia</i> (Krombh.) Moser	DEF,G	P	soil
Amanitaceae	<i>Amanita princeps</i> Corner & Bas	DEF	EM,E	soil
	<i>Amanita griseofarinoso</i> Hongo	DEF	EM,Unk	soil
	<i>Amanita hemibapha</i> (Berk. & Br.) Sacc. similis (Boed.) Corner & Bas	DEF,DDF	EM,E	soil
	<i>Amanita hemibapha</i> (Berk. et. Br.) Sacc. <i>hemibapha</i>	DEF,DDF	EM,E	soil

Family	Scientific name	Forest Type	Role/ Edibility	Substrate
Astraeaceae	<i>Amanita vaginata</i> (Bull. : Fr.) Vitt.	DEF	EM,E	soil
	<i>Amanita volvata</i> (Peck) Martin	DEF	P	soil
	<i>Astraeus hygrometricus</i> (Pers.) Morgan	DDF	EM,E	soil
Auriculariaceae	<i>Calostoma fuscum</i> (Berk.) Mass	DEF	EM,E	soil
	<i>Auricularia auricula</i> (Hook.) Underw.	DEF	E	wood
	<i>Auricularia delicata</i> (Fr.) P. Henn.	DEF	E	wood
	<i>Auricularia polytricha</i> (Mont.) Sacc.	DEF	E	wood
	<i>Boletus griseipurpureus</i> Corner	DEF,RF	EM	soil
Boletaceae	<i>Boletus nobilis</i> Peck	DEF	EM	soil
	<i>Boletus ornatipes</i> Peck	DEF	EM	soil
	<i>Heimiella retispora</i> (Pat.&Bak.) Boedijn	DDF	EM	soil
Cantharellaceae	<i>Leccinum album</i> (Peck) Sing.	DEF	EM	soil
	<i>Cantharellus cibarius</i> Fr.	DDF, DEF	EM,E	soil
	<i>Cantharellus cinnabarinus</i> Schw.	DEF	EM,E	soil
	<i>Cantharellus minor</i> Peck	DDF,DEF	EM,E	soil
	<i>Craterellus odoratus</i> (Schw.) Fr.	DEF	EM,E	soil
Clavariaceae	<i>Calvatia craniiformis</i> (Schw.) Fr.	B	D	soil

Family	Scientific name	Forest Type	Role/ Edibility	Substrate
Clavariaceae	<i>Clavaria zollingeri</i> Lév.	B	EM	soil
	<i>Clavulinopsis fusiformis</i> (Sow.:Fr.) Corner	DEF	EM	soil
Clavariaceae	<i>Clavulinopsis</i> sp.	DEF	EM	soil
	<i>Deflexula</i> sp.	DEF	D	soil
Coprinaceae	<i>Pterula multifida</i> (Chev.) Fr.	DEF	D	Soil
	<i>Coprinus disseminatus</i> (Pers.: Fr.) S.F. Gray	DEF	D	branches
	<i>Panaeolus</i> sp.	G	D	trunks
	<i>Flabellophora superposita</i> (Berk.) G. Cunn.	DEF	D	branches
Dacrymycetaceae	<i>Pycnoporus cinnabarinus</i> (Jacq.:Fr.) Karst.	DDF,DEF	D	branches
	<i>Dacrymyces minor</i> Peck	DEF	D	branches
Ganodermataceae	<i>Dacrymyces</i> sp.	DEF	D	branches
	<i>Dacryopinax spathularia</i> (Schweinitz) Martin	DEF,DDF	D	branches
	<i>Amauroderma rugosum</i> (Fr.) Tor.	DEF	Unk	soil
Geastraceae	<i>Ganoderma lucidum</i> (Leyss. ex Fr.) Karst.	DEF	D,M	wood
	<i>Geastrum fimbriatum</i> Fr.	DEF	D	soil
Geastraceae	<i>Geastrum mirabile</i> (Mont.) Fisch.	DEF	D	soil
	<i>Geastrum nanum</i> Pers.	DEF	D	soil

