MUSHROOM DIVERSITY IN CENTRAL NEPAL: AN ETHNOMYCOLOGICAL APPROACH

A Thesis Submitted to the Central Department of Botany

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Under The Guidance Of
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2008

Supervisor's Recommendation

This is to certify that the thesis entitled "Mushroom Diversity in Central Nepal : An Ethno mycological Approach" , submitted to Tribhuvan University for the degree of Doctor of Philosophy in Botany, is the outcome of the original research work carried out by Mrs. Nina Pandey, the Lecturer at Department of Botany, Patan Multiple Campus, Patan Dhoka, Lalitpur (Nepal), under my supervision. This work has not been submitted for a degree of any other university.

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Candidate's Declaration

I hereby declare that the work presented in this thesis has been done by myself, and has not been submitted elsewhere for the award of any degree. All sources of information have been superficially acknowledged by reference to the authors and institutions.

_____

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Date: 10th September 2007

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List of Abbreviations and Acronyms

AOAC	:	Association of Official Analytical Chemists
BSA	:	Bovine serum albumin
C	:	Central part of Nepal
CAT	:	Center for Applied Technology
CDB, T.U.	:	Central Department of Botany, Tribhuvan University
CDM, T.U.	:	Central Department of Microbiology, Tribhuvan University
^{o}C	:	Degree Centigrade
cm	:	Centimeter
DDU	:	Din Dayal Uppadhaya University
DFTQC	:	Department of Food Technology and Quality Control
DSS	:	Decision Support System
GIS	:	Geographic Information System
GN	:	Government of Nepal
Gm	:	Grams
Hcl	:	Hydrochloric acid
H_2SO_4.	:	Sulphoric acid
IOST	:	Institute of Science & Technology
IUCN	:	International Union for Conservation of Nature
IIT	:	Indian Institute of Technology
KATH	:	National Herbarium, Godawary Kathmandu
KDa	:	Kilo decabyte
Km	:	Kilometer
Km^2	:	Square kilometer
KSCN	:	Potassium thiocynite
L	:	Latin
Lab	:	Laboratory
m	:	Meter
MFSC	:	Ministry of Forest and Soil Conservation
MOEST	:	Ministry of Environment, Science and Technology
ml	:	Milliliter
mm	:	Millimeter
µm	:	Micron
N	:	North , Normal

NARC	:	National Agricultural Research Center
NAST	:	Nepal Academy of Science & Technology
%	:	Percentage
Pot	:	Potassium
PMSF	:	Phenyl Methyl Sulphonic Flouride
O.D	:	Optical density
pH	:	Phosphate buffer
Rf	:	Relative frequency
RLABB	:	Research Laboratory for Agriculture Biotecchnology and Biochemistry
Sing	:	Singular
Sol^n	:	Solution
Std	:	Standard
TCA	:	Tricarboxylic acetic acid
TUCH	:	Tribhuvan University Central Herbarium, Kirtipur, Kathmandu
USSR	:	Union of Soviet Socialist Repbulic
Vol	:	Volume
W	:	West Part of Nepal
Wt	:	Weight
WWF	:	World Wild Life Fund

Abstract

Nepal is a multi lingual, multi religion and multi ethnic country. The country is rich in biodiversity due to topographic and climatic variation. The ethnic groups in Nepal are distributed within all the 75 districts of the country. The main Mycophagus groups in the study area are Tamang, Gurung, Sherpa, Lama, Chepang, Danuwar, Tharu, Rai, Limbu, Newar etc.

Mycodiversity is the branch of biodiversity, which reflects the fungi diversity. Larger fungi of the divisions Ascomycotina and Basidiomycotina are called mushrooms. Edible species are called "Mushroom" and "Poisonous" ones as "Toadstools" (Pacioni 1985).

In Nepal, mushroom collection and consumption have been on-going since time immemorial by different ethnic groups The mycological collections from Nepal started with the works of Lloyd (1808) (with one *Ganoderma* species) and Berkeley (1838) (with one *Polystictus* species).Since then, J.D. Hooker in (1848-1854), gathered many fungal species during his botanical expedition to eastern Nepal.His collections were studied and reported by Berkeley (1854). There- after, many Nepalese and foreign mycologists have contributed in this field.

In the initial stages of research on mycological specimens in Nepal, there were no specific intentions of ethno mycological investigations. However, mushrooms were collected and reported as edible or non edible according to human uses (Singh 1966, 1973, 1974; Adhikari 1976). Ethno mycological studies and Ethno botanical studies including mycological species were later under-taken by several workers with regard to those consumed by selected ethnic tribes or those used by people in selected geographic areas in Nepal.

The present research aims to enumerate and document wild Mushrooms, conduct chemical analysis of some important mushrooms, explore ethno mycological knowledge of local people, and thereby provide recommendations.

Central Development Region of Nepal is the main Study Area of the thesis. The study was limited to Langtang National Park (Dhunche to Kyanginj ghumpa), Kathmandu Valley including adjoining areas(Sunadrijal, DhuliKhel, Surya-binayak, Champadevi, Nagarjun, Matatirtha e.t.c) and Chitwan (Tikauli Samudayik Ban, Amrit Dharapani Samudayik Ban). The collection of mushrooms started from the year 2001 to 2005 mainly during the months of May, June, July, August, September and October.

During the collection of samples, geographical information of area i.e. Latitude, Longitude,

Altitude, Soil-type, Forest type, Habitat, Climate, Temperature along with Date, Collection Number and Place of Collection were recorded.

The field work was conducted from July 2001 to August 2005 at different areas of Central Nepal. While conducting field trips in various sites, a professional mushroom hunter and some other friends were accompanied. The mushrooms were photographed in their natural habitat before they were collected. Broken, rotten and insect- eaten species were discarded and only mushrooms with healthy basidiocarps were picked up. All morphological characters were recorded. Spore prints were obtained. Each specimen of same species or different species collected from the same locality or different localities were cleaned up with the help of the brush. They were placed in separate wax- paper bags so as to prevent mixture of spores. Bamboo baskets and paper bags were used for the collection of specimens in the field.

The specimens were preserved in dry condition through blotting the water by different means (sun dry, placing near fire place etc.) - knowing that 'The dried preserved samples only can be utilized for microscopic study and for chemical analysis, while the liquid preserved samples can be used only for museum specimen'.

The specimens were brought to the laboratory for the microscopic studies. The specimens were identified with the help of standard literatures. After identification, they were filed and stored each with a Label tag. Napthalene balls and Para-dichlorobenzene were used as insect repellents in the storage cabinet. The cabinet was kept in dry, well aerated and sunny room. SEM (Scanning Electron Microscopy) was done to the closely related species at IIT (Indian Institute of Technology), New Delhi for spore ornamentation. This technique helps for proper identification of the particular species.

The ethnomycological information were collected by Participatory Rural Appraisal (PRA) and Rapid Rural Appraisal (RRA).

For the chemical analysis of Mushroom, determination of moisture, ash, acid insoluble ash, as well as minerals like Calcium, Phosphorus and Iron were done in the Department of Food Technology and Quality Control in accordance with AOAC (1995). Carbohydrate determination was done only of 'reducing sugar' through the Fehling's test. The Quantitative estimation of total free amino acid content in mushrooms was found using the Ninhydrin Reaction (Colorimetric method). Qualitative determination of amino acids in Mushroom was done by 'ascending paper chromatography'. Quantitative Determination of Crude Protein was done by Micro – Kjeldahl's Method. Determination of soluble protein of mushroom was done by Bradford's Method. These analysis were performed in Central Department of Microbiology,TU.

Determination of Protein profile by SDS-PAGE was performed in RLABB (Research Laboratory for Agriculture Biotechnology and biochemistry).

In the present study, 575 species belonging to 54 families and 82 genera have been identified, of which 251 and 324 samples were identified up-to genus and species level respectively. Similarly, in the present study, 50 ethnomycologically important species have been enumerated and through the same 25 recorded species are added in the mycoflora of the country. Among the identified species, 10 species are added in the list of edible species of the country. According to literature review, this research has increased the list of edible mushrooms in Nepal to 181.

Significantly, ethno mycological study has mainly been focused on Tamang and Chepang, as they are the traditional mycophilic groups besides others. Here, some useful descriptions including 'five reasons for the forbiddance of use of mushrooms by Brahmins, different uses of mushrooms , ethnic and modern mushroom recipes , methods to minimize mushroom poisonings etc.' have been made.

The present study has found out that no poisoning and mortality cases were found in high altitude as well as in Terai region (study area): the reason behind this being the locals' ability to identify the edible mushrooms from the poisonous ones.

Further, it was found out that the highly prized wild edible mushrooms are *Coprinus commatus*, *Amanita caserea, Cantharellus cibarius, Laccaria laccata, Russula chlorides, R. cyonoxantha, Scleroderma species, Oudemensiella radicata, Volvariella bombycina* etc. These mushrooms are suggested for artificial culture in lab so as to develop mass commercial production technology.

In the course of study, 13 research articles were published in different journals and proceedings. Two related reports were also submitted to UGC and DNPWC.

1. Introduction

1.1 Biodiversity

Biodiversity or Biological diversity is the variability among living organism from all sources. It includes diversity within species, between species and of ecosystems. According to the definition of the 1992 UN Conference on Environment and Development (UNCED) Convention, "biodiversity" includes all of its manifestations. Therefore, in addition to its terrestrial biodiversity it covers marine and other aquatic biodiversity as well. As such, biodiversity means the richness and variety of living things in the world as a whole or in any location within it. Several investigators and amateurs have studied the biodiversity of Nepal enthusiastically (Chaudhary 1998).

Nepal offers a wide spectrum of habitats and ecosystems due to diverse bio-geographic setting, horizontal and vertical dissimilarities, climatic contrasts and altitudinal variations. The biodiversity is reflected in the country's varied macro-ecological provinces comprising the mountains, hills and lowlands with all their complex micro climates, biospheric extensions and morphological characteristics. The country exhibit most of the major ecological zones and is ranked at around 25th position in the global context and 11th position in the continental scale of biological diversity richness. Especially, Eastern Himalayas of Nepal have been identified as one of the rich biodiversity hotspots in the world with high species diversity and high levels of endemism (Meyers 1988).

Mycodiversity is the branch of biodiversity, which reflects the fungi diversity. Larger fungi of the divisions Ascomycotina and Basidiomycotina are called mushrooms.

1.2 Overview of Fungi

Fungus (Pl. fungi; L. *fungus* = mushroom from Gr. *Spongos* = sponge) include eukaryotic, spore bearing achlorophyllous organisms that generally reproduce sexually and asexually whose usually filamentous, branched somatic structures are typically surrounded by cell walls containing chitin or cellulose, or both of these substances, together with many other complex organic molecules (Alexopoulos and Mims, 1993).

1.2.1 General glimpse on classification

The classification of the fungi presents innumerable difficulties (Alexopoulos & Mims, 1963).Taxonomically, fungi are classified on the basis of their vegetative characters, reproductive structures and spore characters (Sharma, 1989).Different opinions have been found on the concept of classifications of fungi. Among them some concepts are as follows-

In 1623, Bauhin (1560-1624) described 81 species under the name fungus, which are now distributed among Agaricaceae, Boletaceae, Polyporaceae, Clavariaceae, Lycoperdaceae, Pezizaceae and other families.

In 1729, Micheli (1679 -1737) was the first man to use microscope for the study of fungi and is the founder of Mycology. In his work *Nova Plantarum Genera* (1729), he gave the usable keys for the identification of genera and the species. Some of the keys were so excellent that they can be used even today (*Clavaria, Lycoperdon, Geaster*).

In 1753, Linnaeus (1707 -1778) advanced the knowledge on fungi. His great work *Species plantarum* (1753) placed all fungi in 24th class "Cryptogamia". This consist all Basidiomycetes, *Auricularia* and one more species of *Tremella.* All the Agaricaceae were included in the genus *Agaricus*.

In 1838, Fries (1794 -1837) made greatest contribution to the knowledge of the Hymenomycetes through his *Systema Mycologicum*.

Gwynne –Vaughan & Barnes (1937) divided the fungi into three main classes (Phycomycetes, Ascomycetes and Basidiomycetes) on the basis of septation of mycelium and characters of spores.

Bessey (1950) organized the fungi under the following categories:

Fungi I Aseptate mycelium (Phycomycetes)

II Septate mycelium (a. Ascomycetes b. Basidiomycetes c. Deuteromycetes)

Smith (1955) purposed to include all fungi in two divisions and seven classes, as follows:

Division I: Myxomycophyta	Division II: Eumycophyta
Classes:	Classes:
1. Myxomycetae (Slime moulds)	1. Phycomycetae (Algal fungi)

2. Plasmodiophorine	2. Ascomycetae (Sac fungi)
3. Acrasieae	3. Basidiomycetae (Club fungi)
	4. Deuteromycetae (Imperfect fungi)

Hawker (1966) preferred to divide all fungi into *Lower Fungi and Higher fungi* .All lower fungi are treated under *Phycomycetes* whereas all higher fungi are separated into two classes on the basis of the presence of characteristic endogenous ascospores (Ascomycetes) or exogenous basidiopores (Basidiomycetes).

Stevenson (1970) placed all fungi in division Mycota, which includes six classes (Chytridiomycetes, Oomycetes, Zygomycetes, Ascomycetes, Basidiomycetes, and Deuteromycetes or Fungi Imperfecti).

Webster (1 979 – 80) adopted the following classification of fungi:

Mycota

A. Myxomycota (Myxomycotina) B. . Eumycota.It is divided into 5 divisions.

i. Mastigomycotina ii. Zygomycotina iii. Basidiomycotina

iv. Ascomycotina iv. Deuteromycotina

Ainsworth (1973) purposed the mode of classification for fungi following the *Dictionary of Fungi* (1971).In this system, the fungi with plasmodia or pseudoplasmodia are classified in the division Myxomycota, whereas most of the remaining, usually filamentous fungi which do not have any plasmodium or pseudoplasmodium, are classified in division *Eumycota.*

In accordance with the recommendations of the committee on International Rules of Binomial Nomenclature, which mycologists endorse, the names of the divisions of fungi should end in – mycota, subdivisions in – mycotina, classes in – mycetes, and subclasses in –mycetideae. Similarly, names of orders end in –ales, and of families in –aceae; while genera (sing, genus; L.genus = race) and species (both s. and pl.species; L.species = concept) have no standard endings. The name of an organism is a binomial (L .bi =two +nomen =name) that is, it is composed of two words. The first is a noun designating the genus in which the organism has been classified and the second is often an adjective, describing the noun, which denotes the species .The genus name is always capitalized (Alexopoulos & Mims, 1979).

The most recent and updated classification of fungi is given by Jim Decan 2oo6 which is updated in 2010 also by British Mycological Society. This classification is proposed after the incorporation of the sequences of the ITS region of the rRNA of fungi.

Fungus-like organisms

True fungi (Mycota or Eumycota)	**Straminipila**	**Slime moulds**
Chytridoimycota	Oomycota	Myxomycota
Zygomycota	Hyphochytridiomycota	Plasmodiophoromycota
Glomeromycota	Labirinthulomycota	Dictyosteliomycota
Ascomycota		Acrasiomycota
Basidiomycota		
Mitosporic fungi		

I have adopted the following classification for the present study (Courtecuisse and Duhem 1994):

Kingdom *Fungi*
Division **Amastigomycota**
Subdivision **Ascomycotina**
Class **Ascomycetes**
Subclass **Pyrenomycetidae**
Order Xylariales
Subclass **Pezizomycetideae**
Order Helotiales
Order Ostropales
Order Pezizales
Order Tuberales
Subdivision **Basidiomycotina**
Class **Phragmabasidiomycetes**
Order Auriculariales
Order Tremellales
Class **Homobadisiomycetes**
Subclass **Aphyllophoromycetideae**
Order Cantharellales
Order Clavariales
Order Ganodermatales
Order Polyporales
Suclass **Gasteromycetidae**
Order Lycoperdales
Order Sclerodermatales
Subclass **Agaricomycetideae**
Order Agaricales
Order Amanitales
Order Boletales
Order Cortinariales
Order Entolomatales
Order Pluteales
Order Russulales
Order Tricholomatales

The present study mainly focuses on higher fungi (Mushroom), i.e. subdivisions **Ascomycotina**

The present study mainly focuses on higher fungi (Mushroom), i.e. subdivisions **Ascomycotina** and **Basidiomycotina.**

Class-Ascomycetes: Ascomycetes are characterized by sac-shape fruiting body of relatively big size (up to 400 micros) which are called "asci", with spores inside, the "ascospore". They are called "higher fungi". They differ from the Basidiomycetes in their reproductive cells. Their reproductive cells are surrounded by sterile ones, the "paraphyses". Both are part of the hymenium. The most interesting species from a gastronomic and commercial point of view are from the following genera *Morchella, Helvella, Tuber, Terfezia* etc.

Class-Phragmobasidiomycetes: The basidia have membranous septa orientated transversally or longitudinally. They are of gelatinous or ligneous consistence. They can produce secondary spores from the basidiospores.

Class-Homobasidiomycetes: The basidia do not have septa, are not clavate (club-shaped) or cylindrical and their basidiospores never produce secondary spores. They form the majority of the known species.

Subclass-Aphyllophoromycetideae: This order includes fungi of various shapes and have hymenia formed of either of pleats, spines, tubes, alveoli, scales etc. and other smooth ones.

Subclass-Agaricomycetideae: These umbrella-shaped fungi have hymenium made up of gills and its flesh is fibrous. This subclass has the highest diversity of species and it represents the majority of edible (*Amanita,Russula,Lactarius, Macrolepiotas, Agaricus*, etc.) and poisonous (*Amanita, Lepiota, Entoloma, Cortinarius,* etc.) fungi.

Subclass-Gasteromycetideae: Differing from the precedent group, the hymenium of these species is protected or enclosed inside fruiting-bodies. This group includes "puffballs" (*Lycoperdon, Calvatia*). They can be hypogeous or epigeous.

1.2.2 Mushrooms

The word mushroom is derived from French *Mousseron (Mucerom)* from *mousse*, moss (fast growing) (Ramsbottom, 1954). Rinaldi and Tyndalo (1972) defined that the structures that are commonly known as mushrooms are nothing else but the fruiting bodies of those organisms that the mycologists call higher fungi, or macromycetes (Macromycetes = large fungi), even though the dimensions of the caps of some mushrooms might be only a few millimeters across. Mushrooms are generally termed as the edible or poisonous gill bearing fleshy agarics. Generally, agaricus or fleshy

species of other groups of fungi, bearing cap and gills on the underside (producing spores), are recognized as mushrooms. The term "Mushroom" applies only to the "Agaric" which is commercially cultivated (Dickinson and Lucas, 1979; Philips, 1981). The general form of an agaric fruiting body is umbrella shaped with a central stipe, supporting a cap or pileus with numerous radially arranged gill or lamellae on the lower side of the cap (Webster, 1970).

