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A Checklist of Mushrooms of Phou Khao Khuoay National Protected Area (PKKNPA) of Lao-PDR

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Abstract

Mushroom survey was conducted in the Phou Khao Khuoay National Protected Area (PKKNPA) located at east direction 65km from Vientiane, the capital city of Lao-PDR from September 2015 to November 2016. During this periods, mushroom specimens were collected from 10 different survey sites, and then were identified and classified into 149 species, 113 genera, and 55 families by morphological and molecular analyses. The mushrooms belongs to Ascomycota were classified into 13 species, 7 genera, 5 families, and 5 orders, while those belongs to Basidiomycota were classified into 136 species, 113 genera, 55 families, and 18 orders, respectively. Among these mushrooms, the most species-rich families were Polyporaceae (18.1%), Marasmiaceae (11.0%), Ganodermataceae (8.6%), Xylariaceae (5.8%), Russulaceae (5.4%), Agaricaceae (4.7%), Boletaceae (4.7%), Hymenochaetaceae (3.9%), and Amanitaceae (3.6%), and comprised 65.8% of the total specimens identified.

Key Words: fungal biodiversity, mushroom collection and identification, Phou Khao Khuoay national protected area (PKKNPA), ascomycota, basidiomycota

Introduction

Phou Khao Khuoay National Protected Area (PKKNPA), also called Buffalo Horn Mountain, is located at east direction 65km from Vientiane, the capital city of Lao-PDR. (latitude 18°14'-18°32'N, longitude 102°38'-102°59'E). It was designated as National Protected Area by PM Decree 164 in October 29, 1993 (Soukhavong et al. 2013). This area covers 200,000ha including 4 provinces (Vientiane Prefecture, Vientiane Province, Bolikhamxay Province and Khet Phiset Xaisomboon Province). (Sirivongs and Tsuchiya 2012) The elevation ranges from 200m to 1,761m. PKKNPA has monsoonal climate similar to the rest of central Lao-PDR (Lucas et al. 2013). The rainy season is starting from May and lasting through to October, and distinct dry season is from November to April. Mean annual rainfall is 2,202.4 mm with the 92% in rainy season. Average annual temperature and humidity are 26.6°C and 73%, respectively. PKKNPA has 74% forest cover and diverse forest types including tropical montane evergreen, dry evergreen dipterocarp, mixed deciduous (mainly *Fabaceae*) and mixed coniferous (mainly *Pinaceae*) forests (Lucas et al. 2013). PKKNPA is known for its high biodiversity, and thus there are many species of flora and

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fauna including mammals, birds, reptiles, as well as trees and orchids (DRFC et al. 2010; Soukhavong et al. 2013). However, forests in this region have been affected by human activities such as forest encroachment, illegal logging, shifting cultivation, wildfire and wildlife hunting, and consequently lead to habitat loss and biodivesity decrease (Sirivongs and Tsuchiya 2012; Lucas et al. 2013). Mushroom survey in this area was conducted for getting information on the diversity of higher fungi in tropical rain forests.

Materials and Methods

Survey sites

Ten sites including Tad Xai, Tad Leuk, Houayke, Napheng, Nam Mang Dam, Wang Heau Village, Houaybon, Phaset, Haiyon, and Ban Na Xay in PKKNPA were surveyed and mushrooms were collected (Fig. 1).

Field survey and mushroom collections

Field survey and mushroom collections were mostly conducted during wet season, from May to October, for 30 days. Whenever we found a mushroom in the survey sites, the photo was taken for recording the image of original shape, and then various information, such as color, single or group, substrate, habitat, etc., were recorded in the field data sheet. The collected mushroom was wrapped with a small paper with the serial number in the cooking hoil and put in the collection bag. Before drying mushroom in the portable mushroom dryer, the small piece of tissue was taken from mushroom body, and put it in 70% ethanol for molecular identification by DNA extraction, PCR amplification, sequencing, and NCBI BLAST search. Dried mushrooms for 12hrs were kept with silicagel in Ziploc® bags labelled with collection informations (date, location, coordinates, collectors, and scientific name, etc.) in the NIBR(National Institute of Biological Resources) specimen herbarium.

Mushroom identification

The collected mushrooms were identified by morphological and molecular analyses. Morphological identification was done by observing dried specimens and photos according to the identification key in the illustrated mushroom books (Lowy 1958; Stuntz et al. 1973; Imazeki and Hongo 1989; Bi et al. 1993; Philips 2005; Tan et al. 2007, 2009; Suwanarit et al. 2008; Chandrasrikul et al. 2011; Wannathes et al. 2009; Sanoamuang 2010; Antomín and Noordeloos 2010; Lee et al. 2012; Whalley et al. 2012; Lee et al. 2015; Kim et al. 2017; Lee et al. 2017) and Index Fungorum system (www. indexfungorum.org). For the molecular identification, total DNA was extracted from mushroom tissue preserved in 100% ethanol, and then ITS (Internal Transcribed Spacer) and/or LSU (Large Sub Unit) regions were amplified by using primers and PCR. The amplified products were sequenced, and the results were BLAST-searched from NCBI GenBank to find the sequence with high similarity.