Family	Scientific name	Forest Type	Role/ Edibility	Substrate
Hygrophoraceae	<i>Geastrum saccatum</i> (Fr.) Fisch.	DEF	EM	soil
	<i>Hygrocybe firma</i> (Berk. et Broome) Sing.	DEF	EM	soil
Hymenochaetaeae	<i>Hygrocybe occidentalis</i> (Dennis) Pegler	DEF	EM	soil
	<i>Hymenogaster</i> sp.	DEF	D	branches
Lycoperdaceae	<i>Lycoperdon echinatum</i> Pers.:Pers.	DEF	S	soil
	<i>Pisolithus tinctorius</i> Pers.	RF	EM	soil
Nidulariaceae	<i>Cyathus striatus</i> Willd.: Pers.	DEF	D	wood
	<i>Dictyophora duplicata</i> (Bosch.) Fisch.	DEF	D	soil
Phallaceae	<i>Dictyophora indusiata</i> (Vent.: Pers.) Fisch.	DEF	E	soil
	<i>Dictyophora multicolor</i> Fisch.	DEF	D	soil
Pleurotaceae	<i>Mutinus bambusinus</i> (Zoll.) Fischer	B	D	soil
	<i>Leninus ciliatus</i> Lév.	DEF	D	wood
	<i>Leninus polychrous</i> Lév.	DEF	D,E	wood
Polyporaceae	<i>Coltricia cinnamomea</i> (Pers.) Murr.	DEF	EM	soil
	<i>Microporus affinis</i> (Blume & Nees ex Fr.) Kntz.	DEF	D	wood
	<i>Microporus xanthopus</i> (Fr.) Kuntze	DEF	D	branches

Family	Scientific name	Forest Type	Role/ Edibility	Substrate
	<i>Polyporus alveolarius</i> (DC.:Fr.) Bond. & Sing.	DEF	D	branches
	<i>Polyporus badius</i> (Pers.:S.F. Gray) Imaz.	DEF	D	branches
	<i>Polyporus tricholoma</i> Mont.	DDF, DEF	D	branches
	<i>Schizophyllum commune</i> Fr.	DEF	D,E	branches
Ramariaceae	<i>Ramaria cyanocephala</i> (Berk. & Curt.) Corner	DEF	EM	soil
	<i>Ramaria</i> sp.	DEF	EM	soil
	<i>Ramariopsis</i> sp.	DEF	EM	soil
Russulaceae	<i>Lactarius hygrophoroides</i> Berk. et Curt.	DEF	EM,E	soil
	<i>Lactarius piperatus</i> (Scop. ex Fr.) S.F.Gray	DEF	EM,E	soil
	<i>Russula alboareolata</i> Hongo	DEF	EM,E	soil
	<i>Russula cyanoxantha</i> (Schaeff. Ex Secr.) Fr.	DEF	EM,E	soil
	<i>Russula densifolia</i> (Secr.) Gill.	DEF	EM,E	soil
	<i>Russula emetica</i> (Schaeff.& Fr.) S.F. Gray	DEF,DDF,R F	EM,E	soil
	<i>Russula nigricans</i> (Bull.) Fr.	DDF,DEF	EM,E	soil
	<i>Russula rosacea</i> (Pers.) S.F. Gray	DEF,DDF,R F	EM,E	soil
Strobilomycetaceae	<i>Boletellus emodensis</i> (Berk.) Singer	DEF,RF	EM,E	soil

Family	Scientific name	Forest Type	Role/ Edibility	Substrate
	<i>Strobilomyces velutipes</i> Cooke & Masee	DEF,RF	E	soil
Tremellaceae	<i>Tremella fuciformis</i> Berk.	DEF	D	branches
Tricholomataceae	<i>Anthracoophyllum nigrinum</i> (Lév.) Kalchbr.	DEF	D	twigs
	<i>Campanella junghuhnii</i> (Mont.) Sing.	DEF	D	branches
	<i>Crinipellis stipitaria</i> (Fr.) Pat.	DDF	D	branches
	<i>Favolaschia fujisaiensis</i> Kobay.	DEF	D	logs
	<i>Favolaschia thwaitesii</i> (Berk. & Br.) Sing.	DEF	D	logs
	<i>Filoboletus manipularis</i> (Berk.) Sing.	DEF	D	logs
	<i>Marasmiellus candidus</i> (Bolt.) Fr.	DEF	D	branches
	<i>Marasmius papyraceus</i> Masee	DEF	D	leaves
	<i>Marasmius pulcherripes</i> Peck	DEF	D	leaves
	<i>Marasmius purpureostriatus</i> Hongo	DEF	D	leaves
	<i>Marasmius siccus</i> (Schwein.) Fr.	DEF	D	leaves
	<i>Tricholoma crassum</i> Berk.	DEF	D,E	soil
	<i>Trogia infundibuliformis</i> Berk. & Br.	DEF	D	branches
Xerocomaceae	<i>Xerocomus chrysesteron</i> (Bull.) Fr.	DEF	EM	soil
	<i>Xerocomus</i> sp.	DEF	EM	soil