Miller (1984) defined mushrooms as the term applied to both edible and poisonous species and agarics as the gilled mushrooms. Similarly, Purukayastha and Chandra (1985) pointed out that agarics or fleshy species of other groups of fungi are recognized as "Mushrooms" which may be edible, inedible, poisonous or non-poisonous. According to the "Dictionary of Fungi", mushroom was defined as an agaric, any agaric like or agaric as from Agaricaceae having edible value. The wild mushrooms seem to have been traditionally consumed by men since very early times, but these were then probably considered a food in wilderness which now has come to occupy a very popular place in the modern dietic regimen because of its nutritional value (Bano, 1976). Pacioni (1985) made a clear distinction between "Mushrooms" considering only the edible species and "toadstools" as inedible or poisonous species.

The Mushrooms have been variously regarded as "earth's excrescence" or "the evil ferments" of the earth (Ramsbotton, 1954).The Greeks believed mushrooms as the consequence of lightening, while Romans believed that mushrooms sprang from ground in places struck by the lightening. The Guatemalan and Mexican Indian tribes still correlate the appearance of the "Fly Agaric" to thunderbolt (Lowy, 1974). Similar are the beliefs held by most of the tribal people in India for the appearance of majority of the mushrooms. The Tamang ethnic group of Nepal also seem to relate mushrooms with sky and thunder since they use the term "Muguding" for *Morchella* sps (In Tamang language, Mu means sky and guding means ringing).

The Manusmriti (written by Manu: the son of Brahma and the ancestor of humankind) listed the names of mushrooms in Sanskrit and advised not to eat the mushrooms growing anywhere. Such mushrooms are generally known as "Kavak" (general name for mushrooms), "Chhatrak" (head with umbrella), "Chhatrika" (with small umbrella or cap), "Shilindhram" (which grows on organic materials), "Swedajam" (Which grows on warm and humid place), and "Prithavikandam" (which

grows on soil). Actually, these names do not provide detailed characters or ideas for the identification of the mushrooms (Adhikari, 2000).

In the mean time, it is observed that practically all types of languages chyau (Nepali), Bammhukan (Newari), Shymo or Shyamu (Tamang), Shamu (Sherpa), Chyabo (Gurung), Mugan (Magar), Pat (Limbu), Chhani (Tharu) and Kukurmutta (Hindi) are being used to distinguish the mushrooms in Nepal(Adhikari,2000).

1.2.3 Ethnomycology

Ethnomycology is a branch of Ethnobotany. The word ethnobotany was coined by an American botanist John W. Harsberger in 1895, originally for the study of plants used by primitive and aboriginal people. The word is derived from two Greek words: *ethnos,* referring to the human aspects in biological relationship and *botanicos,* denoting to the study of plants. Ethnobotany is a multidisciplinary science embracing botany, ecology and anthropology. Ethnobotany deals with the study of the relationship between people and plants; and most commonly refers to the study of how people of a particular culture and region make use of indigenous plants (Rajbhandary, 2001). Ethnobotany, in totality, is virtually a new field of research and is a multidisciplinary science (Manandhar, 2002). Ethnobotanical knowledge can be studied into two parts: that part which is gained in Schools and Universities and the other part acquired from local knowledge or folkore, which is usually communicated verbally. In Nepal, it is the traditional knowledge acquired by experience and observation, which is communicated vocally, and which has formed the basis for Nepalese ethnobotany.

Ethnomycology is specifically dedicated to mushrooms, which have consciousness expanding qualities imbedded in the religious traditions, writings and indigenous knowledge of mankind. (http://www.ethnomycology.com). The investigation and study about the utilization of mushrooms by different ethnic groups is called ethnomycology. This aspect is not yet studied in detail in Nepal (Adhikari, 2000). "Dictionary of the fungi" defined Ethnomycology as a branch of Ethnology in which edible mushrooms and religion is closely inter-related. Gordon Wasson (1969) is also credited with coining the term "Ethnomycology". His studies concentrated on the use of mushrooms by Mesoamerican, Russian, English and Indian cultures. As the saying goes, the Great Lord Buddha died due to the consumption of

mushroom offered by someone in his bowl. Today, Ethnomycology has been attracting researchers of various disciplines all over the world, particularly in the developing countries where large portion of indigenous population depend upon the minor natural resources. Wild edible mushrooms are one of the important minor forest products, which are locally traded in local markets of different parts of Nepal (Kharel & Rajbhandary, 2005).

The world treasure of fungi probably comprises of 1.5 million species, of which 69000 species have yet been described (Hawksworth 1974) and others are awaiting their discovery. Among the described species include about 10,000 species of fleshy macro fungi (Kendrick,1985), very few of which are deadly poisonous. About 2000 species belonging to more than 30 genera are edible mushrooms. Among these edible forms, 80 species have been grown experimentally, 40 species cultivated economically, about 20 species cultivated commercially and 5-6 species are produced on an industrial scale (Chang and Miles 1993).

Although study of fungal diversity of Nepal was initiated by foreigners (Berkley, 1854), yet the impetus for collection and research on Mushrooms and other fungi of Nepal gained momentum after the founding of post-graduate teaching in Botany in Tribhuvan University in November 1965. Specimen collection became a part of the academic activity since they were needed for laboratory works (Singh, 2007). For the first time, Sailesh Chandra Singh initiated a mini- project on "Investigations on wild Mushrooms and other fungi of Kathmandu valley" in 1973 (Singh. 1973 a, 1973 b). Thus research and cultivation of mushroom can be said to have started in 1973 in Nepal (with experiments). Adhikari (2000) has presented a very impressive account of mycological investigations and species of mushrooms reported from Nepal in his book on "Mushrooms of Nepal". Here, it will be relevant to state that 'utilitarian values of Nepalese wild Mushrooms so far recorded are: 110 – Edible, 13- Medicinal, 45 – Toxic and 6- Others' (Adhikari 2000).

Till 2000, Seven hundred seventy six (776) species of mushroom belonging to Seventy seven (77) families and two hundred thirteen (213) genera have been recorded (Appendix XXII).

After Adhikari (2000), there are few additions to the Nepalese mycoflora. These are: *Daedalea dickinsii* (Adhikari & Adhikari , 2003); *Rhizina undulata* (Pandey & Budhathoki, 2003); *Amanita japonica* and *A. sychnopyramis* (Adhikari & Manandhar, 2004a); *Pleurotus sapidus, Fomes pomaceus, Panellus mitis* and *Fomitopsis rhodophaea* (Adhikari & Manandhar, 2004b); *Ascobolus magnificus* (Devkota *et al.* 2005a), *Aphelaria tuberosa, Clavaria fumosa Lentaria mucida* (Devkota *et al.* 2005b),*Thelephora fuscella* (Pandey *et al.* 2005), *Pulveroboletus ravenelii (*Rana and Giri

2006), *Microsporous falbiformis (*Pandey *et al.* 2006), *Volvariella bombycina, Hypholoma capsonoides, Dictyophora duplicate* (Pandey and Budathoki 2007d), *Agaricus praeclarusquamosus*, *A placomyces, leucocoprinus fragilissimus* (Pandey and Budathoki 2007e) and *Boletellus emodensis, Gyroporus atroviolaceus, Stroibillomyces mirandus* (Pandey and Budathoki 2007f).

Till 2007, Seven hundred and nine (709) species along with 45 new species of mushroom belonging to eighty (80) families and two hundred fifty five(255) genera have been recorded (Adhikari, 2007).

1.2.4 Ethnic groups Of Nepal

Nepal is a cultural heritage for diverse ethnic groups of Mongolian, Australoid and Aryan stocks differing in language, race, religion, custom and cultures. The different ethnic groups, with their own distinct culture and language handed down gradually by their ancestors, are traditionally linked in different ways to resources available in forest (Siwakoti & Siwakoti 1998); and the forest biodiversity has supported the livelihood of many indigenous tribal people who live in inaccessible remote areas of Nepal.

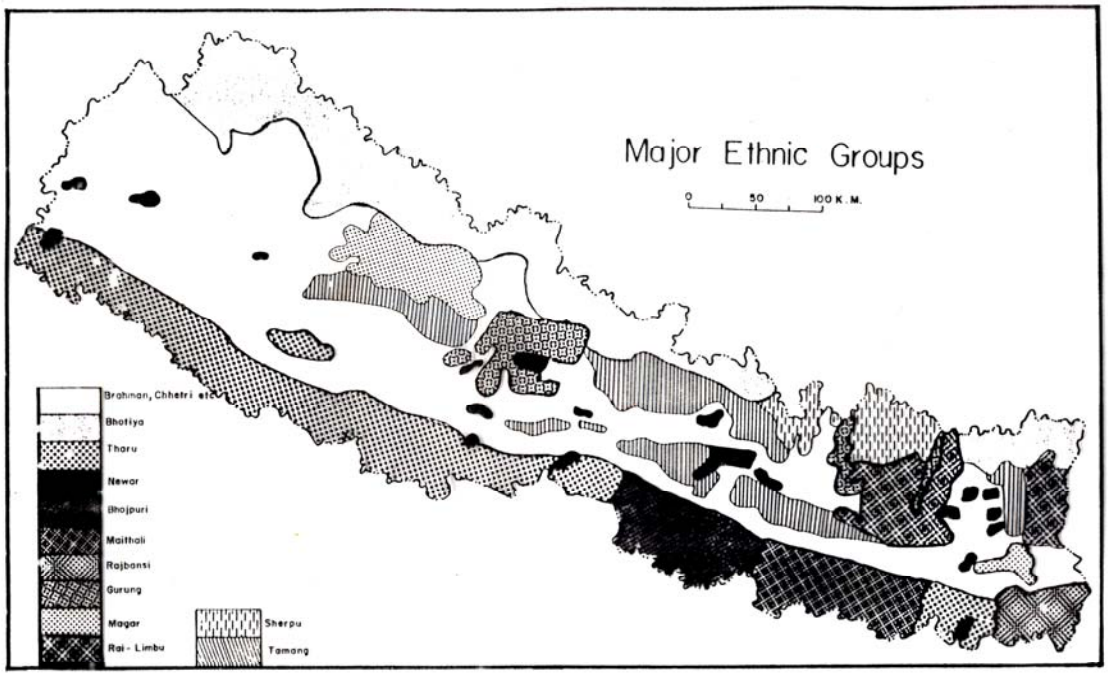
Tamang is one of the largest ethnic groups in Nepal and occupies 5.6% of total population of the country (CBS 2001). Tamangs mainly occupy the medium high elevations, generally between 1500 to 2100m above the sea level, from western Nepal towards central part to Eastern Nepal. They are not only one of the largest ethnic groups but also the largest Tibeto-Burman speaking community of Nepal. Their religion originates from Tibet and they follow “Lamaism”.

Majority of the Tamangs live in the hilly region of Nepal, adjoining sides of Kathmandu valley, the capital of Nepal as well as in Rasuwa, Nuwakot and Sindhupalchowk districts lying north, north-east and north-west of Kathmandu respectively.

Agriculture is the main occupation of the Tamangs followed by animal husbandry, and most are largely dependent on forest resources for various needs. They are also famous for their delivery of fresh mushrooms to the urban markets (Singh 1966, Adhikari & Adhikari 1997; Joshi & Joshi 1999, Adhikari 2000, Kharel and Rajbhandaryi 2005. Pandey *et al.* 2006).

Nepal is a multi lingual, multi religion and multi ethnic country. The ethnic groups in Nepal are distributed in all the 75 districts of the country. The population Census of 2001 has listed one hundred

and two Ethnic groups (Appendix XX). These Ethnic groups have ninety two different Native languages (Appendix XXI).



Major Ethnic Groups: Infact, there has been no detailed country-wide survey on the ethnic groups of Nepal. On the basis of mother tongue statistics, Nepali-speaking groups such as Brahman, Chhetri, Thakuri, etc. shares over 50% of the total population. It is followed in a discending order by Maithili, Bhojpuri, Tamang, Tharu, Newar, Magar, Rai, Gurung, Limbu and Sherpa representing from 12% to 0.1% approximately. The above map reveals the core areas occupied by various ethnic groups. Due to increasing travel facilities, now a days almost all types of ethnic groups can be met with in several parts of the country.

Figure 1.1: Map of Nepal showing main ethnic groups.

Among them, the ethnic groups which are still found to depend heavily on collection and consumption of wild mushrooms for food and medicine include Chepang, Tharu, Danuwar , Raute, Newar etc. in the Terai Plain, Tamang, Gurung, Magar, Rai, Newar etc. in the hills and Bhote , Sherpa, Lama etc.at high altitude.

1.2.5. Difference between Edible and Poisonous Mushrooms

Mushrooms have since long been valued as highly flavorsome and nutritional foods by many societies. Man's hunt for food dates back to his origin on the earth. He went on tasting a large variety of food plants in the past when he wandered from place to place in search of food. Thus, in course of

time, he came across a wide variety of wild plants which could be used as items of food. To this long list he added such forest products which we know now as mushrooms (Das, 2001).

The difficulty in identifying fungi is due to lack of exact knowledge about them. Thus, though many probably claim to be able to recognize a mushroom, many of them do have no clear picture in their minds of the essential points to be looked for the mushrooms to be edible (Ramsbottom,1954). The wild edible species in Nepal are collected from the forests and fields, but it is difficult to differentiate the edible mushrooms from the poisonous ones since there are no hard and fast rules to define toxic and edible mushrooms. As a matter of fact, a mushroom hunting is an art where trial and error and "do it yourself " methods do not count. Moreover, this is a skill where experience and patience prevails (Bhandary, 1991).

To know whether a fungus is safe to eat we must be able to recognize it and know its proved reputation. There are many traditional methods for testing these fungi but they are not reliable. Some of the views related to the consumption of wild Mushrooms are as follows (Ramsbottom, 1954, Rinaldi & Tyndalo, 1985; Adhikari, 1993; Devkota, 2005); and none of them can be taken as totally true.

Table: 1.1 Edible vs. Poisonous – True or False

S.N.	General belief	Status	Edible species	Poisonous Species
1.	Spring Mushrooms are edible.	False	*Morchella* sp.	*Helvella* sp.
2	Autumn Mushrooms are edible.	False		*Amanita phalloides, A. muscaria*
3	All Mushrooms growing on live trees are edible.	False	*Pleurotus* sp. *Lentinus* sp. *Laetiporus* sp.	*Clitocybe olearia.*
4	All the Mushrooms growing on decaying straw or manure are poisonous.	False	*Coprinus comatus*	*Stropharia* sp. *Psilocybe* sp. *Paneolus* sp. *Coprinus disseminatus*
5	All soil inhabiting species are deadly poisonous	False	*Morchella conica, Russula delica, Amanita caeseara, fulva*	*Amanita verna, A. phalloides*

6	Voilet colored Mushrooms are poisonous	False	*Laccaria amethystine, Mycena pura, Cortinarius violaceus*	*Rhodopaxillus nudus*
7	Bright colored Mushrooms are poisonous	False	*Amanita caesarea, Cantharellus cibarius Tricholoma nuduns*	*Amanita pantherina, A. muscaria, Russula emetica, R. fragilis*
8	Mushrooms with rough warty cap and texture are poisonous	False	*Amanita rubescens, Macrolepiota procera*	*Pholiota adipose*, *Amanita cokeri*
9	Mushroom with smooth capped species are edible.	False		*Amanita sp., Hygrophorous* sp., *Lepiota* sp.
10	Mushrooms whose flesh changes after touching and brushing are said to be poisonous	False	*Boletus cyanescens*	*Boletus luridus*
11	Mushrooms bearing annulus are edible.	False	*Agaricus bisporus, Amanita caesarea, Armillariella mellea*	*Amanita citrine, A. muscaria*
12	Mushrooms bearing vulva are poisonous.	False	Amanita caesarea, A. hemipha, *Volvariella volvacea*	*Amanita muscaria, A. pantherina*
13	Mushrooms which cause milk or egg to coagulate are said to be poisonous	False	*Amanita caesarea, Boletus edulis*	
14	Mushrooms that produce latex on being injured are said to be poisonous	False	*Lactarius deliciosus,L. volemus, L. delica ,L. corrugis*	*Lactarius torminosus, L. sariflus, L. rufus*
15	Mushrooms with bitter, acrid or pungent taste are poisonous	False	*Lactarius piperetus*	
16	Poisonous Mushrooms can be detoxified after boiled in water with or without salt or vinegar	False		Deadly *Amanita* sp. retains their poisonous chemical even after prolonged and repeated

			boiling.
17	All Mushrooms loose their poison through exsiccations	False	This is true for *Gyromitra esculenta*, which when fresh cause serious intoxication but after exsiccations become completely harmless. However, this is not true for the deadly *Amanita* spp. which remains deadly even after exsiccation.
18	Mushrooms that are consumed by flies, squirrels, cats, monkeys are edible to humans.	False	The digestive activities in these animals are quite different from human beings.
19	Poisonous Mushrooms tarnish a silver spoon, onion, and garlic pieces.	False	In case of deadly *Amanita* spp. *like A. phalloides, A. verna and A. muscaria the colour of spoon, onion and garlic doesnot change in colour while cooking*
20	When the mushrooms are poisonous, they change the color of bitten rice black.	False	Not applicable in all cases.

Depending upon the places and countries, the above prejudices vary, for example *Ramaria aurea* and *R. flava* are considered edible in Nepal, but the same species have been reported poisonous in Japanese literature (Imazeki *et al.* 1998). *Scleroderma aurantium, S. cepa, S. citrinum,* and *S. verrucosum* are edible in Nepal, while these species are considered as poisonous in Europe and Japan (Adhikari, 1996, 1998).

1.3 Scope and Significance of the Study

Use of wild fungi resources in Nepal is an old practice. The local people possess a remarkably detailed knowledge of species identity and characteristics. Since ethnomycology is a relatively new discipline in our context, significant amount of research needs to be done in order to enrich our knowledge of this enigmatic fungal form and its uses in a broader context. Due to high content of nutrients, some wild mushrooms can be used to fulfill human nutrition and medicinal requirements.

1.4 Hypothesis

The research was started with the intention mentioned above. In the present study, it has been assumed that the ethnic people of the study area have a vast reservoir of knowledge of ethnomycology exploration of more of which will popularize widely its related aspects affecting the socio-economy and also benefit the humankind through the nutritional values of the wild mushrooms. Thus, this research is based on the following hypothesis:

- Different ethnic groups do possess unique knowledge based on their own experience.
- Such knowledge do vary area wise.
- Thus, exploration group-wise and area-wise will bring out good information.
- Nutritional analysis based on the ethno information, mentioned above, will be highly valuable.

1.5 Aim and Objectives

The major objectives of the present research are to explore and document wild mushrooms; and to explore associated ethnomycological knowledge of local people. The specific objectives are:

- To enumerate mushrooms species growing in the study area
- To explore associated ethnomycological knowledge with respect to utilization pattern, local perception and habitat characteristics
- To analyze chemical constituents of mushrooms
- To extend recommendations based on the above findings

1.6 Justification

Nepal is rich in terms of biodiversity (Hara *et al.* 1978, 1982; Hara and Williams, 1979; Koba *et al*. 1994; Chaudhary, 1998; Press *et al.* 2000; DPR, 2001).The ethnomycological aspects have been documented by Singh (1966), Adhikari & Adhikari (1996 –1997, 1999), Adhikari (1976, 1981-82, 1996, 1991, 1999, 2004), Adhikari *et al.* (2003), Sacherer (1979), Bhandary (1985, 1991), Bills & Cotter (1989), Tullons & Bhandary (1992), Tullons *et al.* (1992), Adhikari & Manandhar (1993),

Adhikari & Durrieu (1999), Joshi & Joshi (1999), Kharel & Rajbhandary (2005), Devkota *et al.* (2005), Christensen *et al.*(2006).

