

TAXONOMIC STUDY ON TEN WILD MUSHROOMS FROM NGALAIK RESERVED FOREST IN NAYPYITAW UNION TERRITORY

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Abstract

The taxonomic study on wild mushrooms was undertaken from Ngalaik Reserved Forest in Naypyitaw Union Territory. The study areas are situated between North latitude 19° 59.974' and East longitude 96°16. 795'. Ten species were collected during the year from July to October in 2022. The 10 species belonging to 6 genera, 4 families and 2 order were collected, preserved, classified and identified. The collected species were identified as *Agaricus arvensis* Schaeff., *Agaricus bitorquis* (Quel.) Sacc., *Lepiota castaneidisca* Murrill., *Termitomyces bulborhizus* T.Z.Wei, *Termitomyces clypeatus* R.Heim., *Termitomyces eurhizus* (Berk.) R.heim, *Termitomyces heimii* Natarajan., *Podaxis pistillaris* (L.)Fr., these 8 species are growing on the soil *Podoscypha petalodes* (Berk.) Boidin.and *Ganoderma lucidum* (Curtis) P. Krst., are growing on decaying wood and root. In the present study, the edible, inedible, and medicinal wild mushrooms species were also found. Among them 7 species were edible 2 species were inedible and 1 species were usable for medicinal mushroom. The edible mushrooms were found under genus of *Agaricus arvensis* Schaeff., *Agaricus bitorquis* (Quel.), *Podaxis pistillaris* (L.), *Termitomyces bulborhizus* T. ZWei, *Termitomyces clypeatus* R. Heim, *Termitomyces eurhizus* (Berk.) R.Heim, *Termitomyces heimii* Natarajan. Inedible 2 species are *Lepiota castaneidisca* Murrill., *Podoscypha petalodes* (Berk.) Boidin. *Ganoderma lucidum* (Curtis) P.Karst. was usable for the medicinal purpose. An artificial key to the studied species was constructed and presented.

Keywords: Taxonomic of ten wild mushrooms, Ngalaik Reserved Forest, Naypyitaw Union Territory

Introduction

Fungi are important organisms that serve many vital functions in forest ecosystem including decomposition, nutrient cycling, symbiotic relationships with trees and other plants, biological control of other fungi, and as the causal agents of diseases in plants and animals. Mushrooms are sources of food for wildlife and fungi that cause decay in living trees are beneficial to many species of birds and mammals. Macrofungi are distinguished from other fungi by their fruiting structure that we know as mushrooms (Ostry *et.al* 2010).

Mushrooms are familiar to everyone. Edible as well as medicinal properties of mushrooms were known to many of the ancient civilization. There are about 45,000 known species of fungi and about 2000 of them are considered edible (Nair 1990). Mushrooms are one of the most important sources of nutritious food and of great economic importance. They also have rich nutritional value with high contents of proteins, vitamins, minerals, fibers, trace elements and low no calories and cholesterol (Smith *et al.* 2002).

Mushroom, even today, are still not widely accepted as useful medicinal. More than 1,000 kinds of wild mushrooms are sold as edible mushrooms around the world. More than 400 kinds are medicinal and are being used by people in almost every country (Lincoff 2010). In this research, the study area, Ngalaik Reserved Forest is situated between North latitude 19° 59.974' and East longitude 96°16. 795'. In this research, the 10 wild mushrooms were collected in Ngalaik Reserved Forest.

In 2015, Aye Aye Maw presented taxonomic studies on wild mushrooms from Monywa District. The taxonomic studies on the wild mushrooms from Southern Shan State were presented

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by Ohnmar Htwe (2017). Meiktila, Popa and Yinmarbin areas in Mandalay Region were studied by Nilar Cho (2018), Katha District, Sagaing Region were revealed by Chaw Thiri Mon (2020). Loikaw District in Kayah State were studied by Au Au Khaing (2021). Although previous researchers had done to identify and classify the mushrooms in Myanmar, the taxonomic studies on wild mushrooms from Naypyitaw Union Territory are still lacking. Therefore, it is needed to carry out this research. The present research works were focused on those areas for fulfillment the information on the wild mushroom flora of Naypyitaw Union Territory.

