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STUDY OF MUSHROOM DIVERSITY AND ITS ECONOMIC VALUE IN SAGARMATHA NATIONAL PARK

FINAL REPORT

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TABLE OF CONTENTS

1.	INTRODUCTION	1
1.1	Background	1
1.2	Ecology and Habit	2
1.3	Nutritional medicinal and agricultural value of mushrooms	2
1.3.1	Edible mushrooms	2
1.3.2	Medicinal mushrooms	4
1.3.3	Agriculture	5
1.4	Nepalese context	5
1.4.1	Ecological factors affecting mycoflora	5
1.4.2	Mycodiversity	6
1.5	Review of past mushroom studies in Nepal	6
1.6	Objective	12
1.7	Study area	12
2.	MATERIAL AND METHODS	15
2.1	Equipments	15
2.2	Methodology	15
3.	RESULTS AND DISCUSSION	17
3. 1	Enumeration of mushroom species	27
4.	RECOMMENDATION	43
5.	REFERENCES	49
6.	ANNEXES I	56
7.	ANNEXES II	61

1. INTRODUCTION

1.1 Background

Generally, the term "mycology" is the study of fungi which is derived from the Greek word mykes (fungi) and logos (discourse). Both the Greek and Latin words "mykes" and "fungus" respectively mean mushroom. In the broad sense mushrooms are fungi. But all fungi are not necessarily considered as mushroom. Usually agarics or fleshy species of higher fungi are recognized as mushroom.

Much curiosity and speculation has been expressed since time immemorial on the appearance of mushrooms in nature. To the ancient Romans mushroom was "the food of the Gods" resulting from bolts of lightening thrown to the earth by Jupiter during thunder storms. The Greek believed mushrooms to be a consequence of lightening, since they appeared suddenly after rains (Lakhanpal, 1996). The Egyptians considered them as "gift from the God Osiris" while the Chinese viewed them as "elixir of life". According to Hindu Mythology, as recorded in the Rigveda, 'Parjnya the God of Thunder' was the father of the divine plant 'Soma' (Wasson, 1969), he has also cited evidence to conclude that 'Soma' was obtained from *Amanita muscaria*. The Mahabharat depicts an interesting mythological legend. It was nearly 5000 years back when Indra (king of gods) killed Britrasur (the demon) and the mushrooms grew where the foam of the devil's blood spread.

Ethnomycology is specifically dedicated to mushrooms which have consciousness expanding qualities imbedded in the religious traditions, writings and indigenous knowledge of mankind. The discipline of ethnomycology can be said to have begun with the work of R. Gordon Wasson (1898-1986). 'Ethno' pertaining to people, and 'mycology' referring to the study of fungi. Ethnomycology is the study of the traditional human use of fungi. It is a synthesis of anthropology and science, often touching upon the areas of religion, ethnomedicine, shamanism, history, poetry, linguistics, and art. So ethnomycology is a single discipline composed of multi-disciplinary knowledge.

In Nepal mushroom collection and consumption have been continuing since time immemorial by different ethnic groups. The wild edible mushrooms serve as important natural seasonal crop which play an important role in the development of economic condition of the rural people (Adhikari, 2000). Even though Nepal is rich in mycodiversity very few scientific research have been conducted and the number of involvement of scientist in this field is very few (Adhikari, 2000). It has been observed that mycological study is mainly concentrated in the central region as compared to the eastern and western regions. So far, in Nepal very few studies have been conducted regarding the utilization of mushroom by different ethnic groups. Therfore, it is crucial to identify potential indigenous wild edible mushrooms and to conduct ethnomycological studies to safeguard the traditional knowledge handed over from generation. Even though many mushrooms are used as medicine by Nepalese people their chemical estimation and pharmaceutical investigation have yet been performed (Rajbandari, 1999).

1.2 Ecology and habitat

Mushrooms grow either in the ground or on an organic substrate i.e. on living or dead under humid condition. They are found generally amongst grass, fallen leaves on log, tree stumps, dung or enriched soil, burnt ground or burnt wood, bog and marshlands living trees, woody debris and even other fungi. Although mushrooms constitute different mode of habitat but in general it can be summarized in three basic forms namely Saprophytic, Parasitic and Mycorrhiza.

Saprophytes

The fungi included here live on dead organic matter, including leaves, grass, logs, pine cones, nuts, dung or even other dead or living fungi. In most cases, a fungus will attack only a certain type of organic matter. *Agrocybe pediades* for example lives on dead grass, *Pleurotus ostreatus* on dead wood, and *Panaeolus separans* on horse dung. Some species are of course quite versatile: *Coprinus comatus*, is able to live on buried wood and other organic litter anywhere on earth, but it is always found on bare, hard ground or in grassy areas (Miller, 1984).

Parasites

Parsitic fungi invade and sometimes kill living plants and animals. Some of the woody polypores are parasites on trees. A number of other fungi, including several species of *Pholiata*, are weak parasites and are able to attack and kill only a host previously weakened by other factors. In some unusual cases, one fungus will parasitize another. *Boletus parasiticus* is found only on the puffball *Scleroderma aurantium*, and *Volvariella surrecta* fruits on living specimens of *Clitocybe nebularis* (Miller, 1984).

Mycorrhizal Associations

Mycorrhiza (Gr.mykes=fungus, rhiza=root) is a symbiotic relationship between a fungus and the roots of higher plants. Through the fungus the host tree or shrub is able to obtain nitrogen, phosphorous, and other nutrients which are otherwise relatively unavailable. The fungus, on the other hand, obtains moisture and protection even under adverse environmental conditions. Primarily, families like Amanitaceae, Boletaceae, Cortinariaceae, Russulaceae, Tricholomataceae, Rhizopogonaceae and Sclerodermataceae form mycorrhizal associations (Miller, 1984)

1.3 Nutritional, medicinal and agricultural value of mushrooms

1.3.1 Edible mushrooms

In many parts of the world wild edible species have a special significance in terms of catastrophic crop failures, by protecting local population from starvation (Joshi *et al.* 2003). Mushrooms hold a unique place in the world today. Human population expands by 2.1 representing a rise of 75 million per year. Thus food production has to keep pace with

population increase. Therefore, there is good possibility of using edible mushrooms for alleviating worldwide shortage of food. FAO has recommended the growing of mushrooms in the developing countries an additional source of protein rich food. The rate of consumption of mushrooms in many countries has increased considerably in recent years and it has become imperative to explore the sources of new edible species (Purkayastha & Chandra, 1985).

Proteins

Mushrooms have good nutritional value particularly as a source of protein that can enrich human diets especially in some developing countries where animal protein may not be available and are expensive (FAO 1978). The protein content of fresh mushroom is 3.7%. (FAO, 1978, cited in Nail & Balkrishnan, 1995). On dry weight basis protein content ranges between 21-30 % (Wasser 2002). They are rich in proteins as compared to cereals, pulses, fruits (apple 0.31, banana 0.8%, grape 1%) and vegetables (cabbage 1.4%, carrot 1%, potato 1.8% and tomato 1%). Their proteins contain adequate quantities of most of the essential amino acids and amides as compared to that of egg protein, twice that of vegetables and four times that of oranges. The proteins have high digestibility. High concentration of lysine in mushroom protein makes them an ideal food to supplement the cereal diet for overcoming lysine deficiency. *Clavaria coralloides* and *Boletus loyus* are the best protein sources but are deficient in the amino acids methionine and cysteine (Schmeda *et al.* 1999). Mushrooms are also low in cholesterol.

Minerals

Mushrooms are reported to be rich in potassium, phosphorus, sodium, calcium magnesium, etc. They also supply fair quantities of iron and copper with large quantities of folic acid. The mineral content of mushroom is also higher than that of meat or fish and almost twice that of any other vegetable. *Agaricus bisporus* is reported to contain considerable amounts of phosphorus, copper and iron. The highest phosphorus is found in *Lepista nuda* in comparison to wood destroying fungi (Vetter, 1998).

Vitamins

They are a good source of vitamin (B, C & K). The vitamins are well retained during cooking, canning, drying and freezing. Vegetables are a poor source of vitamin b12. This requirement can be fulfilled by taking about 3 g of fresh mushrooms (Hayes & Hand 1981). Similarly, vitamin A, D and E appear to be present only in very low amounts (Sohi & Sharma, 1997).

Carbohydrate

Carbohydrates are the main components of mushrooms. It ranges between 3-28 % (on fresh weight basis) in various species. A higer value (46.2-81.8) % on dry weight basis is found in different species of *Pleurotus* (Bano & Rajarathnam, 1982). Since they are

devoid of starch and low in calories and carbohydrates mushrooms are ideal food for diabetic and heart patients (Shanmugar, 1955).

Dietary fibers

Dietary fibers are abundant in the tissue of all mushrooms; they absorb bile acids or hazardous material in the intestine, and thus decrease the chances of carcinogenic and other poisoning (Shanmugar, 1955).

1.3.2 Medicinal mushrooms

Medicinal mycology has deep and firm roots in fungi's traditional uses in medicine of the Far East. For centuries, Chinese and other healthcare practitioners employed mushrooms to treat various diseases. Only at the end of 1960s Eastern and Western Scientists started to investigate the mechanisms of the health effects of mushrooms. Malone *et al.* (1967) reported Basidiomycete containing antitumour activity of calvacin isolated from *Calvatia gigantea*, a direct gift of the folklore. The first successful research discovered the antitumour of hot water extracts of several mushroom species (Ikekewa, 1969). In Japan, China, Russia and Korea, several different polysaccharide antitumor drugs have been developed from various medicinal mushrooms such as shiitake (*Lentinus edodes*) reishi (*Ganodema lucidum*), turkey tail (*Trametes versicolor*), etc.

Perhaps the most fascinating aspect of ancient mushroom usage is related to the pscho-active, hallucinogenic properties of some mushroom. There is an extensive literature implicating certain mushrooms in ancient religious beliefs and practices (Arora, 1985). Investigations have demonstrated extensive past use of the tiny psycho-active hallucinogenic mushrooms *Psilocybe* spp and *Panaeolus* spp.

Biologically active substances from higher mushrooms possess antifungal, antibacterial, and antiviral properties. *Flammulina velutipes* has received some attention for its antibacterial property. Some of the compounds isolated from *Clitocybe, Marasmium, Pleurotus, Psathyrella* and *Tricholoma* are characterized with antibacterial activity (Pathak, 1995). Chaumont and Simeray (1983) studied *in vitro* antifungal properties of some mushrooms. Among them it was found that genus like *Boletus*, *Hebeloma*, *Collybia*, *Tricholoma*, *Cortinarius* and *Lactarius* are found more or less active against phytopathogens (Pathak, 1995). The predominant mushrooms showing promise for their antiviral activities are polypores. A number of unique antiviral drugs such as Lentinan from *Lentinus edodes*, ganoderic acid and Lucidumol from *Ganoderma luciderm* have shown efficacy in inhabiting the replication of the human immunodeficiency virus (Kim *et al.* 1994, Colins, 1997 & Ghoneum, 1998). Mushroom provides regular challenge to the immune system in a non hostile manner (www.gmushrooms.com). If mushrooms are take everyday we can fight against diseases like Beriberi, Scarvi, Leprosy, etc. (Flamingo India, 2003).

Similarly, *Amanita muscaria* a highly poisonous mushroom has been effective in China to cure neural disorders and epilepsy (Balkrishan & Nair, 1994). Medicine from *coriolus*

versicolar is a top selling anti-cancer drug in Japan (Pai *et al.* 1990). In homeopathy 'Agarus' is an effective drug for treating ailments of heart, mental disorder epilepsy, etc. (Devkota, 2005).

The study of medicinal mushrooms through the last three decades has proved its many beneficial outcomes and has been followed by the rapid development of manufacturing business dealing with commercial cultivation of mushrooms. In 1999 world production of mushroom amounted to U.S$18 billion (Chang, 1999).

Most mushroom-derived preparation and substances find their use not as pharmaceuticals, but as a novel class of dietary supplements or "nutraceuticals". The market value of mushroom dietary supplement products worldwide is estimated at US$ 6 billion per year. The market value of reishi mushroom – based dietary supplement alone in 1999 was estimated at more than US$1.628 billion (Chang, 1999).

1.3.3 Agriculture

Besides helping to supplement production of food protein mushroom cultivation also leads to recycling of agricultural wastes. In a forest ecosystem the natural mushroom flora partially helps in biodegrading of woody waste. Out of several important potential uses of mushrooms, one is lignocelluloses conversion, into food. In a country like ours, where agriculture is the most dominant profession of the people, the agriculture waste is quite abundant. Most of the agriculture and forest waste are burnt or allowed to rot. The conversion of this waste to some extent can be achieved by transforming it in the form of protein of edible mushroom. In the world, only few mushrooms are cultivated commercially, but there is a big possibility of finding potential, indigenous edible mushroom which can be grown on available agricultural as well as forest wastes, etc. and provide them for human consumption.

1.4 Nepalese context

1.4.1 Ecological factors affecting mycoflora

The Nepal Himalaya is unique in terms of richness of biodiversity, cultural heritage and geomorphology within a relatively small geographical area of 0.09% (147,181 sq. km) of the worlds land surface (Jha, 1992, Jha *et al.*1996). Presence of diverse topography with high altitudinal gradients (from ca. 60 masl in the south to 8850 masl to the North) and accompanying diversity in climate and edaphic conditions have provided a variety of habitats ecological and bio-geographical zones within the narrow vertical width of 145-241 km in the country, which are characterized by diverse vegetation types, flora and fauna. These varied factors have also lodged this land with numerous interesting diverse mycoelements have embraced the growth of different types of mushroom.

In Nepal the distribution of mushrooms in a particular locality depends on topography soil types, rainfall temperate and vegetation pattern (Adhikary, 2000). The appearance mushrooms and their dominance are controlled by different factors such as altitude,

phytogeography, climate (particularly seasonal changes followed by thermal conditions and other factors of the region). The majority of the species appear in average climate temperature fluctuating between 15-30 °C in tropical, 12-30 °C in subtropical 10-25 °C in temperate and 5-20 °C in sub-alpine region (Kharel, 1998). The main months for their occurrence, growth and dominance lie in between mid-June to mid September although few species start to appear from May to November.

1.4.2 Mycodiversity

To date near about 860 species of wild larger fungi have been reported from Nepal. Among these, some are used for various purposes such as edible (110 species), poisonous (48 species), fermentation (5 species), decoration (10 species) mycorrhizal (50 species), medicinal (17 species) and other uses (Adhikary, 2000).

1.5 Review of past mushrooms studies in Nepal

The investigation and study on mushrooms of Nepal started since the period of J.D. Hooker (1848-1854), who explored east Nepal in a botanical survey. The result of his gatherings was published by Berkley (1845 a, b, c & d). Berkley reported 44 higher fungi in Indian Fungi in Hooker's Journal of Botany. The papers included 18 new species for Nepal viz. *Irpex zonatus, Lentinus nepalensis, L. inquinans, Lycoperdon elongatum, L. emodense, Polyporus cereus, and P. elatinus. P. flavidus, P. florideus, P. nepalensis, P. pictilis, P.vivax, Radulum spongiosum, Scleroderma nitidum, Sphaeria neplensis, Stereum endocrocinum, Trametes tephroleuca, T. versatilis* and *Xyalaria fistuca.*

Cooke (1888) reported only one species of agaric from Nepal without mentioning the place and date of its collection.

Balfour- Browne (1955) studied and published the gatherings (40 genera & 74 species) made by O. Polunin, W.R. Sykes and L.H.J Williams in 1948-50, from Jumla area, (1800-5400 masl) the western region of Nepal. She listed nine genera and nine species of Ascomycetes, 17 genera and 24 species of Hymenomycetes and five genera and seven species of Gasteromycetes. In the same paper some new species by herself and Corner were also added. New species were *Ramaria Fuscobrunnea* Corner and *Pleurotus nepalensis* Corner. The newly described monotype genus *Amylaria*, *A. himalayenis* Corner.was also included in the same paper.

Thind (1961) included three species in "*The Clavariaceae of India*" which are reported earlier by Balfour-Browne (1955).