Mushroom fruitifications are composed of two basic parts, pileus and stipe which can take various shape, size and color (Szwey kowska and Szwey kowski 2003). The flesh gills fungal frutification differs in color and consistency depending on the species (Deremek Pilat 1988 cited by Bernas *et al*.).

The chemical composition of these mushrooms determine their nutritional value and it differs according to species as well as on the substratum, atmospheric condition, age, and the part of frutification (Manzi *et al.* 2001).

In general, edible mushrooms contain 160-350 (g /kg dry weight) protein and 20-60(g /kg dry weight) carbohydrate. They are the useful sources of iron, phosphorous, potassium etc. The nutritional value of protein is usually very high in the majority of fungi (Hievaska & Petrovska 2002). Ogundana and Fagade (1981) cited by Adejumo and Awasanya (2003) indicated that mushroom consists of about 16.5% dry matter out of which 7.4% is crude fiber, 14.6% is crude protein and 4.48% is fat and oil.

From the literature, it is concluded that most of the analysis was done only on cultivated species and only few on wild mushrooms. Some species have been screened for chemical constituents (Adhikari *et al.*. 1996).

In the present investigation, chemical analysis of 25 useful mushrooms of Central Nepal have been done. The present research would bring out the picture of mushrooms and their inter-relationship with the human beings. Hence, the research will help to emphasize the importance of wild mushroom in rural livelihoods and the information obtained from the present research will help for the management of natural resources and towards uplifting the peoples' livelihood

1.7. Limitations

Study area – Central Development Region, Langtang National Park, Kathmandu Valley and adjoining areas, Chitwan (Narayangath)

Time period – 3 years to 5 years

Collection and identification problems

Major collection season for mushrooms is the rainy season. But due to the topographical factors, the collection procedure might get hampered in some cases. In Nepal, collection of Mushrooms is tedious because of the following reasons:

a) High probability of landslides

b) Extensive attacks from Leeches as well as other insects

c) Mushrooms are located in slippery areas, which make it impossible for the collectors to pick it easily.

d) Literature- Relevant reference literature is not easily accessible.

e) Financial constraints – The research being conducted is self-financed (despite huge expenses involved there in).

1.8. Study Area

1.8.1 Country background

Nepal ($26^{o}22'$ N to $30^{o}27'$ N latitude, 80^{o} 04' E and $88^{o}12'$ E longitude) is a central segment of the Himalayan mountain systems with the vast plains of the Indian subcontinent to the South, East and West and the high Tibetan plateau of the People's Republic of China to the North. It has 885 km length from East to West and the width varies from 145 km to 241 km with an average width of 193 km from North to South. It occupies an area of 147,181 sq. km. The geographical features of Nepal are complex. Giant mountain peaks (as high as 8848m), deep valleys and gorges, alluvial plains (as low as 70m), and cold deserts are found within a distance of a few kilometers. The slope of the land from the flat river plain in the south to the Himalayas in the North has a marked effect on all aspects of Nepalese life. Climate, vegetation, agricultural crops, ethnic groups, livelihoods and cultures are dictated by this topography.

Scientists have attempted to divide Nepal conceptually into Geographical, Physiographical and Ecological regions (Table 1).

Table 1.2: Geographical, Physiographical and Ecological Regions of Nepal

Geographical Region	Physical Feature	Ecological Zone	Physiographic Region	Elevation (m)
Mountain (Himal)	Tibetan Marginal Mountain	High Himalayas	High Himalayas	4000
	Inner Himalayas			
	Himalayas			
Hill (Pahar)	Midlands	Transition zone	High Mountain	
	Mahabharat Lekh		Middle Mountain	2000
Plain (Terai)	Siwalik Zone	Siwalik	Siwalik	
	Terai	Terai	Terai	

Source: Joshi and Joshi (2005)

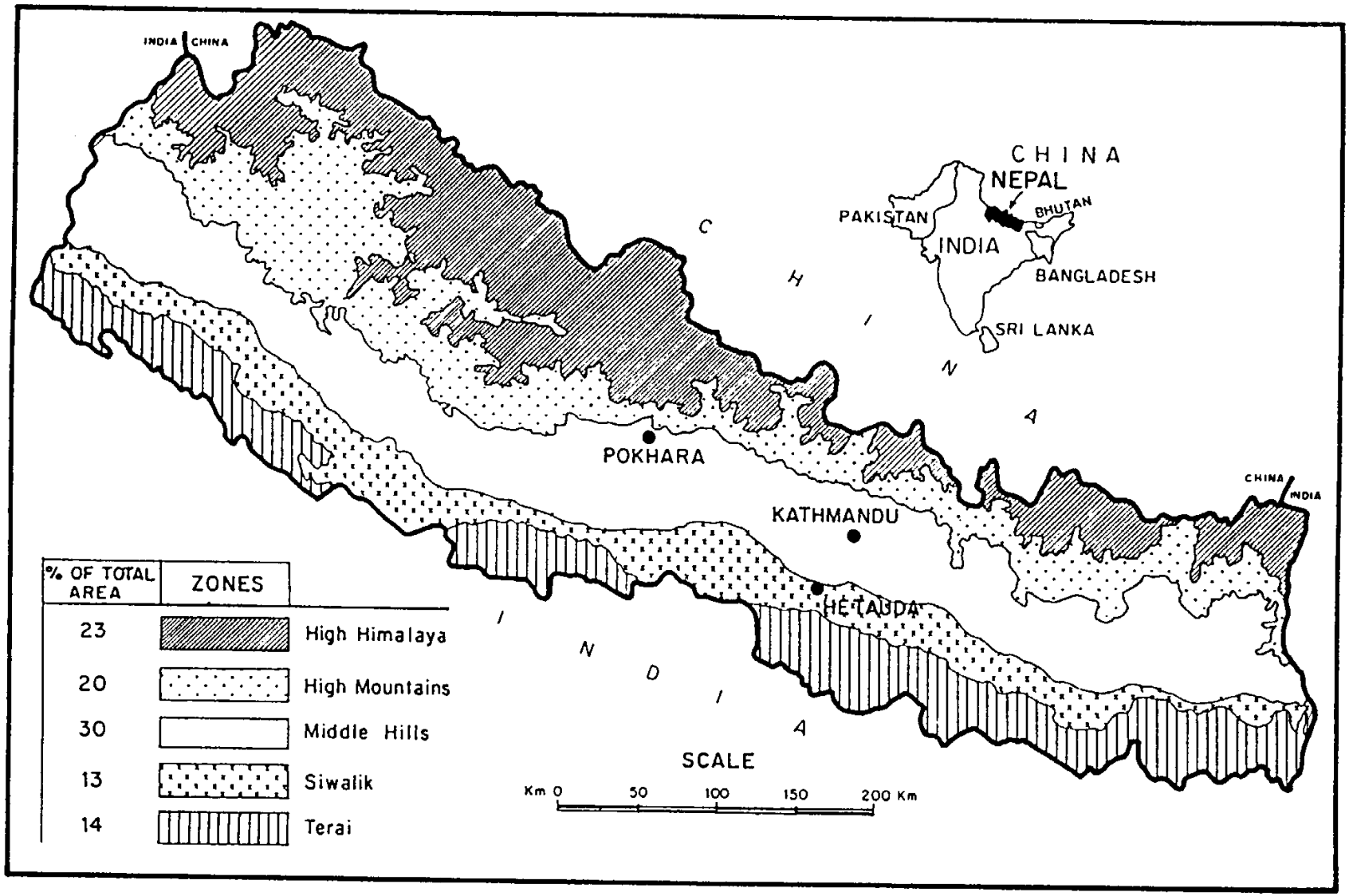


Figure 1.2: Phytogeographic Zone of Nepal

1.8.2. Climate

Although Nepal lies to the North of the Tropic of Cancer, the Himalayas seal it off from the immediate influence of the air-masses produced in Central Asia. So, Nepal falls within the monsoonal system of the sub-continent of India on the South. (Shankar and Shrestha, 1999). Nepal enjoys a monsoon type of climate with wet summer and dry winter. Due to great variations in altitude, there is a wide range in climatic conditions from tropical in the Terai region to nival in the high Himalayas. Maximum percentage of rainfall occurs during June to September. The eastern part of the country receives more rainfall than the Western part (HMGN/MFSC 2002). The climate in Nepal is controlled by the monsoonal winds and altitudinal variations. The rainfall pattern reflects local differences, ranging from less than 2.5 cm per year to 600 cm per year (Dobremez, 1976). The southern slope of the Mahabharat receives maximum annual rainfall, (5500mm at Lumle), and the rainfall is minimum, (295 mm annually at Jomsom) in the inner Himalayan valleys (Stainton, 1972). Some examples are Jomsom, 10-40/yr, (altitude of 2600m, North central Nepal; no forest); Jumla, 40-90cm/yr, (2400m, West Nepal; conifer forest); Biratnagar, 80-250cm/yr, (80m, East Nepal; subtropical Angiosperm forest) (Stainton, 1972; Dobremez, 1976).

Dobremez (1972) has identified 11 bio– climatic zones from lower tropical zone (below 500m) to nival zone (above 5000m) along the slope of the Himalayas (Table 2).

Table.1. 3: Physiographic Zone with Corresponding Bio-climatic Zones and Sub ones

Physiographic Zone	Bio – Climatic Zones	Sub zone (Altitudinal range)
High Himal	Nival	(above 5000m)
High Mountain	Alpine	Upper (from 3501-4000m) Lower (from 3001-3500m)
	Sub-alpine	Upper (from 4501-5000m) Lower (from 4001-4500m)
Mid Hills	Temperate	Upper (from 2501-3000m) Lower (from 1501-2500m) Lower (from 1001-1500m)
Siwaliks	Tropical	Upper (from 501-1000m)
Terai	Tropical	Lower (below 500m)

Source: Dobremez (1972)

1.8.3. Vegetational Zones

Scientists have divided Nepal in different ways to study its flora and fauna and vegetation. This is another illustration of the complexity of the plant of Nepal (Manandhar, 2002). Stearn (1960) proposed three divisions, based on three important river systems: a) Karnali, west b) Gandaki, central and c) Koshi, east. On the bases of ecology and vegetation, Dobremez (1972) recognized four vegetational belts: 1) Western, 2) Northwestern, 3) Central, and 4) Eastern. Swan and Leviton (1962) classified the vegetation of Nepal into seven vegetaional zones: 1) Lower monsoon, 2) Middle monsoon, 3) Upper monsoon 4) Deciduous and Rhododendron, 5) Conifer and Rhododendron, 6) Wet alpine and 7) Dry alpine. Stainton (1972) made further phytogeographical divisions and identified eight climatic and vegetaional divisions: 1) Terai and outer foot hills, including the Siwalik Hills and the valleys, 2) Midlands and Southern slopes of the main Himalayan ranges, 3) Western midlands 4) Central midlands 5) Eastern midlands, 6) South of Annapurna and Himalchuli, 7) Dry river valleys, and 8) Arid zone.

1.8.4. Central Development region

The study area is the Central Development region (Langtang National Park, Kathmandu Valley and adjoining area, Chitwan-Tikauli Samudayik Ban, Amritdharapani Samudayik Ban).

Study Area

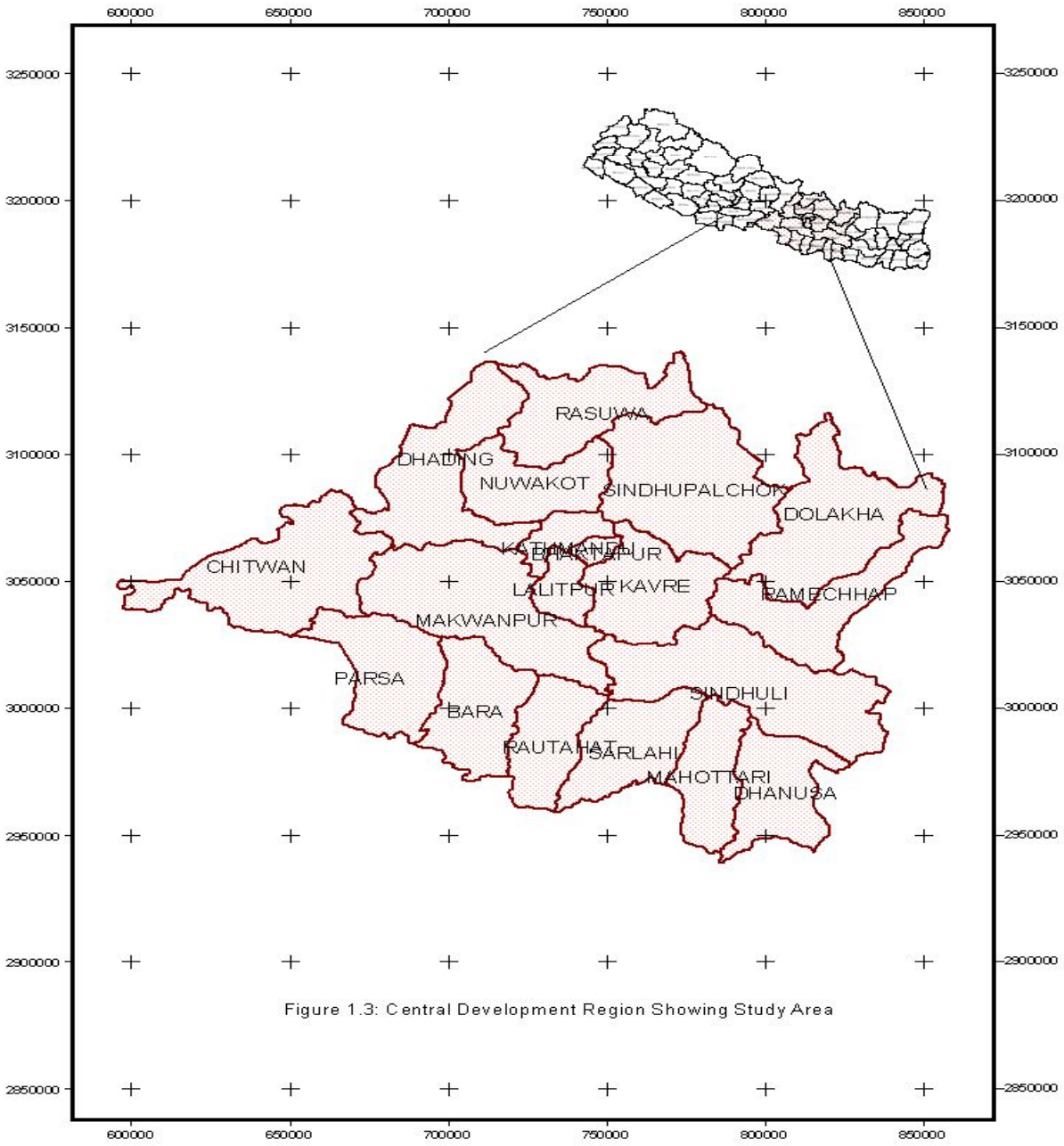


Figure 1.3: Central Development Region Showing Study Area

1.8.4.1 Langtang National Park

1.8.4.1.1. Physical setting

It is situated in the North of central Himalayan region of Nepal and is the nearest park to Kathmandu. The southern boundary is some 32 km north of Kahtmandu. The region is defined by Bhote Koshi and Trishuli Ganga to the West, Tibetan Autonomous Region of China to the north and east. It is located in between latitudes 28^0 00' N to 28^0 20' N and longitudes 85^0 15' E to 86^0 00' E covering a total area of 1710 sq. km (HMG/Nepal, 1976).It is the protected National Park of Nepal.

1.8.4.1.2 Climate

Langtang was designed as the first Himalayan National Park in 1970-71, and was gazetted in March 1976. Altitude varies from 792 on the Bhote Koshi to the peak of Langtang Lirung at 7245m. The park is characterized by varied climatic conditions. The Helambu area which is exposed to the full force of the monsoon receives over 2500mm; whereas Langtang valley is shielded by the Gosaikunda ridge and receives about 1,000mm. Dhunche (1950m), the district headquater receives annual precipitation of 1820mm and mean annual temperature is 12.1^0 C (Chaudhary, 1998).

The park is the home of several ethnic groups. The majority of people belong to Tamangs, an ancient Nepalese race. The Tamang population is mainly occupying the lower and medium altitude whereas other ethnic groups like Bhote and Sherpas are living at higher altitudes.

1.8.4.1.3. Vegetation

Most striking feature of the vegetation is the variety of forest types. Six forest types belonging to tropical, subtropical, temperate, sub-temperate, sub-alpine and alpine zone exist within the area.

1.8.4.1.4. Ethnic groups

The specific villages selected for the present study were Dhunche, Syabrubesi, Thulosyabru, Lamahotel,Ghoda tabela, Langtang Village and Kyangjn Ghompa. The prominent tribe in the area are Tamangs. Besides Tamangs, there are also Lama, Sherpa, Newar, Damai, Sarki etc.

The economy of local community has traditionally been agriculture, livestock herding and trading with expedition team members. Nowadays, the local economy is becoming increasingly dependent on the increasing tourism in the area. The indigenous knowledge regarding the use of wild mushrooms in Langtang National Park is since time immemorial among the local people.

