Diversity of edible mushroom in Phu Phra Bat Historical Park, Udon Thani province

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ABSTRACT: The diversity of edible mushrooms in Phu Pra Bat Historical Park was explored. The research was conducted from May 2014 to July 2014 during the rainy seasons. The samples were collected along the nature trails. The results showed that the total number of 12 species of edible mushrooms in 12 genera belonging to eight families in order Basidiomycotina. The edible mushrooms in Boletaceae (3 species) were found predominantly followed by *Phallaceae*, *Russulaceae*, *Amanitaeae*, *Sclerodermatanceae*, *Lycoperdaceae*, and *Lentinaceae*.

Keywords: edible mushroom, diversity

Introduction

Phu Phra Bat Historical Park is located in Muang Pan, Ban Phu district, Udon Thani province, Thailand. It is a part of the mountain in Phu Phan Mountains. Phu Phra Bat Historical Park is registered for the historic site on 1981 and has the wilderness forest area of 3,430 hectares (UNESCO, 2014). There are many kinds of animals and trees including mushrooms, which utilized as the food of high quality with a pleasant flavor, appealing texture, chemical compound and nutritional value (Bua-art et al., 2011). Moreover, mushrooms can also be used as a bioindicator of environmental quality (Wongchalee and Pukahute, 2012).

Mushrooms are classified in fungi group (Ascomycota & Basidiomycota) consists of underground fungal mycelium and forming a fruiting body. They live in diverse niches in nature in the dry dipterocarp forest ecosystem, and the rainy season is suitable to find many mushrooms. Mushrooms have been separated into two groups, edible and poisonous mushrooms (Hall et al., 2003; Butkrachang et al., 2005). Ecologically, mushrooms were classified into three groups: (1) saprophytes, (2) parasites and (3) symbiotic (which include mycorrhizal). In Thailand, the local people knew the kind of mushrooms (edible, non-edible and poisonous mushrooms) by learning from their parents, or experienced senior neighbors (Butkrachang et al., 2005). Mushrooms are an important source of water much more than 90 percent including of the protein, fat, minerals and vitamins containing vitamin B1, vitamin B2 (Sultana et al., 2007). Wongchalee and Pukahute (2012) reported the diversity of mushrooms in The Phu Phan Nation Park in Sakhon Nakhon Province, Thailand.

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There is no report of the edible mushrooms in Phu Phra Bat National Park. Therefore, in this study we investigated the diversity of edible mushrooms and collected the information with the utilization of edible mushroom using questionnaires.

Materials and Methods

Collection sites

The study area is Phu Phra Bat Historical Park, which is situated in Ban Phu district, Udon Thani province, Thailand. The mushrooms samples were collected from 39 field sites (**Figure 1**). The mushroom surveys depend on timing three months during the rainy seasons on the walking track and areas nearby within 300 meters from the path. The average temperature was ranged from 26-30°C.

Collection of mushrooms

The mushrooms survey was conducted from May 2014 to July 2014. All mushrooms were collected in each study site by hand, separately labeled, kept in paper bags and brought to the laboratory for identification. The information on mushrooms such as habitat, color, scales, gills, pileus and the presence of the annulus was recorded in the data sheet for the fresh material. Photographs were taken in its natural habitat. At the same time a spore print was prepared for analysis taking the piles downwards on a half black and half white paper and then covered with breaker (Pushpa and Purushothama, 2012; Dwivedi et al., 2012). All locations were recorded using a GarminNuvi 203 (Garmin (Asia) Co., Taiwan). The specimens of mushrooms were identified based on available morphological description (Soytong, 1994; Hall et al., 2003; Anong et al., 2008).

Figure 1 Walkway Map of Phu Phra Bat Historical Park showing collection localities in 39 sites ( ). 1=Information center, 2=Parking area, 3=Ticket box, 4=kork Mah Noi, 5=Kork Mah Tao Baros, 6=Tham Ruesi, 7=Tham Wua-Tham khon, 8=Pha Sadet, 9=Chang Khao Phran,10=Pheng Hin Nok Kratha, 11=Bor Nam Nang U-Sa, 12=Hor Nang U-Sa, 13=Tham Chang, 14=Heebsob Porta, 15=Heebsob Nang U-sa, 16=Heebsob Tao Baros, 17=Kou Nang U-sa, 18=Tham Phra, 19=Wat Porta, 20=Bot Wat Porta, 21=Wat Louk Koei, 22=Tham Phra Siang, 23=Chedi Raang, 24=Tham Dinphiang

Results and Discussion

A total mushrooms samples were collected from Phu Phra Bat National Park in Udon Thani, Thailand. Twelve species of mushrooms were found including *Amanita princeps*, *Boletus auripes*, *B. griseipurpureus*, *B. pallidus*, *Calvatia craniformis*, *Dictyophora* sp., *D. duplicata*, *Lentinus squarrosulus*, *R. mairei*, *Russula virescens*, *Astraeus hygrometricus* and *Termitomyces clyeatus* (**Figure 2**). Also, the distribution of those mushrooms was found in various localities as shown in **Table 1**. According to the different genera of mushrooms, it had a different optimal growth condition (Wongchalee and Pukahute, 2012). From these study, the various genera of mushrooms had a slightly different growth condition (26-27°C, pH 6-7). Therefore, some mushrooms genera have been found in a tiny number. However, the important factors affect the diversity and quantity of mushrooms are the weather, temperature, pH of soil, light intensity and environment around that area (Ceci et al., 2011). To classify the usefulness of these mushrooms, the results showed that twelve species were found to be edible, and only *B. auripes* and *B. griseipurpureus* were used as a laxative (data not shown). A similar result was also found by Wongchalee and Pukahute (2012), who reported the diversity of mushrooms in dry dipterocarp forest at Phu Phan National Park, Sakon Nakhon Province. However, some similar genus including *Russula* sp., *Termitomyces* sp., *Lentinus* sp., *Astraeus* sp., and *Boletus* sp. were found in Lampang Province (Chidburee et al., 2014).