The aim and objectives of this study were to identify and classify the morphological characteristics of the wild mushrooms from Ngalaik Reserved Forest, Ottarathiri Township in Naypyitaw Union Territory, to record their taxonomic characteristics and distribution, and to fulfill for providing the scientific information and the compilation of the wild mushroom flora in Myanmar.

Materials and Methods

The study areas of on wild mushrooms was undertaken from Ngalaik Reserved Forest in Naypyitaw Union Territory were situated between North latitude 19° 59.974' and East longitude 96°16. 795. The fresh specimen of wild mushrooms were from Ngalaik Reserved Forest from July to October in 2022.

All the fresh specimens were recorded with digital camera to get their actual habitat and noted their fruiting characteristics. The collection, preservation and the spores print technique were followed by Thomas (1948), Krieger and Schaffer (1967) and Schaffer and Pacionic (1981). The fleshy mature specimens were selected. The stipe was removed by cutting it off as close as possible to the point of attachment of cap. It is obtained by placing a cap with the hymenium facing down on a sheet of white, black paper or a piece of glass-slide. A blow can serve as a cover after a few hours, a layer of the spores was deposited. The real color of the spores was determined by spore prints.

The collected specimens were preserved in Formalin-Acetic acid - Alcohol (FAA) by the ratio of 5: 5: 90. Some of the dried specimens were placed in plastic bags and plastic bottles. The classification and identification of collected specimens were done by comparing the literature: Thomas (1948), Alexopoulos (1962), Krieger (1967), Pacioni (1981), Keizer (1998). An artificial key to the studied species was also constructed and presented. The herbarium specimens will numbered and deposited at the herbarium room of Department of Botany, University of Mandalay for the references and other scientific studies.

Result

Ten species belonging to 6 genera, 4 families and 2 order were collected, from Ngalaik Reserved Forest in Naypyitaw Union Territory. These species are *Agaricus arvensis* Schaeff., *Agaricus bitorquis* (Quel), *Lepiota castaneidisca* Murrill, *Podaxis pistillaris* (L.) Fr. *Termitomyces bulborhizus* T.Z.Wei, *Termitomyces clypeatus* R. Heim, *Termitomyces eurhizus* (Berk.) R.Heim, *Termitomyces heimii* Natarajan, *Ganoderma lucidum* (Curtis) P.Karst. *Podoscypha petalodes* (Berk.) The morphological and spores characters of those species were classified and identified. The lists of collected species and their comparable morphological characteristics were shown in Table 1-2 and Figure 1-10.

Table1. List of collected wild mushroom species from Ngalaik Reserved Forest

Territory Sub-Class	Order	Family	No.	Scientific Name
Homobasidiomycetidae	Agaricales	Agaricaceae	1.	<i>Agaricus arvensis</i> Schaeff
			2.	<i>Agaricus bitorquis</i> (Quel) Sacc.
			3.	<i>Lepiota castaneidisca</i> Murrill.
			4.	<i>Podaxis pistillaris</i> (L.) Fr.
	Lyophyllales	Lyophyllaceae	5.	<i>Termitomyces bulborhizus</i> T.Z.Wei
				<i>Termitomyces clypeatus</i> R. Heim
			7	<i>Termitomyces eurhizus</i> (Berk.) R.heim
			8	<i>Termitomyces heimii</i> Natarajan
	Polyporales	Ganodermataceae	9	<i>Ganoderma lucidum</i> (Curtis) P.Krst.
		Meruliaceae	10	<i>Podoscypha petalodes</i> (Berk.) Boidin.