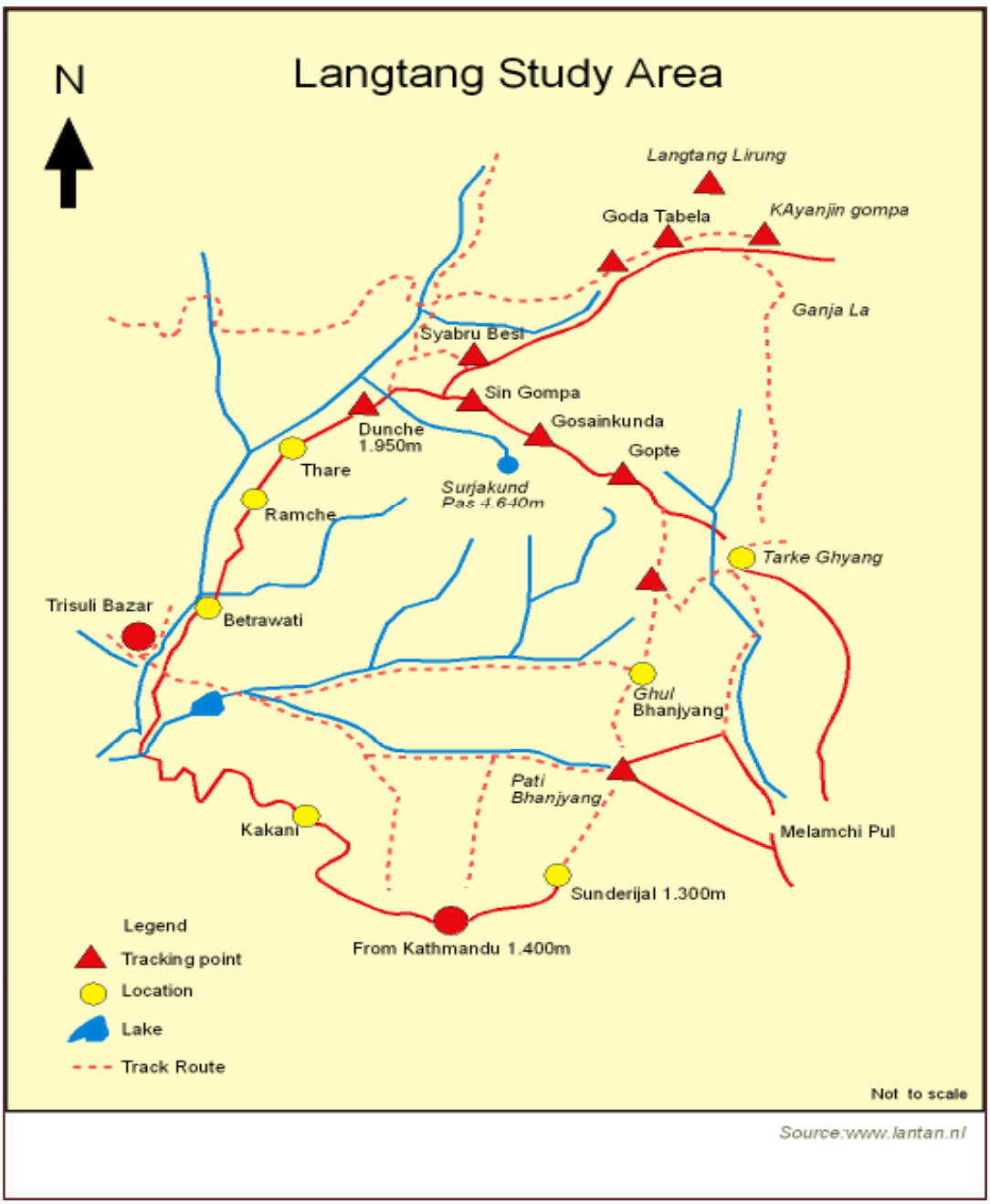


Figure 1.4: Langtang Showing Study Area

1.8.4.2 Kathmandu area

1.8.4.2.1 Physical setting

The valley of Kathmandu, the capital city of Nepal, is located between latitudes 27^0 34' N to 27^0 48' N and longitudes 85^0 10' E to 85^0 32' E. It consists of three main districts, Kathmandu, Lalitpur and Bhaktapur. It is saucer – shaped valley with the valley floor lying at about 1350m. altitude surrounded by the mountains, the highest peak being Phulchowki (2715m.) which is situated on the South-east corner of the valley. Its area is approximately 650 Square Km (Malla *et al.* 1986).

1.8.4.2.2 Climate

Kathmandu valley is characterized by typical monsoon climate with rainy summer and dry winter. Pre-monsoon season during March to May is mostly dry and warm. This period is characterized by hazy atmosphere with dusty winds. Later part of this season brings down some precipitation with thunderstorm and is frequently associated with hailstorms. Over 80% of the total rainfall is encountered during monsoon period starting from early June and ending by late September. Post-monsoon, starting from September to November is sunny and is mostly dry with gradual decrease in rainfall and temperature. Few spells of rain are, however, brought down during winter from January to February (Malla *et al.* 1986).

1.8.4.2.3 Vegetation

The areas (Nagarjun, Shivapuri, Manichaur, Nagarkot, Suryavinayak, Phulchoki, Lele, Dakshinkali, and Chandragiri) surrounding the valley consists of sub-tropical to temperate forests. The sub-tropical elements predominate at lower elevations, while temperate forest species dominate towards the top of the mountains surrounding the valley and its adjoining areas. The main vegetation types prevalent in the valley are *Schima –Castanopsis* on the valley floor and hill slopes, *Pinus roxburghii* on lower hill slopes and on the southern aspects, *Oak* forest at high level, *Quercus lanata* dominating upper hill slopes of Phulchoki, Shivapuri and Chandragiri and *Rhododendron* sps. on the upper reaches of valley hills (Joshi & Joshi,1999).

The evergreen broad-leaved forest is mainly composed of *Schima wallichii, Castonopsis indica* with other predominant trees like *Ilex doniana*, *Zizyphus incurva, Leucosceptrum sanum, Myrica esculenta, Rhododendron arboretum,* etc. Wet ravines and gullies are occupied by *Alnus nepalensis*. Prominent

shrubs are Daphney papyracea, Mahonia nepalensis, Rubus ellipticus, Phyllanthus parvifolius, Eurya acuminate, etc. (Malla et al.1986).

1.8.4.2.4 Ethnic groups

Kathmandu being the capital, many people migrate here seeking opportunities for jobs, higher education and other facilities. Hence, all castes are found here, but the main dominant group is of Newars.

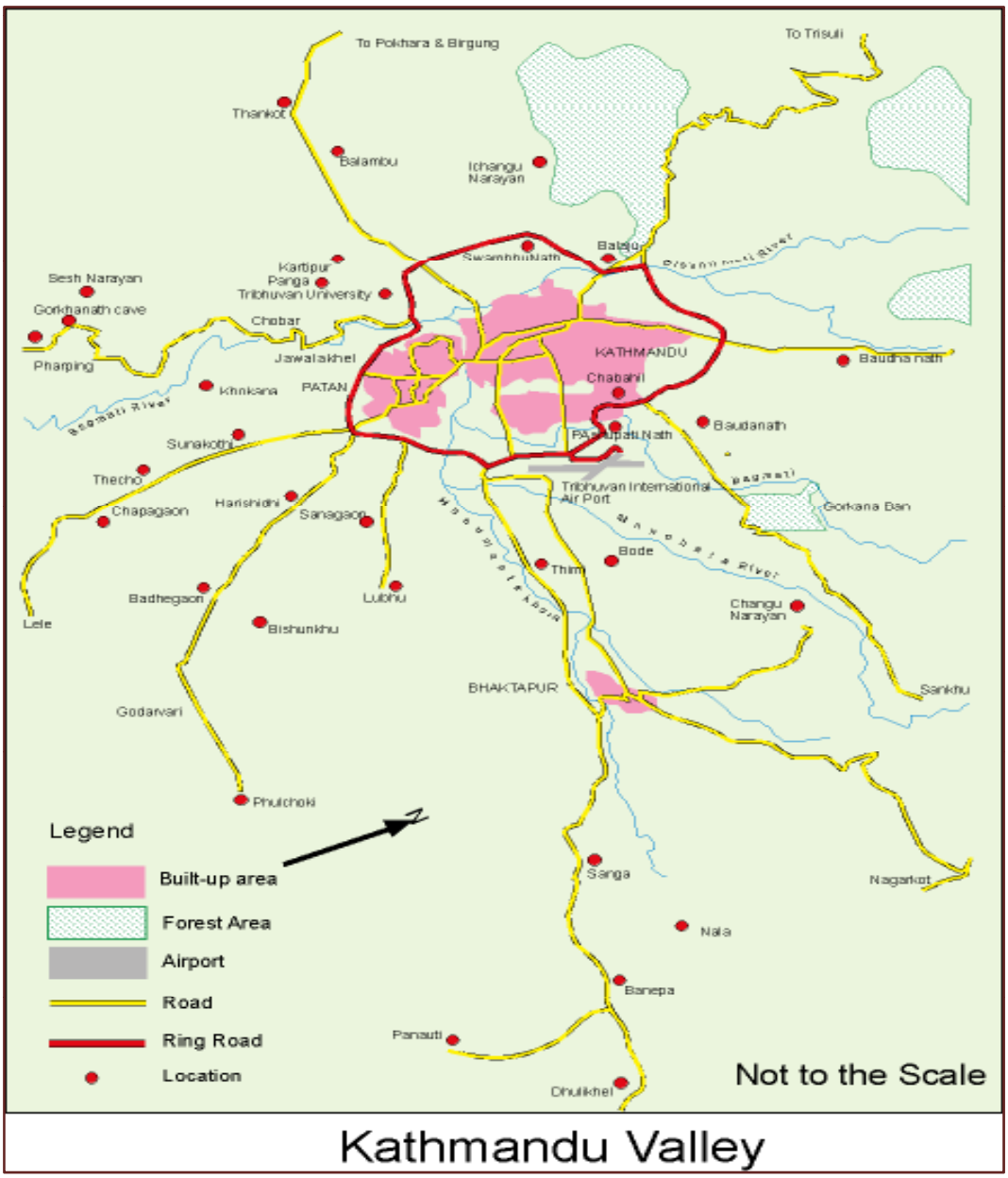


Figure 1.5: Map of Kathmandu Valley and adjoining area

1.8.4.3 Chitwan

1.8.4.3.1 Physical Setting

The study was undertaken in Amritdharapani and Tikauli forest. They fall in the national forest of Chitwan district and Buffer zone of Royal Chitwan National Park respectively. Chitwan district is located in the central terai (low land) region of Nepal covering an area of 2238.39 km^2 and extends between latitude 27^0 21' to 27^0 64' N and longitude 83^0 55' to 84^0 48' E.

1.8.4.3.2 Climate

It has subtropical climate with a mean annual rainfall of 1512mm and equable temperature (7-39^0C).

1.8.4.3.3 Vegetation

The forest type comprises Bhabar and Terai forest and Doon sal forests. The vegetation is more or less uniform throughout the study areas comprising valuable tree species of Sal (*Sorea robusta*). The important tree species found in the area are Asna (*Terminalia tomentosa*), Harro (*Terminalia chebula*), Barro (*Terminalia bellirica*), Jamun (*Syzygium cumini*), Sissoo (*Dalbergia sissoo*) and Dabdabe (*Lannea coromandelica*) etc.

1.8.4.3.4 Ethnic groups

The ethnic groups are Praja (Chepang), Kumal, Tharu, Darai, Sarki, Danuwar and Rai; Newar being mixed with Chettris and Brahmins.

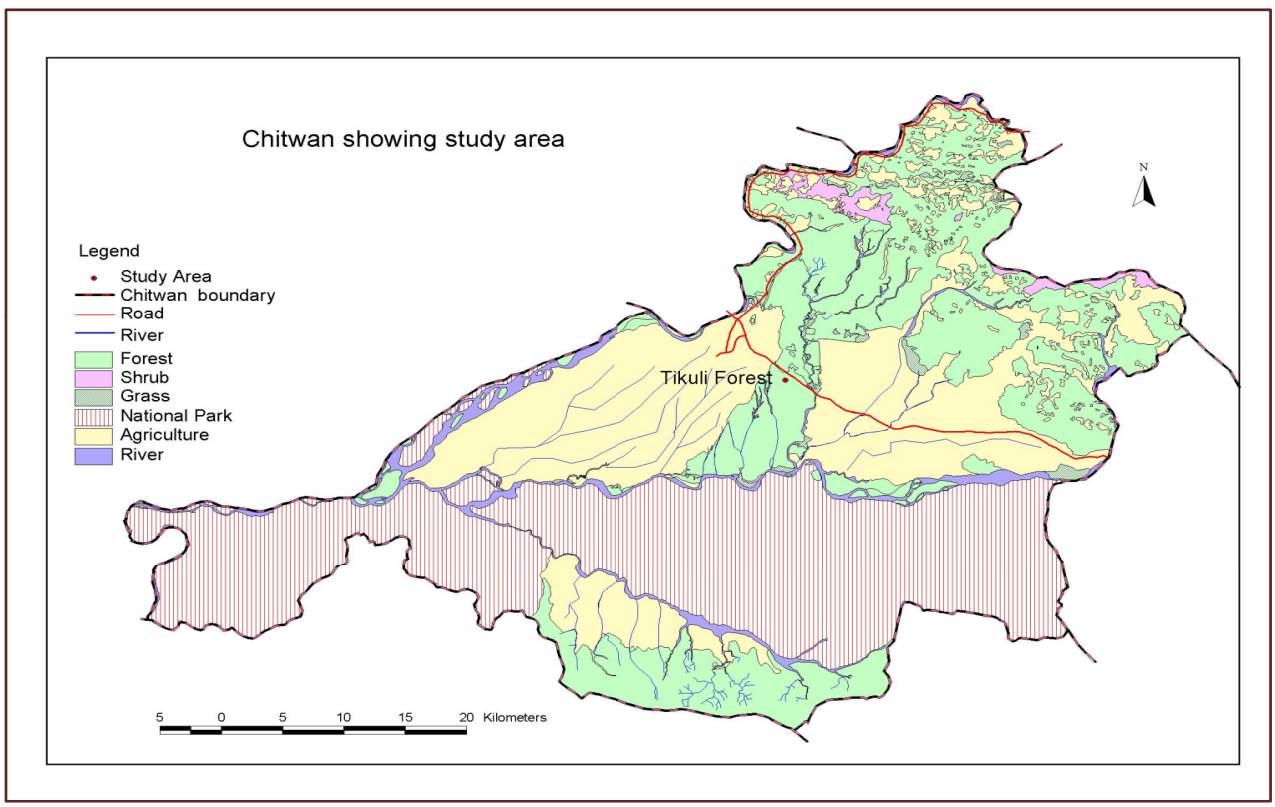


Figure 1.6: Map of Chitwan National Park

2. Literature Review

2.1 Status of Mycological Explorations in Nepal

2.1.1. Mycological exploration

The mycological collections from Nepal started with the works of Lloyd (1808) (with one *Ganoderma* species) and Berkeley (1838) (with one *Polystictus* species). J.D. Hooker (1848-1854) explored east Nepal in a botanical survey (Flora of Nepal). The result of his gatherings was published by Berkeley (1854 a, b, c, d). He 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, P. elatinus, P. flavidus, P. florideus, P. nepalensis, P. pictilis, P. vivax, Radulum spongiosum, Scleroderma nitidum, Sphaeria nepalensis, Stereum endocrocinum, Trametes tephroleuca, T. versatilis* and *Xyalaria fistuca.* Thind (1961) included three species in "*The Clavariaceae of India*" which were reported earlier by Balfour-Browne (1955).Cooke (1888) reported only one exotic species of *Agaricus* from Nepal without mentioning the place and date of its collection.Balfour - Browne (1955) studied and published the gatherings made by O. Polunin, W.R Sykes and L.H.J. Williams in 1948-50, from Jumla area, 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 monotypic genus *Amylaria: A. himalayensis* corner was also included in the same paper. Kreisel (1964, 1967, 1969, 1976) enumerated Gasteromycetes from the collections 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.* Balfour - Browne (1968) published the fungal species collected from eastern and central Nepal by Stainton (1952-56), Norkett (1961-62), Polunin (1949) and Stainton, Sykes and Williams (1954). This paper included 12 species of Ascomycetes, 73 species of Hymenomycetes and six species of Gasteromycetes. In this paper, *Clavulina alata* Corner and *Lentaria macrospora* Corner were added as new species. A new combination viz. *Panus polychrous* (Lev.) Singer: Balfour-Browne (=

Lentinus polychrous Lev.) was also proposed in the same paper. Kobayashi (1865) recorded the occurrence of *Calostoma* from east Nepal. Bhatt (1966) enumerated 118 species of fungi from different parts of Nepal .Enumerated species were Myxomycota -1, Mastigomycotina and Zygomycotina -8, Ascomycotina -27, Basidiomycotina -33, Deuteromycotina- 51. Imazeki *et al.* (1966) reported 3 genera and 3 species (1 Ascomycotina, and 2 Basidiomycotina) collected in botanical expedition organized by National Science Museum, Tokyo, Japan.

Singh (1966) reported 18 wild edible species of mushrooms sold at Kathmandu market in bamboo packages. Singh (1968) also reported 4 species of Hymenomycetes from Kathmandu valley. Poelt (1969) collected 55 species of Myxomycetes from Khumbu Himal and its adjoining areas. The two species viz *Arcyria nepalensis* and *Lamproderma nigrisplendidum* were newly reported to science. Onsberg (1973) recorded two species of Myxomycetes in which *Lycogola fuscoiviolaceunm* was added new to science. Singh and Nisha (1974) recorded the occurrence of three species of *Exobasidium*. Among them *Exobasidium butleri* from Dhulikhel was new to Nepal. Adhikari (1976) listed about 30 wild edible species of mushrooms collected during 'in season' as food by local herds at 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 cornucopioides* on ground from Sundarijal. Singh and Nisha (1976 b and c) published five species of larger Ascomycetes, 68 species of Hymenomycetes and eight species of Gasteromycetes. 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.

Pegler (1977) reported two species of *Pleurotus* deposited in Kew Herbarium. They were *Pleurotus nepalensis* collected by Polunin, Sykes and Williams in 1952 from Chakure Lekh. Ryavarden (1977) studied J. Poelt's collections of the wood inhabiting aphylloporaceous fungi from Eastern Nepal. In his study, fifty (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 Japanese, Fennoscandian, Siberian and American elements. Waraitch and Thind (1977a, b, and c) reported 29 genera and 37 species of Ascomycotina from central Nepal. Singh and Upadhyaya (1978) listed five species from Suryavinayak (Kathmandu), Jomsom and Tukuche (Central Nepal). New species were *Morchella smithiana, Amanita citrina, Asterophora lycoperdoides, Russula nigricans* and

Peridermium ephedrae. Sacherer (1979) in an ethnobotanical study of Rolwaling Sherpas listed about 14 specimens of mushrooms in their local names without proper taxonomic identification.

Bhandary (1980) collected 13 species of macromycetes related to seven different families, among which eight species were new to Nepal. They were *Leotia lubrica, Hygrophorus miniatus, Tricholoma terreum, Cystoderma amianthinum, Flammulina velutipes, Mycena galericulata, Pholiota aurivella* and *Phallus impudicus*. Otani (1982 a, b) provided the critical study on *Engleromyces* and listed 15 genera and 27 species of cup fungi. Among them, *Spathularia bifurcata* and *Leotia himalayaensis* 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 (1983a and 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 Himalayan Helotials collected by Norkett (1961-Central Zone), and J.D. Stainton (1962-Central Zone). Adhikari (1984) reported *Asterophora parasitica* and *Russula densifolia* in Pine forest of Godavari, Kathmandu. Bhandary (1984) prepared a checklist of edible and poisonous mushrooms along with their local names. Hjortstam and Ryvarden (1984) published the occurrence of 60 genera and 95 species of Basidiomycetes (Aphyllophorales) from Pokhara and Annapurna region. The new species described were *Peniophora bicornis, Grammothele bambusicola, Innotus hemisetulus, Phlebia albo - fibillosa* and *Phellinus acontextus*. Cotter and Bhandary (1985) reported the occurrence of *Cavimalum indium* (Clavicipitaceae) on *Arundinaria sp*. Shrestha (1985) reported *Cordyceps nutans* from Lato Manang (2140m) of Manang. 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 (1987) received his doctorate degree on the Pine – *Suillus* mycorrhizal research. He collected 18 samples of *Suillus* from different phytogeographic belts and compared them with West Virginian species. His thesis work included 530 species (gathered from Kathmandu valley, Daman, Muktinath, Myagdi, Langtang and Chitawan National Park). 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 with brief notes on their description, distribution and key to facilitate the identification of Gasteromycetes. Adhikari (1988 a) prepared the checklist of Polypores (Wood rotting fungi) of Nepal. The check list was provided with 54 genera and about 150 species, including three species – *Inonotus hispidus, Fibuloporia vaillantii, and Heterobvasidium annosum* – new to

the country. The list also was followed by brief notes on their distribution and economic importance. 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, Clavulinopsis aurantiocinnabarina, Cortinarius callisteus, Gymnopilus spectabilis, Panellus stypticus, Peziza 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 upon the tissue morphology and spore ultrastructure of *Calostoma junghuhnii* (Gasteromycetes). Bills *et al.* (1989) studied taxonomy and ethnomycology of *Lactarius* Sec. Dapetes (Russulaceae) in Nepal. Adhikari (1990a) provided a brief review on history of mycological explorations carried on by the investigators till 1990. The paper 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 auricula, Cantharellus cibarius, C. odoratus, Entoloma subcostatum, Ramaria aurea, Russula 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* from Jugedi, Chitawan used as food by Chepangs. Adhikari and Parajuli (1993) provided the checklist of *Amanita.* Adhikari (1994) introduced four wild mushroom stamps (*Amanita caesarea, Cordyceps sinensis, Russula nepalensis,* and *Morchella conica)* issued by 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 (1995a, b) studied *Lepiota* and its allied genera of Nepal. Adhikari (1995-1996) reported ten wild mushroom species in and around the Kathmandu valley. Newly reported species were *Amanita hemibapha, A. pseudoporphyria, A.vittadini, Cantharellus subalbidus, C. tubiformis,*

Clavulina cinerea (*Clavaria cinerea), C. cristata, Clavaria cristata,* and *Clavaria rosea.* Adhikari (1996a) received doctorate degree on Basidiomycotina in Nepal from UPS, Toulouse, France. The thesis deals with the mycodiversity of Basidiomycetes flora (821 species), including the list of Hymenomycetes (520 species) 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 Kathmandy 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 which 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. 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,* gathered from Kanchanjunga (4300m) and Kathmandu valley market, was described as new to Science.

