Ethnomycological studies on some macro-fungi in Rupandehi District, Nepal

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This ethnomycological investigation explores the wild edible microfungi with their identification and documentation of nutritional potential and indigenous knowledge. The study area occupies 154.75 hectare-land, and lies within a narrow limit of altitude between 110 m and 165 m above sea level in tropical deciduous riverine forest. *Amanita caesarea*, *A. chepangiana*, *A. pantherina*, *Agaricus augustus*, *Coprinus comatus*, *C. plicatilis*, *Macrolepiota fuliginosa*, *M. rhacodes*, *Russula emetica*, *R. foetens*, *R. nigricans*, *Scleroderma bovista*, *S. citrinum*, *Termitomyces clypeatus* and *T. eurhizeus* are found to be dominant. The collected samples represented 27 species of Basidiomycetes belonging to 6 orders, 13 families and 18 genera. The dried specimens are housed in the Tribhuvan University Central Herbarium, Kirtipur, Kathmandu, Nepal. The area embraces many mycophagous ethnic communities. The mycoelements prevailing in this area need sustainable conservation and utilization.

Key words: Basidiomycetes, macrofungi, mushroom diversity, indigenous, mushrooms

Nepal is considered as the homeland for the mushroom floral diversity (Aryal *et al*., 2012). So far, 812 mushroom species have been identified (Adhikari, 2009). Out of them 228 edible (Christensen *et al*., 2008), 66 poisonous (Pandey, 2008; Adhikari, 2009) and 75 medicinal species (Adhikari, 2009) have been reported.

The investigation and study on mushroom of Nepal started since 19th century (Lloyd, 1808; Berkeley, 1838). Since then, several papers have been published and several botanical investigations have been done. Among these, very few reveal the studies and investigation on macrofungi from western Nepal. This is a preliminary report on ethnomycological investigation carried out at Baunnakoti Community Forest in Rupandehi District. The area has not been previously investigated so far.

This paper highlights the indigenous knowledge of the wild edible mushrooms in the district. Presently, 27 species of the Basidiomycetes belonging to 6 orders, 13 families and 18 genera have been reported from Baunnakoti Community Forest, situated in the tropical climate.

Materials and methods

Study area

The study area lies in Rupandehi District of Lumbini Zone, and partial parts of Chiliya, Madhauliya, Padsari and Tikuligadh Village Development Committees (VDCs) in the Western Terai of Nepal (Fig. 1). The total human population of the study area was 32,256 (DDC, 2007) with 5,531 households (DFO, 2012). The forest vegetation is dominated by species of the *Dipterocarpaceae*, *Combretaceae* and *Leguminosae* families. The forest covered area of Chiliya VDC is 96.85 ha (10.45%), followed by Tikuligadh 46.1 (2.16%), Padsari 9.9 ha (1.02%) and Madhauliya 1.9 ha (0.15%). This study included 2.95% of forested land (DFO, 2012), and lies between 27.5421^{o} – 27.5623^{o} N latitudes and 83.40611^{o} – 83.47643^{o} E longitudes. The altitudinal range varies from 110 m –165 m above sea level. The average annual rainfall is 1,391 mm (GoN, 2010).

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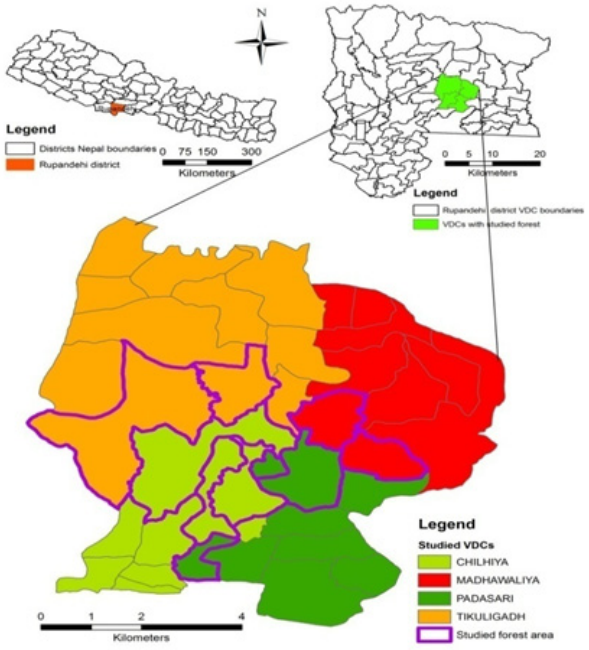