Kreisel (1964, 1967, 1969, 1976) enumerated Gasteromycetes from the collection of J. Poelt (Khumbu Himal region: east Nepal) and J.F. Dobremez (other parts of Nepal). In 1969, he enumerated 15 species, which included three new species: *Bovistella poeltii, Lycoperdon niveum* and *L. yetisodale.* In 1976 he again recorded *Bovista substerilis, B.vascelloides, Disciseda alpine, D. ochrochaleea, Lycoperdon altimontanum, L. lambinoii var. quercetorum* and *L. perlatum var dobremezianum.*

Kobayashi (1965) recorded the occurrence of *Calostoma* from East Nepal.

Bhatt (1966) enumerated 118 species of fungi from different parts of Nepal which includes Myxomycota-1, Mastigomycotina and Zygomycotina-8 Ascomycotina-27 Basidiomycotina-33, Deuteromycotina-51.

Imazeki *et al.* (1966) reported 3 genera and 3 species (1 Ascomycotina, 1 Hymenomycetes and 1 Gasteromycetes) collected in botanical expedition organized by National Science Museum, Tokyo, Japan.

Singh (1966) reported 18 wild edible mushrooms sold in Kathmandu market.

Singh (1968) reported 4 species of Hymenomycetes from Kathmandu valley.

Balfour- Browne (1968) published "Fungi of recent Nepal expedition which listed the species collected from Eastern and Central Nepal by Stainton (1952-56), Norkett (1961-62), Polunin (1949) and Stainton, Sykes and Williams (1954) (cited in Adhikari, 2000). The paper includes 12 species of larger Ascomycetes, 73 species of Hymenomycetes and 6 species of Gasteromycetes. *Lentaria macrospore* Corner and *Clavulina alta* Corner were added as new species. A new combination viz. *Panus polychrous* (Lev.) Singer Balfour- Brown (*Lentinus polychrous* Lev.) was also proposed in the same paper.

Imazeki *et al.* (1966) reported 3 genera and 3 species (1 Ascomycotina, & 2 Basidiomycotina) collected in botanical expedition organized by National Science Museum, Tokyo, Japan.

Singh (1966) reported 4 species of Hymenomycetes from Kathmandu valley.

Singh and Nisha (1974, 1976b & 1976c)) recorded the occurrence of three species of *Exobasidium*. Among them *Exobsidium butleri* from Dhulikhel was new to Nepal. They published five species of larger Ascomycetes, 68 species of Hymenomycetes and 8 species of Gasteromycetes.

Adhikari (1976) listed about 30 wild edible species of mushrooms collected from Manichur, Kathmandu valley.

Pandey (1976) published a list of 314 specimens of Basidiomycotina collected from central and eastern Nepal. In this paper most of the specimens were identified to generic level only. He gave the information on the distribution pattern of different taxa.

Ranjitkar and Bhatt (1976) collected *Craterellus cornucopiodes* on ground from Sundarijal.

Singh and Adhikari (1977) described four genera and five species of fleshy fungi collected from Manichur, Kathmandu valley. Five species were new records to Nepal viz;

Trichoglossum velutipes, Dacromyces palmatus, Clavaria sp., *Clavulinopsis fusiformis* and *Clavulinopsis* sp.

Peglar (1977) reported two species, *Pleurotus platypus* and *Pleurotus nepalensis* collected by Polunin, Sykes & Williams from Chakure Lekha which were deposited in Kew Herbarium.

Ryavarden (1977) studied J. Poelt's collections of the wood inhabiting aphylloporaceous fungi from eastern Nepal. 50 species including a newly described species (*Phellinus poeltii*) were included along with the affinities of two tropical and subtropical and nine temperate species with Japan, Fennoscandia, Siberia and American elements.

Waraitch and Thind (1977 a, b & c) reported 29 genera and 37 species of Ascomycotina from Central Nepal.

Singh and Upadhyaya (1978) reported five new species *Morchella smithiana, Amanita citrina, Asterophora lycoperdoides, Russula nigricans* and *Peridermium ephedrae* from Suryavinayak (Kathmandu), Jomsom and Tukuche (Central Nepal).

Sacherer (1979) in an ethnobotany study listed about 14 specimens mushrooms of Rolwaling Sherpas

Bhandari (1980) collected 13 species of macrofungi related to seven different families, among them eight species were new to Nepal. They were *Leotia lubrica, Hygrophorus miniatus, Trichloma terreum, Cystoderma amianthinum, Flammulina velutipes, Mycena galericulata, Pholiata aurivella* and *Phallus impudicus.*

Otani (1982) provided the critical study on *Engleromyces* and listed 15 genera and 27 species of cup fungi. Among them *Spathuria bifurcate* and *Leotia himalayaenis* were new record to the country.

Manjula (1983) included four species of Nepalese Hymenomycetes in the list of Agaricoid and Boletoid fungi from India and Nepal.

Sharma (1983 a & b) while studying the type specimens at PAN Herbarium reported two species collected from central Nepal among which *Dasyscyphus thindii* was introduced as new to science.

Thind and Sharma (1983) enumerated 28 species from the critical study of Nepalese Himalyan Helotials collected by Norkett (1961- Central zone) J.D. Stainton (1962- Central Zone).

Adhikari (1984) reported *Asterophora parasitica* and *Russula densifolia* in Pine forest of Godavari, Kathmandu.

Hjortstam and Ryvarden (1984) collected and published 60 genera and 95 species of Basidiomycetes (Aphllophorales), from Pokhara and Annapurna region. The new species described were *Peniophora bicornis, Grammothele bambusicola, Innotus hemisetulus, Phlebia albo-fibillosa* and *Phellinus acontextus.*

Shrestha, K (1985) reported *Cordyceps nutans* from Lato Manang (2140m) of Manang.

Cotter (1987) gathered 530 species of fungi from Kathmandu Valley, Daman, Muktinath, Myagdi, Langtang and Chitwan National Park. He also collected 18 samples of *Suillis* from different phytogeographical zones and compared the specimens with West Virginian species.

Adhikari (1987) threw light on different ethnic groups associated with the collection and consumption of wild edible mushrooms in different phytogeographical belts of Nepal.

Cotter and Miller (1987) studied the ectomycorrhizal association of the Bolete genus *Suillus* in Nepal.

Adhikari (1988) reported nine species of higher fungi gathered in a botanical expedition from Langtang and adjoining areas and prepared key for the identification of Gasteromycetes.

Adhikari (1988a) prepared the checklist of Polypores (Wood rotting fungi) of Nepal. A check list is provided with 54 genera and about 150 species, including three species- *Inonotus hispidus, Fibuloporisa vaillantii,* and *Heterobasidium annosum* new to the country.

Adhikari (1988b) reported ten species of fleshy fungi during the mycological investigation in and around the Kathmandu valley viz- *Boletus luridus, Cantharellus subcibarius, Clavaria acuta, Clavulinpsis aurantiocinnabarina, Cortinarius callisteus, Gymnopilus spectabilis, Panellus stypticus, Pezziza petersii, Psathyrella hydrophilla* and *Psathyrella velutina.*

Adhikari (1988c) reported ten species of the genus *Russula* from in and around the Kathmandu valley viz;- *Russula delica, R. emetica, R, fragilis, R. galochroa, R. lactea, R. ochroleuca, R.rosacea, R. sanguinea, R. sororia* and *R. subfoetens.*

Manandhar and Adhikari (1998) reported three *Agarics* new to Nepal.

Miller and Cotter (1988) studied the tissue morphology and spore ultrastructure of *Calastomas junghuhnii* (Gasteromyces).

Bills and Cotter (1989) jointly studied 4 *Lactarius* species collected by Cotter in 1985 from *Abies*, *Pinus* and *Rhododendron* forest of Nepal. *Lactarius thaklorum* was reported new species.

Adhikari (1990a) traces out in brief the historical attempts of investigation by different explorers and experts since the period of J. D.Hooker (1884-1885) till 1986 in the "History of mycological explorations in Nepal". The paper also recorded about 428 genera and 1200 species.

Adhikari (1990b) reported 11 species of the genus *Russula* collected during a mycological expedition to East Nepal. Among collected species eight species were new to Nepal viz; - *R. luteotacta, R. nitida, R. olivacea, R. pectinata. R. pseudodelica* and *R. subnigricans.*

Adhikari (1991c) collected 24 species of higher fungi from the trail and vicinity from Manichaur to Gosainkunda, Central Nepal. Among them the new records for Nepal were- *Amanita caesarea, Auricularia auricular, Cantherellus cibarius, C. odoratus, Entoloma subcostatum, Ramaria rubra* and *Thelophora terrestris.*

Bhandary (1991) reported 25 species of edible and medicinal fungi from Dumre to Manang, Mustang and Pokhara areas. Edibility of *Coltricia perennis* and *Daldinia concentrica* and medicinal application of *Daldinia concentrica* and *Pycnoporus cinnabarinus* were not reported earlier.

Tullons *et al.* (1992) reported *Amanita neoovoidea* from Nala, Kathmandu valley.

Tullons and Bhandary (1992) reported *Amanita chepangiana* used as food by Chepangs of Jugedi and Chitwan areas.

Adhikari and Parajuli (1993) provided the checklist of *Amanita.*

Adhikari (1994) introduced four wild mushroom stamps (*Amanita caesarea, Cordyceps sinensis, Russula nepalensis & Morchella conica*) issued by His Majesty's Government (HMG) Postal Service Department, Nepal.

Adhikari *et al.* (1994) reported the occurrence of *Amanita rubrovolvata* in Nepal.

Adhikari (1995b) reported two species of fleshy fungi *Hygrocybe nigrescens* and *Termitomyces eurhizus* from Kathmandu valley.

Manandhar and Adhikari (1995 a, b) studied *Lepiota* and its allied genera of Nepal.

Manandhar and Adhikari (1995-1996) reported ten wild mushroom species in and around the Kathmandu valley. Newly reported species were *Amanita hemibapha, A. pseudo porphyria, A. vittadini, Cantharellus subalbidus, C. tubiformis, Clavulina cinerea (Clavaria cinerea), C. cristata, Clavaria cristata* and *Clavaria rosea.*

Adhikari (1996a) thesis deals with the mycodiversity of Basidiomycotina flora (821 species) including the list of Hymenomycetes (520) with taxonomic studies on the genera such as *Amanita*, *Russula*, *Lactarius* and Gasteromycetes species. It included 40 species new to Nepalese mycoflora with seven species new to science.

Adhikari (1996b) recorded nine species of Hymenomycetes from Kathmandu valley.

Adhikari and Durrieu (1996) studied the ethnomycological approaches with the Ayurvedic concepts about the mushrooms.

Adhikari and Manandhar (1996) provided the monographic study of *Lactarius* genus which deals with six species among them one species (*L. confroversus*) was new to Nepal and five species were new to Himalayan ranges of Indian subcontinent.

Adhikari and Parajuli (1996) reported the occurrence of ectomycorrhizal fungi (27 species) prevailing in the pine forest of Kathmandu valley.

Poudel (1997) collected 55 mushroom specimens from Hetauda area. Among them *Cantharellus lateritius, Geastrum drimmondii, Gomphus steroids* and *Scleroderma texense* were new to Nepal.

Adhikari and Manandhar (1998) recorded the occurrence of *Calvatia gigantia* from Kathmandu valley.

Zang and Kinjo (1998) gave an account of 33 species of the genus Cordyceps collected from the alpine areas of China and Nepal. Among these *Cordyceps nepalensis* was described as new to Science gatherers from Kanchanjunga (4300m) and Kathmandu valley market.

Adhikari (1999c) published a list of Gasteromycetes and the keys for their identification. New species recorded were *Bovista gunnii, Lycoperdon invidum Rhizopogon luteolus, R. roseolus, Scleroderma areolatum, S. cepa* and *Vascellum pretense.*

Adhikari (1999d) reported 15 species and two varieties of the genus Russula from in and around the Kathmandu valley. *Russula adulterine, R. alboareelata, R. alutacea, R. amoena, R.chloroides var chloroides, R. chloroides var. godavarinsis, R. claroflava, R. delica var dobremezii, R. gracilis, R kathmanduensis, R. laurocerasi, R. lilacea, R. puellaris, R. senecis, R. velenovskyi* and *R. vesca* were new to Nepal or to the Indian Subcontinent.

Joshi and Joshi (1999) reported 36 species of ethnobotanically important wild mushrooms collected from different parts of Kathmandu and Pokhara.

Kharel (1999) reported *Lentinellus ursinus* an edible mushroom from Bharedeo VDC, Lalitpur.

Adhikari (2000e) reported nine genera of Ascomycotina and twenty-eight genera of Basidiomycotina from Maipokhari, East Nepal which were new to that area.

Adhikari (2001) reported 11 wild mushrooms species from Kahtmandu valley viz; *Hypomyces* sp. *Leccinum rugosiceps, Pleurotus cornucopiae, Polyporellus varius, Ramaria aurea, R. flava. R. formosa, Sarcodon laevigatus* and *Suillus bovines.*

Adhikari and Adhikari (2003) collected 12 species of fleshy fungi from the vicinity of Durandanda, Lumjung. *Daedalea dickinsii* was new to Nepal.

Maharjan and Budhathoki (2003) collected 28 polypores specimens from Raniban, Pokhara. Three species viz. *Coriolus hirsutus, Microporus xanthopus and Pycnoporus cinnabarinus* were studied in detail.

Pandey and Budhathoki (2003) reported *Rhizinia undulata* from Pinus forests of Champadevi, Kirtipur, Kathmandu.

Adhikari (2004) reported about the state of mushroom poisoning in Nepal.

Adhikari and Manandhar (2004a) recorded *Amanita japonica* and *A. sychnopyramis* from Central Nepal.

Adhikari and Manandhar (2004b) recorded four wood rotting mushrooms *Pleurotus sapidus, Fomes pomaceus, Panellus mitis* and *Fomitopsis rhodophaea* from Kathmandu valley.

Devkota (2005) collected 76 wild mushrooms from Lumle and vicinity of Kathmandu valley. Among them 20 species were used for culinary and 6 for medicinal purpose. *Ascobolus magnificus, Lentaria mucida, Xylaria plebeja, X. filiform, X. nigresescens Clavaria fumosa, Aphelaria tuberose* were new to Nepal.

1.6 Objective

1. Prepare an inventory on mushroom diversity in representative random sites.
2. Identification of collected mushrooms samples.
3. Ecological investigation of mushroom comprising their habitat, distribution and local status.
4. Listing of economically important mushroom available in the study area.

1.7 Study area

Location and physiography

The study area lies in Solu-Khumbu District of the Northeastern region of Nepal. It encompasses the Sagarmatha National Park (1,148 sq.km) and its buffer zone area (Fig. 1). The park includes the upper catchment areas of the Dudh Kosi and Bhote Kosi Rivers. The park is largely composed of the rugged terrain and gorges of the high Himalayas ranging from 2845 m at Monju to the top of the world Sagarmatha (Mount Everest) at 8848 m above sea level.Unesco listed the park as a World Heritage Site in 1979 for its unique natural, cultural and landscape characteristics.



Fig. 1. Study Area

Climate

The summer climate is cool and wet winter is cold and dry. Almost all the annual precipitation, averaging less than 1,000 mm. falls during the summer monsoon, from the end of May to September. From December to February the day time temperature often falls below 0 °C and there is heavy snow fall.

Biophysical resources

Geology

According to the continental--drift theory, the Himalaya were uplifted at the end of the Mesozoic Era, some 60 million years ago. The resulting young mountains of this region are still rising, and the net growth is a few centimeters per century.

Vegetation and flora

The park contains 3% forest, 28% grazing land and 69% barren land above the tree line. The dominant vegetation at the lower elevation of the park below 3000 meter above sea level (masl) is composed mostly of Blue pine and hemlock forest. The lower subalpine region above 3000 masl comprizes of forests of *Pinus walliachana*, *Abies spectabilis* and *Juniper recurva*. The upper subalpine, above 3600masl consists of Birch-Rhododendron forest (*Betula utilis*, *Rhododendron campanulatum* and *R. campylocarpum*) and the lower alpine region above the timber–line at 3800-4000 masl houses scrubs (*Juniper* spp, *R. anthopogan* & *R . lepidotum*).