Adhikari (1999c) published a list of Gasteromycetes with additions of nine species 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 which were new to Nepal or to Indian Subcontinent. The species were – *Russula adulterina, R. alboareelata, R. alutacea, R. amoena, R. chloroides var. chloroides, R. chloroides var. godavariensis, R. claroflava, R. delica var. dobremezii, R. gracilis, R. kathmanduensis, R. laurocerasi, R. lilacea, R. puellaris, R. senecis, R. velenovskyi* and *R. vesca.* Joshi and Joshi (1999), in their ethnobotanical study, presented the ethnobotany of 36 species of wild mushrooms collected from different parts of Kathmandu and Pokhara. Kharel (1999) reported *Lentinellus ursinus*, an edible Mushroom, from Bhardeo VDC, Lalitpur.

Adhikari (2000) brought the first definite reference for the mycoflora of Nepal, providing result of investigations done on alpine, subalpine, temperate, sub-temperate. 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 Kathmandu valley viz. *Hypomyces sp., Leccinum rugosiceps, Pleurotus cornucopiae, Polyporellus varius,*

Ramaria aurea, R. flava, R. formosa, Sarcodon laevigatus and *Suillus bovines.* Pandey and Budathoki (2002) highlighted the relation of mushrooms with the different ethnic groups of Kathmandu valley. Adhikari and Adhikari (2003) collected 12 species of fleshy fungi from the vicinity of Duradanda, Lamjung. Among the collection, one species *Daedalea dickinsii* was recorded for the first time from Nepal. A paper "Does the plant Soma exist ?" was written as a critique against the publication of Wasson (1969 and 1971) who wrote 'Soma', the divine plant of immortality, to be *'Amanita muscarina'* a mushroom of hallucinogenic importance (Adhikari *et al.* 2003). Maharjan and Budhathoki (2003) collected 28 polypores specimens from Raniban, Pokhara. Among the collection, three species viz. *Coriolus hirsutus, Microporus xanthopus* and *Pycnoporus cinnabarinus* were studied in detail. Pandey and Budhathoki (2003) reported *Rhizina undulate,* a wild inedible mushroom, from the coniferous *Pinus* dominant forests of Champadevi, Kirtipur, Kathmandu. Adhikari (2004) studied the mushroom poisoning and its state in Nepal. He found the annual casualty rate between 15 to 30 in the urban areas.

Pandey (2004) analyzed 25 wild mushrooms species from Kathmandu valley for their protein constituents. Chemical study revealed that higher amount of the total amino acid was detected on *Coprinus comatus* (13.80 mg/ml) followed by *Amanita caesarea* (13.67 mg/ml) and *Agaricus bisporous* (13.39 mg/ml). Adhikari and Manandhar (2004a) recorded two species *Amanita japonica* and *A. sychnopyramis* from central Nepal. Adhikari and Manandhar (2004b) recorded four species of wood rotting mushrooms, viz. *Pleurotus sapidus, Fomes pomaceus, Panellus mitis* and *Fomitopsis rhodophaea.* Devkota (2005) studied upon the mushrooms of western Nepal (Lumle, Kaski) and Clavariales of vicinities of Kathmandu valley. He has reported 76 species from Lumle and 9 Clavariales allied species from both the study areas. Kharel and Rajbhandary (2005) studied upon the ethnomycological knowledge of some wild mushrooms in Bhardeo, Lalitpur. Devkota *et al* (2005) reported 31 species of mushrooms from Lumle, Kaski, Western Nepal, in which they have documented brief ethnomycological knowledge among the local people. Devkota *et al* (2005) recorded *Ascobolus magnificus* from Lumle, Kaski which was found growing on the buffalo dung. Devkota *et al* (2005) recorded three clavariales viz. *Aphelaria tuberosa, Clavaria fumosa* and *Lentaria mucida* from Dakshinakali - Kathmandu, Godavary- Lalitpur and Lumle –Kaski respectively. Christensen *et al.* (2006) studied upon the uses of wild mushrooms in the Annapurna Conservation Area. They have reported 38.species with their different values among local peoples. Some new reports for the country were: *Thelephora fuscella* (Pandey *et al* 2005), *Pulveroboletus ravenelii (*Rana *et al.* 2005), *Thelephora fuscella and Microsporous falbiformis (*Pandey *et al.,*

2006), *Volvariella bombycina, Hypholoma capsanoides* and *Dictyophora duplicate* (Pandey and Budathoki 2007c), *Agaricus praeclarusquamosus*, *A placomyces ,leucocoprinus fragilissimus* (Pandey & Budathoki 2007e) and *Boletellus emodensis , Gyroporus atroviolaceus, Stroibillomyces mirandus* (Pandey & Budathoki 2007f).

2.1.2 Outside Nepal

It is practically impossible to review the literature on ethnomycological studies done in other countries; however an attempt has been made to cite some important explorations.

Malayi (1987) studied edible mushrooms reserves in the Belorussian (USSR) and the possibility of their effective use. 14 species were determined in the study area ; and among them important genera were *Boletus, Leccinum, Cantharellus* and *Morchella.* He made suggestions that the special areas should be selected for the purpose of collecting and processing of those mushrooms reserves. Bedenko (1988) studied edible and poisonous mushrooms in the Central Russian Plain (USSR), in which a total of 734 were edible, 145 were inedible, 65 were poisonous and in 179 *sps*. edibility was unknown. He found that *Amanita phalloides, A.verna* and *Lepiota brunneeo-incarnata* were extremely poisonous, and 29 species were promising for cultivation.

Granetti (1991) studied the role and importance of mushrooms in the natural ecosystem of Rieti (Italy). He related the importance of saprophytic and parasitic mushrooms in the organic matter cycle, within the natural ecosystem, pasturelands, woods and forests, as well as mentioned about the symbiotic mushrooms ' vital relationship with the autotrophic plants. Vyshchepan (1992) studied Macromycetes of Virgin Steppes in the Azov Sea area of Rostov oblast, USSR. He collected 105 species and interspecies macromycete taxa from the Pezizales, Agaricales, Lycoperdales and Nidulariales orders. Due to him, *Agaricus bernardiiformis, A. macrosporoides* and *Leucocoprinus cretatus* were recorded for the first time in the commonwealth of Independent State. He found that *Clitocybe angustissima, C. dealbata, C. rivulosa* and *Agaricus xanthodermus* are most dangerously poisonous. Natour *et al.* (1992, 1993) studied wild mushrooms in Jordan. They collected 270 wild mushroom specimens from 15 different localities in Jordan. Among them, 56 mushroom species were identified; one of which *Boletus sp*. was the first mushroom species recorded in the world. They studied the toxicity tests of mushroom extracts using albino mice, which revealed *Clitocybe claviceps, Coprinus macrocephalus, Lycophyllum decastes* as most poisonous mushrooms. The crude extract of these mushrooms caused death to all mice tested within 4 hours after treatment.

Gecan and Stanley (1993) studied the toxic mushrooms contamination of wild mushrooms in commercial distribution. After 2 years' survey, they found that 21% of the morel and 15% of the wild canned mushrooms were contaminated with toxic look–alike species. Harkonen *et al.* (1993) studied upon Tanzanian mushrooms and their uses - especially of *Russula.* They collected 36 specimens of *Russula* between 1989-1991 of which 21 species were identified and 19 species were recorded for the first time from Tanzania. They made key to the collected *Russula* species. Their systematic position, distribution, possible host trees and discussion on *Russula* were also made. Verheesen (1995) recorded 574 mushroom species from the eastern part of the province of Noord – Brabant and adjacent Limburg. Among the collected species, 72 mushroom species occurred in the Red Data list - of which most frequently recorded were *Hypholoma fasciculare, Mycena galericulata, Paxillus involutus* and *Scleroderma citrinum.*

Zamora *et al.* (1995) studied natural production of wild edible mushrooms in the South Western rural territory of Mexico City, Mexico, during the summers of 1990 and 1991. From the study, the relationship between production and soil characteristics were established; and the best emergence of the mushrooms came under open canopy. Moreno *et al.* (1996) reported kuto-mo'ko-a: An edible mushroom of the Raramuri Indians of Mexico. In addition, the mushroom is described taxonomically and is reported for the first time for Mexico as *Neolenlinus ponderosus.*

Frature (1997) collected three mushroom species in the Libyan Desert. The three species were *Podaxis pistillaris, Tulostoma caespitosum,* and *Schizostoma laceratum* which were of new records to the country. Moore *et al.* (1998) studied fungal differentiation. They found that differentiation appears to be quite flexible and greatly influenced by the immediate microenvironment. It is a serious problem for authentication and quality control of *Cordyceps* on the market (Hsu *et al.*2002). Dekesel and Vanholen (2000) studied the problems faced by macro – mycetes of the out skirts of Brussels. The most important problems were erosion of the slopes by excessive trading and large scale mushroom picking. Arnolds (2001) studied the causes of increasing fruiting macrofungi. He found that the rich mushrooms season was caused by a combination of favorable conditions, probably including the decrease of acidification and nitrogen deposition. Das (2001), in an ethnobotanical study of East Siang District of Arunachal Pradesh, listed ten specimens of wild edible mushrooms with their mycological names, local names and brief description of the species, including the methods of preparation of dishes. Ten species of wild edible mushroom were described from Arunanchal Pradesh in Ethnobotany (Das 2001).

Marques *et al.* (2001) used GIS for monitoring and ecological studies of edible macrofungi in Parque Natural do Alvao. They obtained the maps of distribution of each species of edible mushrooms and developed and implemented a long term monitoring program using a Geographic Information System (GIS). Yorou *et al.* (2001) studied the diversity and productivity of edible mushrooms from the protected forests of Wari –Maro (Benin, West Africa). They found that specific productions of the edible taxa were affected by host – tree composition reflected in the forest type; and also that species showing a continuous production throughout the rainy season were rare. The study also illustrated that the edible macromycetes from Wari-Maro forest had sustainable importance as a renewable non-timber forest products. Zotti *et al.* (2001) introduced a Decision Support System (DDS) for the management of accidental mushrooms and plant poisoning. Problems involved with mushroom poisoning and identification were analyzed to highlight which elements or characters must be taken into account in devising a computerized expert system. Das *et al.* (2002) studied the wild edible mushrooms in Himanchal Pradesh, India. They collected 70 edible mushrooms belonging to different species, and provided their brief description.

Kuyper and Thomas (2002) studied ethnomycological aspect both in eastern and western Africa. They found that large differences in mushroom consumption existed between eastern and western Africa. They also suggested from their study that – "It is important to understand social and cultural factors that affect mushroom consumption before mushroom cultivation can become a source for improving food security."

Akpaja *et al.* (2003) studied the ethnomycology and uses of edible and medicinal mushrooms among the Igbo people of Nigeria. They found that over 95% of the respondents consumed edible mushrooms because of taste, 86% used them as substitute for meat and flesh, while 36.36% used for medicinal purposes. The study also revealed that mushroom hunting and eventual sales are status and gender related issues, being generally regarded as work for women and children. Fisher *et al.* (2003) collected some rare and other remarkable mushrooms (Basidiomycetes) from the Prignitz region, NW Brandejnjburg, Germany. The observation were mostly made in the last ten years, and many species were new for the territory.

Straatsma *et al.* (2003) studied assemblage structure, species richness, abundance and distribution of fungal fruit bodies in a seven years plot – based survey near Vienna. They found that the presence and abundance of species depend on factors other than the general productivity of a year, and long term surveys were important for understanding the structure of mushroom assemblages and their biodiversity. Afyon *et al.* (2004) collected macrofungi specimens from Sinop Province between

1998 - 2000. They found 170 taxa belonging to 32 families and 32 of those taxa were added to Turkey's macromycota, as new records.

Mycologists have never agreed but there are plenty of evidences in recent years that sporal ormentation does not necessarily correlate to actual generic difference (Michel Kuo, 2004). http://www.3simpatico.ca/ross.fraser/links.html

Upadhyay *et al.(* 2005) reported five dark spored *agarics* from North Western Himalayas, which are recorded for the first time from India, viz. *Gymmopilus subspectabilis* Hosler, *Gymnopilus zenkari* (P.Henn) Singer, Agrocybe bodia(Petch) Pegler, *Pholiota squmosa* (Fr.) singer and *cortinarius collinitus* Fr.

Kanaujia. R. described 184 species of mushroom for culinary purposes in her Ph.D Thesis (2006) from India (Faizabad).

2.1.3 Ethnomycological study

In the initial stages of research on mycological specimens in Nepal, there were no specific intentions of ethnomycological investigations. However, mushrooms were collected and reported as edible or non edible according to human uses (Singh 1966,1973,1974; Adhikari 1976). Ethnomycological studies and Ethnobotanical studies including mycological species were later undertaken by several workers with regard to those consumed by selected ethnic tribes or those used by people in selected geographic areas in Nepal.

Some ethnic groups covered in ethnomycological studies include Chepangs (Tullons and Bhandari, 1992), (Pandey and Budathoki, 2006); Sherpas (Sacherer, 1979); Tamangs (Kharel, 1999), (Pandey *et al*., 2006); and Thakali (Bill and Cotter, 1989).The geographical areas covered by ethnomycological studies in Nepal include Kathmandu (Singh,1966,1974); Kathmandu valley and adjoining areas (Pandey and Budathoki, 2002), (Pandey and Budathoki, 2006 a,b,c); Manichur (Adhkari, 1976); Dumre, Pokhara, Mustang, Manang (Bhandari,1991); Pokhara and Kathmandu valley (Joshi and Joshi, 1999); Rolwaling (Sacherer, 1979) and Western Central Region of Nepal (Adhikari *et al*., 2005).

Adhikari (2000) has presented a very impressive account of mycological investigations and species of mushrooms reported from Nepal in his book "Mushroom of Nepal".

However, till 2000 A.D., the total number of mushrooms of ethnomycological significance recorded in Nepal included more than 110 edible species, of which 13 were medicinals, 45 were toxic and 6 species were of other uses (Adhikari 2000). Singh (1966) reported 18 wild edible species of mushrooms sold at

Kathmandu market in bamboo packages. Adhikari (1976) listed about 30 wild edible species of mushrooms collected during 'in season' as food by local herds at Manichur, Kathmandu valley. Sacherer (1979), in an ethnobotanical study of Rolwaling Sherpas, listed about 14 specimens of mushrooms in their local names without proper taxonomic identification. Bhandary (1980) collected 13 species of macrofungi related to seven different families, among which eight species were new to Nepal, viz. *Leotia lubrica, Hygrophorus miniatus, Tricholoma terreum, Cystoderma amianthinum, Flammulina velutipes, Mycena galericulata, Pholiota aurivella* and *Phallus impudicus.* Bhandary (1984) prepared a checklist of edible and poisonous mushrooms along with their local names. Adhikari (1987) threw light on different ethnic groups associated with the collection and consumption of wild edible mushrooms in different phytogeographical belts of Nepal. Bills *et al.* (1989) studied taxonomy and ethnomycology of *Lactarius Sec*. Dapetes (Russulaceae) in Nepal. Bhandary (1991) reported 25 species of edible and medicinal fungi from Dumre to Manang, Mustang and Pokhara areas. In this regard, edibility of *Coltricia perennis* and *Daldinia concentrica* and medicinal application of *Daldinia concentrica* and *Pycnoporus cinnabarinus* were not reported earlier. Tullons and Bhandary (1992) reported *Amanita chepangiana* from Jugedi, Chitawan, used as food by Chepangs.

Adhikari (1996a) received doctorate degree on Basidiomycotina in Nepal from UPS, Toulouse, France. The thesis deals with the diversity of Basidiomycetes 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 and Durrieu (1996) studied the ethnomycological approaches with the Ayurvedic concepts about the mushrooms. Joshi and Joshi (1999), in their ethnobotanical study, presented the ethnobotany of 36 species of wild mushrooms collected from different parts of Kathmandu and Pokhara. Kharel (1999) reported *Lentinellus ursinus,* an edible mushroom from Bhardeo VDC, Lalitpur. Pandey and Budathoki (2002) highlighted the relation of mushrooms with the different ethnic groups of Kathmandu valley. Kharel and Rajbhandary (2005) studied upon the ethnomycology of some wild mushrooms in Bhardeo, Lalitpur. Devkota *et al* (2005) reported 31 species of mushrooms from Lumle, Kaski, Western Nepal, in which they have documented brief ethnomycological knowledge among the local people. Many writers have made studies on *Cordyceps sinensis* In some parts of Nepal, *C. sinensis* is powdered and combined with the rhizome of *Dactylorhiza hataginea* for consumption (Adhikari, 2000).It is also used for tonic for Yak and Sheep. Local people believe that it gives good strength and hence they used to give it as gift to relatives and friends (Devkota 2006). *C. sinensis* is consumed mixed with rice flour in boiled milk.

Traditionally, it has been consumed with a variety of meats of chicken, duck and pork (depending upon the type of ailments) in the form of a medicinal soup (Zhu *et al* 1998;winkler, 2004).

Christensen *et al.,* (2006) studied upon the uses of wild mushrooms in the Annapurna Conservation Area. They have reported 38 species with their different values among local peoples. Pandey and Budathoki, (2006) gave the account of mushrooms in Langtang area with their use and local names. Pandey *et al.,* (2006) listed 94 Tamangs name of mushroom and their use among the Tamangs of Nepal. The paper focused on the diversity of species used and the distribution of use pattern of various wild mushrooms among the Tamangs of Nepal. Similarly, Pandey and Budathoki, (2007c) also described the ethnic view of Chepang on mushrooms and their local names.