Fig. 1 : Map of the study area

The area lies in tropical zone embracing different types of vegetation and soil composition. The tropical riverine belt is composed of khair (*Acacia catechu*), karma (*Adina cordifolia*), banjhi (*Anogeissus latifolia*), simal (*Bombax ceiba*), satisal (*Dalbergia latifolia*), sissoo (*Dalbergia sissoo*), Sindure (*Mallotus philippinensis*), kandel (*Phoenix sylvestris*), sal (*Shorea robusta*), kusum (*Schleichera oleosa*), jamun (*Syzygium cumini*), sagwan (*Tectona grandis*), saj/asana (*Terminalia alata*) and barro (*T. bellirica*) etc. (Stainton, 1972; Shrestha, 1998). The diverse phytodiversity and ecological conditions provide a good homeland for the growth of tremendous parasitic, saprophytic and mycorrhizal fungi (Aryal and Budathoki, 2012). The northern belt of the area is composed of loamy sand, while the southern belt consists of sandy loam to loamy soil.

Materials and methods

Altogether, 27 mushroom samples were collected, and the local informants were interviewed. Indigenous knowledge survey was conducted from 15 to 31 May 2010, and specimens were collected from 1 June to 31 October 2011. The Participatory Rural Appraisal (PRA) technique was adopted with the local people aimed at getting information largely on nutritional aspects. Data were obtained using combined semi-structured questionnaire, participatory discussions and field observations.

Mushroom samples were photographed in their natural habitat, and their morphological characters were noted. The samples were well dried and packed in wax paper bags with proper tag numbers. The habitat including ecological parameters *viz*. altitude, vegetation composition, soil type, soil pH, soil moisture, humidity, and temperature were recorded. The paper bags were brought to the Central Department of Botany, Tribhuvan University for further microscopic examination.

The identification was done with the help of relevant literatures (Bakshi, 1971; Dickinson and Lucas, 1979; Singer, 1986, Kumar *et al*., 1990) and websites (biodiversity library.org; Index fungorum; Jstor.org; Mycobank.org; Scircus; tropicos.org; Agaricus in the Pacific Northwest; Boletes in the Pacific Northwest). The voucher specimens were deposited in Tribhuvan University Central Herbarium.

Results and discussion

Results

During field survey, altogether, 27 species of Basidiomycetes from 6 orders belonging to 13 families and 18 genera were recorded with their brief descriptions (Annex 1).

A notable frequency of *Amanita caesarea*, *A. chepangiana, A. pantherina*, *Agaricus augustus*, *Coprinus comatus*, *C. plicatilis*, *Macrolepiota fuliginosa*, *M. rhacodes*, *Russula emetica*, *R. foetens*, *R. nigricans*, *Scleroderma bovista*, *S. citrinum*, *Termitomyces clypeatus* and *T. eurhizeus* were observed. Out of the total collection, 55% mushrooms were found to be under Agaricales order followed by Polyporales, Russulales, Boletales, Hymenochaetales and Tricholomatales (Fig. 2).

Indigenous knowledge and therapeutic use

On the basis of the information collected, 92.5% of the mushrooms were found to be used as food, 5.5% as medicine, 1.5% as taste and flavor, and 0.5% as tonic. The food values of wild edible mushrooms were found to be more significant in the study sites. The consumption data revealed that mushrooms were found to be mostly used as food by 51% women followed by 31% children and 18% men. People were found to have used these mushrooms for the remedy of different

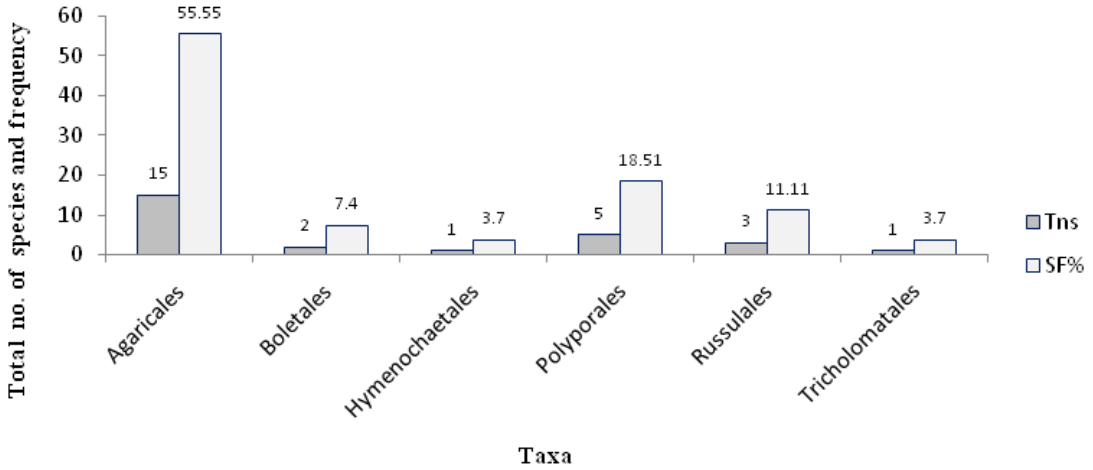

Fig. 2: A graph showing the total no. of species (Tns) and % of frequency of groups (SF%) of Basidiomycotina