Wild life

The wild animals mostly found are the Himalayan tahr, goral, serow, musk deer and Himalayan black bear. Other mammals are weasels, martens, Himalayan mouse hare (pika), jackals and langurs. The park provides a habit for at least 118 species of birds, The most common birds to be seen are the Impeyen pheasant, blood pheasant, cheer pheasant, jungle crow, red-billed and yellow-billed coughs and snow pigeon. Fairly common birds are the Himalayan griffon, Lammergier, Snow patridge, Skylark and others.

Settlement

The park is populated by approximately 3,000 of the famed Sherpa people. The Tamangs and other caste reside in the minority in various settlements within the park and buffer zones. The Sherpas belong to the Nyingma sect of Tibetan Buddhism. They occupied the Khumbu valley about 600 years ago and inherit a rich culture of their identity. The main settlements are Namche Bazar, Khumjung, Khunde, Thame, Tengboche, Pangboche and Phortse.

Tourism

The economy of the Sherpa community has traditionally been agriculture, animal husbandary and trade with Tibet. Since 1950s mountaineering expedition and trekking

tourism have increasing led the Sherpa people to depend on tourism business. The total number of tourist that visited the national park was 15,370 in the fiscal year 2059/60 and 21,810 in the fiscal year 2060/2061 (Source–Namche SNP office Data, 2005).

2. Materials and Method

2.1 Equipments

Following equipments were used for the collection of mushrooms:

- Basket
- Butter paper bags
- Knife
- Forceps
- Marking pen
- Field note book
- Pencil
- Colour pencils
- Measuring Scale
- Digital camera
- GPS
- White paper
- Black paper

2.2 Methodology

The study was conducted from Lukla to Pangboche (Fig. 1) during the month of August to September 2004. The study was mainly focused on Sherpa and Tamang ethnic groups. Different age group (10-70 years) people were interviewed by applying artifact and inventory interviewing methods (Nepal *et al.*1999) and filling the questionnaire (Annex 1).

The mushroom specimens were collected by carefully digging them with the help of a sharp knife. Data on habit and habitat such as ecological parameters such as altitude forest type, etc. were recorded in the field. The collected mushroom specimens were photographed in their natural habitat before they were picked up. Each collection was placed in butter paper bags and tag numbers were assigned to them. The morphological characters such as spore print and colour, habitat, forest type, pileus and tube colour, colour change induced after bruising or cutting and exposing to chemicals such as KOH, $FeSO_4$ were noted (Annex 2). The specimens were either sun dried or dried by placing them on tin foil over a local oven. Dried specimens were placed in butter

paper bags. Naphthalene balls were used as insect repellents. The dried specimens were identified in the laboratory with the help of literature and studying macro and microscopic characters. The collected specimens are deposited in RONAST Laboratory.



Collecting fresh mushrooms



Post field work



Sun drying collected mushroom



Collecting polypores



Interview with the local people



Interview with the local people

Fig. 2. Showing different activities in the field.

3. Results and Discussion

A total of 150 mushrooms specimens belonging to 37 families and 65 genera were collected from Lukla (2600 masl) to Pangboche (4000 masl). Out of the collected mushrooms specimens except 5 species, all were identified upto the generic level and 68 were identified upto species level (Table 3). Regarding the ethnomycological study, 23 species were identified as edible mushrooms (Table 2), 2 as medicinal (*Lycoperdon perlatum*, *L. pyriforme*), 1 decorative (*Ganoderma* sp) by the local communities. The largest families were Boletaceae and Russulaceae having 18 species, followed by Tricholomataceae (16sps), Polyporaceae (9 sps) and Cortinariaceae (8 sps). During the survey different microhabitat of mushrooms were also recorded. Most of the mushrooms were found on soil followed by trees / plants, forest litter, etc. (Fig 3).

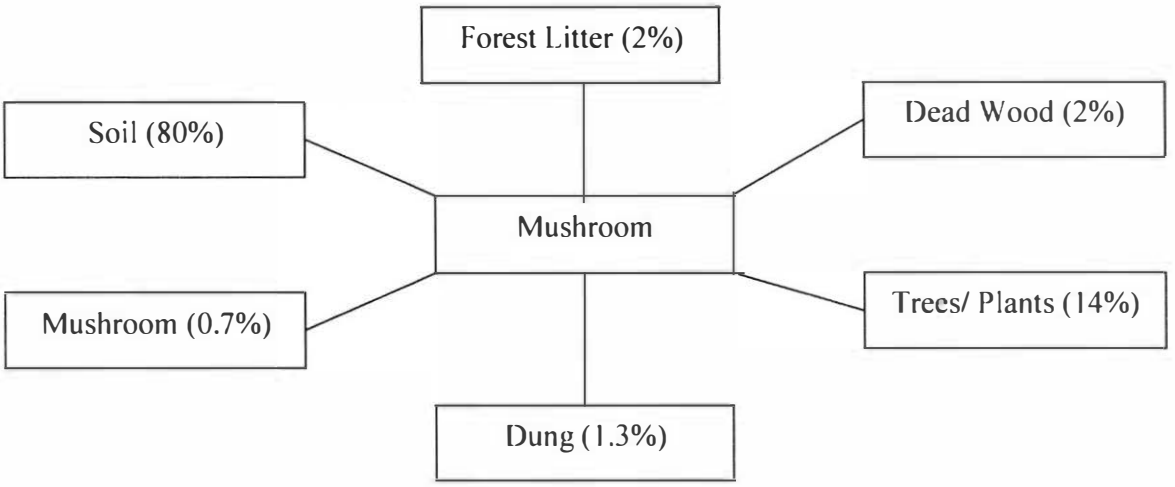


Fig. 3. Different microhabitats of mushrooms in the study area.

In the present study, it was found that Muse forest bears a maximum number of mushroom species (24 sps) followed by Deboche forest (18 sps), Jami Khiau (13 sps), Khunde (12 sps), Jorsalle (12 sps), Phurte (15sps), Lausasa (10 sps), Tengboche (10 sps), Fungi Tenga (7 sps), Ghat (7 sps), Khumjung (6 sps), Namche (5 sps), Tok Tok (4 sps), Pangboche (4 sps), Phakdin (2 sps) and Syangboche (1 sps) (Table 3).

In Nepal, the distribution of mushrooms in a particular locality depends on topography, soil type, rainfall and temperature, and vegetation pattern. The appearance and occurrence of mushrooms and their dominance are controlled by different factors such as altitude, phytogeography, etc. The diversity of mushroom specimens was found high at an altitudinal range between 3500-4000 masl followed by 2500-3000 masl and 3000-3500 masl. Between 3500-4000 masl the dominant vegetation is mixed forest of *Abies*, *Rhododendron*, *Betula*, *Juniperus*. A total of 84 species, belonging to 30 families were recorded within this range. The diversity of Russulaceae, Coprinaceae, Lycoperdaceae,

polyporaceae was found high. Similarly, between 3000-3500 masl the main vegetation is the mixed forest of *Abies*, *Rhododendron*, *Pinus* and *Betula*. A total of 14 species of 11 families were recorded between this altitudinal ranges. The diversity of the family Boletaceae, Coprinaceae, Cortinariaceae, etc. was found high. The dominant or mixed forest types of *Rhododendron*, *Abies*, *Betula* provide different micro-ecological condition suitable for the origin, development and growth of diverse mycotaxa such as saprohytes, parasites (Adhikari, 2000). Similar, type of results (eg. *Coprinus* sp, *Mycena* sp, *Nyctalis* sp, etc.) were recorded in the present study. Between 2500-3000 masl the main dominated species is *Pinus*. A total of 52 species belonging to 15 families were recorded. Within this range, the diversity of Boletaceae was found high followed by Tricholomataceae, Amanitaceae and Strophariaceae, etc. The litter debris of the pine trees control and regulate the temperature of soil moisture, texture and nutrition for the growth of Amanitaceae, Boletaceae, Russulaceae, Tricholomataceae (Adhikari, 2000). Similar types of results were obtained in the present study.

Out of total collected edible mushrooms *Chroogomphus tomentosus*, *Paxillus involutus*, *Russula metachroa*, *Tylopilus eximus*, and *Naematoloma capnoides, Boletus auripes*, *B. pulverlentus* and 2 species of *Boletus* were found new to the list of edible mushrooms of Nepal recorded by Adhikari (2000). The collected wild edible mushrooms belong to the family Boletaceae (6), Amanitaceae (3), Tricholomataceae (3), Gomphaceae (2), Ramariaceae (1), Clavulinaceae (1), Hydnaceae (1), Strophariaceae (1), Auriculariaceae (1), Russulaceae (1), Cantharellaceae (1), Paxillaceae (1), and Gomphidaceae (1). The identification of one mushroom specimen was not confirmed. The diversity of wild edible mushrooms are high in Khumjung (with association of *Abies, Rhododendron*, *Quercus* & *Betula* forest), followed by Lukla (association of *Pinus wallichiana* forest), Khunde (association of mixed forest of *Pinus*, *Abies* and *Rhododendron*), Deboche (mixed forest of *Rhododendron-Abies)*, Phurte (association of *Abies, Tsuga, Betula* & *Rhododendron* mixed forest) and Pangboche (association of *Abies* & *Rhododendron*) respectively. The diversity of wild edible mushrooms of the family Boletaceae was found high in *Abies, Betula*, and *Pinus* forest. The high diversity of family Amanitaceae was found in mixed forest of *Tsuga, Quercus* and *Rhododendron* and Russulaceae in *Abies-Rhododendron* forest.

Similar results were also observed by Cotter (1987) and Rajbhandari (1999). The above result revealed that coniferous and broad leaved *Quercus* forest is suitable habitat for wild edible mushrooms. Most of the wild edible mushrooms were found on the soil surface, only *Auricularia polytricha* was found on *Rhododendron* tree trunk.

The local people aged between 10–70 years could easily identify the wild edible and poisonous mushroom. Mushrooms are called "Shyamo" in Sherpa dialect which means cap. The local name of the wild edible mushrooms have been mostly derived on the basis of their appearance, nature of growth, colour, etc. *Gomphus clavatus* is known as Ee-shyamo in Sherpa dialect (Eng: Mother-in-law). The name of this mushroom is derived from its growth characteristic. As the mother-in-law plays a dominant role in the family this mushrooms grows dominantly (about 5-7 kg) in one place. Since *Gomphus floccosus*

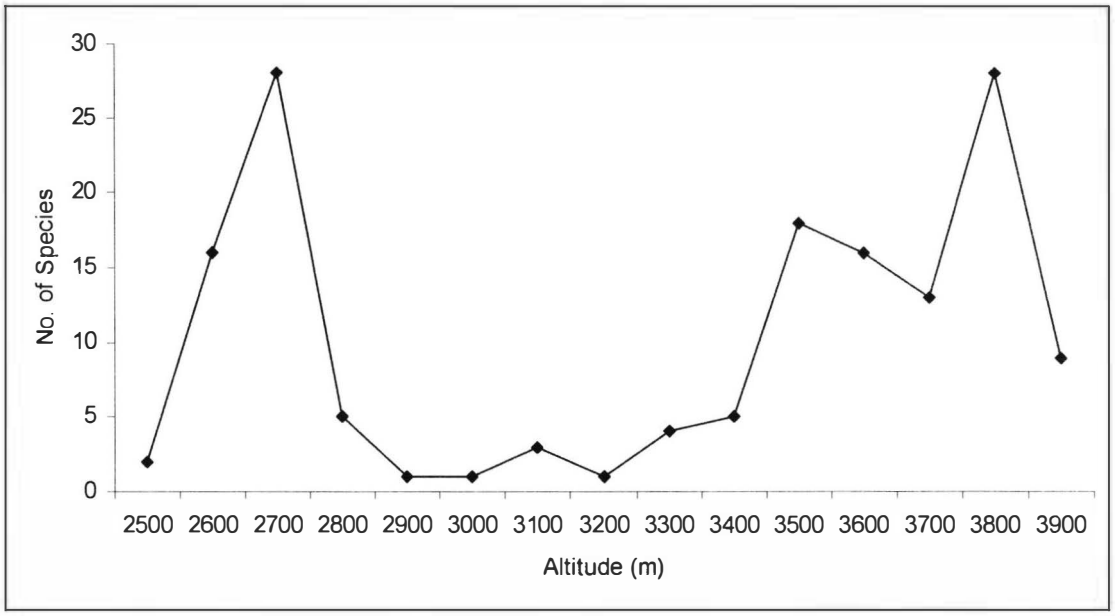


Fig. 4. Altitudinal distribution of collected mushroom species

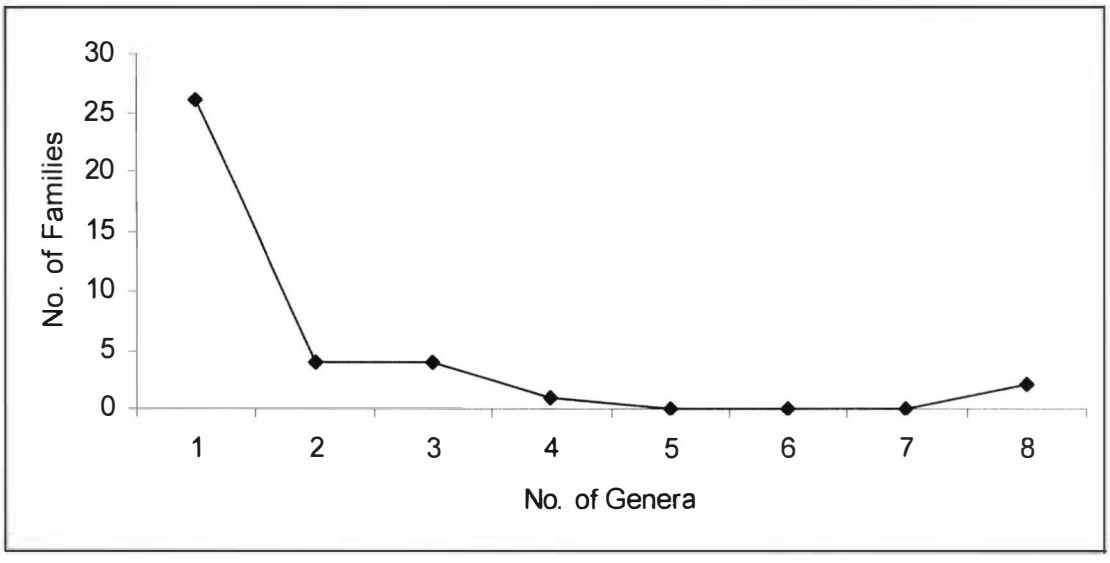


Fig. 5. Number of families with their respective genera

Table 1. Different localities with their GPS readings and dominant vegetation.