2.1.4 Chemical Analysis

According to Boa, (2004), about 1200 species of fungi are used in 85 different countries for their gastronomic value and medical properties. The use of mushroom as food is probably as old as human civilization. They were preferred only for culinary characteristics; while the nutritive value of mushrooms was recognized much later (Crison and Sands 1978; Garcha *et al.,*1993).

An edible mushroom contains high level of dietary fiber, substantial amount of protein, vitamins and minerals, but it is low in fat. It also has various health benefits such as antioxidative, antitumour and hypercholesterolemic effects (Wong and Cheung, 2001).

The chemical compositions of mushrooms differ according to species as well as depend on the substratum, atmospheric condition, age and part of the frutification (Przybylowicz 1988, Vetter 1994, Shah *et al.*1997, Manzi *et al*. 2001).

In general, edible mushrooms contain 160-350 (gm/kg dry weight) protein, 20-60 (gm/kg dry weight) fat and 280 -339 (gm/kg dry weight) carbohydrate. They are the useful sources of Iron, Phosphorous, Potassium etc. The nutritional value of protein is usually very high in the majority of fungi (Ilievsaka and Petrovska ,2000).

Most of the amino acids are found in mushrooms (Kurtzman 1978).Mushroom fructification are composed of two basic parts: pileus and stipe which can take various shapes ,sizes and colors (SzweyKowska and SzweyKowska 2003).the flesh-filled fungal fructification differ in colour and consistency depending on the species (Deremek and Pilot 1988 cited by Bernas *et al*. 2006)

Dried mushrooms in general contain contain 19-40% crude protein (Kurtzman 1978)

The fructifications of mushrooms are characterized by a high level of well assimilable mineral constituents (Mattila *et al.,* 2001)

According to Vetter (1994), the level of macro constituents such as Sodium, Potassium and Phosphorous are constant, while the contents of Calcium, Magnesium and Sulphur depend on the composition of substratum.

Mineral content of mushroom is generally higher than many fruits and vegetables (Manning 1985).

In Nepal research has been concentrated in precommercial important edible mushrooms such as *Pleurotus, Ostraeatus, Volvariella volvacea, Agaricus bisporus* and *Lentinula edodes* e.t.c. However, focus has not yet been centered on the potential wild edible mushrooms. *Pleurotus* species which is collected Phulchowki hill has been reported to contain 0.1% fat, 0.6% carbohydrate and 2% protein (Singh and Nisha, 1973).

Joshi *et al* (1996) studied upon the food value and toxic wild mushrooms of Kathmandu and Pokhara Valleys. Eighteen species were subjected to food value screening tests (moisture, protein, ash, acid insoluble ash, calcium, iron, phosphorous, carbohydrate, ascorbic acid, thiamine, pyridoxine, riboflavin and nicotinamide contents).

Pandey (2004) analyzed twenty five Mushrooms species from Kathmandu valley for their protein constituents. Chemical study reveled that the higher amount of the total amino acid was detected on *Coprinus comatus* (13.80 mg/ml) followed by *Amanita caesarea* (13.67 mg/ml) and *Agaricus bisporous* (13.39 mg/ml).

Pandey and Budathoki (2006) studied the protein and major proteins of the mushrooms samples using SDS Page (Sodium dodecylsulphate-polyacrylamide gel electrophoresis).

Rana and Giri (2007) analyzed different parameters of eleven wild edible mushrooms of Sagarmatha National Parks and its adjoining areas.

3. Material and Methods

3.1 Material and Equipments necessary for the collection trip can be found in Appendix I.

3.1.1 Field trips

The collection of mushrooms started from the year 2001 to 2005 mainly during the months of May, June, July, August, September and October.

In high altitude like Langtang, two visits were made in the years 2003 and 2005. In low land like Chitwan, two visits were also made in the years 2002 and 2003.

Similarly, Phulchowki was visited twice in the years 2001 and 2002 and other places like Godawari, Lele, Sunadrijal, Dhulikhel, Surya-binayak, Champadevi, Nagarjun, Matatirtha etc. were visited several times during the season. Single visits were made at Namo-budha, Kavre; Ti-gaun, Nuwakot; Shivapuri; Tistung Palung; and Dakchinkali.

The details of each visit, collection of species and all necessary information are placed in Appendix XIII.

3.2 Pre Field Study

Screening, compilation and review of secondary sources of information, such as relevant reports, documents, articles etc. were made with a view to collect information on physical and biological resources of the study areas.

3.3 Field Study

3.3.1 Geographical information – Latitude, Longitude, Altitude, Soil-type, Forest type, Habitat, Climate, Temperature belonging to the collected mushrooms were noted down along with Date of collection, Collection number and Place of collection.

3.3.2 Mushroom Survey and Study

3.3.2.1 Collection of Mushrooms

The field work was conducted from July 2001 to August 2005 at different areas of Central Nepal. While conducting the field trips at the selected sites, a professional mushroom hunter and some other friends, including porter at certain very difficult places, were accompanied.

The mushrooms were photographed in their natural habitat before they were collected. The broken, rotten and insect eaten species were discarded. The basidiocarps were picked up by digging them out carefully with the help of sharp knife. Attempts were made to collect all the developmental stages of the basidiocarps to have an idea of all morphological characters. Two types of field observation format were prepared (Appendix-III) to record information about all the morphological and chemical characters including surrounding ecology of the specimens. Specific collection numbers were given for each species. These formats were filled up at the time of collection itself. Spore prints were also obtained as far as possible at the collection sites.

Each specimen of same species or different species collected from the same locality or different localities were cleaned with the help of the brush. They were placed in separate wax paper bags to prevent the mixture of spores. Bamboos baskets and paper bags were used for the collection of specimens in the field. Macroscopic features are based on the original description of the sample in the field.

The indigenous knowledge and beliefs on the wild mushrooms were obtained with the help of the questionnaire (Appendix-V).

3.3.3 Preservation of mushrooms

The specimens were preserved in two ways : Dry condition (dry preservation) and some in liquid (liquid preservation)

3.3.3.1 Dry Preservation

The specimens gathered were dried immediately in order to prevent from rotting. Sun drying is suitable for drying mushrooms. However, the collections made during the poor weather conditions and in rainy season could not be dried in sunlight. In such cases, wire trays with mushrooms specimens were placed over the hearth in near about 40^0C to dry mushrooms. After well drying, the specimens were packed in paper bags with some 'Naphthalene ball' and sealed in 'auto lock plastic bags' to prevent from decay and insect. Preserved specimens were thoroughly checked and were sun dried at the intervals of 1-2 months.

Photo Plate 1 Dry Preserved

Photo Plate 2 Liquid Preserved

3.3.3.2 Liquid preservation: The fleshy specimens for museum were preserved in a mixture of distilled water, alcohol and formalin or distilled water and formalin with 70:25:5 or 95:5 concentrations following Ainsworth (1971).

3.4. Post field studies

The specimens were brought to the laboratory for the microscopic studies. The microscopic character (Appendix-IV) was observed applying the system of section passing through the epicutis to hymenial surface (spore bearing layer) which was taken with the help of razor blade. The section of dried materials was then mounted in water with a drop of 10% KOH or NaOH solution. Melzers solution was also used to test reaction. Then the section was covered with microscopic cover slip and gently tapped with a blunt of a pencil and observed under 15 x10 and 15 x 40 powers for further studies. Spore shape was determined at the length, width ratio of 20-30 randomly selected spore. In some samples, microscopic photograph were taken, while in some others camera- lucida drawings were made. The specimens were studied at Central Department of Botany, T.U., Kirtipur ; National Herbarium and Plant Laboratories, Godavary and Central Department of Microbiology, T.U., Kirtipur. The specimens were identified with the help of standard literatures (Adhikari, 2000; Arora, D 1986, Bakshi, 1971; Corner, 1968, 1970; Dickinson & Lucas, 1979; Fries, 1938; Imazeki, Otani & Hongo, 1988; Kibby, 1979; Kumar *et al.* 1990; Konemann,V. 1999, Lakhanpal, 1986 ; Mckenny,M .1971; Pacioni, 1985; Pegler and Spooner, 1997; Philips, 1981; Purukayastha & Chandra, 1985; Rinaldi & Tyndalo, 1972; Singer 1932, 1951,1955,1962, 1971,1972,1986; Svreck, 1975; Teng, 1988; and Thind, 1961). They were also compared with the specimens at Tribhuvan University Central Herbarium (TUCH), Herbarium of KATH (Godavari) and Herbarium of Kolkota (Balljung), herbarium deposited at Faizabad (Ayodhaya) and herbarium deposited in the Natural History Museum at Shoyambhu. Some of them were identified by consulting other relevant literatures of respective sites. Nomenclature follows Adhikari (2000). The voucher specimens were deposited in TUCH.

3.5. Filing and Storage

Every packet, either dry or wet (Preserved in bottle), contain a label tag. It contains Collection number, Date of collection, Locality, Altitude, Substractum etc.

Napthalene balls and Para-dichlorobenzene were used as insect repellents in the storage shelf. The shelf was kept in dry, well aerated and sunny room.

Tribhuvan University Central
Herbanium

Collection no. Date:
Scientific Name:
Local Name :
Family:
Substractum:
Locality:
Altitude:
Collector : Nina Pandey

Figure 3.1: Model of Label Tag

Photo Plate 3 Samples Cabinet

Photo Plate 4 Drawer of Cabinet

3.6. Ethno information

The ethnomycological information were collected by two methods: 1.Participatory Rural Appraisal. (PRA), 2. Rapid Rural Appraisal (RRA).

Participatory rural appraisal (PRA):- It is an approach for the analysis of local problems and the formulation of tentative solution with local stakeholders. It makes use of a wide range of visualization method for group based analysis. It mainly deals with a community level scale analysis. It comprises a set of techniques aimed to share learning between local people and outsiders.

Rapid Rural appraisal (RRA):- A core concept of RRA is that research should be carried out not by an individual, but by the team comprised of some members with relevant technical backgrounds (Chamber, R, 1992). The techniques of RRA include:

- Interview and question/ design/ techniques for individual, household and key informant interviews
- Methods of cross-checking information from different sources
- Sampling techniques that can be adapted to a particular objective
- Method of obtaining quantitative data in a short time frame
- Group interview techniques, including focus- group interviewing
- Methods of direct observation at site level and
- Use of secondary data sources

From the study area, 127 collectors were interviewed. Among them, only 6 members were above the age of 60 and all of them were male. 105 members were in the age group of 20 to 50, among which 56 were male, and 49 were female. The remaining 16 were kids below the age of 11. The kids could not distinguish between the edible and poisonous mushrooms, but they knew where mushrooms were found. Among the adults, only about 36 persons shared their knowledge on mushrooms. The questionnaire is attached in Appendix V.

3.7. Chemical Analysis

Proximate analysis (moisture, ash, acid insoluble ash) was performed in the Department of food technology and Quality control in accordance with AOAC (1995).

3.7.1. Percentage of moisture determination

3.7.1.1. Fresh weight basis

Five (5) gm different fresh mushroom samples were weighed on an electronic balance. This gave the wet weight. The weighed samples were dried in the sun or, otherwise through fan heaters until it completely dried. The dried weight was also noted down, and moisture percentage was calculated in the following manner:

$$\text{Percentage of moisture} = \frac{\textit{Wet weight} - \textit{Dry weight}}{\textit{Wet weight}} \times 100$$

$$= \frac{\textit{Weight of moisture}}{\textit{Weight of sample}} \times 100 = \frac{A - B}{A} \times 100$$

Where, A= Fresh weight of sample B= Dry weight of sample

3.7.1.2. Dry weight basis

The sample, weighed accurately about 2gm, was put in a tarred shallow porcelain dish (dia 7.5gm), the dish was shaken until the contents were evenly distributed, left the shaken contents to dry in the dish at a temperature of 100^0C $\pm$ 50^0C for 2 hours, then cooled in desiccators and weighed the sample. This process of heating, cooling and weighing was repeated until the difference in weight between the successive weighing was one milligram.

Calculation,

$$\text{Moisture \% on dry Wt. basis} = \frac{\textit{Weight of moisture}}{\textit{Weight of sample}} \times 100 = \frac{(B - C)}{(B - A)} \times 100$$

Where,

A = Weight of empty basin B = Weight of empty basin + sample

C = Weight of sample after dehydration

B – A = Weight of sample B – C = Weight of moisture

3.7.2 Total ash determination

Accurately 2 gm of the over dried mushroom sample was put in a tarred charred pot at low temperature on the oven , and then the sample was incinerated in muffle for four hours or more until they were free from all carbonaceous material and the ash was white or a grayish white. The sample, then, was cooled in crucible; dried with ash partly on asbestos sheet and then in dessicator; and weighted. Repeated process such as ignition in the muffle furnace, cooling and weighing were taken at half hours interval until the difference between two successive weighing was less than one milligram. Thus, the lowest weight was noted down.

Calculation,

$$\text{Total ash, percentage by weight} = \frac{\textit{Weight of Ash}}{\textit{Weight of sample}} \times 100 = \frac{(B - C)}{(B - A)} \times 100$$

Where,

A = Weight of empty crucible B = Weight of empty crucible

C = Weight of crucible after ignition

B – A = Weight of sample B – C = Weight of ash

3.7.3. Acid insoluble ash determination

As described previously, after determination of ash, 25 ml of 5N hydrochloric acid was added in the ash containing crucible and heated on an asbestos sheet for 10 minutes till boiling point, after which it was allowed to cool and filtrated with 'whatman No 41 filter paper'. Then, the filter paper was washed to get it free from the acid, the filtrate was collected in volumetric flask and stirred for mineral estimation.

The residue on the filter paper was folded and inserted in the same crucible and ignited on the electric oven maintained at 135^0C $\pm$ 20^0C for three hours. Then, the same was ignited in the muffle furnace at 500^0C $\pm$ 20^0C for 3 hours, after which the crucible was cooled in dessicator and weighed. The process of igniting in the muffle furnace, cooling and weighing was repeated at half-hour interval until the difference between two successive weighing was less than one milligram. The lowest weight was noted down.

Calculation

$$\text{Acid insoluble ash, \% weight} = \frac{(W_2 - W)}{W_1} \times 100$$

Where,

W_2 = Weight in gm of the crucible and acid insoluble ash

W_1 = Weight in gm of sample taken for analysis

W = Weight in gm of empty crucible

3.7.4 The Quantitative estimation of total free amino acid content in mushrooms, using the Ninhydrin Reaction

A. Extraction of sample: Free amino acids were extracted by grinding 0.5 gm of individual mushrooms samples in separate mortar in 10 ml of 70 % ethanol (heated at 70°C). The homogenate was centrifuged at 10,000 rpm for 10 minutes.

The supernatant thus obtained was again subjected to centrifugation by adding 5 ml. of 70% ethanol to ensure complete extraction. The supernatant of each sample was collected separately and the volume was adjusted equally by adding 70% ethanol. The bottles were labeled and stored at $4^{o}C$.

B. Quantitation: Quantitation was done by colorimetric method. For this: Control was made by mixing 1 ml. of distilled water in 2 ml. of ninhydrin solution in a test tube. For standard, 1 ml. of working solution (Glycine) was added to 2 ml. of ninhydrin solution in another test tube and then mixed.

For the test, 0.5 ml. of the extract was added to 0.5 ml. of distilled water and this mixture was mixed with 2 ml. of ninhydrin solution in a test tube.

All these test tubes were incubated at 90°C for 10 min. and the absorbance was read at 570 nm.

Calculation was done by:

$$\text{Free amino acid content in mg\%} = \frac{0.D \text{ of test X total vol. Extract X } 100}{0.D \text{ of Standard X Vol. Use for test}}$$

$$= \frac{0.D \text{ of test X } 20 \text{ X } 100}{0.D \text{ of standard X } 0.5}$$

$$= \frac{0.D \text{ of test } 4000}{0.D \text{ of standard}}$$

$$\text{mg/100 gm} = \frac{0.D \text{ of test X } 4000}{0.D \text{ of Standard X } 1000}$$

$$\text{mg/100 gm} = \frac{0.D \text{ of test}}{0.D \text{ of standard}} \text{ X } 4 \text{ X } 2$$

(because 0 .5 gm sample was taken)

3.7.5 Qualitative determination of amino acids in Mushroom by ascending paper chromatography

Whatman No. 1 filter paper sheet of 20 x 20 cm^2 was taken. Base line was drawn 2 cm above the edge of paper. Small circular marks were marked at equal distance of 3 cm apart from each (6 marks). Altogether 20 µl of the extract was loaded in each spot applying 5 µl in each time drying with a hair-drier to maintain excess spreading. Six samples were loaded in the paper at one time. The paper was inserted inside the tank having the solvent system of butanol: acetic acid: distilled water of ratio 12:3:5 and carefully hanged vertically with the help of thread and clips and left for 4 hours. After four hours, the paper was taken out, dried and sprayed with Ninhydrin solution (Appendix-VI, a). Different marks were observed. Rf values were calculated as follows:

$$Rf = \frac{\text{distance traveled by unknown amino-acid from the baseline}}{\text{distance traveled by the solvent from the baseline.}}$$

Different types of amino – acids were identified by comparing their Rf values with those of reference standards (Appendix XI)

3.7.6 Quantitative Determination of Crude Protein by Micro – Kjeldahl's method

A. Digestion: For digestion, 0.5 gm of mushroom sample (cut into pieces) were taken in a long-necked digestion flask. 10 ml of conc. sulphuric acid was added. Before adding conc. sulphuric acid, 0.2 gm of copper sulfate and 0.1 gm of potassium sulfate were added as a catalyst and the sample was digested on Kjeldahl's heating until the solution became clear. While heating, the flask was rotated at times in order to complete digestion. It was cooled and was transferred to 50 ml volumetric flask.

B. Distillation: The digestion flask was rinsed in such a way that outlet of the condenser of micro-kjeldahl's distillation apparatus remained dipped into the boric acid solution. 10 ml of acid digested sample was transferred to the steam chamber of micro-Kjeldhal's apparatus and 16 ml of 40% NaOH was added to digest the sample. Immediately, the stop-cock was closed and the steam was passed through the steam- chamber to distilled ammonia till about 30-40 ml of distillate was collected in the receiving boric acid container flask. Then the receiving flask was removed from the condenser outlet and was rinsed with water.

C. Titration: Titration was done by burette method. In this method, drop-wise 0.1 N HCl was added till the bluish green color changed to pink. Then the volume of hydrochloric acid consumed was noted.

3.7.7 Determination of soluble protein of mushroom by Lowry Method.

(a) Extraction of Samples: 0.25 gm of dried mushroom samples were cut into small pieces with a scissor and grinded in mortar in 5 ml of phosphate buffer (pH 7.6) and the material was transformed to centrifuge tube. The homogenate was centrifuged at 8000 rpm for 20 minutes. The supernatant was pooled and the extraction was repeated 2 times to ensure complete extraction. The supernatant was combined and the volume of all were adjusted to equal level and stored in freeze in 4° C.