Family	Scientific name	Forest Type	Role/ Edibility	Substrate
Phylum Ascomycotina Class Ascomycetes				
Geoglossaceae	<i>Trichoglossum hirsutum</i> (Pers.: Fr.) Boud. f. <i>hirsutum</i>	DEF	D	soil
Leotiaceae	<i>Bisporella citrina</i> (Batsch.: Fr.) Korf & Carpenter	DEF	D	twigs
Sarcoscyphaceae	<i>Cookeina sulcipes</i> (Berk.) Kuntze	DEF	D	branches
	<i>Cookeina tricholoma</i> (Mont.) Kuntze	DEF	D	branches
	<i>Microstoma floccophilus</i> (Schw.) Raitr.	DEF	D	branches
	<i>Sarcoscypha coccinia</i> (S.F. Gray) Lamb.	DEF	D	branches
Xylariaceae	<i>Daldinia concentrica</i> (Bolt.) Ces et De Not.	DEF	D	wood
	<i>Entonema splendens</i> (Berk. & Curt.) Lloyd	DEF	D	wood
	<i>Galiella celebica</i> (P.Henn) Nannf.	DEF	D	wood
	<i>Xylaria carpophyla</i> (Pers.) Fr.	DEF	D	wood
	<i>Xylaria polymorpha</i> (Pers.) Grev.	DEF	D,M	wood

Dry Dipterocarp forest	DD	Role	Edibility	Medicine	M
Grassland	G	-Ectomycorrhiza	-Edible	E	
Reforested areas	RF	-Decomposer	-Poisonous	P	
Bamboo patch	B	-Saprophyte	-Unknown	Unk	

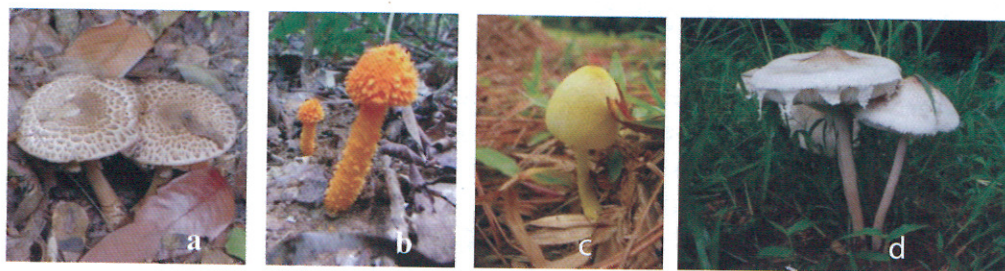


Figure 2. Agaricaceae: **a.** *Agaricus silvaticus* Schaeff. **b.** *A. trisulphuratus* Berk. **c.** *Leucocoprinus birnbaumii* (Corda) Sing. **d.** *Macrolepiota gracilentata* (Krombh.) Moser.



Figure 3. Amanitaceae: **e.** *Amanita hemibapha* (Berk.et.Br.). Sacc. *hemibapha* **f.** *A.princeps* Corner & Bas Berk. **g.** *A. vaginata* (Bull.:Fr.) Vitt.



Figure 4. Russulaceae: **h.** *Lactarius hygrophoroides* Berk.et.curt. **i.** *Russula emetica* (Schaeff.:Fr.) S.F.Gray. **J.** *R. nigricans* (Bull.) Fr.

DISCUSSION

There were 210 genera with different morphology that could not be identified to species level. The most studied species: those that have been named and identified by local people and by experts are the larger edible mushrooms. Less familiar, are the

tiny examples that are seldom seen because they may be immature or grow in dark hollows. Many of these were seen and collected only once during this study. These factors contribute to the difficulty of identification with limited published material.

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