types of diseases and ailments. Out of the 150 respondents, 30% people were found to have used it for the remedy of measles. Similarly, 24% people were found to have used it for the treatment of yellow fever, 20% for the treatment of jaundice, 16% for the treatment of inappetence, 4% for the treatment of constipation, 4% for the treatment of mumps, ear pain and cut wounds, 2% for the treatment of skin diseases, 1.3% for the treatment of muscular pain, and 0.6% for the treatment of stomach pain. Their medicinal uses for the treatment of different types of disease were found to have made them more significant for the people of the area.

Discussion

Wild edible mushrooms are not only an important source of food for local people, but are equally used for medicinal purpose. The present survey on the macrofungi revealed that there are plenty of edible species of mushroom. The most common among them such as *Cleroderma bovista*, *T. clypeatus*, *T. eurhizeus* and *Volvorella volvacea* are collected, sacked in bags and carried to market for selling.

Among 27 species identified, 15 are edible, 4 inedible, 4 poisonous and 4 species possess medicinal value. Some of the edible species such as *S. bovista, T. clypeatus* and *T. eurhizeus* are also used for medicinal purpose. The medicinally important tropical polypore like *Pycnoporus cinnabarinus* is used for the remedy of infectious disease (mump), ear pain etc. *Scleroderma citrinum*, the medicinal species is also used as food. *Schizophyllum commune*, the cosmopolitan inedible species is sometimes used for culinary purpose in food deficit condition. This species has religious value too, and is used as 'Sagun' i.e. good luck in the marriage ceremony in Newar community.

During surveys, it was found that the mushroom flora of *Macrolepiota fuliginosa*, *M. rhacodes*, *R. nigricans*, *T. clypeatus*, *T. eurhizeus* and *V. volvacea* is declining since the last two decades due to deterioration of forest lands. Notable frequencies of species were found in abundance during sample collection. Being saprophytic, obligatory symbionts as well as part of the mycorrhizal association, these microfungi play an important role in increasing soil fertility in the forest through biodegradation as well as decomposition of the lignocellulose compounds of leaf litter. The litter debris of vascular flora favours the regulation and maintenance of temperature and moisture in the soil for these microfungi. The toxic species listed are *Amanita pantherina*, *Coprinus plicatilis*, *Russula emetica* and *R. foetens*.

Conclusion

The reported mushrooms occur in tropical to temperate belts throughout the nation. Extensive investigation is needed to find out their species richness, distribution pattern, species diversity index and ethnomycological uses. Some of the important macrofungi such as *Macrolepiota*, *Scleroderma*, *Termitomyces* and *Volvorella* spp. need special attention to be conserved against threat to avoid their unmanaged and unscientific exploitation. Besides, their harvesting should be done in scientific manner rather than using traditional methods. The mycoelements prevailing

in this area need sustainable conservation and utilization.

Acknowledgments

The authors would like to acknowledge Nepal Academy of Science and Technology for providing research grant to conduct this study. The authors are obliged to the Central Department of Botany, Tribhuvan University for providing laboratory facilities. The authors are also grateful to the Institute of Agriculture and Animal Science for granting study leave to one of them (Mr. H. P. Aryal). Further, the authors would like to appreciate Prof. Dr. R. D. Tiwari for his kind cooperation during the study period. Last but not least, sincere thanks are extended to the local people of the study area for providing information to the authors.

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Annex 1: Wild macrofungi collected from Baunnakoti Community Forest, Rupandehi District, Nepal