(b) Precipitation: After extraction, 1 ml of extract was taken out and 1 ml of 20% TCA was added and was left for 30 minutes in room temperature. It was centrifuged at 8000 rpm for 20 minutes. The pellet thus obtained was washed with acetone twice and was again centrifuged. The supernatant was discarded and the pellet was collected. The pellet was dissolved in 5 ml of 0.1 N Na0H and was mixed well to dissolve completely.

(c) Quantitation by colorimetric method: One milliliter of distilled water was taken in a test tube and 5 ml of alkaline copper sulphate solution was added and this mixture was used as the control.

1 ml of working solution of BSA (1mg/ml) was taken in a test tube and 5 ml of alkaline copper sulphate solution was added and this mixture was used as standard.

0.5 ml of mushroom extract was taken in a test tube and 0.5 ml of distilled water was added and 5 ml of alkaline copper sulphate was added in this mixture and was used as the test sample.

All these tubes were incubated for ten minutes in room temperature and 0.5 ml of Folin's reagent was added in each tube and was well mixed, and incubated 30 minutes. The optical density was measured at 660 nm.

D) Calibration Curve : The standard curve of BSA was drawn against absorbance (Appendix X.a). The amount of protein per gram of the sample was calculated.

3.7.8.Determination of protein by Bradford's method

An amount of 2 gm of mushroom samples were cut into pieces with a scissor and grinded in mortar with 5ml of phosphate buffer (pH 7.6) and was then transformed to the centrifuge tubes. The homogenate was centrifuged at 8000 rpm for 20 minutes. The supernatant of different mushroom

samples were put in separate tubes. The volume of all of the samples in tubes were then made equal by adding phosphate buffer solution and the extraction were stored in the refrigerator at 4^0c for further analysis.

After extraction, 30µl of different mushroom samples were taken out in separate tubes and were mixed with 70µl of distilled water separately. In all of these separate sample tubes, 2.9 ml of Coosmassic Brillaint Blue solution was added and mixed thoroughly. The total volume now was 3ml in each tube. All these tubes were incubated for 5 minutes at room temperature and absorbance at 600(595) nm was recorded against the reagent blank. A standard curve of Absorbance (600 nm) versus Concentration (µg) of protein was plotted (Appendix X.b).

3.7.9. Carbohydrate determination

3.7.9.1. Reducing sugar: For carbohydrate determination, test of reducing sugar only was done by fehling's test.

Preparation of sample:

One gm of mushroom samples (cut into pieces) was added to a mortar, and was grinded in distilled water which is converted to final volume of 100 ml. It was left over night. The same process was followed for each sample.

The burette was filled with mushroom filtrate and was trickled over the boiling Fehling's solution in conical flask. The end point was determined when the blue color turned into brick red and the value thus obtained was determined as below:

% Reducing Sugar = Factor X Dilution X 100/Titre X Wt of sample taken

3.7.10. Quantitative estimation of calcium by volumetric method

Calcium was precipitated as calcium oxalate. The precipitate was not dissolved in dilute sulphuric acid and titrated. Pipette 50ml of the ash solution obtained by dry ash to a 250ml of saturated ammonium oxalate solution and two drops of methyl indicator. Make the solution slightly alkaline by adding acetic acid until the color is faint pink, then heat the solution to the boiling point. Allow to stand at room temperature for at least 4 hours or preferably overnight. Filtrate through Whatman no. 40 paper and wash with hot distil water till the filtrate is oxalate free, which was indicated by the formation of precipitate with silver nitrate solution. Break the tip of the filter paper core with a glass rod. Wash the precipitate first using non dilute H_2SO_4 (1:4). Then wash with hot water and titrate with 0.1N Km solution to the first permanent pink colour. Finally add

filter paper to solution and complete the titration. (AppendixVIII. a).

Calculation,

Percentage of Calcium = $\frac{Titrate \times Normality\ of\ KmNO_4 \times 20 \times total\ vol. \times 100}{m_1\ soln\ taken\ for\ ash\ formation \times wt.\ of\ sample\ taken\ for\ ash}$

Precaution – Potassium permanganate solution needs to be frequently standard

3.7.11 Determination of Phosphorous by colorometric method

Take 5ml aliquot ash solution in 100ml volumetric flask, add 5ml of molybdate aliquot and mix. Add 2ml of aminonapthe sulphuric acid solution, mix and make the volume to 100ml. Similarly, prepare a blank using distil water in place of sample, allow to stand for ten minutes and measure the color at 650mm setting the blank at 100% transmission. For standard, prepare similarly, and add 1ml of standard phosphorous.

Calculation,

Percentage of Phosphorous = $\frac{O.D.\ sample \times 0.1 \times Total\ vol.\ ash\ sol^n \times 100}{O.D.\ of\ std. \times ash\ sol^n\ taken \times wt.\ sample\ taken\ washing}$

Precautions – The blue color is stable up to 20 min. If the number of samples for phosphorous assay is large; develop color in manageable lots so that their observance can be revealed within this time limit (AppendixVII.b).

3.7.12. Determination of iron through spectro photometer method

Iron was determined by converting it to ferric form using oxidizing agent potassium persulphate and teraling there with potassium thiocynate to form red ferriothocynate. The optical density was measured at 480mm.

Take 45ml of ash solution. In this solution, add 0.5ml conc. H_2SO_4 in which add 1ml pot. Persulphate and 2ml 3N KSCN (potassium thiocynate) one after another and adjust volume at 50 ml. Similarly, standard was prepared by taking 0.5ml conc. H_2SO_4 in which 1ml pot. Persulphate , 2ml 3N KSCN and lastly 1ml standard Iron solution was added. The blank was prepared by taking 0.5ml of Conc H_2SO_4 in which 1ml pot. Persulphate and 2ml of 3n KSCN was added. The vol. was adjusted to 50ml by adding distil water.

The optical density of each sample & their standard value were measured at 480mm. (Appendix VIII. c).

Percentage of iron (Iron mg/100gm)

$$= \frac{O.D.\ sample \times 0.1 \times Total\ vol.\ ash\ sol^{n} \times 100}{O.D.\ std. \times 45 \times wt.of\ sample\ taken\ for\ ash\ vol.\ taken\ for\ estimation}$$

3.7.13. Determination of Protein profile by SDS- PAGE

SDS-PAGE was done by the method of Laemali (1976). SDS- PAGE of mushroom proteins were done on 12% separating gel (Appendix XII. a) of length 5.5 cm and 5% stacking gel of length 2.5cm.

Loading samples along with the standard protein were prepared by mixture 1:2 ratio of each protein sample and Quenching mixture (Appendix XII. b) and were boiled for 5 min in water along with the microfuge tube. On loading, concentration of each protein in each lane was determined. For this, the concentration of the protein was reconfirmed by Bradford method and the concentration per lane was determined.

Electrophoresis was done at 75 volt for 1 ½ - 2 hours on gel mold, of slab size 10.5 x 8 cm^2 and the thickness of the gel was 1mm. After resolving the gel, it was soaked in 20% TCA for 20 minutes and was stained on Staining Solution (Appendix XII. c) for overnight and followed with distaining on Distaining Solution (Appendix XII. d).

Calibration curve was plotted against the standard protein (BSA-66 kDa, Casein-20 kDa and lysozymes-14 kDa) by R_f value V_s of log of molecular weight. According to this, the molecular weight of each band resolved on gel was determined. (Appendix X. b).

Before electrophoresis, 1mg/ml of BSA, Casein and lysozyme of each were prepared in separate microfuse tube. Protein concentration of each mushroom was determined and the net protein content in each lane of the gel was determined.

During sample preparation prior to the electrophoresis, 10 µl of each mushroom protein from the stored proteins with known concentration (as determined in Bradford method) were mixed with 40 µl of the quench (Appendix VI. c) at the ratio of 1:4, according to which 50 µl of the total mixture have fixed concentration of protein and BSA, Casein and Lysozyme each of which had 10 µg of protein content. The quenched mixture was then used for load.

4. Result

4.1 Composition of Mycoflora

In the present study, 575 species were identified and documented (Appendix XIII) from the study area. The species come under 54 families and 82 genera. 251 samples were identified only upto generic level while 324 upto species level. Among a total of 324 identified species, the same species repeated in different collection sites were merged in one category and thus, total identified species came to be 174. Out of the 174 species, ethnomycologically important 50 species were enumerated while 25 species already reported by mycologists were described in detail as new records for the country. These species had not been enumerated from the country until 2000 (Adhikari, 2000) and other research papers from different scholors from 2000 to 2007 do not mention these species as being new either. Among them, 10 species are edible which can be added in the list of edible mushroom. Edibility of mushrooms was recorded from the versions of local people, through testing a little quantity by researcher in the study area during field visit, through chemicals test as well as through consultations of previous literatures.

Among the 54 families, the first largest family was *Russulaceae* followed by *Boletaceae*, *Polyporaceae* and so on as given below in table 4.1.1. and also in the pie chart showing the detail family-wise- distribution. Among the above-mentioned 25 new records for the country, the following macro fungi were already published (Appendix XXIII) : *Rhizina undulata* (Pandey and Budhathoki, 2003), *Thelephora fuscella, Microsporous falbiformis (*Pandey) *et al*., 2006), *Volvariella bombycina, Hypholoma capsonoides , Dictyophora duplicate* (Pandey and Budathoki 2007d) , *Agaricus praeclarusquamosus*, *A placomyces, leucocoprinus fragilissimus* (Pandey and Budathoki 2007e) and *Boletellus emodensis , Gyroporus atroviolaceus, Stroibillomyces mirandus* (Pandey and Budathoki 2007f).

The utility of mushroom species according to literature and outcome of the thesis are listed as follows:

Mushroom utility	**No of Species**
Edible	180
Toxic	66
Medicinal	19
Other	7

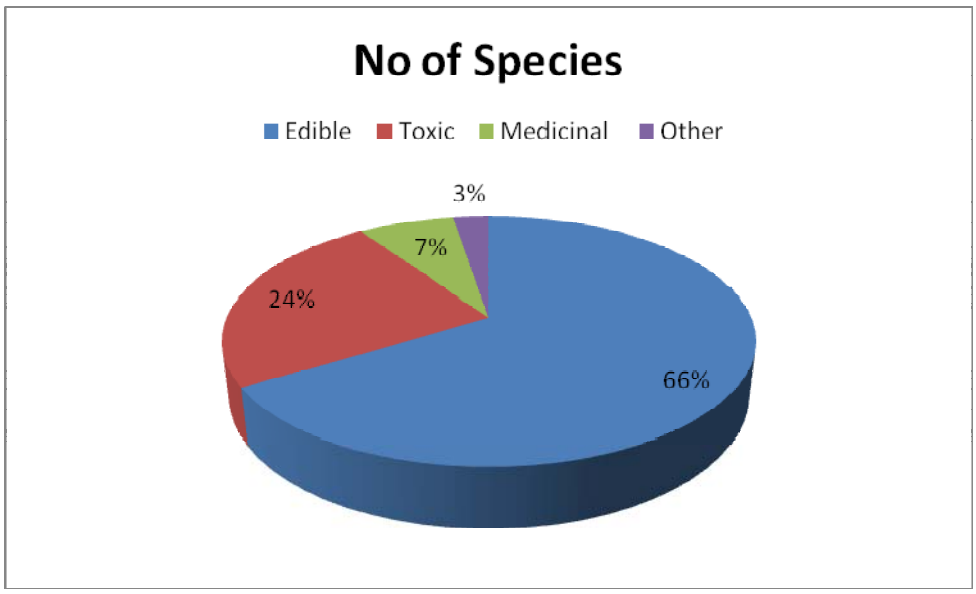


Fig. 4.1.: Utility of mushroom species according to literature and outcome of the thesis.

Edible , Toxic, Medicinal mushroom list are in appendix XV, XVI,XVII respectively.

4.1.1 Geographical disruibution of mushroom in the study area:

Only few localized mushrooms are found at particular altitude and ecological habitat; otherwise they are cosmopolitan, found everywhere when the habitat is favourable.Temperature, rainfall, appropriate habitat and moisture are the main determining factors for fungal growth.

For example, Cordyceps sinensis are found at high altitude (3800-4500 m), *Scleroderma polyrhizum* and *Termitomyces eurhizus are* found at low altitude ie terai belt and Different species of *Amanita,Agaricus,Russula, Lactarius.Laccaria, Catharellus* are found in Subtropical, Temperate and Sub-temperate zone.

Table 4.1: Ten largest families on the basis of specimens collected from various sites of the study area.

Family	Total number
Russulaceae	69
Boletaceae	58
Polyporaceae	49
Tricholomataceae	31
Coprinaceae	26
Pleurotaceae	24
Hymenochetaceae	23
Amanitaceae	23
Agaricaceae	21
Marasmiaceae	20

All the collected 575 mushroom samples are listed in Appendix XIII. According to substractum, large number of mushrooms are found on soil (360), then second large on stump (167), and few in other substractum as shown in the graph 4.1.2. Similarly, 157 samples were found around 1400-1600 m, 131 samples were found in between 1200-1375 m and so on as shown in the graph 4.1.3.

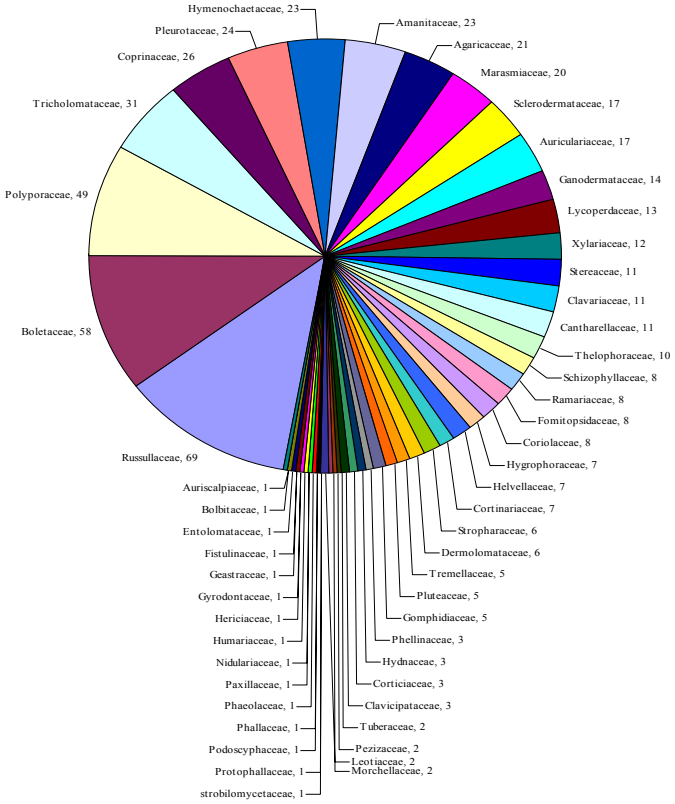


Figure 4.2: family wise distribution of Mushrooms in the study Area

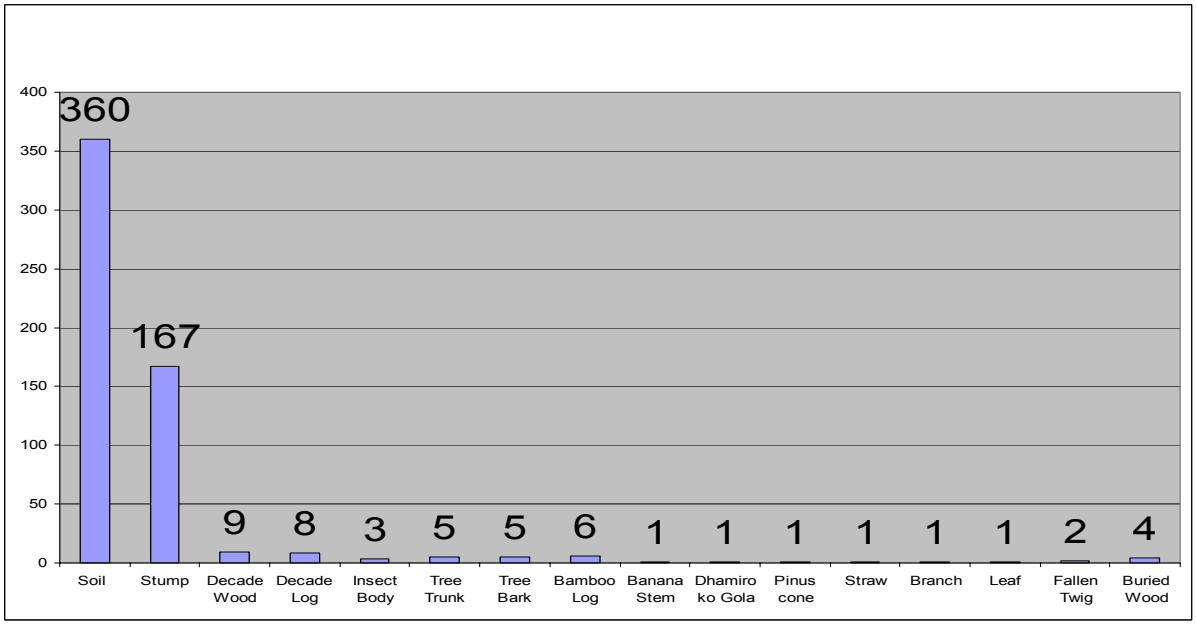


Figure 4.3: Distribution of mushroom according to habitat.

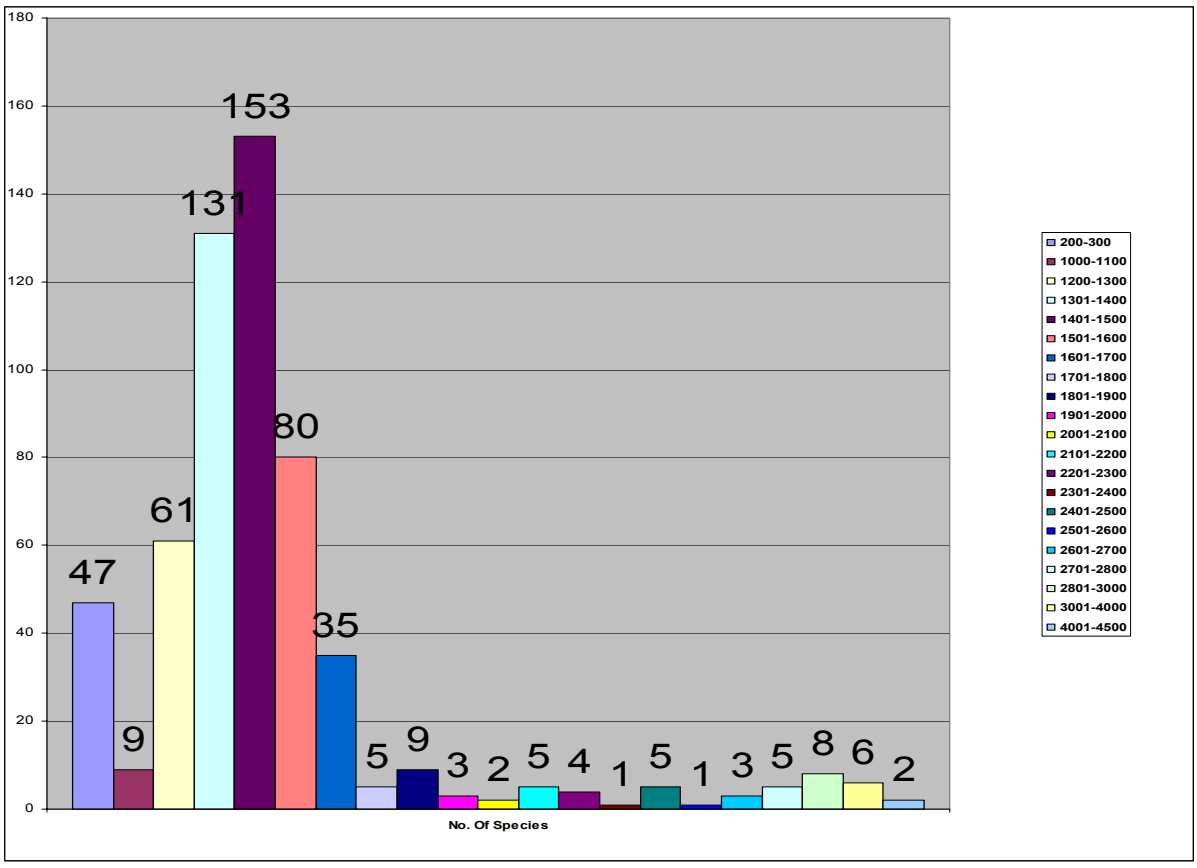


Figure 4.4: Distribution of mushroom according to Altitude

4.2 Description of Ethnomycologically Important Mushroom Species

A.Subclass-Agaricomycetideae:

These umbrella-shaped fungi have hymenium made up of gills and the flesh is fibrous. This subclass has the highest diversity of species and it represents the majority of edible (some species of *Amanita, Russula, Lactarius, Macrolepiotas, Agaricus*, etc.) and poisonous (*Amanita, Lepiota, Entoloma, Cortinarius,* etc.) fungi.

