Mushroom Diversity in Phu Krathing Waterfall, Phu Toei National Park

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Abstract

A survey of the mushroom diversity was performed from August to November 2008 at **Phu Krathing waterfall**, Phu Toei national park, Supanburi province. Fifty-three specimens were collected and identified in 10 families, 18 genera and 17 species. Of these, 11 species are edible (*Amanita hemibapha*, *A. princes, A. Vaginata, Clitocybe* sp. (KS0814), *Clitocybe* sp. (KS0818), *Hygrocybe miniata*, *Russula alboareolata, R. cyanoxantha, R .flavida, Termitomyces clypeatus* and *Tricholoma crassum*), while 3 species are poisonous (*A. virosa, A. solitaria* and *Gymnopilus penetrans*). 28S rDNA of 20 specimens were amplified by PCR, sequenced and compared to known sequences in database. The phylogenetic relationship revealed that morphological characteristics of the mushrooms agreed with 28S rDNA sequences.

Keywords : 28S rDNA, Diversity, Mushroom, Phu Toei National Park

Introduction

Fungi are one of the most diverse groups of organisms. It was estimated that there are 1,500,000 species on our Earth. However, only 70,000 fungal species are described and of these, 10,000 species are mushroom (Hawksworth et al., 1995). In Thailand, the mushroom diversity was first studied by Rostrup and Massee (1902) at Koh Chang, Trad province and there are extensive studies up till now. Approximately 6,000 mushroom species are estimated in Thailand, but only 2,437 species are reported (Chandrasrikul et al., 2011). This is suggested that 40% of mushrooms are documented.

The knowledge of mushroom diversity can supply information, for example, species range, habitat preference, changing of mushroom diversity and ethnomycology. The studies of mushroom diversity in Thailand are frequently reported from either the North or the North-East. To our knowledge, there is no report from the West of Thailand, including Phu Toei national park, Supanburi province.

The aim of this study is to achieve information of mushroom diversity in **Phu Krathing waterfall**, Phu Toei national park, Supanburi province. The data can be useful for the national park to provide information of mushroom for people lived nearby or visitors.

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Materials and Methods

The mushroom specimens were collected from **Phu Krathing waterfall**, Phu Toei national park, Supanburi province during August to November 2008. The mushrooms were photographed and theirs characteristics were recorded. Identification was performed based on morphology. The specimens were either dried or preserved in FAA, and deposited at Department of Microbiology, Faculty of Science, Silpakorn University. The tissue was taken for DNA extraction and DNA was used as a template for amplification of 28S rDNA fragment. Then, the 28S rDNA fragments were sequenced and compared with known sequence in database.

Results and Discussion

In the survey, 53 mushroom specimens were collected. Amount of mushroom in each month was correlated with rainfall (Table 1). The amount of mushroom in August was low due to the survey was started in the last week of August. The specimens were identified in 10 families, 18 genera and 17 species, but 31 specimens could not identify to species (Fig.1 and Table 2). The most common genera were *Agaricus, Amanita, Marasmius* and *Russula*. In consideration to habitat, many species belonged to genus *Amanita* and *Russula* are found to be associated dipterocarp trees as they were reported to be the ectomycorhyza in deciduous dipterocarp and pine forest (Chandrasrikul et al., 2008). 2 species of *clitocybe*, locally named as "Hed Pai (เห็ดไผ่)", grow on only dead bamboo stump. In concern to edibility, 11 species are edible (*Amanita hemibapha*, *A. princes, A. vaginata, Clitocybe* sp. (KS0814), *Clitocybe* sp. (KS0818), *Hygrocybe miniata*, *Russula alboareolata, R. cyanoxantha, R .flavida, Termitomyces clypeatus* and *Tricholoma crassum*), 3 species are poisonous (*A. virosa, A. solitaria* and *Gymnopilus penetrans*), while 34 species are not reported (Fig. 2-15).

Table 1 Meteorological data of Supanburi province in August – November 2008 and amount of mushroom found in this study

Month	Min-Max Temperature (°C)	Min-Max Relative humidity (%)	Min-Max Rainfall (mm)	Amount of mushroom
August	27.9-31.8	68-92	0.0-40.4	5
September	27.5-31.0	74-90	0.0-31.4	26
October	24.6-30.3	77-97	0.0-84.7	19
November	22.7-31.3	68-82	0.0-1.3	3