S. N	Locality	Longitude	Latitude	Altitude (m)	Vegetation
1	Muse Forest (Lukla)	86°43.396'	27°41.867'	2783	Mixed forest of *Rhododendron*, *Quercus*, *Tsuga*, *Pinus wallichiana*
2	Ghat	86°42.98'	27°42.44'	2604	Dominated by coniferous forest (*Pinus wallichiana*)
3	Phakdin	86°42.753'	27°44.916'	2480	Pine forest (*Pinus wallichiana*)
4	Tok Tok	86°42.89'	27°46.782'	2725	Pine and *Rhododendron* mixed forest
5	Jorsalle	86°43.067'	27°47.255'	2690	Pure Pine forest
6	Namche	86°42.598'	27°48.156'	3150	Mixed forest of *Rhododendron* and pine
7	Phurte	86°42.362'	27°48.269'	3615	*Abies*, *Tsuga*, *Betula* *Rhododendron and Juniper* mixed forest
8	Sangboche	86°42.692'	27°48.792'	3700	Mixed forest of *Juniperus* and *Rhododendron*
9	Khunde	86°42.589'	27°49.022'	3900	*Pinus*, *Abies* and *Rhododendron* mixed forest
10	Khumjung	86°43.697'	27°48.915'	3800	Mixed forest of *Abies*, *Rhododendrons*, *Quercus and Betula*
11	Jamikiau Forest	86°44.002'	27°50.00'	3825	Mixed forest of *Abies*, *Rhododendrons*, *Juniperus*
12	Lausasa	86°44.105'	27°49.625'	3770	Mixed forest of *Rhododendron* and *Abies* forest
13	Phungi Tenga	86°45.119'	27°50.113'	3440	Mixed forest of *Abies*, *Rhododendrons*, *Betula*
14	Thyangboche	86°46.019'	27°50.256'	3776	Mixed forest of *Rhododendron* and *Abies* forest
15	Deboche	86°46.366'	27°50.472'	3665	Mixed forest of *Betula*, *Rhododendrons*, *Abies*, *Juniperus*
16	Pangboche (Omakha forest)	86°46.425'	27°50.572'	3890	*Abies*, *Betula* and *Rhododendron* mixed forest

looks like a burning *diyo* (oil lamp) it is called Diyo Chyau or Khumbhe Chyau. *Clavulina cinerea* and *Ramaria flava* is known as Che shyamo due to its grass like appearance. *Hydnum repandum* is locally named as Kasturi Chyau due to its resemblance to the skin of musk deer (Nep: Kasturi Mriga). *Amanita* species which have an egg like volva are known as Anda Chyau (Eng: Egg mushroom). Further depending on its size or colour of the cap a prefix may be added such as Sano (small), Rato (red), Seto (white), etc. One of the *Boletus* sp locally called as Fhe Shyamo or Muse Chyau got its name due to its resembles with a mouse. *Armillaria mellea* is known as Chiple (Eng: Sticky) chyau because of its sticky honey like cap surface. *Naematoloma capnoides*, locally known as Taktale which means growing in layers, one above the other in a bunch.

The study reveals that 90% of the total population of the area consumed wild edible mushrooms. It was also observed that mushroom were collected mainly by lower economic group of persons aged between 15-45 years by utilizing local knowledge handed down from generations. Among them, men played a crucial role in collecting mushrooms. Wild edible mushrooms are regarded as a delicacy food in that region. It was found that even economically sound people hired men to collect mushroom occasionally. The main staple food of this region is buckweat and potato. Meat and fresh green vegetables is scarce, very expensive and rarely eaten item especially in higher regions above Namche. They are brought all the way from Jiri and are usually available only in the weekly market (Haat Bazaar) of Lukla and Namche. The local inhabitants are dependent on the seasonal mushrooms as a substitute of meat and vegetables. However, in local hotels the use of wild mushrooms was not observed.

Below Namche the local people hardly preserve mushrooms for culinary uses. This may be due to availability of the variety of vegetables in this region as compared to the upper high altitude region. Field survey reveals that a superstition "storing mushrooms results in the death of their livestock" still prevails among some Sherpas of lower region (Lukla, Benkar, etc.). However, above Namche drying mushrooms in Nanglo (Bamboo woven) and preserving them as pickle was frequently observed (Fig. 6).

In addition to food item mushroom is also used in health treatment by the rural people. According to local informants spores of *Lycoperdon perlatum* and *L. pyriforme* are used as powder to heal wounds. Hobbs (1987) reported several species of *Lycoperdon* can be used to stop bleeding in a fresh wound. Similar results were reported by Adhikari (1988), Bhandari (1991) and Ghimire *et al.* (2001) from eastern and western regions of Nepal. Some locals use mushrooms like *Ganoderma* sp. for decorative purposes while some polypores are used to make lids of bottle and stop cork. This was also reported by Kharel (1999), Adhikari (2000). However, the use of mushroom as medicine, biofertilizer etc are certainly limited in the area. It may be due to the lack of scientific knowledge among the local ethnic groups.

Though previously Tamang and Newar communities have used mushroom for religious purposes (Adhikari, 2000), in this study it was observed that mushrooms were not used for religious or ceremonial purposes.

In the Nepalese mycoflora there are at least forty species of mushrooms which have been known to be toxic and dangerous (Basnet, 2004). Adhikari (2000) has reported that annually 15-20 persons die due to mushroom poisoning in Nepal. As per interviews with local people, hospital staff and traditional healers no mushroom poisoning cases were reported till date in the study. It was observed that local people boil mushrooms along with Lasun (*Allium sativum*) and Timur (*Xanthoxylum armatum*) and discard the broth to minimize the possible poisoning from mushrooms. Besides this, the local people easily distinguish the poisonous mushrooms which they refer to as "Bhoot Chyau" in Nepal

dialect and "Sindi Shyamo" in Sherpa dialect. Some local people believe "Mushrooms become poisonous only after being bitten by a poisonous snake." Therefore, in their view the mushrooms are not that poisonous because there are no poisonous snakes in that region. However, two species of *Russula* and one species of *Entoloma* were identified as poisonous by the locals.

Species like *Ganoderma applanatum* from which suede like substances is obtained is used to make garments, dresses, caps, picture frames, etc. (Dey, 2004). *Auricularia auricular* is used as balm to cure the swelling of eyes and throat. *Boletus edulis* is most widely used and traded wild mushroom in the world (Singer, 1975). Species such as *Suillis placidus, Boletus edulis and Strobilomyces floccopus* form mycorrhizal association with forest trees such as *Pinus*, *Quercus*, *Rhododendron*, *Betula* sp (Sharma & Lakanpal, 1981). Some of the compounds isolated from *Clitocybe*, *Marasmium*, *Pleurotus and Tricholoma* are characterized with antibacterial activities. *Boletus edulis* have compounds that might be having antitumer activies. Other mushroom such as *Armillaria mellea* and *Coprinus comatus*, *Russula emetica* have antiviral effects (Pathak, 1995). Though, the applications of wild mushrooms are enormous, in the present study, it was observed that local knowledge is limited mainly to edible purposes only. Therefore, it is important to further investigate them.

The nutrient values of most of above identified mushrooms have not been assessed yet nor has their toxicity assay been conducted. In Nepal the nutrient component of very few wild edible mushrooms has been assessed (Table 4). In the field survey it was observed that the local people collect the mushrooms haphazardly. The local who goes early gets a good collection of mushrooms. Fungi are a seasonal perishable item therefore, people should be encouraged to manage and harvest the mushrooms in a sustainable way. In order to get good supply of the seasonally found mushrooms it is important to conserve the habitat of natural forest.



Freshly collected mushrooms



Dried mushrooms

Fig. 6. Freshly collected and dried mushrooms by the locals

Table 2. Different types of wild edible mushrooms with their scientific names, deliciousness ranking and locality.

S. N.	Scientific Name	Local Name	Deliciousness ranking	Locality
1	*Amanita hemibapha* (Berk. & Br.) Sacc.	Rato anda chyau	1	Lukla forest
2	*Amanita vaginata* (Fr.) Vitt.	Seto anda chyau	2	Lukla forest, Khunde, Khumjung
3	*Amanita* sp.	Sano anda chyau	2	Lukla
4	*Auricularia polytricha* (Mont.)	Durkho chyau	4	Khunde
5	*Boletus* sp.	Muse chyau (Fhe shyamo)	1	Khunde, Deboche forest, Pangboche
6	*Boletus edulis* Bull. ex Fr. Steinpliz	Pani chyau	1	Lukla forest
7	*Boletus* sp.	Rato martip	1	Namche, Khumjung, Pangboche, Deboche
8	*Boletus auripes* (Peck)	Seto martip	1	Lukla to Phurte forest
9	*Tylopilus eximus* (Peck) Sing	Petok shyamo	3	Khunde, Khumjung
10	*Boletus pulverlentus* Opat	Kalo martip	4	Phurte, Lukla forest
11	*Cantharella cibarius* (Bull.: Fr.) Kummer)	Kyujir (keti)	1	Khunde, Khumjung to Deboche
12	*Chroogomphus tomentosus* (Schw.) Singer	Kyujir (keta)	1	Kunde, Khumjung, Pangboche
13	*Clavulina cinerea* (Bull.: Fr.) Schroet.	Che shyamo	4	Phurte
14	*Gomphus clavatus* (Pers. ex Fr.) S. F. Gray	Ee-shyamo	1	Phurte forest, Khumjung to Lausasa
15	*Gomphus floccosus* (Schw.) Sing.	Khumbhe chyau	1	Phurte forest to Deboche
16	*Hydnum repandum* L. : Fr.	Kasturi chyau	1	Khumjung
17	*Ramaria flava* (Sch. : Fr.)	Che shyamo	1	Namche to Deboche
18	*Russula metachroa* Hongo	Pakar shyamo	3	Namche, Khumjung, Phungi tenga forest
19	*Naematoloma capnoides* (Fr.) Karst.	Taktale	4	Phurte
20	*Collybia butyraceae* (Fr.: Fr.) Fr.	Karshya pothi	2	Namche
21	*Armillaria mellea* (Vahl.: Fr.) Kummer	Chiple chyau	2	Lukla forest, Phurte forest
22	*Laccaria laccata* (Fr.) Berk. and Br.	Chinduk shyamo	3	Khumjung forest
23	*Paxillus involutus* (Batsch :Fr.) Fr.	Dyanba chyau	3	Khumjung forest

Note: 1. Most Delicious 2. Delicious 3. Average Delicious 4. Less Delicious

Table 3. Collected wild mushrooms with their scientific names, family, locality and altitude.

S. No.	Coll. No.	Coll Date	Locality	Altitude (m)	Loc. name	Sc. name	Family	Remarks
1	1	13.8.2004	Muse forest	2783	Chiple chyau	*Armillaria mellea*	Tricholomataceae	Chaurikarka
2	3	13.8.2004	Muse forest	2783		*Crepidotus* sp	Crepidotaceae	
3	4	13.8.2004	Muse forest	2783		*Mycena capillaris*	Marasmiaceae	2750 m, Chaurikarka
4	10c	13.8.2004	Muse forest	2783		*Laccaria amethystina*	Tricholomataceae	2783 m Chaurikarka
5	10d	13.8.2004	Muse forest	2783		*Tylopilus* sp	Boletaceae	Chaurikarka
6	10 e	13.8.2004	Muse forest	2783		*Ganoderma* sp	Ganodermataceae	Chaurikarka
7	10 f	13.8.2004	Muse forest	2783		*Conocybe* sp	Bolbitiaceae	Chaurikarka
8	10 gh	13.8.2004	Muse forest	2783		*Lactarius piperatus*	Russulaceae	Chaurikarka
9	10i	13.8.2004	Muse forest	2783		*Boletus edulis*	Boletaceae	Chaurikarka
10	10j	13.8.2004	Muse forest	2783		*Boletus* sp	Boletaceae	2783 m, Chauri karka
11	10k	13.8.2004	Muse forest	2783		*Microporus* sp	Polyporaceae	
12	10 L	13.8.2004	Muse forest	2783		*Lactarius subdulcis*	Russulaceae	chaurikarka
13	20	13.8.2004	Muse forest	2783	Rato anda chyau	*Amanita hemibapha*	Amanitaceae	
14	21	13.8.2004	Muse forest	2783	Seto anda chyau	*Amanita vaginata*	Amanitaceae	
15	22	13.8.2004	Muse forest	2783	Kalo martip	*Boletus pulverulentus*	Boletaceae	chaurikharka
16	23	13.8.2004	Muse forest	2783	Sano anda chyau	*Amantia* sp	Amanitaceae	Chari kharka
17	24	13.8.2004	Muse forest	2783		*Russula olivacea*	Russulaceae	
18	25	13.8.2004	Muse forest	2783		*Russula* sp	Russulaceae	
19	26	13.8.2004	Muse forest	2783		*Russula* sp	Russulaceae	
20	27	13.8.2004	Muse forest	2783		*Cortinarius* sp	Cortinaraceae	chaurikarka
21	30	13.8.2004	Muse forest	2783		*Tricholoma* sp	Tricholomataceae	
22	32	13.8.2004	Muse forest	2783		*Gyrodon merulioides*	Boletaceae	2750m
23	33	13.8.2004	Muse forest	2783	Seto martip	*Boletus auripes*	Boletaceae	
24	40	13.8.2004	Muse forest	2783		*Marasmuis* sp	Marasmiaceae	Chauri karkha
25	41	14.8.2004	Lukla/Ghat	2604		*Strobilomyces strobilaceus*	Strobilomycetaceae	Lukla to Phakdin
26	42	14.8.2004	Lukla/Ghat	2604		*Phylloporus bellus*	Boletaceae	2604 m Lukla –ghat
27	43	14.8.2004	Lukla/Ghat	2604		*Pulveroboletus ravenelli*	Boletaceae	Lukla to ghat
28	50	14.8.2004	Lukla/ Ghat	2604		*Tylopilus alboater*	Boletaceae	Lukla to ghat
29	51	14.8.2004	Lukla/Ghat	2604		*Strobilomyces* sp	Strobilomycetaceae	
30	54	14.8.2004	Lukla/Ghat	2604		*Tricholoma sp*	Tricholomataceae	
31	56	14.8.2004	Lukla/Ghat	2604		*Collybia* sp	Marasmiaceae	2604 m way to Ghat.
32	61	14.8.2004	Phakdin	2500		*Laccaria bicolor*	Tricholomataceae	
33	70	14.8.2004	Phakdin	2500		*Boletinus cavipes*	Boletaceae	2550 m
34	81	15.8.2004	Tok Tok	2725		*Coltricia perennis.*	Hymenochaetaceae	
35	82	15.8.2004	Jorsalle	2685		*Pholiata* sp	Strophariaceae	
36	84	15.8.2004	Tok Tok	2725		*Boletinus asiaticus*	Boletaceae	
37	85	15.8.2004	Tok Tok	2725		*Boletinus sp*	Boletaceae	
38	86	15.8.2004	Tok Tok	2725		*Paxillus* sp	Paxillaceae	
39	87	15.8.2004	Jorsalle	2685		*Heterobasidion* sp	Polyporaceae	
40	89	15.8.2004	Jorsalle	2685		*Nematoloma*	Strophariaceae	
41	90	15.8.2004	Jorsalle	2690		*Marasmium* sp	Marasmiaceae	
42	91	15.8.2004	Jorsalle	2690		*Heterobasidion annosum*	Polyporaceae	
43	100	15.8.2004	Jorsalle	2690		*Gloeophyllum sepiarium*	Formitopsidaceae	

Continued..