Table 2. Comparable morphological characteristics of wild mushrooms form Ngalaik Reserved Forest in Naypyitaw Union Territory

No	Scientific name	Growing habitat	Edible/ Inedible	Caps		Gills/Pores		
				Colour	Shape	Umbo nate	Colour	Attach ment
1	<i>Agaricus arvensis</i> Schaeff.	soil	edible	white	expanded	absent	chocolate - brown	free
2	<i>Agaricus bitorquis</i> (Quel.) Sacc.	soil	edible	white	expanded	absent	dark-brown	free
3	<i>Lepiota castaneidisca</i> Murrill.	soil	inedible	white with reddish bown	expanded	present	white	free
4	<i>Podaxis pistillaris</i> (L.) Fr.	sandy soil	edible	white	cylindrica l	absent	white	-
5	<i>Termitomyces bulborhizus</i> T.Z.Wei	soil	edible	greyish brown	expanded	present	pale pink	
6	<i>Termitomyces clypeatus</i> R.Heim.	soil	edible	pale brown	expanded	present	pale pink	free
7	<i>Termitomyces eurhizus</i> (Berk.) R.heim	soil	edible	yellowish brown	expanded	present	pale pink	free
8	<i>Termitomyces heimii</i> Natarajan.	soil	edible	white	expanded	present	white	free
9	<i>Gandoderma lucidum</i> (Curtis) P.Krst.	decaying	inedible	reddish-brown	kidney-shaped	absent	cream colored	free
10	<i>Podoscypha petalodes</i> (Berk.) Boidin.	wood	inedible	pale brown	funnel	absent	cream colored	-

Table 2 Continued

No.	Scientific name	Stipes			Spores				
		Shape	Colour	Hollow/Solid	Rings	Colour	Shape	Texture	Size
1.	<i>Agaricus arvensis</i> Schaeff.	equal	white	hollow	present	brown	ellipsoid	smooth	10.0-15.5× 7.5-10.5µm
2	<i>Agaricus bitorquis</i> (Quel) Sacc	equal	white	solid	present	brown	ellipsoid	smooth	10.0-15.0× 7.5-12.5µm

No.	Scientific name	Stipes				Spores			
		Shape	Colour	Hollow/Solid	Rings	Colour	Shape	Texture	Size
3.	<i>Lepiota castaneidisca</i> Murrill.	bulbous	white	hollow	present	white	ellipsoid	smooth	10.0-12.5× 7.5-10.5µm
4.	<i>Podaxis pistillaris</i> (L.) Fr.	equal	white	solid	absent	white	ellipsoid	smooth	10.5-20.0× 6.5-7.5µm
5.	<i>Termitomyces bulborhizus</i> T.Z.Wei	equal	white	solid	absent	pink	ellipsoid	smooth	12.5-15.0× 10.0-12.5µm
6.	<i>Termitomyces clypeatus</i> R.Heim.	equal	yellowish brown	solid	absent	pink	ellipsoid	smooth	10.5- 12.5× 7.5-10.0µm
7.	<i>Termitomyces eurhizus</i> (Berk.) R.heim	equal	pale brown	solid	absent	pink	ellipsoid	smooth	12.5-17.5× 7.5-12.5µm
8.	<i>Termitomyces heimii</i> Natarajan	equal	white	solid	present	white	ellipsoid	smooth	12.5-20.0× 7.5-10.0µm
9	<i>Ganoderma lucidum</i> (Curtis) P.Krst.	equal	reddish brown	solid	absent	brown	ellipsoid	smooth	8.5-10.5× 5.5-6.5µm
10	<i>Podoscypha petalodes</i> (Berk.) Boidin.	flattened cylindrical	pale yellow	solid	absent	white	ellipsoid	smooth	7.5-10.0× 5-7.5µ



Figure 1. *Agaricus arvensis* Schaeff.

(A. Growing habitat, B. Fruiting body in lateral view, C. Fruiting body in longitudinal section, D. Pileus in lower view, E. Spores)



Figure 2. *Agaricus bitorquis* (Quel.) Sacc

(A. Growing habitat, B. Fruiting body in lateral view, C. Fruiting body in longitudinal section, D. Pileus in lower view, E. Spores)