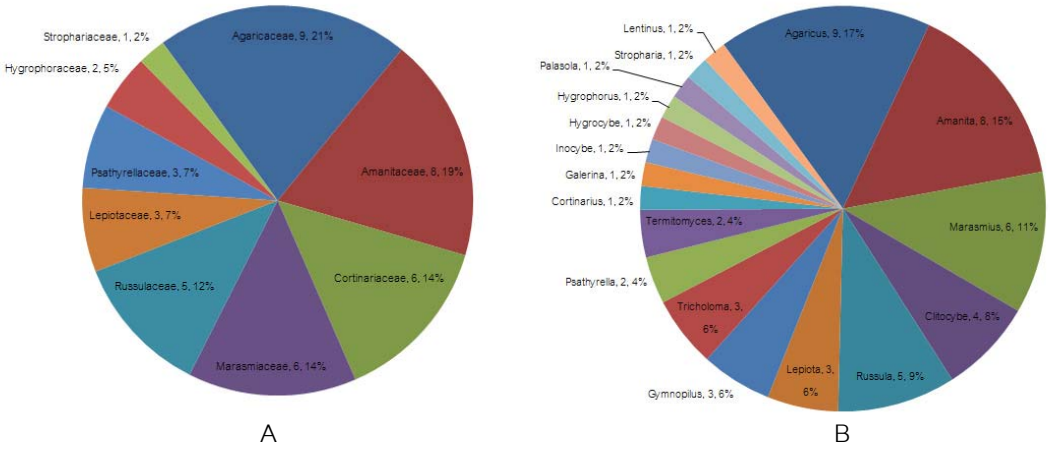

Fig. 1 Amount and percentage of mushroom identified in family (A) and genus (B).

The label indicated family (A) or genus (B), amount, percentage.

Table 2 List of mushroom species collected in this study.

Family	Genus	Species and habitat	Edibility
Agaricaceae	*Agaricus*	*Agaricus trisulphuratus* Berk. Solitary on humus	No report found
Amanitaceae	*Amanita*	*Amanita hemibapha* (Berk. & Br.) Sacc. subsp. *Javanica* Cor. & Bas. Solitary or in group under dipterocarp trees	Edible
		Amanita cf. *populiphila* Tulloss & Moses Solitary under dipterocarp trees	No report found
		Amanita princes Cor. & Bas. Solitary or in group under dipterocarp trees	Edible
		Amanita solitaria (Bull. Ex Fr.) Karst Solitary under dipterocarp trees	Poison
		Amanita vaginata (Fr.) Vitt. Solitary on ground	Edible
		Amanita virosa (Fr.) Bertellon Solitary under dipterocarp trees	Poison
Cortinariaceae	*Gymnopilus*	*Gymnopilus penetrans* (Fr. ex Fr.) Murr. Scattered on dead log	Poison
Hygrophoraceae	*Hygrocybe*	*Hygrocybe miniata* (Fr.) Kumm. Scattered on ground	Edible but too small to attention
Marasmiaceae	*Marasmius*	*Marasmius* oreades (Bolt. ex Fr.) Fr. Scattered on humus	No report found
		Marasmius siccus (Schw.) Fr. Solitary of scattered on twigs	No report found

Table 2 (Cont.) List of mushroom species collected in this study.

Family	Genus	Species and habitat	Edibility
Psathyrellaceae	*Palasola*	*Parasola plicatilis* (Orton) Redhead, Vilgalys & Hopple Scattered on ground	No report found
Russulaceae	*Russula*	*Russula alboareolata* Hongo Solitary under dipterocarp trees	Edible
		Russula cyanoxantha (Schaeff. Ex Secr.) Fr. Solitary under dipterocarp trees	Edible
		Russula flavida Frost ex Peck Solitary under dipterocarp trees	Edible
Tricholomataceae	*Termitomyces*	*Termitomyces clypeatus* Heim Solitary on ground	Edible
	Tricholoma	*Tricholoma crassum* Berk. Gregarious on ground	Edible

Fig. 2 *Amanita hemibapha*, the edible mushroom grown under dipterocarp trees.

Fig. 3 *Amanita princes*, the edible mushroom grown under dipterocarp trees.

Fig. 4 *Amanita vaginata*, the edible mushroom grown on ground.

Fig. 5 *Clitocybe* sp. (KS0814) or "Hed Pai" (local name), the edible mushroom grown on dead bamboo stump. Their spores are dextrinoid.

Fig. 6 *Clitocybe* sp. (KS0818) or "Hed Pai" (local name), the edible mushroom grown on dead bamboo stump. Their spores are inamyloid.

Fig. 7 *Hygrocybe miniata*, the edible mushroom grown on ground, but too small to be attained.

Fig .8 *Russula alboareolata*, the edible mushroom grown under dipterocarp trees.

Fig. 9 *Russula cyanoxantha*, the edible mushroom grown under dipterocarp trees.

Fig. 10 *Russula flavida*, the edible mushroom grown under dipterocarp trees.

Fig. 11 *Termitomyces clypeatus*, the edible mushroom associated with termite.

Fig.12 *Tricholoma crassum*, the edible mushroom grown on ground.

Fig. 13 *Amanita solitaria,* the poisonous mushroom grown under dipterocarp trees.

Fig. 14 *Amanita virosa*, the poisonous mushroom grown on ground.

Fig. 15 *Gymnopilus penetrans*, the poisonous mushroom grown on dead wood in pine forest.

To confirm identification by morphology, identification by comparison of 28S rDNA was performed. DNA of all mushrooms were extracted and used as the templates for amplification of 28S rDNA by PCR technique. Unfortunately, DNA fragments from only 20 specimens could be generated. This probably be due to phenolic compound found in some mushrooms could inhibit the PCR reaction (Wan and Wilkins, 1993). The 28S rDNA fragments were sequenced and compared with known sequences in database. The 28S rDNA sequences of *A. solitaria* and *A. vaginata* showed perfect match of those in database. The phylogenetic relationship revealed that morphological characteristics of the mushrooms agreed with 28S rDNA sequences (Fig. 16).