S. No.	Coll No.	Coll Date	Locality	Altitude (m)	Loc. name	Sc. name	Family	Remarks
44	101	15.8.2004	Jorsalle	2690		*Amanita* sp	Amanitaceae	
45	102	15.8.2004	Jorsalle	2690		*Laccaria proxima*	Tricholomataceae	
46	105	15.8.2004	Jorsalle	2690	Chiple chyau	*Armillaria* sp	Tricholomataceae	
47	110	16.8.2004	Jorsalle/Namche	2800		*Nematoloma* sp	Strophariaceae	Chaurikarka
48	120	16.8.2004	Jorsalle/Namche	2800		*Amanita* sp	Amanitaceae	
49	121	17.8.2004	Phurte	2840	Takatale	*Nematoloma capnoides*	Strophariaceae	2750 m, Chaurikarka
50	125	17.8.2004	Phurte	2840		*Russula* sp	Russulaceae	2783 m Chaurikarka
51	126	16.8.2004	Jorsalle/Namche	2800		*Clitocybe* sp	Tricholomataceae	Chaurikarka
52	128	16.8.2004	Namche	3150		*Suillus placidus*	Boletaceae	Chaurikarka
53	129	16.8.2004	Namche	3065		*Amanita gemmata*	Amanitaceae	Chaurikarka
54	130	16.8.2004	Namche	3150		*Suillus sibiricus*	Boletaceae	Chaurikarka
55	140	16.8.2004	Namche	2900		*Lyophyllum* sp	Tricholomataceae	Chaurikarka
56	141	16.8.2004	Namche	3150	Pothi karshya	*Collybia butyraceae*	Marasmiaceae	2783 m, Chauri karka
57	201	17.8.2004	Phurte	3585	Rato martip	*Boletus* sp	Boletaceae	chaurikarka
58	202	17.8.2004	Phurte	3585	Bhale chyau	*Amanita* sp	Amanitaceae	
59	203	17.8.2004	Phurte	3585	Pakar shyamo	*Russula metachroa*	Russulaceae	chaurikarka
60	205	17.8.2004	Phurte	3547		*Cortinarius* sp	Cortinariaceae	
61	206	17.8.2004	Phurte	3546	E shyamo	*Gomphus clavatus*	Gomphaceae	chaurikharka
62	207	17.8.2004	Phurte	3615	Che Shyamo	*Ramaria flava*	Ramariaceae	Chari kharka
63	208	17.8.2004	Phurte	3615	Pothi karshya	*Tricholoma saponaceum*	Tricholomataceae	
64	209	17.8.2004	Phurte	3615	Sindi shyamo	*Russula* sp	Russulaceae	
65	210	17.8.2004	Phurte	3585		*Clavaria acuta*	Clavariaceae	
66	211 A	17.8.2004	Phurte	3585		*Ramaria* sp	Ramariaceae	chaurikarka
67	211 B	17.8.2004	Phurte	3585		*Cyathus striatus*	Nidulariaceae	
68	212	17.8.2004	Phurte	3885		*Hygrophorus* sp	Hygrophoraceae	2750m
69	213	17.8.2004	Phurte	3885	Sindi shyamo	*Russula* sp	Russulaceae	
70	221	20.8.2004	Khunde	3770		*Lycoperdon* sp	Lycoperdaceae	Chauri karkha
71	222	20.8.2004	Khunde	3830		*Coprinus* sp	Coprinaceae	Lukla to Phakdin
72	227	20.8.2004	Khunde	3900		*Hygrocybe strangulata*	Hygrophoraceae	2604 m Lukla - ghat
73	229	20.8.2004	Khunde	3900		*Hygrocybe coccinea*	Hygrophoraceae	Lukla to ghat
74	230	20.8.2004	Khunde	3900		*Hygrocybe* sp	Hygrophoraceae	Lukla to ghat
75	233	20.8.2004	Syanboche	3940		*Laccaria laccata*	Tricholomataceae	
76	234	20.8.2004	Khunde	3900	Sindi shyamo	*Entoloma* sp	Entolomataceae	2604 m way to Ghat
77	237	20.8.2004	Khunde	3900	Kujir (Keti)	*Cantharellus cibarius*	Cantharellaceae	
78	238	20.8.2004	Khunde	3900		*Scleroderma* sp	Sclerodermataceae	2550 m
79	240	20.8.2004	Khunde	3800	Fhe shyamo	*Boletus* sp	Boletaceae	
80	241	20.8.2004	Khunde	3900	Kujir (Keta)	*Chroogomphus tomentosus*	Gomphidiaceae	
81	243	20.8.2004	Khunde	3900	Aallu chyau	*Scleroderma citrinum*	Sclerodermataceae	
82	250	21.8.2004	Khumjung	3800		*Boletus* sp	Boletaceae	2705 m Tok tok
83	251	21.8.2004	Khumjung	3800		*Pholiata nameko*	Strophariaceae	
84	258	22.8.2004	Khumjung	3800	Durkho chyau	*Auricularia polytricha*	Auriculariaceae	
85	259	22.8.2004	Khumjung	3800		*Auricularia* sp	Auriculariaceae	
86	260	22.8.2004	Khumjung	3800	Tuk shya	*Lactarius violacens*	Russulaceae	
87	261	22.8.2004	Khumjung	3800		*Dermocybe phoenicea*	Cortinariaceae	
88	262	22.8.2004	Jami khiau	3840		*Nyctalis* sp	Tricholomataceae	
89	265	22.8.2004	Jami khiau	3825		*Russula* sp	Russulaceae	
90	267	22.8.2004	Jami khiau	3825		*Lycoperdon* sp	Lycoperdaceae	

S. No.	Coll No.	Coll Date	Locality	Altitude (m)	Loc. name	Sc. name	Family	Remarks
91	268	22.8.2004	Jami khiau	3825	Che shyamo	*Clavulina cinerea*	Clavulinaceae	
92	269	22.8.2004	Jami khiau	3825		*Amanita* sp	Amanitaceae	
93	270	22.8.2004	Jami khiau	3825	Petok/ jip chyango	*Tylopilus eximus*	Boletaceae	
94	271	22.8.2004	Jami khiau	3825	Dangba	*Paxillus involutus*	Paxillaceae	
95	273	22.8.2004	Jami khiau	3825		*Cordyceps* sp	Clavicipitaceae	
96	274	22.8.2004	Jami khiau	3825		*Trichoglossum* sp	Geoglossaceae	
97	275	22.8.2004	Jami khiau	3825	Kyati shyamo	Unidentified		
98	279	22.8.2004	Jami khiau	3860		*Coprinus radians*	Coprinaceae	
99	280	22.8.2004	Jami khiau	3860	La shyamo	*Hydnum repandum*	Hydnaceae	
100	281	22.8.2004	Jami khiau	3825		*Tyromyces* sp	Polyperaceae	
101	300	22.8.2004	Khunde	3890		*Lactarius* sp	Russulaceae	
102	302 A	23.8.2004	Lausasa	3770		*Stropharia semiglobata*	Strophariaceae	
103	302 B	23.8.2004	Lausasa	3570		*Cortinarius* sp	Cortinariaceae	
104	303	23.8.2004	Lausasa	3570		*Lactarius deliciosus*	Russulaceae	
105	304	23.8.2004	Lausasa	3570			Polyperaceae	
106	306	23.8.2004	Lausasa	3570		*Pleurotus dryinus*	Plerotaceae	
107	308	23.8.2004	Lausasa	3570		*Clitocybe* sp	Tricholomataceae	
108	311	23.8.2004	Lausasa	3570		*Amanita* sp	Amanitaceae	
109	312	23.8.2004	Lausasa	3570		*Ganoderma applanatum*	Ganodermataceae	
110	320	23.8.2004	Lausasa	3570		*Gomphus floccosus*	Gomphidiaceae	
111	321	23.8.2004	Lausasa	3570		*Polyporus* sp	Polyporaceae	
112	400	24.8.2004	Phungi Tenga	3340		*Clitocybe* sp	Tricholomataceae	
113	401	24.8.2004	Phungi Tenga	3340		*Tyromyces* sp	Polyperaceae	
114	403	24.8.2004	Phungi Tenga	3340		*Otidea onotica*	Pyronemataceae	
115	404	24.8.2004	Phungi Tenga	3370		*Cortinarius* sp *(sub gr Telamonia)*	Cortinariaceae	
116	405	24.8.2004	Phungi Tenga	3440		*Cortinarius* sp	Cortinariaceae	
117	407	24.8.2004	Phungi Tenga	3590		*Lycoperdon pyriforme*	Lycoperdaceae	
118	408	24.8.2004	Tengboche	3702		*Pholiota aurivella*	Strophariaceae	
119	409	24.8.2004	Tengboche	3702		*Clitocybe* sp	Tricholomataceae	
120	410	24.8.2004	Tengboche	3702		*Coprinus micaceus*	Coprinaceae	
121	411	24.8.2004	Tengboche	3702		*Psathyrella* sp	Coprinaceae	
122	413	24.8.2004	Tengboche	3645		*Russula paludosa*	Russulaceae	
123	415	24.8.2004	Deboche	3700		*Marasmium* sp	Marasmiaceae	
124	420	24.8.2004	Deboche	3700		*Fomitopsis* sp	Formitopsidaceae	
125	421	24.8.2004	Deboche	3700		*Inocybe* sp	Cortinariaceae	
126	425	24.8.2004	Deboche	3700		*Lactarius* sp	Russulaceae	
127	427	24.8.2004	Tengboche	3702		*Russula densifolia*	Russulaceae	
128	430	24.8.2004	Deboche	3738		*Lycoperdon* sp	Lycoperdaceae	
129	450	24.8.2004	Deboche	3700		*Amanita pachycolea*	Amanitaceae	
130	500	25.8.2004	Deboche	3665		*Russula* sp	Russulaceae	
131	501	25.8.2004	Deboche	3665		*Entoloma* sp	Entolomataceae	
132	502	25.8.2004	Deboche	3665		*Lactarius volemus*	Russulaceae	
133	504	25.8.2004	Deboche	3665		*Polypore*	Polyporaceae	
134	505	25.8.2004	Deboche	3665		*Lycoperdon perlatum*	Lycoperdaceae	
135	507	25.8.2004	Deboche	3665		*Pseudohydnum* sp	Tremellaceae	
136	508	25.8.2004	Deboche	3665		*Polypore*	Polyporaceae	
137	509	25.8.2004	Deboche	3665		*Clavaria* sp	Clavariaceae	

S. No.	Coll No.	Coll Date	Locality	Altitude (m)	Loc. name	Sc. name	Family	
138	550	25.8.2004	Omakha forest	3890		*Pseudohydnum gelatinosum*	Tremellaceae	
139	551	25.8.2004	Omakha forest	3890		*Hohenbuehelia* sp	Tricholomataceae	
140	552	25.8.2004	Omakha forest	3890		*Cortinarius traganus*	Cortinariaceae	
141	553	25.8.2004	Omakha forest	3890		Unidentified		
142	554	25.8.2004	Deboche	3665		*Aleuria aurantia*	Pyronemataceae	
143	570	26.8.2004	Deboche	3665		*Vascellum* sp	Lycoperdaceae	
144	571	26.8.2004	Deboche	3665		*Lycoperdon* sp	Lycoperdaceae	
145	572	26.8.2004	Deboche	3665		*Scutellinia scutellata*	Pyronemataceae	
146	579	26.8.2004	Tengboche	3445		*Coprinus niveus*	Coprinaceae	
147	581	26.8.2004	Tengboche	3445		*Coprinus* sp	Coprinaceae	
148	583	26.8.2004	Phungi tenga	3255		*Agaricus xanthodermus*	Agaricaeae	
149	590	26.8.2004	Tengboche	3445		*Peziza badia*	Pezizaceae	
150	591	26.8.2004	Tenboche	3445		*Cystoderma* sp	Dermolomataceae	

3.1 Enumeration of mushroom species

1. *Armillaria mellea* (Vahl.: Fr.) Kummer.
Growing under Coniferous forest, Lukla, Muse forest, 2783m, 13 Aug. 2004 (Giri, Rana and Shrestha) Co. 1.
Previously recorded but host not mentioned, (Pandey,1976; Arun valley (Balfour-Browne,1968); Phulchoki (Singh & Nisha,1976c); Kutungsang and Kalopani (Cotter,1987) and growing on decayed log in moist shady place in afforested area of pine (exotic), Kakani (1780m)(Adhikari *et al.* 1996).

2. *Laccaria amethystine* (Huds.) Cooke
Growing on moist soil under Coniferous forest, Lukla, Muse forest, 2783m, 13 Aug. 2004 (Rana, Giri and Shrestha, 2004) Co.10c.
Previously recorded from Hetauda (Pandey 1976) and Suryavinayk (Bhandari, 1980); in *Pinus* forest, Kakani (1540); Matatirtha (1620m) and Sundarijal (1780m) (Adhikari and Adhikari, 1997); Lukla (2783) in *Pinus* forest (Giri, Rana & Shrestha, 2004).

3. *Lactarius piperatus* (Fr.) S.F. Gray
Growing on moist soil under Coniferous forest, Muse Forest, Lukla, 2783m, 13 Aug. 2004 (Giri, Rana & Shrestha), Co. 10GH.
Previously recorded from Kathmandu valley (Singh 1966) Daman (Pandey, 1976); growing on soil in *Pinus roxbugii* forest, Tokha (1520m); Nagarkot (1600m) (Adhikari, 1996 a; Adhikari *et al.*1996a); Suryavinayak (1540m); Lele (1380m) and Phulchoki (1700m) (Adhikari,1996a) Hetauda (Poudel ,1997).

4. *Boletus edulis* Bull ex Fr. Steinpilz
Growing on moist soil, under mixed forest of *Pinus* and *Tsuga*, Muse Forest, Lukla, 2783m, 13 Aug. 2004 (Giri, Rana & Shrestha), Co. 10l.
Previously recorded form Kakani (Pandey, 1976); Syabru (Cottes, 1987) and Suryavinayak (1540) (Adhikari et al 1996). Muse forest, Lukla (2783m).

5. *Amanita hemibapha* (Berk. & Br.) Sacc.
On moist soil, under mixed forest of *Rhododendron* and *Tsuga*, Muse Forest, Lukla, 2783m, 13 Aug. 2004 (Rana, Giri & Shrestha), Co. 20.
Previously recorded from Manichur (1800m); Suryabinayak (1450m); Dakshinkali (1500m); Kakani (1800m); Nagarkot (1700m) Brajayoginin(1600m); Kathmandu valley ((Adhikari, 1976-1996a) and amongst grasses under tree, Sundarijal (Singh & Nisha,1976c) (Pandey 1976).

6. *Russula olivicea* (Schaeff. ex Secr.) Fr.
On moist soil, under mixed forest of *Rhododendron* and *Tsuga*, Muse Forest, Lukla, 2783m, 13 Aug. 2004 (Giri, Rana & Shrestha), Co. 24.
Previously recorded from mixed forest of *Pinus wallichiana-Abies*, Junbesi-Rachuwa (2600m) (Adhakari, 1990b).

7. *Gyrodon merulioides* (Schw.) Singer
Growing on moist soil in open place near to *Rhododendron* and *Quercus* forest, Muse Forest, Lukla, 2783m, 13 Aug. 2004 (Giri, Rana & Shrestha), Co. 32.

8. *Boletus auripes* Peck
Growing on moist soil, under *Rhododendron* & *Quercus* forest, Muse Forest, Lukla, 2783m 13 Aug. 2004 (Rana, Giri & Shrestha), Co. 33.

9. *Strobilomyces strobilaceus* (Scop.:Fr.) Berk.
Growing on moist soil under Coniferous forest, Lukla/Ghat, 2604m, 14 Aug. 2004 (Rana, Giri& Shrestha), Co. 41.
Previously recorded in Phulchowki (Sing & Nisha, 1976c) and Suryavinayak (1540m) (Adhikari, 1996).

10. *Phylloporus bellus* (Mass.) Corner
Growing on dry soil at steep wall under Coniferous forest, Lukla/Ghat, 2604m, 14 Aug. 2004 (Giri, Rana & Shrestha), Co. 42.

11. *Pulveroboletus ravenelii* (Berk.et Curt.)
Growing on moist soil under Coniferous forest, Lukla/Ghat 2604m, 14 Aug. 2004 (Rana, Giri & Shrestha), Co. 43.

12. *Tylopilus alboater* (Peck) Sing.
Growing on steep wall on moist soil, under Coniferous forest, between Lukla to Ghat, 2604m, 14 Aug. 2004 (Giri, Rana & Shrestha), Co. 50.

13. *Gloeophyllum sepiarium* (Wulf.: Fr.) Karst.
Growing on *Pine* root, *Pinus* forest, Jorsalle, 2690m, 15 Aug. 2004 (Rana, Giri & Shrestha) Hetauda (Pandey,1976), Co. 100.

14. *Lacccaria proxima* (Boudier)
Growing on moist soil, under Pine forest, Jorsalle, 2690m, 15 Aug. 2004 (Giri, Rana & Shrestha), Co. 102.

15. *Naematoloma capnoides* (Fr. ex Fr.) Kumm.
Growing on moist soil in bunch, under *Pinus* and *Rhododendron* forest, Phurte 2840m, 17 Aug. 2004 (Rana, Giri & Shrestha), Co. 121.

16. *Laccaria bicolor* (Maire) P.D.
Growing on moist soil associated with mosses, under Pine forest, Phakdin, 2500m, 14 Aug. 2004 (Rana, Giri & Shrestha), Co. 61.