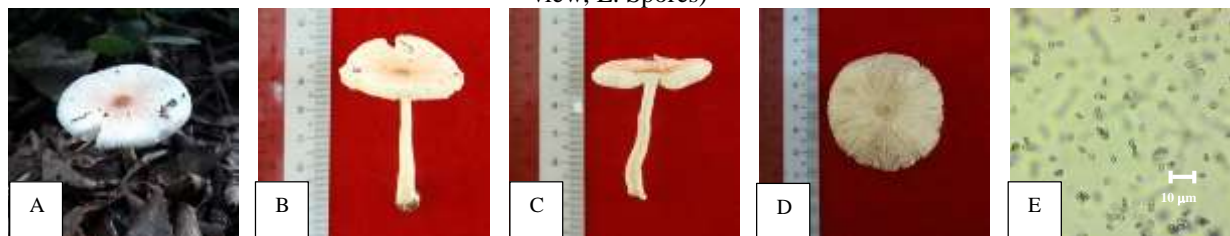


Figure 3. *Lepiota castaneidisca* Murrill.

(A. Growing habitat, B. Fruiting body in lateral view, C. Pileus in lower view, E. Spores)

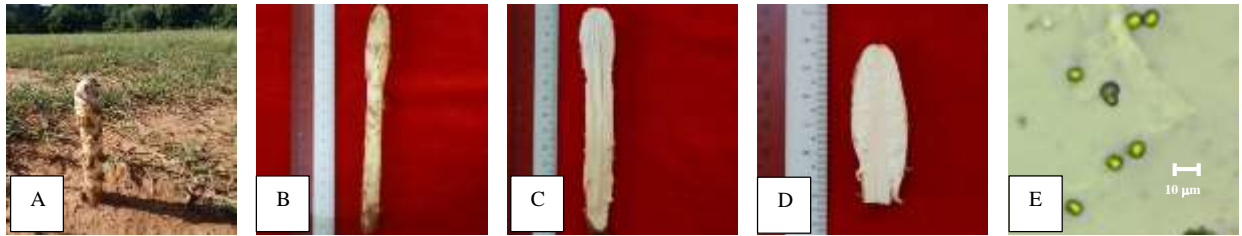


Figure 4. *Podaxis pistillaris* (L.) Fr.

(A. Growing habitat, B. Fruiting body in lateral view, C. Fruiting body in longitudinal section, D. Pileus in lower view, E. Spores)



Figure 5. *Termitomyces bulborhizus* T.Z Wei

(A. Growing habitat, B. Fruiting body in lateral view, C. Fruiting body in longitudinal section, D. Pileus in lower view, E. Spores)



Figure 6. *Termitomyces clypeatus* R. Heim

(A. Growing habitat, B. Fruiting body in lateral view, C. Pileus in lower view, D. Spores)



Figure 7. *Termitomyces eurhizus* (Berk.) R. Heim

(A. Growing habitat, B. Fruiting body in lateral view, C. Fruiting body in longitudinal section, D. Pileus in lower view, E. Spores)



Figure 8. *Termitomyces heimii* Natarajan

(A. Growing habitat, B. Fruiting body in lateral view, C. Pileus in lower view, D. Spores)



Figure 9. *Ganoderma lucidum* P.Karst

(A. Growing habitat, B. Fruiting body in lateral view, C. Fruiting body in longitudinal section, D. Pileus in lower view, E. Spores)

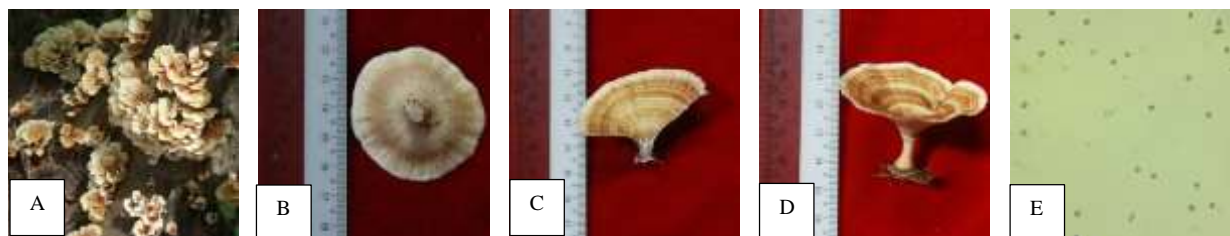


Figure 10. *Podoscypha petalodes* (Berk.) Boidin.