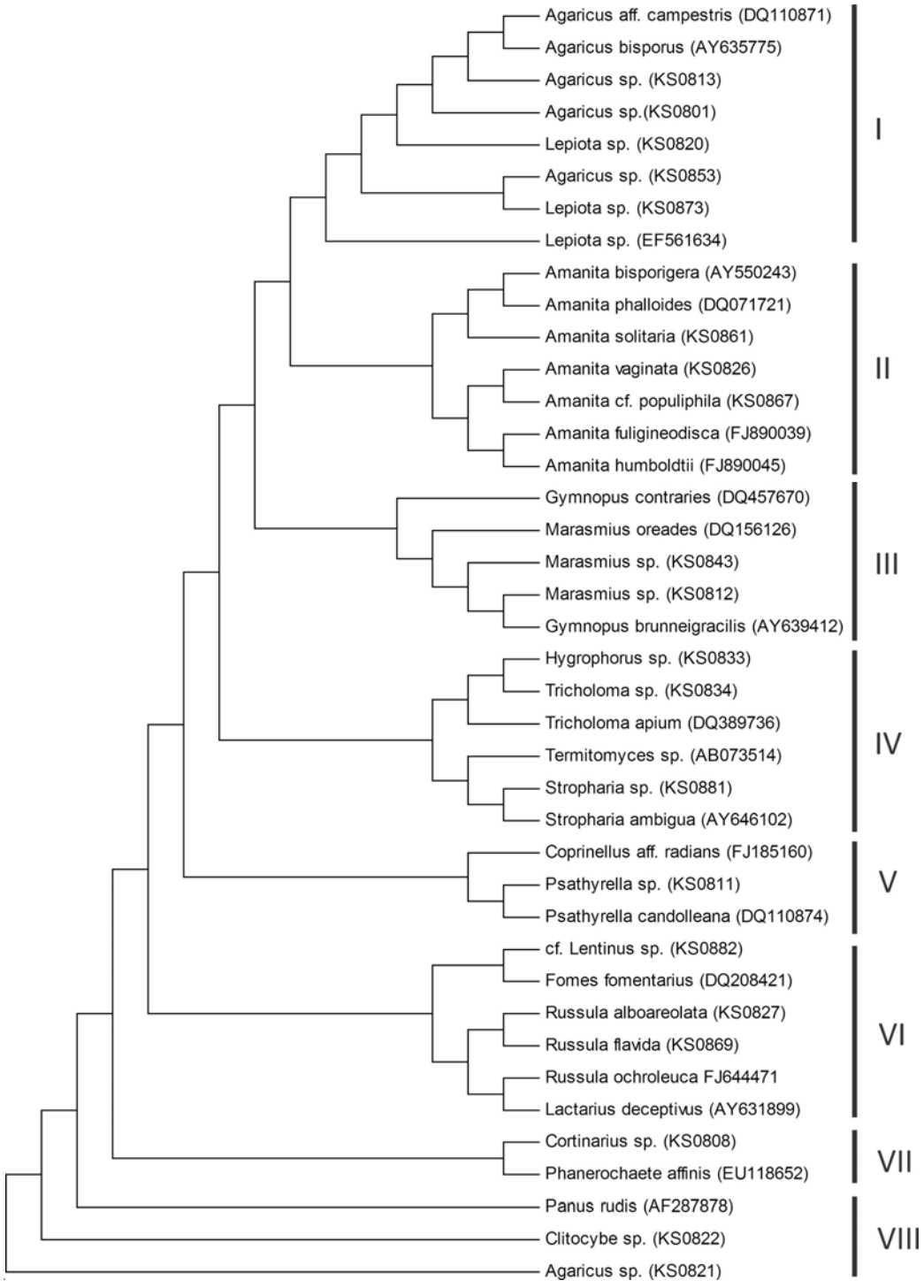

Fig. 16 Phylogenetic tree analysis based on 28S rDNA sequences. Group I compose of mushrooms with gill free and ring. Group II belongs to genus *Amanita*. Group III is the member of family Tricholomataceae. Group IV comprises of mushrooms with white spore, gill attached and neither ring nor volva presence. Group V fits to family Coprinaceae. Group VI is the member of family Russulaceae. Group VII belongs to family Cortinariaceae. Group VIII is out group. The codes in the parentheses indicated either NCBI accession number or code of specimen in this study (KS08XX).

Conclusion

Fifty-three mushroom specimens were collected from Phu Krating waterfall, Phutoei national park, Suphanburi during August to November 2008. They were identified in 10 families, 18 genera and 17 species, while 31 specimens could not identify to species. Of these, 11 species are edible, 3 species are poisonous. The phylogenetic relationship revealed that morphological characteristics of the mushrooms are agreed with 28S rDNA sequences.

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