17. *Coltricia perennis* (Fr.) Murr.
Growing on dry and sandy soil in open area, Tok Tok, 2725m, 15 Aug. 2004 (Giri, Rana & Shrestha), Co. 81.
Previously recorded from Thodung, Lamjura, Rigmo, and Dudh Koshi (Ryv., 1979); on moist groung, Phulchowki(Lalitpur Dist.) (Singh & Nisha, 976c) and on thick humus soil with mosses, Seti khola Agra goan forest (Bajhang Dist.) (1880m) (Adhikari, 1988a).

18. *Suillus placidus* (Bonord.) Singer
Growing on moist soil under *Pinus* and *Daphnea* forest, Namche, 3150m, 16 Aug.2004 (Rana, Giri & Shrestha), Co. 128.
Previously recorded from Chautara, Daman, Nagarkot and Syabru (Cotter, 1987).

19. *Amanita gemmata* (Fr.) Gill.
Growing on dry soil in open area, Namche, 3065m, 16 Aug. 2004 (Giri, Rana & Shrestha), Co. 129.

20. *Suillus sibiricus* (Singer) Singer
Growing on rocky soil in open area, near to Pine forest, way to Namche, 3150 m, 16 Aug. 2004 (Giri, Rana & Shrestha), Co. 130.
Previously recorded from Ghasa, Godavary, Kakani, Larjung, Lete, Syabru (Cotter, 1987) and Pisang (Bhandary, 1991).

21. *Collybia butyracea* (Bull.:Fr.) Kummer
Growing on moist soil, under Coniferous forest, way to Namche, 3150 m, 16 Aug. 2004 (Giri, Rana & Shrestha) Co. 141.
Previously recorded from Godavary (Pandey, 1976).

22. *Boletinus asiaticus* (Klotz.:Fr.)Kalchbr.
Growing on moist soil, in Pine forest, Tok Tok, 2725m, 15 Aug. 2004 (Rana, Giri & Shrestha), Co. 84.
Place not mentioned (Singh, 1966).

23. *Russula metachroa* Hongo
Growing on moist soil in open place, in *Abies* forest, Phurte, 3585m, 17 Aug. 2004 (Giri, Rana & Shrestha), Co. 203.

24. *Gomphus clavatus* (Pers.:Fr.) S.F. Gray
Growing on soil, shady and moist place, under *Abies* forest, Phurte, 3546m, 17 Aug. 2004 (Giri, Rana & Shrestha), Co. 206.
Previously recorded from Kakani (Pandey, 1976).

25. *Tricholoma saponaceum* (Fr.:Fr.) Kummer
Growing on shady places, on soil, under *Abies* forest, Phurte, 3615m, 17 Aug. 2004 (Rana, Giri & Shrestha), Co. 208.
Previously recorded from Godavary (Pandey, 1976).

26. *Clavaria acuta* Sch.: Fr.
Growing on moist soil, under *Abies* forest, Phurte, 3585m, 17 Aug, 2004 (Giri, Rana & Shrestha), Co. 210.
Previously recorded on soil in *Castanopsis* forest, Godavary (Adhakari, 1988b); in mixed forest, Suryavinayak (1540m) and Sundarijal (1780m) (Adhakari, 1996; Adhikari *et al.*, 1996).

27. *Cyathus striatus* (Hud.: Pers.) Will.
Growing on moist twigs of *Abies*, Phurte, 3585m, 17 Aug. 2004 (Rana, Giri & Shrestha), Co. 211B.
Previously recorded on ground and rotten wood in forest, Sundarijal (Singh & Nisha, 1976).

28. *Hygrocybe strangulata*
Growing on moist soil under *Rhododendron* forest, Khunde, 3900m, 20 Aug. 2004 (Giri, Rana & Shrestha), Co. 227.

29. *Cantharellus cibarius* Fr.
Growing on moist soil, in *Rhododendron* forest, Khunde, 3900m, 20 Aug. 2004 (Rana, Giri & Shrestha), Co. 237.
Previously recorded from Bajrajogini (Adhakari, 1976, 1988, 1996).

30. *Chroogomphus tomentosus* (Schw.) Singer
Growing on moist soil, in *Rhododendron* forest, Khunde, 3900m, 20 Aug, 2004 (Giri, Rana & Shrestha), Co. 241.
Previously recorded on earth bank in *Quercus* forest (Balfour-Browne, 1968); in humus in *Abies-Betula* forest, Ratomata, Chakure Lekh (Balfour- Browne, 1955) and on ground, in the mixed forest, Syabru (Adhikari, 1966a).

31. *Scleroderma citrinum* Pers.:Pers.
Growing on soil in shady places, in *Rhododendron* forest, Khunde, 3900m, 20 Aug. 2004 (Rana, Giri& Shrestha), Co. 243.
Previously recorded in moist shady places, in *Pinus roxburghii* forest, Meth and Pokhara (Balfour- Browne, 1968); Nagarjoon (Pandey, 1976); Godavary (Singh & Nisha, 1976c),Manuchur, Sybrubesi (Langtang area), (Adhikari, 1987); Sundarijal, Kathmandu valley (1720m); Matatirtha (1620m) and Pokhara, Raniban (920m) (Adhikari *et al.*1996).Eaten raw by Tamang in Nepal.

32. *Clavulina cinerea* (Bull.:Fr.) Schroet.
Growing on moist soil, Jami khiau forest, Khumjung, 3825m, 22 Aug. 2004 (Giri, Rana & Shrestha, 2004), Co. 268.
Previously recorded from Godavary (Pandey, 1976), and Kathmandu market (Adhikari, 1996); Adhikari, 1997; Adhikari *et al.*, 1996). Common species.

33. *Paxillus involutus* (Batsch : Fr.)
Growing on moist soil under *Rhododendron* forest, Jami khiau 3825m, 22, Aug. 2004 (Rana, Giri & Shrestha), Co. 271.

34. *Cordyceps* sp
Growing very deep in soil, under *Abies* & *Rhododendron* mixed forest, Jami khiau, 3825 m, 22 Aug. 2004 (Giri, Rana & Shrestha), Co. 273.

35. *Stropharia semiglobata*
Growing on Yak dung, Lausausa, 3770m, 23 Aug. 2004 (Rana, Giri & Shrestha), Co.302A.

36. Lycoperdon pyriforme Schaeff.: Pers.
Growing on moist soil, under *Rhododendron* forest, Phungi tenga, 3590m, 24 Aug. 2004 (Giri, Rana & Shrestha), Co.407.
Growing on rotten dead wood in moist shady places, Suliigadh (West Ndepal) (Balfour-Browne, 1968); Thodung, Lamjura and Junbesi (Kreisel, 1969); Phulchowki and Sundarijal (Singh & Nisha, 1976c) and Kakani (Pandey, 1976); Kali gad, surmasarowa Lekh, Khuli, Simen, Langtang valley (Kreisel, 1976); between Syabru besi and Lama hotel (1380m); Langtang National Park (Adhikari, 1996); Kakani (1780m) and Pokhara (980m) (Adhikari *et al.*, 1969).

37. *Hygrocybe* sp
Growing on moist soil under *Rhododendron* forest, Khunde, 3900m. 20 Aug. 2004 (Rana, Giri & Shrestha), Co. 230.

38. *Pholiata aurivella* (Batsch.: Fr.) Kummer
Growing on *Abies* tree trunk in a bunch, shady moist place, Tengboche, 3702m, 24 Aug. 2004 (Giri, Rana & Shrestha), Co.408.
Manichur (Adhikari, 1976), Market and Landrung (Bhandary, 1984).

39. *Coprinus micaceus* (Bull. ex Fr.) Fr.
Growing on moist soil and dead tree trunk open area near *Rhododendron* and *Abies* forest, Tengboche, 3702m, 24 Aug. 2004 (Rana, Giri & Shrestha) Co. 410.

40. *Russula paludosa* Britz.
Growing on moist soil under *Rhododendron* and *Abies* tree, Tengboche 3645m 24 Aug. 2004 (Giri, Rana & Shrestha), Co.413.

41. *Amanita pachycolea* (Bull.exFr.)Vitt
On moist soil, under *Rhododendron* Forest, Debuche, 3700m, 24 Aug .2004 (Rana, Giri & Shrestha), Co.450.

42. *Lactarius subdulcis* (Fr.) Fr.
Growing on Moist soil, Muse Forest, Lukla, 2783m, 13 Aug. 2004 (Giri, Rana & Shrestha), Co. 10L.

43. *Lycoperdon perlatum* Pers.: Pers.
Growing on soil, under *Abies* tree, Deboche, 3665m, 25 Aug. 2004 (Rana, Giri & Shrestha), Co.505.
Surmasarowa Lekh (Kreisel, 1976)

44. *Pseudohydnum gelatinosum* (Scop.: Fr.) Karst.
Growing on dead log of *Rhododendron* tree, Omaka forest (Pangboche), 3890m, 25 Aug.2004 (Giri, Rana & Shrestha),Co. 550.

45. *Hohenbuehelia* sp.
Growing on soil under *Rhododendron* forest, Deboche, Omaka Forest (Pangboche), 3890m, 25 Aug. 2004 (Rana, Giri& Shrestha), Co. 551.

46. *Cortinarius traganus* (Fr. ex Fr.) Fr.
Growing on moist soil, under *Rhododendron* Forest, Omaka Forest (Pangboche), 3890m, 25 Aug. 2004 (Giri, Rana & Shrestha), Co. 552.

47. *Aleuria aurantia* (Fr.) Fuck.
Growing on moist places on twigs of *Rhododendron*, Deboche, 3665m, 25 Aug. 2004 (Giri, Rana & Shrestha), Co. 554.
Previously recorded from Ghar Khola (Balfour-Browne, 1968; Singh & Nisha, 1976c); Kyumnu (Otani, 1982) and recently collected from Maipokhari area (1800m), Ilam (Adhikari, 1998).

48. *Scutellinia scutellata* (L.: Fr.) Lamb
Growing on Longma tree, Deboche, 3665m, 26 Aug. 2004 (Rana, Giri & Shrestha), Co. 572.
Previously recorded on soil, dead Yucca and twigs, Balaju, Kathmandu (Waraitch & Thind, 1977a).

49. *Pleurotus dryinus* (Pers.: Fr.) Kummer
Growing on tree trunk of *Abies spectabilis*, Lausasa, 3570m, 23Aug. 2004 (Giri, Rana & Shrestha), Co. 306.
Previously recorded from the tree trunk of *Tsuga* forest, Khot bas Chakure kekh (Balfour-Browne, 1955).

50. *Ganoderma applanatum* (Pers.) Pat.
Growing on dead log of *Abies*, Lausasa 3570m, 23 Aug. 2004 (Rana, Giri & Shrestha), Co. 312.
Previously recorded from Terai forest, Dharan (Balfour-Browne, 1968); on rotten tree trunk, Bakhri Kharka (north of Pokhara); Taglung (Kaligandaki) (Balfour-Browne,

1968); Hetauda (Pandey, 1976); on Quercus sp., Daman (Singh, 1976); on stump, Phulchoki (Lalitpur Dist.) (Singh & Nisha, 1976c); on tree trunk, Namrung (Gorkha Dist.) (2460m) (Adhikari, 1988a) and on wood of *Betula utilis*, Nilgatti Odar (Bajhang Dist.) (3500m) (Adhikari, 1988a). In tropical to temperate belts (Adhikari, 1996a).

51. *Boletus pulverulentus* Opat.
Growing on moist soil, under mixed forest of *Rhododendron* and *Tsuga*, Muse Forest, Lukla, 2783m, 13 Aug. 2004 (Rana, Giri & Shrestha), Co. 22.

52. *Gomphus floccosus* (Schw.) Singer
Growing on moist soil, under *Abies* forest, Lausasa 3570m, 23 Aug. 2004 (Giri, Rana & Shrestha), Co. 320.
Previously recorded on earth bank on *Quercus* forest (Balfour-Browne, 1968); in humus in *Abies–Betula* forest, Ratomata, Chakure Lekh (Balfour-Browne, 1955) and on ground, in the mixed forest, Syabru (Adhikari, 1966a).

53. *Hygrocybe coccinea* (Schaeff.: Fr.) Kummer
Growing on moist soil under *Rhododendron* forest, Khunde, 3900m, 20 Aug. 2004 (Rana, Giri & Shrestha), Co. 229.
Previously recorded from Phulchowki (Singh & Nisha, 1976c).

54. *Otidea onotica* (Pers.: Fr.) Fuck.
Growing on moist soil, Phungi tenga, 3340m, 21 Aug. 2004 (Giri, Rana & Shrestha), Co. 403.
Previously recorded from Dhunche, Sing Gompa (Otani, 1982).

55. *Amanita* sp.
Growing on moist soil, under *Pine* forest, Jorsalle, 2800m, 16 Aug. 2004 (Giri, Rana & Shrestha), Co. 120.

56. *Auricularia polytricha* (Mont.) Sacc.
Growing on moist soil under *Pine* forest, Khumjung, 3800m, 22 Aug. 2004 (Rana, Giri & Shrestha), Co. 258.
Previously recorded on tree branch, Tamrang khola (Balfour-Browne, 1968).

57. *Coprinus niveus* Fr.
Growing on moist soil in open area, near to Pine forest, Tengboche 3445m, 26 Aug. 2004 (Rana, Giri & Shrestha), Co. 579.

58. *Ramaria flava* (Schaeff.: Fr.) Quel.
On Moist Soil, under *Abies spectabilis* tree, Phurte, 3615m, 17 Aug. 2004. (Giri, Rana & Shrestha), Co. 207.
Previously recorded at Kathmandu market (Adhikari, 1996a; Adhikari &Adhikari, 1997; Adhikari *et al.* 1996). Common species. Japanese literature considers it as poisounous species.

59. Heterobasidion annosum (Fr.) Bref.
Growing on cut stump of *Pinus* tree, Jorsalle 2690m, 15 Aug. 2004 (Rana, Giri & Shrestha), Co. 91.
On wood of *Rhododendron arboreum*, Manichur (2145m) (Adhikari, 1988a). In tropical to temperate belts (Adhikari, 1996a).

60. Coprinus radians (Desm.: Fr.) Fr.
Growing on twig of *Rhodendron* tree, Jami khiau forest 3860m, 22 Aug. 2004 (Giri, Rana & Shrestha), Co.279.

61. *Laccaria laccata* (Scop.: Fr) Berk.et Br.
Growing on moist soil under *Rhododendron* and *Juniperus* forest, Syanboche, 3940m, 20 Aug. 2004 (Giri, Rana & Shrestha), Co. 233.

62. *Dermocybe phoenicea* (Bull.) Moser in Gams
Growing on moist soil, under *Rhododendron & Abies* mixed forest, Khumjung, 3800m, 22 Aug. 2004 (Giri, Rana & Shrestha), Co. 261.

63. *Russula densifolia* (Secr.) Gill.
Growing on moist soil under Pine forest, Tengboche, 3702m, 24 Aug. 2004 (Giri, Rana & Shrestha), Co. 427.
Previously recorded from Royal Botanical Garden, Godavary (1515m) (Adhikari, 1966a; Adhikari &Durrieu, 1999).

64. *Peziza badia* Pers.: Fr.
Growing on dry soil, under mixed forest of *Rhododendron & Abies*, Tengboche, 3445m, 26 Aug. 2004 (Rana ,Giri, & Shrestha), Co.590.

65. *Tylopilus eximus* (Peck) Sing.
Growing on moist soil, under pure *Rhododendron* forest, Jami khiau, 3825m, 22 Aug. 2004 (Giri, Rana & Shrestha), Co. 270.

66. *Pholiota nameko* (T. Ito) S. Ito et Imai in Imai
Growing on moist soil, under *Abies* tree, Khumjung, 3800m, 21 Aug. 2004 (Rana ,Giri, & Shrestha), Co. 251.

67. *Fomitopsis* sp.
Growing on dead stump of *Rhododendron* tree, Jami khiau, 3825m, 22 Aug. 2004 (Giri, Rana & Shrestha), Co.420.