(A. Growing habitat, B. Fruiting body in lateral view, C. Fruiting body in longitudinal section, D. Pileus in lower view, E. Spores)

An Artificial Key to the Studied Species

1. Hymenium pores ----- 2
1. Hymenium gills ----- 4
 2. Gleba present; cap shaped cylindrical, white ----- 4. *Podaxis pistillaris*
 2. Gleba absent; cap shaped kidney or funnel, reddish or pale- brown ----- 3
3. Stipe equal, reddish brown; spore brown ----- 9. *Ganoderma lucidum*
3. Stipe flattened cylindrical, pale yellow; spore white ----- 10. *Podoscypha petalodes*
 4. Umbo absent ----- 5
 4. Umbo present ----- 6
5. Stipe hollow; gills color chocolate- brown ----- 1. *Agaricus arvensis*
5. Stipe solid; gills color dark- brown ----- 2. *Agaricus bitorquis*
 6. Spore color white ----- 7
 6. Spore color pink ----- 8
7. Stipe bulbous, hollow; cap color with reddish brown ----- 3. *Lepiota castaneidisca*
7. Stipe equal, solid; cap color white without reddish brown ----- 8. *Termitomyces heimii*
 8. Stipe color yellowish brown; spore 10.5- 12.5×7.5-10.0µm ----- 6. *Termitomyces clypeatus*
 8. Stipe color white or pale brown; spore 12.5-15.0×10.0-12.5µm ----- 9
9. Cap color greyish brown ----- 5. *Termitomyces bulborhizus*
9. Cap color yellowish brown ----- 7. *Termitomyces eurhizus*

Discussion and Conclusion

The taxonomic study on wild mushrooms was undertaken from Ngalaik Reserved Forest in Naypyitaw Union Territory. The study areas are situated between North latitude 19° 59.974' and East longitude 96° 16. 795'. Ten species were collected during the year from July to October in 2022. The 10 species belonging to 6 genera, 4 families and 2 order were collected, preserved, classified and identified.

Among them 7 species were gill mushrooms type, *Agaricus arvensis* Schaeff., *Agaricus bitorquis* (Quel.), *Lepiota castanneidisca* Murrill, *Termitomyces bulborhizus* T.Z Wei, *Termitomyces clypeatus* R. Heim, *Termitomyces eurhizus* (Berk.) R.Heim, *Termitomyces heimii* Natarajan. These were gills free type. The 1 species of puffball was *Podaxis pistillaris* (L.) Fr, these 8 species are growing on the soil. The 2 species of porous were, *Ganoderma lucidum* (Curtis) P.Karst. and *Podoscypha petalodes* (Berk.) Boidin., these species are growing on decaying wood and root.

Five species, *Lepiota castanneidisca* Murrill, *Termitomyces bulborhizus* T.Z Wei, *Termitomyces clypeatus* R. Heim, *Termitomyces eurhizus* (Berk.) R.Heim, *Termitomyces heimii* Natarajan. were present the umbo on the cap. The others, *Agaricus arvensis* Schaeff., *Agaricus bitorquis* (Quel.), *Podaxis pistillaris* (L.) Fr, *Ganoderma lucidum* (Curtis) P.Karst. and *Podoscypha petalodes* (Berk.) Boidin., were absent umbo on the cap. These findings were in agreement with Thomas (1948), Nair (1990).

Two kinds of mushroom species; pore mushrooms and gillsmushrooms were recorded in this study. Among them, *Ganoderma lucidum* (Curtis) P.Karst and *Podoscypha petalodes* (Berk.) Boidin was pore mushrooms type.

Various cap shapes were also observed in this study areas. *Agaricus arvensis* Schaeff., *Agaricus bitorquis* (Quel.), *Lepiota castanneidisca* Murrill, *Termitomyces bulborhizus* T.Z Wei, *Termitomyces clypeatus* R.Heim, *Termitomyces eurhizus* (Berk.) R.Heim, *Termitomyces heimii* Natarajan were convex to expanded, *Podaxis pistillaris* (L.) Fr, is cylindrical, *Podoscypha petalodes* (Berk.) Boidin. is funnel shaped, *Ganoderma lucidum* (Curtis) P.Karst is kidney-shaped. These findings were in agreement with Keizer (1998), Phillips (2006).