S.N.	Sample collection no.	Scientific name	Local name	Order	Family	Host/ Substratum	Ecology	Application
1	100755	*Amanita caesarea* (Scop.) Pers.	Suntale Chyau	Agaricales	Amanitaceae	Soil	Mycorrhizae	Used as vegetable
2	100772	*Amanita chepangiana* Tulloss & Bhandary	Salleu, Kukhura Phule-chyau	Agaricales	Plutaceae	Soil	Mycorrhizae	Used as vegetable
3	100773	*Amanita pantharina* (D C.) Kromb.	Bhut Chyau	Agaricales	Amanitaceae	Soil	Mycorrhizae	Deadly poisonous
4	1209561	*Agaricus augustus* Fr.	Kaile Chyau	Agaricales	Agaricaceae	Soil	Saprophytic	Used as vegetable
5	1010524	*Agaricus sylvicola* (Vittad.) Peck.	Sal Chyau	Agaricales	Plutaceae	Soil	Saprophytic	Not edible
6	1008149	*Armellaria Mella* (Vahl.: Fr.) Kummer.	Todke Chyau	Agaricales	Marasmiaceae	On decayed log from crevices in moist shady areas	Parasitic	Used as vegetable/ soup
7	1007214	*Asterophora parasitica* (Bull.) Sing.	Chyau mathi Seto Chyau	Tricholomatales	Tricholomataceae	In moist shady place (above the Russula)	Parasitic	Not edible
8	1008329	*Coltricia cinninenea* (Pers.) Murrill.	Soli Chyau	Hymenochaetales	Hymenochaetaceae	On leaf mould soil	Saprophytic	Not edible
9	1009500	*Cpprinus Comatus* (O.F. Mill.) Pers.	Gobre Chyau	Agaricales	Coprinaceae	Soil	Saprophytic	Edible at young stage; offered to child, in the form of powder mixed with rice or milk, for good sleep
10	100707	*Coprinus plicatilis* (Curtis) Fr.	Payeje Chyau	Agaricales	Coprinaceae	On log (*Acacea catechu*)	Saprophytic	Poisonous
11	100708	*Daldinia concentric* (Bolt.) Ces et de not.	Dalle/ Kale Chyau	Polyporales	Polyporaceae	On log (*Dalbergia sissoo*)	Saprophytic	Not edible; used to treat burns
12	100954	*Flammulina velutipes* (Curtis) Sing.	Patpate Chyau	Agaricales	Marasmiaceae	On soil/ decaying log	Saprophytic	Edible, but not popularly used
13	1007107	*Ganoderma lucidium* P. Karst.	Dadhu Chyau	Polyporales	Ganodermataceae	Trunk (*Bombax ceiba*)	Parasitic	Used for decorative purpose and for removing evil spirit
14	100759	*Lentinus tigrinus* (Bull.) Fr.	Vedi Chyau	Polyporales	Polyporaceae	On stump (*Syzygium cumini*)	Saprophytic	Edible, but not popularly used
15	1008118	*Macrolepiota fuliginosa* (Barla) Bon.	Gobre Chyau	Agaricales	Agaricaceae	Soil	Saprophytic	Used as vegetable
16	1008330	*Macrolepiota rhacodes* (Vittad.) Sing.	Gobre Chyau	Agaricales	Agaricaceae	Soil	Saprophytic	Used as vegetable
17	1008315	*Nigroporus vinosa* (Berk.) Murrill	Jhule Chyau	Polyporales	Fomotopsidaceae	On log (*Syzygium cumini*)	Parasite/ Saprophyte	Not edible

18	100711	*Pycnoporus cinnabarinus* (Jacq.) P. Karst.	Sindure Chyau	Polyporales	Polyporaceae	Stump (*Syzygium cumini*)	Saprophytic	Used for relief of ear pain and mumps
19	1007171	*Russula emetica* (Schaeff.) Pers.	Ratteuo	Russulales	Russulaceae	Litter	Mycorrhizae	Poisonous medicine that causes vomiting
20	1008350	*Russula foetens* Pers.	Gandhe Chyau	Russulales	Russulaceae	Soil	Mycorrhizae	Poisonous
21	100751	*Russula nigricans* Fr.	Handi Chyau	Russulales	Russulaceae	Soil	Mycorrhizae	Edible; used as pickles
22	101002	*Schizophyllum commune* Fr.: Fr.	Pankha Chyau	Agaricales	Schizophyllaceae	Decayed wood (*Shorea robusta*)	Saprophytic	Edible; used for culinary purpose; has religious/ cultural values
23	1009152	*Scleroderma bovista* Pers.	Alu Chyau, Ptteu	Bolatales	Scleroderma-taceae	Soil	Mycorhizae	Edible; used as vegetable; has medicinal values
24	1007317	*Scleroderma citrinum* Fr.	Dalle Chyau	Bolatales	Scleroderma-taceae	Soil	Mycorhizae	Not edible; causes gastric disorders or acute indigestion
25	1010530	*Termitomyces clypeatus*. R. Heim.	Dhamere Chyau, Vemti	Agaricales	Tricholomataceae	Termites nest	Saprophytic	Edible; used for treatment of feaver and measles
26	1007119	*Termitomyces eurhizeus* (Berk.) Heim.	Dhamere/ Bagale Chyau	Agaricales	Tricholomataceae	Termites nest	Saprophytic	Edible; used for treatment of feaver and measles
27	1109856	*Volvorella volvacea* (Bull.:Fr.) Sing.	Parale Chyau	Agaricales	Plutaceae	decomposed paddy straw	Saprophytic	Used as vegetable