68. *Amanita vaginata* (Bull.: Fr.) Vitt.
Growing on moist soil, under *Tsuga* and *Rhododendron* forest, Muse Forest, Lukla, 2783m, 13 Aug. 2004 (Rana, Giri & Shrestha), Co. 21.
Previously recorded from Manichur (1800m); Suryabinayak (1450m); Dakshinkali (1500m); Kakani (1800m); Nagarkot (1700m); Brajayogini (1600m); Kathmandu valley (Adhikari, 1976- 1996a) and amongst grasses under tree, Sudarijal (Singh & Nisha, 1976c) (Pandey, 1976).

69. *Hydnum repandum* L.: Fr.
Growing on moist soil under *Rhododendron* forest, Jami khiau, 3860m, 22 Aug. 2004 (Giri, Rana & Shrestha), Co. 280.
Previously recorded from Daman, Kakani, (Pandey, 1976), Kathmandu; Manichur (Adhikari, 1976); Suryavinayak (Singh & Nisha, 1976c); market (Adhikari, 1987) and Tokha (Adhikari 1966a; Adhikari & Adhikari, 1997; Adhikari *et al*., 1996).

70. *Boletus* sp.
Growing on moist soil under *Rhododendron* tree, Khumjung 3800m, 21Aug. 2004 (Giri, Rana & Shrestha), Co. 250

71. *Agaricus xanthodermus* Genevier
Growing on soil in shady places, under Pine forest, Fungi tenga, 3255m, 26 Aug. 2004 (Rana, Giri & Shrestha), Co. 583.

72. *Crepidotus* sp.
Growing on *Pine* twig, Muse Forest, Lukla, 2783m, 13 Aug. 2004 (Giri, Rana & Shrestha), Co. 3.

73. *Tylopilus* sp.
Growing on soil at shady place, Muse Forest, Lukla, 2783m, 13 Aug. 2004 (Rana, Giri & Shrestha), Co. 10d.

74. *Ganoderma* sp.
Growing on trunk of *Rhododendron*, Muse Forest, Lukla, 2783m, 13 Aug. 2004 (Giri, Rana & Shrestha), Co. 10e.

75. *Conocybe* sp.
Growing on moist soil in large group, Muse Forest, Lukla, 2783m, 13 Aug. 2004 (Rana, Giri & Shrestha), Co. 10f.

76. *Boletus* sp.
Growing on moist soil, under mixed forest of *Rhododendron* and *Quercus*, Muse Forest, Lukla, 2783m, 13 Aug. 2004 (Giri, Rana & Shrestha), Co. 10J.

77. *Microporus* sp.
Growing on moist soil, under mixed forest of *Rhododendron* and *Quercus*, Muse Forest, Lukla, 2783 m, 13 Aug. 2004 (Rana, Giri & Shrestha) Co.10 K.

78. *Amanita* sp.
Growing on moist soil, Muse forest, Lukla, 2783m, 13 Aug. 2004 (Giri, Rana & Shrestha), Co. 23.

79. *Russula* sp.
Growing on moist soil, Muse forest, Lukla, 2783m, 13 Aug. 2004 (Rana, Giri & Shrestha), Co. 25.

80. *Russula* sp.
Growing on moist soil, Muse forest, Lukla, 2783m, 13 Aug. 2004 (Giri, Rana & Shrestha), Co. 26.

81. *Cortinarius* sp.
Growing on moist soil, Muse forest, Lukla, 2783, 13 Aug. 2004 (Rana, Giri & Shrestha), Co. 27.

82. *Marasmius* sp.
Growing on moist forest, Muse Forest, Lukla, 2783m, 13 Aug. 2004 (Giri, Rana & Shrestha), Co. 40.

83. *Strobilomyces* sp.
Growing on soil in open area, on the way to Ghat, 2604m, 14 Aug. 2004 (Rana, Giri & Shrestha), Co. 51.

84. *Collybia* sp.
Growing on soil, under way to Ghat, 2604m, 14 Aug. 2004 (Giri, Rana & Shrestha), Co. 56.

85. *Boletinus* sp.
Growing on moist soil at the base of *Pinus wallichiana*, Toktok, 2725m, 15Aug. 2004 (Rana, Giri & Shrestha), Co. 85.

86. *Paxillus* sp.
Growing on soil in open area in bunch, Tok Tok, 2725m, 15 Aug. 2004 (Giri, Rana & Shrestha), Co. 86

87. *Heterobasidion* sp.
Growing on dead log of Pine, Jorsalle, 2685m, 15 Aug.2004 (Rana, Giri & Shrestha), Co. 87.

88. *Marasmius* sp.
Growing on moist soil, under Pine forest, Jorsalle, 2690m, 15 Aug. 2004 (Giri, Rana & Shrestha), Co. 90.

89. *Amanita* sp.
Growing on soil, under Pine forest, Jorsalle, 2690m, 15 Aug. 2004 (Rana, Giri & Shrestha), Co. 101.

90. *Lactarius* sp.
Growing on moist soil under *Rhododendron* and *Abies* forest, Khumjung 3800m 22 Aug. 2004 (Giri, Rana & Shrestha) Co.260.

91. *Tricholoma* sp.
On moist soil, under mixed forest of *Rhododendron* and *Tsuga*, Muse Forest, Lukla, 2783m, 13 Aug. 2004 (Giri, Rana & Shrestha), Co. 30.

92. *Armillaria* sp.
Growing on moist soil, under Pine forest, Jorsalle, 2690m, 15 Aug. 2004 (Giri, Rana & Shrestha), Co. 105.

93. *Tricholoma* sp.
Growing on moist soil under Pine forest, Ghat 2604, 14 Aug. 2004 (Giri, Rana & Shrestha) Co.54.

94. *Boletinus cavipes* (Opat.) Kalchbr.
Growing on moist soil associated with mosses, under Pine forest, Phakdin, 2500m, 14 Aug. 2004 (Rana, Giri & Shrestha), Co. 70.

95. *Nematoloma* sp.
Growing on moist soil, under Pine forest, Jorsalle, 2686m, 15 Aug. 2004 (Giri, Rana & Shrestha), Co. 89.

96. *Amanita* sp
Growing on moist soil, under *Abies* forest, Lausasa, 3570m, 23 Aug. 2004 (Rana, Giri & Shrestha), Co. 311.

97. *Clitocybe* sp.
Growing on moist soil in shady places, under *Abies* forest, Phungi Tenga, 3340m, 24 Aug. 2004 (Giri, Rana & Shrestha), Co. 400.

98. *Tyromyces* sp.
Growing on soil, under *Rhododendron* forest, Jami khiau, 3825m, 22 Aug. 2004 (Rana, Giri & Shrestha), Co. 281.

99. *Lactarius* sp.
Growing on soil, under *Juniperus* forest, Khunde, 3890m, 22 Aug. 2004 (Giri, Rana & Shrestha), Co. 300.

100. *Cortinarius* sp.
Growing on moist soil, under *Abies* forest, Lausasa, 3570m, 23 Aug. 2004 (Rana, Giri & Shrestha), Co. 302B.

101. *Lactarius delicious* (L.: Fr.) S.F. Gray
Growing on moist soil, under *Abies* forest, Lausasa, 3570m, 23 Aug. 2004 (Giri, Rana & Shrestha), Co. 303.

102. *Clitocybe* sp.
Growing on moist soil, under *Abies* forest, Lausasa, 3570m, 23 Aug. 2004 (Rana, Giri & Shrestha), Co. 308.

103. *Polyporus* sp.
Growing on moist soil, under *Abies* and *Betula* forest, Lausasa, 3570m, 23 Aug. 2004 (Giri, Rana & Shrestha), Co. 321.

104. *Cortinarius* sp.
Growing on moist soil in shady places, under *Abies* forest, Phungi Tenga, 3440m, 24 Aug. 2004 (Rana, Giri & Shrestha), Co. 405.

105. *Clitocybe* sp.
Growing on moist soil in shady places, under *Rhododendron* & *Abies* forest, Tengboche , 3700 m, 24 Aug. 2004. (Rana, Giri & Shrestha), Co. 409.

106. *Psathyrella* sp.
Growing on dead tree trunk of *Rhododendron*, Tengboche, 3700m, 24 Aug. 2004 (Rana, Giri & Shrestha), Co. 411.

107. *Marasmius* sp.
Growing on moist soil, under the *Rhododendron* forest, Deboche, 3700m, 24 Aug. 2004 (Giri, Rana & Shrestha), Co. 415.

108. *Tyromyces* sp.
Growing on moist soil in shady places, under *Abies* forest, Phungi Tenga, 3340m, 24 Aug. 2004 (Rana, Giri & Shrestha), Co. 401

109. *Inocybe* sp.
Growing on soil, in shady place, under *Rhododendron* forest, Deboche, 3700m, 24 Aug. 2004 (Giri, Rana & Shrestha), Co. 421.

110. *Lactarius* sp.
Growing on moist soil under *Rhododendron* forest, Deboche, 3700m, 24 Aug. 2004 (Rana, Giri & Shrestha), Co. 425.

111. *Lycoperdon* sp.
Growing on soil, under *Rhododendron* forest, Deboche, 3738m, 24 Aug. 2004 (Giri, Rana & Shrestha), Co. 430.

112. *Russula* sp.
Growing on moist soil, under *Rhododendron* forest, Deboche, 3665m, 25 Aug. 2004 (Rana, Giri & Shrestha), Co. 500.

113. *Entoloma* sp.
Growing on moist soil, under *Rhododendron* & *Betula* mixed forest, Deboche, 3665m, 25 Aug. 2004 (Giri, Rana & Shrestha), Co. 501.

114. *Clavaria* sp.
Growing on soil under *Rhododendron* tree, Deboche, 3665m, 25 Aug. 2004 (Rana, Giri & Shrestha), Co. 509.

115. *Vascellum* sp.
Growing on open ground associated with grasses, Deboche, 3665m, 25 Aug. 2004 (Giri, Rana & Shrestha), Co. 570.

116. *Lycoperdon* sp.
Growing on soil in open place, Deboche, 3665m, 26 Aug. 2004 (Rana, Giri & Shrestha), Co. 571.

117. *Cystoderma* sp.
Growing on moist soil under the *Pine* forest, Tengboche, 3445m, 26 Aug. 2004 (Giri, Rana & Shrestha), Co. 591.

118. *Coprinus* sp.
Growing on moist soil, under mixed forest of *Rhododendron* & *Abies*, Tengboche, 3445m, 26 Aug. 2004 (Rana ,Giri, & Shrestha), Co.581.

119. *Nematoloma* sp.
Growing on moist soil, under *Pine* forest, Jorsalle, 2800m, 16 Aug. 2004 (Giri, Rana & Shrestha), Co. 110.

120. *Russula* sp.
Growing on moist soil, under *Abies* forest, Phurte, 2840m, 17 Aug. 2004 (Giri, Rana & Shrestha), Co. 125.

121. *Clitocybe* sp
Growing on moist soil, under *Pinus* forest, Jorsalle (way to Namche), 2800m, 16 Aug. 2004 (Giri, Rana & Shrestha), Co. 126.

122. *Boletus* sp.
Growing on moist soil, under *Abies* forest, Phurte, 3585m, 17 Aug. 2004 (Rana, Giri & Shrestha), Co. 201.

123. *Amanita* sp.
Growing on moist soil, under *Abies* forest, Phurte, 3585m, 17 Aug. 2004 (Giri , Rana & Shrestha), Co. 202.

124. *Cortinarius* sp.
Growing on moist soil, under *Abies* forest, Phurte, 3547m, 17 Aug. 2004 (Rana , Giri & Shrestha), Co. 205.

125. *Russula* sp.
Growing on moist soil, under *Abies* forest, Phurte, 3615m, 17 Aug. 2004 (Giri, Rana & Shrestha), Co. 209.

126. *Ramaria* sp.
Growing on moist soil, under *Abies* forest, Phurte, 3585m, 17 Aug. 2004 (Rana, Giri & Shrestha), Co. 211A.

127. *Hygrophorus* sp.
Growing on moist soil, under *Abies* forest, Phurte, 3885m, 17 Aug. 2004 (Giri, Rana & Shrestha), Co. 212.

128. *Russula* sp.
Growing on moist soil, under *Abies* forest, Phurte, 3885m, 17 Aug. 2004 (Rana, Giri & Shrestha), Co. 213.

129. *Lycoperdon* sp.
Growing on moist soil, under *Pine* forest, Khunde, 3770m, 20 Aug. 2004 (Giri, Rana & Shrestha), Co. 221.

130. *Coprinus* sp.
Growing on moist soil, under *Rhododendron* forest, Khunde, 3830m, 20 Aug. 2004 (Rana, Giri & Shrestha), Co. 222.

131. *Entoloma* sp.
Growing on moist soil, under *Rhododendron* and *Pine* forest, Khunde, 3900m, 20 Aug. 2004 (Giri, Rana & Shrestha), Co. 234.

132. *Scleroderma* sp.
Growing on moist soil, under *Rhododendron* and *Pine* forest, Khunde, 3900m. 20 Aug. 2004 (Rana, Giri & Shrestha), Co. 238.

133. *Boletus* sp.
Growing on moist soil, under *Rhododendron* and *Pine* forest, Khunde, 3900m, 20 Aug. 2004 (Giri, Rana & Shrestha), Co. 240.

134. *Auricularia* sp.
Growing on root of *Rhododendron* tree, Khumjung, 3800m, 22 Aug. 2004 (Rana, Giri & Shrestha), Co. 259.

135. *Nyctalis* sp.
Growing on decaying mushroom, under *Abies* forest, Jami Khiau, 3840m, 22 Aug. 2004 (Giri, Rana & Shrestha), Co. 262.

136. *Russula* sp.
Growing on moist soil, under *Abies* forest, Jami Khiau, 3825m, 22 Aug. 2004 (Rana , Giri & Shrestha), Co. 265.

137. *Lycoperdon* sp.
Growing on moist soil, under *Abies* forest, Jami Khiau, 3825m, 22 Aug. 2004 (Giri, Rana & Shrestha), Co. 267.

138. *Amanita* sp.
Growing on moist soil, under *Abies* forest, Jami Khiau, 3825m, 22 Aug. 2004 (Rana , Giri & Shrestha), Co. 269.

139. *Cortinarius* sp.
Growing on moist soil in shady places, under *Abies* forest, Phungi Tenga, 3370m, 24 Aug. 2004 (Giri, Rana & Shrestha), Co. 404.

140. *Trichoglossum* sp.
Growing on soil, under *Abies* forest and *Betula* mixed forest, Jamikhiau, 3825m, 22 Aug. 2004 (Giri, Rana & Shrestha), Co. 274.

141. *Mycena capillaries* (Schum.:Fr.)Kummer
Growing on leaf of *Quercus*, under mixed forest of *Quercus* and *Rhododendron*, Muse forest, Lukla, 2783m, 13 Aug. 2004 (Rana, Giri & Shrestha), Co. 4.

142. *Lactarius volemus* (Fr.) Fr.
Growing on moist soil, under *Rhododendron* & *Betula* mixed forest, Deboche, 3665m, 25 Aug. 2004 (Giri, Rana & Shrestha), Co. 502.

143. *Pholiota* sp.
Growing on soil, under mixed forest of *Rhododendron* & *Quercus*, Jorsalle, 2685m, 15 Aug. 2004 (Giri, Rana & Shrestha), Co. 82.

144. *Lyophyllum* sp.
Growing on moist soil, under *Rhododendron* forest, way to Namche, 2900m, 16 Aug. 2004 (Giri, Rana & Shrestha), Co. 140.

145. *Pseudohydnum* sp.
Growing on Rhododendron tree, Deboche, 3665m, 25 Aug. 2004 (Rana, Giri & Shrestha),Co. 507.

Table 4: Nutrient Components Found in Some Wild Edible Mushrooms of Nepal.