The stipe shapes of 8 species were equal in *Agaricus arvensis* Schaeff., *Agaricus bitorquis* (Quel), *Podaxis pistillaris* (L.) Fr. *Termitomyces bulborhizus* T.Z.Wei, *Termitomyces clypeatus* R. Heim, *Termitomyces eurhizus* (Berk.) R.Heim, *Termitomyces heimii* Natarajan, *Ganoderma lucidum* (Curtis) P.Karst. *Podoscypha petalodes* (Berk.) is flattened cylindrical shaped, *Lepiota castaneidisca* Murrill is bulbous. The hollow stipes were observed in *Agaricus arvensis* Schaeff and *Lepiota castanneidisca* Murrill. *Agaricus bitorquis* (Quel.), *Termitomyces bulborhizus* T.Z Wei, *Termitomyces clypeatus* R.Heim, *Termitomyces eurhizus* (Berk.) R.Heim, *Termitomyces heimii* Natarajan, *Podaxis pistillaris* (L.) Fr, *Podoscypha petalodes* (Berk.) Boidin., *Ganoderma lucidum* (Curtis) P.Karst were solid stipes. These findings were in agreement with Keizer (1998), Thomas (1948).

The spores colour were brown in *Agaricus arvensis* Schaeff., *Agaricus bitorquis* (Quel), *Ganoderma lucidum* (Curtis) P.Krst., the spores colour were white in *Lepiota castaneidisca* Murrill., *Podaxis pistillaris* (L.) Fr., *Termitomyces heimii* Natarajan *Podoscypha petalodes* (Berk.), the spores colour were pink in *Termitomyces bulborhizus* T.Z.Wei, *Termitomyces clypeatus* R. Heim, *Termitomyces eurhizus* (Berk.) R.Heim. Nair (1990). Among them 7 species

were edible, 2 species were inedible and 1 species were usable for medicinal mushroom. The edible mushrooms were found under genus of *Agaricus arvensis* Schaeff., *Agaricus bitorquis* (Quel.), *Podaxis pistillaris* (L.), *Termitomyces bulborhizus* T.Z Wei, *Termitomyces clypeatus* R. Heim, *Termitomyces eurhizus* (Berk.) R.Heim, *Termitomyces heimii* Natarajan *Ganoderma lucidum* (Curtis) P.Karst. The inedible mushrooms were found under genus *Lepiota castaneidisca* Murrill and *Podoscypha petalodes* (Berk.) Boidin. The medicinal purpose mushrooms were found under genus of *Ganoderma lucidum* (Curtis) P.Karst. These finding were in agreement with Thomas (1948), Phillips (2006), Robert & Joanne (2013), Atkinson, (1901). All the species were identified on the basic of their morphological characters as well as spores shape and texture.

Some wild mushroom species from this Ngalaik Reserved Forest in Naypyitaw Union Territory were also found in Kayah State, Mandalay Region, and Monywa District. These are *Agaricus arvensis* Schaeff., *Agaricus bitorquis* (Quel.). *Ganoderma lucidum* (Curtis) P.Karst.in Monywa District (Aye Aye Maw 2015). *Lepiota castaneidisca* Murrill., *Podaxis pistillaris* (L.) Fr., *Termitomyces eurhizus* (Berk.) R.Heim, *Termitomyces heimii* Natarajan in Mandalay Region (Nilar Cho, 2018), *Termitomyces bulborhizus* T.Z Wei in Kayah State (Au Au Khaing 2021).

Therefore, it would be concluded that the present study was one of the systematic records of wild mushrooms to be used by researchers in various fields of studies. This study will be provided the partial fulfillment of the information on the wild mushrooms distribution in Ngalaik Reserved Forest in Naypyitaw Union Territory and will be beneficial to accomplish the mushroom flora in Myanmar.

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