Table 1 Mushrooms in Phu Phra Bat Historical Park

Family	Species (local name)	Habitat	Locations	
			Latitude	Longitude
Amanitaeae	*Amanita princeps* Cor. & Bas.	Terrestrial, Humus	N17°43'50.45''	E102°21'16.35''
			N17°43'50.46''	E102°21'16.35''
			N17°43'41.55''	E102°21'17.65''
Boletaceae	*Boletus auripes* Peck	Clump of grass, Humidity	N17°43' 51.79''	E102°21' 26.58''
	B. griseipurpureus Cor.	Bamboo or clump of grass	N17°43' 50.42''	E102°21'16.64''
			N17°43' 47.94''	E102°21'14.16''
	B. pallidus Frost	Clump of grass, rock	N17°43' 49.3''	E102°21'22.8''
			N17° 43' 40.93''	E102°21'13.7''
			N17°43' 51.12''	E102°21'13.8''
			N17°43' 53.8''	E102°21'14.63''
			N17°43' 53.79''	E102°21'11.34''
Lycoperdaceae	*Calvatia craniformis* (Schw.) Fr.	Decaying wood	N17°43'49.26''	E102°1'18.09''
Phallaceae	*Dictyophora* sp.	Decaying wood, Leaf debris	N17°44' 2.1''	E102°21'15.3''
	D. duplicata (Bosc) Fisch.	Decaying wood, Leaf debris	N17°43' 53.2''	E102°21'28.64''

Table 1 Mushrooms in Phu Phra Bat Historical Park (Cont.)

Family	Species (local name)	Habitat	Locations	
			Latitude	Longitude
Polyporaceae	*Lentinus squarrosulus* Mont.	Decaying wood	N17°44'5.8''	E102°21'17.2''
			N17°43'39.8''	E102°21'13.0''
			N17°43'50.65''	E102°21'16.49''
			N17°43'40.59''	E102°21'1.99''
Russulaceae	*Russula. mairei* Sing	Leaf debris, Terrestrial	N17°43'51.85''	E102°21'24.27''
			N17°43'51.58''	E102°21'24.24''
			N17°43'53.76''	E102°21'13.70''
			N17°43'53.59''	E102°21'13.66''
	R. virescens (Schaeff.) Fries	Leaf debris, Terrestrial	N17°43'49.3''	E102°21'22.8''
			N17°43'48.75''	E102°21'17.73''
			N17°43'40.86''	E102°21'13.28''
			N17°43'49.15''	E102°21'22.86''
			N17°43'51''	E102°21'27.04''
			N17°43'51.79''	E102°21'20.95''
			N17°43'45.41''	E102° 21'2.84''
			N17°43'46.05''	E102°21'3.07''
			N17°43'50.26''	E102°21'23.4''
			N17°43'45.41''	E102°21'2.84''
			N17°43'46.05''	E102°21'3.07''
			N17°43'48''	E102°21'22.76''
			N17°43'50.26''	E102°21'23.47''
Sclerodermatanceae	*Astraeus hygrometricus* (Pers.) Morg.	The water flows through and accumulated sediments	N17°43'34.5''	E102°21'16.0''
Tricholomataceae	*Termitomyces clypeatus* Heim	Terrestrial, Termites	N17°43' 51.6''	E102°21'26.1''
			N17°43'51.19''	E102°21'29.96''
			N17°43'39.94''	E102°21'16.05''

Conclusion

All 12 mushroom species in Phu Phra Bat Historical Park are edible and belong to 12 genera, 8 families in order Basidiomycotina. The mushrooms in Boletaceae (*B. auripes*, *B. pallidus* and *B. griseipurpureus*) were found more species than Phallaceae (*Dictyophora* sp. and *D. duplicata*), Russulaceae (*R. virescens* and *R. mairei*), Amanitaeae (*A. princeps*), Sclerodermatanceae (*A. hygrometricus*), Lycoperdaceae (*C. craniformis*) and Lentinaceae (*L. squarrosulus*). There were only *B. auripes* and *B. griseipurpureus* that can be used as a laxative.

Figure 2 Edible mushrooms in Phu Phra Bat Historical Park, Udon Thani Province: (A) *Amanita princeps* (B) *Boletus auripes* (C) *B. griseipurpureus* (D) *B. pallidus* (E) *Calvatia craniformis* (F) *Dictyophora* sp. (G) *D. duplicata* (H) *Lentinus squarrosulus* (I) *R. mairei* (J) *R. virescens* (K) *A. hygrometricus* (L) *T. clypeatus*

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