S.N	Species	Fresh Moist % (Fan dried)	Protein	Ash	Acid Insol Ash	Phos-phorus Mg/100g	Calcium mg/100g	Iron mg/100g	Carboh ydrate%
1	*Clitocybe sp*		29.29	15.67	7.12	405	128	32.81	45.62
2	*Coprinus comatus*	93.20	36.04	14.35	5.20	1161	106	30.38	42.11
3	*Hydnum repandum*	19.97	1600	8.91	132	356	356	10.92	52.82
4	*Suillis bovinus*		29.86	9.38	2.98	485	115	12.43	56.48
5	*Oudenmansiella radicata*		23.78	14.20	5.02	392	97	30.84	54.70
6	*Agaricus campestris*	90.00	33.77	19.36	10.29	642	185	24.53	34.28
7	*Scleroderma citrinum*	84.12	20.58	14.16	6.33	588	124	19.14	56.63
8	*Laccaria laccata*	56.2	20.05	37.79	26.29	234	112	-	-
9	*Clavulina cineria*	86.00	19.36	23.14	13.12	334	164	30.38	-
10	*Amanita caesarea*	92.70	28.90	13.05	2.77	690	157	7.63	52.98
11	*Amanita Hemibapha*	92.65	28.53	12.62	2.73	636	175	8.84	53.82
12	*Grifola frondosa*	87.19	22.26	5.66	0.36	410	106	2.01	69.42
13	*Cantharellus cibarius*	94.75	22.78	10.80	2.39	443	102	8.01	61.73
14	*Cantharellus subalbidus*	87.42	23.90	14.43	3.37	431	101	15.25	55.64
15	*Merupillus giganteus*	95.82	21.67	12.61	2.39	435	129	8.91	61.03
16	*Hericium erinaceus*	89.11	22.18	14.61	5.11	360	141	9.13	55.80
17	*Pleurotus cornucopiae*	89.35	19.70	13.97	3.64	411	135	11.10	60.39
18	*Laetiporus sulphureus*	75.68	13.05	11.53	2.17	403	117	11.67	70.95

Source: (Adhikari & Adhikari 1999: Adhikari *et al.* 1996)

4. Recommendation

- Mushrooms are rich source of protein. They could be utilized as protein substitute to meat which is a very expensive and a rarely eaten item especially in the higher regions.
- Mushrooms have been a delicacy since ancient times. About 90% of local people consume wild mushrooms. Therefore, it is very crucial to assess their nutritive value.
- Based on the nutritive value (still yet to be accessed) and deliciousness the best edible mushrooms could be recommended for extensive use by the local people and people in the hotel business.
- Most of the hotels use mushrooms brought all the way from Kathmandu. Hotel owners should be encouraged to set a trend to use the delicious varieties of local mushrooms for cooking various delicacies. This would help further create a market for the local mushrooms and become a good source of income for the local people.
- Mushrooms are only found seasonally. Therefore, standard procedures should be developed for the preservation and storing of their use during off-season. Moreover, researchers and concerned agencies (government and private) should be made aware of the important wild mushrooms of the regions and encouraged to undertake research activities of agriculturally and medically significant mushrooms.
- Fungi are a seasonal perishable item therefore, people should be encouraged to utilize and harvest the mushrooms in a sustainable way. Priority should be given to manage the natural habitat of mushroom.

Some Photographs of Wild Mushrooms Collected in their Natural Habitats of Khumbu region.



Laccaria amethystine



Lactarius piperatus



Ganoderma sp



Amanita hemibapha



Lactarius subdulcis



Armillariella mellea



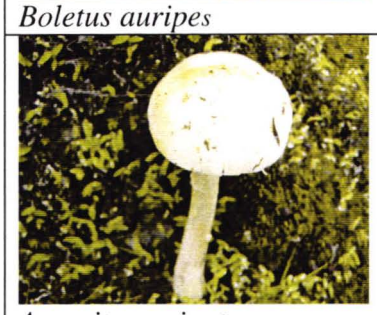
Boletus auripes



Boletus pulverlentus



Gyrodon merulioides



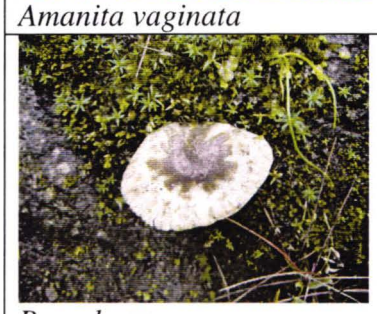
Amanita vaginata



Coltricia perennis



Boletinus cavipes



Russula sp



Russula paludosa



Collybia sp

Some Photographs of Wild Mushrooms Collected in their Natural Habitats of Khumbu region.



Laccaria bicolor



Amanita sp.



Amanita sp.



Boletus sp.



Amanita sp.



Russula metachroa



Nematoloma capnoides



Russula sp.



Heterobasidion sp.



Coprinus sp.



Hygrocybe coccinea



Coprinus sp.



Amanita sp.



Chroogomphus tomentosus



Hygrocybe strangulata

Some Photographs of Wild Mushrooms Collected in their Natural Habitats of Khumbu region.



Tylophilus eximus



Clitocybe sp.



Lactarius sp.



Pholiota nameko



Strobilomyces sp.



Clavulina cinerea



Ramaria flava



Gomphus clavatus



Cortinarius sp.



Tylopilus alboater



Cordyceps sp.



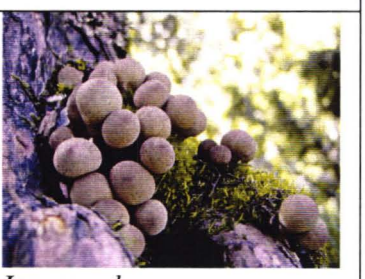
Trichoglossum sp.



Hydnum repandum



Otidea onotica

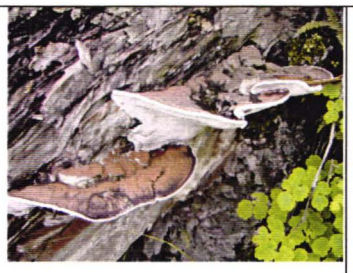


Lycoperdon sp.

Some Photographs of Wild Mushrooms Collected in their Natural Habitats of Khumbu region



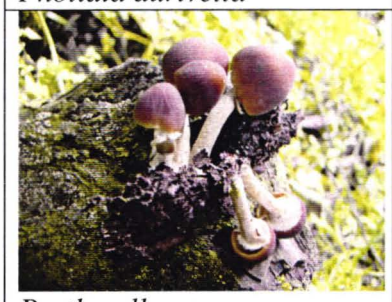
Pholiata aurivella



Ganoderma applanatum



Pseudohydnum gelatinosum



Psathyrella sp.



Unidentified



Cantharellus cibarius



Ramaria sp.



Lactarius delicosus



Pleurotus dryinus



Gomphus floccosus



Pulveroboletus ravenelii



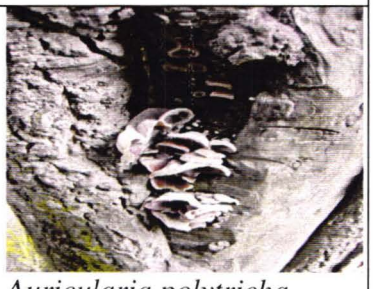
Lycoperdon perlatum



Cortinarius traganus



Clavaria sp.



Auricularia polytricha

Some Photographs of Wild Mushrooms Collected in their Natural Habitats of Khumbu region



Hohenbuehelia sp.



Polypore



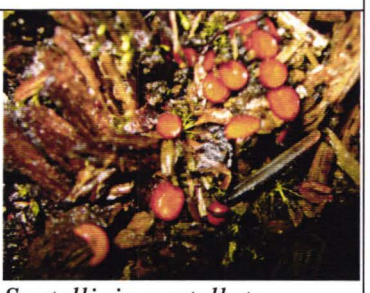
Aleuria aurantia



Fomitopsis sp.



Polypore



Scutellinia scutellata



Pholiota aurivella



Lactarius sp.



Nyctalis sp.



Amanita sp.



Marasmium sp.



Cyathus striatus

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ANNEX - 1

Questionnaire Applied to Collect Social Data of Mushroom from Khumbu Region:

Interview No: **Date:** **Ascribed by:**

Village/Place of interview: **Ward No.:** **VDC:**

A. Socio-economic Condition

1. Respondent's Idiographic Data:

a. Name: b. Ethnicity: c. Sex: Male [ ] Female [ ]

d. Age: e. Religion: f. Education:

g. Occupation: h. Origin:

2 . Occupation:

i) Agriculture: ii) Agri+ Business: iii) Agri + Service:
iv) Business: v) Service + Business: vi) Govt. Service:
vii) Study: viii) Mushroom collection
ix) Others:

B. Purpose for mushrooms collection:

i)Mushroom due to market/ traders demand (high value)
ii) Mushroom collection as major task
iii) Mushroom for religious purpose
iv) Mushroom as staple diet due to poverty
v) Mushroom as insecticide/pesticide
vi) Mushroom for foreigners or trekkers

C. Do you collect mushroom? Yes [ ] No [ ]

i) Mushroom Collection: Daily [ ] Occasionally [ ] Season [ ]
ii) Area/ Locality/ Forest _____
iii) Method of Collection _____
iv) Method of Storing and preservation (Time Period) _____
v) Problems during collection _____

Try to identify the amount collection in a day and also total amount in a year from one household.

D. On what basis do they distinguished the edible or poisonous mushroom?

i) The skills transferred from their forefathers [ ]
ii) Heat and trial method [ ]
iii) Ask if any other methods [ ]

E. Ask what do they do if they take poisonous mushrooms?

i) Treat with their own cultural methods
ii) By the doctor/ dhami
iii) Others

Is it possible to minimize the poisonous nature of mushrooms? Yes [ ] No [ ]

F. Age group involved in the collecting of mushrooms:

a) In the past: Male/Female (Age)_____
b) At the present: Male/ Female (Age)_____

Places of wild mushroom availability and marketting.

SN.	Name of mushrooms	Places of wild availability	Places of Selling	Amount of sale in dharni/yr	Rate		Uses	
					Dharni*	Kg	Medicinal	Others
1								
2								
3								
4								
5								
6								
7								

1 dharni* = 2.5kg

Try to keep the information about the selling of mushrooms:
Note the person to whom they do sell their collected mushroom_____
Note the location and place of selling _____
Note the approximately selling amount in dharni or kilogram_____
Note the rate of selling of collected mushrooms in local unit_____
Is there any change in the socio-economic condition due to the mushroom trade _____

Ranking of economically important Mushroom

SN.	Scientific Name	Local Name	Habitat	Associated sp.	Season	Sp.Character	Use of Purpose	Age of Mushroom *	Ranking **	Reason of Ranking
1										
2										
3										
4										
5										
6										
7										

* 1 = button, 2 = immature, 3 = Mature

** Ranking = Medicinal purpose (1)
Edible purpose (2)
Trade value (3)
Common (4)
Others (5)

Hospital:

Name: **Estd.:** **Donor:**

Locality: **Altitude:** **Date:**

Capacity: **Doctors/Nurses:**

Total No. of Patients/yr:

i) Number:_____
ii) Due to Mushroom Poisoning: _____
iii) Death due to Mushroom Poisoning:_____
iv) By which Mushroom:_____
v) Mostly In which Season:_____

Treatment:

i) No. of Patient Come /yr.:_____
ii) From How Far/Which Place They Come From?_____
iii) Used Muhroom or Chemical Medicine/ Others_____
iv) Death by Mushroom Poisoning (Increase or Decrease) /yr._____

Amchies:

Name: _____ **Locality**:_____
Altitude:_____**Lat**._____ **Lon.**_____

Established Date:_____**Name of Gumba**:_____

Total No. of Patient/ yr:

i) Number:_____
ii) Due to Mushroom Poisoning: _____
iii) Death due to Mushroom Poisoning:_____
iv) By Which Mushroom:_____
v) Mostly In Which Season:_____

Treatment:

i) No. of Patient Come /yr.:_____
ii) From How Far/Which Place They Come From?_____
iii) Mushroom Used as Medicinal Purpose?_____
iv) Death by Mushroom Poisoning (Increase or Decrease) /yr._____

Identification Methods for Poisonous and Non poisonous Mushroom:

Medicinal Mushrooms used in treatment

SN.	Scientific Name of Medicinal Mushroom	Local Name	Source of Collection	Season for Collection	Treatment for Which Disease	Method of Preparation	Price (Rs)
1							
2							
3							
4							
5							
6							
7							

ANNEX - 2

Mushroom Macro details description (Mushrooms of Khumbu Region)

Call No.	Date of collection	Collected by
Common / local name	Latitude	Scientific name
Longitude	Altitude	Season
Photo No	Others	

Growth pattern: Alone/ Clusters/ Ring

Habitat:

Substratum: Soil/ Leaf/ Dung/ Tree/ Stump/ Wood/ Branch

Condition: Moist/ Dry/ Open/ Dark/ Forest

Fruit Body: Fleshy/ Tough/ Corky/ Woody/ Leathery/ Membranous/ Cartilaginous/ Auricular / Clavaroid/ Spathulate/ Round/ Convoluted

Pileus: Present/ Absent

Size:..... cm..... mm

Shaped: Ovoid/ Hemispherical/ Conical/ Convex/ Campanulate/ Umbonate/ Umbillicate/ Infundibuliform/ Turbinate/ Didimiate/ Resupinate/ Applanate

Texture: Smooth/ Wrinkled/ Leathery/ Scales or tiny hairs? Patches of another material on it/ Slimy or dry/ Sticky/ Granular / Powdery/ Others

Margin: Tucked in or straight /Striate (regularly lined or wrinkled) / Wavy/ Entire/ extending beyond hymenial layer and others..... Do these features change?

Pellicle: Thin/ Thick/ Semiseparable/ Not separable/ Separable/ Color under the pellicle...

Color: Do the colors change as the mushroom develops?

Gill Details:

Color:.....

Texture: Lamellate/ Poried/ Smooth/ Spiny/ Corolloid/ within peridium/ Dry/ Thick/ Waxy

Lamellae color..... and color change.....

Attachment: Free/ Adnexed/ Sinuate/Adnate/ Decurrent / or Mixed

Length: Uniform/ Interspaced with shorter ones / Forked / Bifurcate (below or above)/ Equal/ Unequal

Margin: Entire/ Serrate/ Dentate/ Torn

Density: gills crowded, tightly packed or more or less average?

Discoloration: Do the gills appear to discolor as they mature? Use a knife to damage or bruise some of the gills: does this provoke a discoloration

Pore Details:

Density: pores tightly packed / distant from one another/ opening large

Arrangement: like a dense sponge/ radially arranged

Shape: Round/ Angular/ Hexagonal/ Elongate/ Rectangular/ not definite or mixed

Texture: Papillate/ Tubular/ Single layered/ Stratified

Separability: Easy to peel or difficult

Stem Details: Present or Absent

Size: ....cm/ .....mm

Color: ....and color changes

Shape: Straight/ Curved/ Cylindrical/ Swollen below/ Tapering above/ below, with or without rhizoidal strands and others.

Texture: Smooth / Scaly/ Powdery/ Hairy/ Dotted/ Lined/ Netted/ Pitted/ Fibrous/ Slimy/ dry/ easily snapped in half? Snapped away from the cap
Density: Stem hollow/ partially hollow/ tightly stuffed/ change as the mushroom develops.

Base: form a sort of root/ Are they tiny cords of material around the base? Is the base encased in a little sac or film?

Annulus: Skirt/ Pendent/ Sheathing / Cobwebby/ Superior/ Inferior/ Smooth/ Striate/ Single/ Double / Entire/ Lobbed/ Color

Discoloration: Does the stem appear to discolor as the mushroom matures? Use a knife to bruise the surface: does this provoke a discoloration?

Other Details:

Partial veil and universal veil evidence on the cap

Volva: Present/ Absent/ Size/ Color/ Entire/ Divided/ Scaly/ Lobed

Flesh (pileus & stipe): Thickness/ Softness/ Color/ Changes after bruising

Taste: Mild/ Acrid/ Pleasant/ Bitter.

Smell: Fruity/ Rotten fish/ Anise/ Radish/ Corn/ Garlic

Latex: Color...../ Amount...../ Taste.....

Spore Prints:.....Color

Chemical reactions:

FeSO4 Color change on flesh of cap... gill... and stipe.... with crystals.
KOH Color changes..... in the hymenial surfaces.

Remarks .....