Results and Discussion

Five hundreds and ninety one mushroom specimens were collected from 10 survey sites of PKKNPA from 2015 to 2016, and then were identified and classified into 149

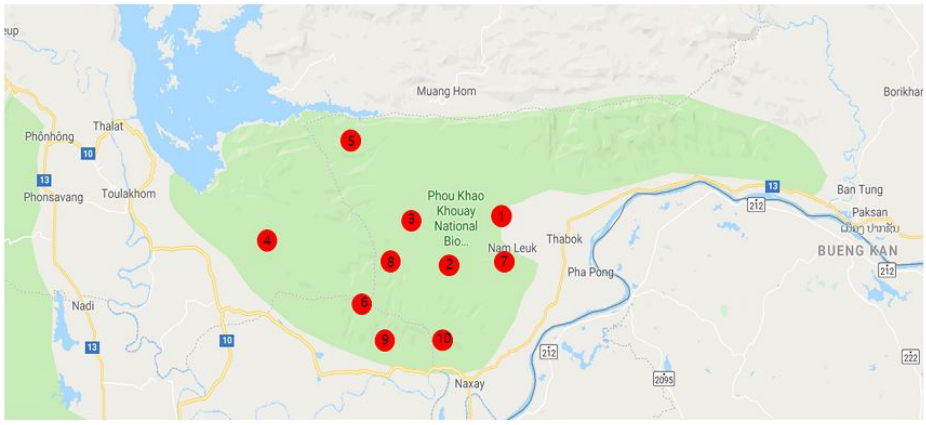

Fig. 1. Survey sites of mushroom diversity in Phou Khao Khuoay National Protected Area (PKKNPA). 1. Tad Xai, 2. Tad Leuk, 3. Houayke, 4. Ban Napheng, 5. Nam Mang Dam, 6. Wang Heau Village, 7. Houaybon, 8. Phaset, 9. Haiyon, 10. Ban Na Xay.

species, 113 genera, 55 families, and 18 orders by morphological and molecular analyses (Fig. 2). The mushrooms belongs to Ascomycota were classified into 13 species, 7 genera, 5 families, and 5 orders while those belongs to Basidiomycota were classified into 136 species, 106 genera, 50 families, and 13 orders, respectively (Table 1). Among these mushrooms, the most species-rich families were Polyporaceae (18.1%), Marasmiaceae (11.0%), Ganodermataceae (8.6%), Xylariaceae (5.8%), Russulaceae (5.4%), Agaricaceae (4.7%), Boletaceae (4.7%), Hymenochaetaceae (3.9%), and Amanitaceae (3.6%), and comprised 65.8% of the total specimens identified (Table 2).

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Table 1. A summary of mushroom classification collected in PKKNPA of Lao PDR

Group	Order	Families	Genera	Species
Ascomycota	5	5	7	13
Basidiomycota	13	50	106	136
Total	18	55	113	149

Table 2. A list of mushroom families exhibiting high species diversity

Rank	Family	No. of Genera	No. of Species	No. of Specimen
1	Polyporaceae	15	31	107
2	Marasmiaceae	6	24	65
3	Ganodermataceae	3	10	51
4	Xylariaceae	1	7	34
5	Russulaceae	2	12	32
6	Agaricaceae	6	10	28
7	Boletaceae	7	14	28
8	Hymenochaetaceae	4	6	23
9	Amanitaceae	1	7	21
10	Mycenaceae	4	5	17
11	Meruliaceae	5	6	10
12	Hydnangitaceae	1	2	10
13	Tricholomataceae	3	4	9
14	Stereaceae	2	2	8
15	Entolomataceae	1	2	8
16	Sarcoscyphaceae	1	2	8
17	Cantharellaceae	2	3	8
18	Auriculariaceae	1	3	8
19	Fomitopsidaceae	2	2	7
20	Phanerochaetaceae	1	2	7
21	Hygrophoraceae	1	4	6
22	Cortinariaceae	1	1	6
23	Sclerodermataceae	2	3	6
24	Geastraceae	1	2	6
25	Dacrymycetaceae	2	3	6

Fig. 2. Mushroom photos collected from Phou Khao Khuoay National Protected Area (PKKNPA) in Lao PDR.

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