Family Russulaceae:-Fruit body is typical agaricoid.Flesh has a friable chalky constancy, not fibrous as in other case of fungi. Spore print is white or offwhite**.**

Key to genera

A.Mushroom exudate watery or colored milk (latex) when broken..…….....……*Lactarius*

B.Mushroom do not exudate latex ….…….....…….....*Russula*

Key to species

A.Fruit entirely white, lamellae white, widely spaced…….....…….. *L.piperatus*

Fruit entirely white, lamellae white, closely spaced …….....…… *L.subpiperatus.*

Fruit body entirely brownish orange, pale yellow to brown …….……..... ……. *L. volemues*

Lactarius piperatus –(Scop) Fr. Cke, Illus. No. 943, t.978.-Saccardo, *Syllog. Fung*. .436, (1887) - Fries, *Epicr. Mycol*. 340,(1838).-Rea, *Biblo. Mycol*. 486.(1922)

Local name: Dudhey chyau

Cap 4-12 cm broad, dull white, convex –umblicate, infundibuliform, dry, smooth, without hairs; **Gills** very crowded,short, narrow dichotomously forked,white to cream in edge; **Stipe** solid, 1-6cm long, 1-2cm thick; taste acrid, milk white,unchanging; **Spores print** White; **Spore** 6-8.5 x 6-6.5 µm almost round.

Specimens examined: On soil in *Pinus* forest at Suryabinayak, 1375m.22.06.2002 PN 22158; on soil in *Pinus* forest at Sundarijal, 1425m, 07.03.2003. PN 3364 TUCH.

Edibility Edible, used to prepare pickle - due to its peppery nature - usually preferred by Tamangs

Previously reported from Kathmandu valley (Singh, 1996); Daman (Pandey, 1976); growing on soil in *Pinus roxburghii* forest, Tokha (1520m); Nagarkot (1600m) (Adhikari, 1996a; Adhikari *et al.,* 1996a); Suryavinayak (1540m); Lele (1380m) Phulchowki (1700m) (Adhikari, 1996a) and Lamjung (Adhikari and Adhikari, 2003) Common species.

Distribution China, Europe, U.S.S.R., North America, Japan, India and Nepal.

Lactarius subpiperatus Hongo.- Imazeki, Otani and Hongo, *Fungi of Japan*. 379, (1988).

Local name Dudhe chyau, Nghe shyamo (T).

Cap 5-12cm white convex later umbrella like; **Gills** adnate decurrent white; **Stipe** cylindrical white; **Spore print** white **Spore** 5-8 x 5-6µm almost spherical echinulate L. piperatus differs from L.subpiperatus in having dense Gills.

Specimens examined On soil in *Pinus* forest, Sundarijal 1425m. 03.07.2003 PN 23364.

Edibility Edible, fair

Previously reported On soil in *Pinus* roxburghii forest, Lele (1380m); Brajayogini (1600m) (Adhikari, 1996a); in mixed forest , Matatirtha (1620m) and Pokhara, Gumba Danda (980m) (Adhikari *et al.*, 1996a).

Distribution Japan and Nepal**.**

Lactarius volemus (Fr.) Fr. – Saccardo, *Syllog .fung*. 447, (1887) – Fries, *Epicri. Syst. Mycol.* 344, (1838).- Rea, *Biblo. Mycol*. 493.(1922).

Local name Dudhey chyau

Cap 5-10 cm broad, hazel –brown, expanded-depressed, broad, thick, flesh white becoming brownish after air; **Gills** close, forked, brownish when bruised; **Stipe** solid 3-9cm long, 10-20mm thick; milk white plentiful in air it changes slowly to brown. **Spore print** white **Spore** 7-10µm almost round, amyloid (blue) reaction of net like ridges.

Specimens examined On soil under *Pinus* forest, Sundarijal 1500m. 03.07.2003 PN 23375, on soil under *Pinus* forest. Champadevi 1425m, 06.07.2003. PN 23393, Tistung palung PN 24570, Kirtipur PN 25670, Dakchinkali PN 25682 TUCH.

Edibility Edible, excellent, local people often eat it in raw condition. It smells pleasant and taste is very good.

Previously reported From Manichaur (Adhikari, 1976); Nagarjoon , Kathmandu valley (Pandey,1976); on soil in *Pinus roxburghii* forest, Nagarkot (1620m); Lele (1380m); Bajrayogini (1600m); Dakshinkali (1340m); in mixed forest, Matatirtha (1520m); Suryavinayak (1560m) and Phulchowki (1750m) (Adhikari, 1996a; Adhikari *et al.*, 1996) and Maipokhari (Adhikari, 2000e). Common species. On soil in the shade of *Rhododendron arboreum*. Mulabari, Lumle, (Devkota, S. 2004).

Distribution China, Europe, N. America, Japan India and Nepal.

B.Mushroom not exudate latex *Russula*

Flesh changing in colour when bruished 1

1. Lamellae thick and distant pileus sooty brown to black, flesh turning black ..... *R. nigricans*

Flesh not changing in colour when bruished 2

2. Lamellae thick and distant, pileus white, smell like rotten fish. Spores 6x10µm .....*R delica*

Lamellae thin and dense with bluish tinge.....3

3. Spores 3.5x7.5µm, verrucose with isolated reticulation .....*R. chloride*s

Lamellae without any tinge 4

4. Pileus with areolately cracked surface developing into greenish scale.....*R virescens*

5. Pileus grayish purple. Spore 7x10µm with short reticulations .....*R.cyanoxantha*

6. Pileus red, blood red to purplish, stipe pinkish, lamellate adnate decurrent. Spores 8x10µm warted and finely reticulate .....*R.sanguinaria*

7. Pileus rosy red, stipe rosy tinged, lamellae thick adnate. Spores 7.5x10µm reticulate..... *R aurora*

Russuala nigricans (Bull.) Fr. Cke. Illus.no.970, t 1015 Rea.*Biblo.Mycol*. 458. (1922).

Local name Handi chyau

Cap 4-10 cm high and 5-18 cm wide, convex at first, but soon becomes depressed in the center, though it retains its inrolled margin for a long time, blood red. When it first emerges from the ground it is white, but soon becomes marbled with gray; **Flesh** is firm and thick, reddening and blackening when cut. There is little or no odor but any smell will be slightly fruity; **Gills** are thick and widely-spaced. Gills of varying lengths are interspersed with each other, a feature which is uncommon in russulas. They are fragile, and break easily if pressed between finger and thumb. They are at first white or cream, later turning red and blackening at the touch; **Stipe** is short and thick, and is also white. **Spore print** white; **Spores** 6-8 x 6 µm, ellipsoid with ornamentation.

Specimen examined On soil, Sundarijal 1400m. 25.09.2001 PN 21102; on soil *Pinus forest* Nuwakot, Tigaun 1100m. 17.07.2003 PN 23422 TUCH.

Edibility Edible

Previously reported Growing on moist shady place, Suryavinayak (1540m) (Singh and Nisha, 1976; Singh and Upadhyaya, 1979); in *Querccus* forest, Jiri (2300m) (Adhikari, 1990); Manichur (2150m) (Adhikari, 1991c) and Nagarkot (1670m).

Distribution Europe, Japan, N.America and Nepal.

Russula delica Fries.-Bres. *Fung.Trid*.t.201 Rea, *Biblo. Mycol*.,457, (1922).

Local name Kan Shyamo(T)

Cap 6-15cm, whitish often with ochreous brown, hemispherical then convex, finally with a wide, deep depression, cuticle not detachable dry; **Gills** white, distant on equal , anastomosed, forked broad, adnate; **Stipe** 2-5 x 1-3cm, white and faintly brownish, hard,full, cylindrical, sometimes truncated-conical, shiny, pruinous, may become slightly rugose with age ;**Flesh** whitish, thick, hard. Odor of fruit or fish, flavour sweet but Gills acrid ; **Spore print** white; **Spores** 7-10 x 6-8.5µm, broadly ovoid, rounded, with mainly obtuse warts, amyloid.

Specimen examined On soil tropical forest Chitwan, Tikauli 200m. 21.07.2002 PN 22218.

Edibility Edible, only in young stage**.**

Previously reported Growing on soil in moist shady place, Daman (Pandey, 1976); Manichur (1800m) (Adhikari, 1976a); in *Pinus roxburghii* forest, Royal Botanical Garden, Godavary (1515m) (Adhikari, 1988); in *Shorea robusta* forest, Padam Pokhari Vrindavan Herbal in Farm (560m); Hetauda (560m) (Adhikari, 1996a); in pine forest, Lele (1650m) and in mixed Sal forest, Pokhara, Beganas Tal (580m).

Distribution Worldwide.

Russula chlorides (Krombh.) Bres .*Fung* .*Trid*. t.202, -Rea, *Biblo. Mycol*., 458. (1922).

Cap 4-10cm broad, convex at center, whole fruit body white.**Gills** dense, with bluish ting, fragile, often spotted fuscous in old age,subdecurrent.**Flesh** not changing colour when bruished, white cheesy.**Spore print** white; **Spores** 3.5-7.5µm,verrucose with isolated reticulation.

Specimens examined On soil, Matatirtha, 1425m. 29.09.2003.PN 23474, on soil coniferous forest Champadevi 1425m. 13.07.2002 PN 22175.

Edibility Edible

Previously reported In Shorea *robusta* forest, Vrindavan Herbal Farm, Hetauda (Adhikari, 1996); Royal Botanical Garden, Godawari and Dackshinkali.

Distribution Europe, Japan, North America and Nepal

Russula virescens (Fr. Schaeff) Fr. Cke.Illus. no.991,t.1039.- Rea, *Biblo.Mycol*. 460.(1922).

Local name Maili chyau, Dhide chyau, Wangu bukacha(Newar)

Cap 5-12 cm or more, gray or bluish green , then brownish in mature specimen, rarely entirely whitish, first globose, then convex and open, slightly depressed at the center, cuticle detachable near edge, tough, dry, cracked into small adnate scales, darker then background, margin thin, curve then straight, obtuse, sometimes radially sulcate; **Flesh** whitish thick, soft. Odor initially slightly fruity, becoming unpleasant, flavors sweet; **Gills** creamy-white with rose-cream coloured iridescence, often

with reddish brown margins, crowded, unequal, forked, often anastomosed, fragile; **Stipe** 3-9 x 1.5-4 cm, whitish, flare beneath Gills, slightly narrowing at the base, full then spongy, pruninous at top, slightly rugose; **Spore print** white; **Spores** 6-8. x 5-6.5 µm, broadly elliptical, with fairly distant warts, amyloid.

Specimen examined On soil under the shade of *Pinus forest,* Sundarijal, 1450m, 09.28.2001 PN 21123, on soil Champadevi 1500m. 06.07.2003 PN 23390, on soil Dakchikali 1440m. 23.08.2005 PN 25681 TUCH.

Edibility Edible, excellent, used as vegetable. It is also used as raw in Dakchinkali.

Distribution Europe, Japan, North America, Nepal and China.

Russula cyanoxantha (Schaeff) Fr.-Cke.Illus. NO.1007,t. 1076.- Rea, *Biblo. Mycol*.,462, (1922).

Local name Bhatmase Chyau

Cap 5-15cm, blackish- violet, pale purple at edge and conspicuous green at disc, varying to slate-gray with lighter areas, or bluish violet or even a uniform green when lighter areas, or bluish violet or even a uniform green when mature, rounded then convex, flat fairy depressed, blood red, cuticle two-thirds detachable, thin, viscous in damp weather, shiny, eith radial fibrils and grooves, margin curved inward then obtuse, sometimes striate when mature; **Gills** white tinged bluish green, fairly crowded, unequal, forked, intervenose, ventricose; **Stipe** 5-10 x 1.5-4 cm, white, sometimes tinged lilac or reddish, with brownish markings, sturdy, even, narrowing and rooting at base, fleshy, soft then spongy, pruinous, slightly rugose; **flesh** white, sometimes grayish when mature, thick, soft, moist. Odor pleasant, flavour first sweet then unpleasent; **Spore print** white, **Spores** 7-10 x 6-7.5 µm ,elliptical, with small isolated warts, amyloid.

Specimen examined On soil Champadevi 1550m. 06.07.2003 PN 23392, on soil Matatirtha 1425m. 29.09.2003 PN 23473.

Edibility Edible, excellent.

Previously reported Growing on soil in moist shady place, in mixed forest, Rhododendron- Abies, Goyam, (East Nepal, Jiri-Junbesi) (3200m) (Adhikari, 1990); Suryavinayak (1540m); Royal Botaical Garden, Godavary (1515m) (Adhikari, 1996a); in mixed forest, Daman (2300m) and in Castanopsis mixed forest, Maipokhari (1880m), Ilam. Edible but not known in Nepal.

Distribution Europe**,** N. America, Japan, India, China and Nepal**.**

Russula sanguineria *(S*chum**.)** Rausch Syn *R . sanguinea* (Bull.) Fr. Cke. Illus.no 981, t. 1019.- Rea *Biblo. Mycol*. Rea 466,(1922).

Local name Sindure chyau

Cap 4-10 cm high and 4-10 cm wide, convex at first then flattened but without becoming depressed blood red . The thin margin remain inrolled for a long time.The carmince cuticle pales and may become discolored with white patches. The cap tens to split when old; F**lesh** is firm, white, red under the cuticle, and very thick.**Gills** are tightly-packed, rather decurrent, and colored cream to pale ocher; **Stipe** are cylindrical or slightly tapering. It is full, firm, slightly tinted with the same coloring as the cap, but burning gray when mature; **Spore print** white. **Spores** 7.5-10 x 6.5-8 µm, broadly ellipsoid, densely covered with conical spines.

Specimen examined On soil *Pinus forest* Champadevi 1500m. 06.07.2003 PN 23391.

Edibility Edible

Previously reported Growing on soil in *pinus roxburghii,* Royal Botanical Garden, Godavary (1515m) (Adhikari, 1988c) and Phulchowki (1980m).

Distribution Australia, Europe, India, Japan and Nepal.

Russula aurora Krombh**.-** Syn.[=*R. rosea* Pers., *R. rosacea* (Pers.) Gray]-Rea, *Biblo. Mycol.*,467, (1922).

Local name Raktey chyau, Sindure Chyau.

Cap 5-9cm broad rosy to blood colour ,convex ,expanding little ,depressed at center.**Flesh** white, no change in colour, smell pleasant, test acrid. **Gills** creamy white, adanate to decurrent fragile. **Stipe** cylindrical whitish in color, slightly pinkish or redish at basal portion; **Sporeprint** white; **Spore** 5.7 - 10 µm m, globose ornamented**.**

Specimen examined On soil Champadevi 1500m. 13.07.2002 PN 22178, on soil Matatirtha 1425m. 15.08.2004 PN 24601, on soil Suryabinayak 1450m. 11.09.2004 PN 24628.

Edibility Edible, good

Previously reported In Pinus *roxburghii* forest*,* Royal Botanical Garden, Godavary (1515m) (Adhikari, 1988c); Bajrayogini (1680m); Phulchowki (1980m) and Lele (1600m) (Adhikari, 2000). On moist ground, under the shade of *Schima wallichii.* Gairi Khoria, Lumle, (Devkota, S 2004).

Distribution China, Europe, India, Japan, N. America and Nepal.

Family Boletaceae The fertile area (gills or tubes) in mature specimens is very easy to separate from the cap by scracting it with a finger nail.The species have with tubes and central stem(boletes); however, a few of them have strongly decurrent gills, although they still belong to this family.

Key to genera

1. Mushrooms with pileus, stem and tubes ……..…….……*Boletes.*
2. Species conneched solely with conifers slimy or very slimy cap pores radially arranged cystidia in fascicles with dark brown incrustations …….…….…….. *Suillus*
3. Dry cap, hollow stem spore deposit bright yellow,spore more or less ellipsoid clamp connection present …….…….…….……... *Gyroporus*
4. Dry or velvety cap, wide pores, stem not very thick or tall and straight ……...…….…….…….…….…….…….*Chalciporus* and *Xerocomus*.
5. White pores turning pink when touched, spores sub fusiform to ellipsoid,stipe solid, marked reticulation on stem no claimp connection …….……*Tylopilus*
6. Very fleshy non slimy cap, very large central stem, covered with red reticulation on or spots, very small pores ,pores not radially arranged cystidia not in fascicles and lacking dark amorphous incrustations stipe reticulate, punctuate to smooth…….…….……*Boletus*
7. Cap with dark gray brown to black scales or warts;spores globose to sub globose, reticulate to verrucose, spore deposit deep reddish black to brown black. **……**…...**…….***Strobilomycetes*

Boletus edulis (Bull.)Fr. Rolland, *Champ*.t.81, 182. ,- Rea, *Biblo. Mycol*. 566, (1922).

Local name Ghada chyau, Pho syamo (T)

Cap 5-25 cm, hemispherical, convex, then flattened, cuticle smooth, slightly viscous in damp weather, barely detachable, whitish, light brown or chestnut, not uniform. Fairly long tubes, almost free from Stipe, first whitish, then grayish yellow; **pores** small, circular, and tube-coloured. **Stipe** 4-18 x 2-5 cm, solid, bulging or cylindrical, white or light, covered by reticulum first, then slightly darker than background. **Flesh** white, unchanging, soft then softening further. Odor nice, flavor sweetish, tasty.

Spores: 14-17 x 4.5-6.5 µm. Olive brown, fusiform, smooth, inequilateral in side view, hyaline to pale ochraceous in KOH, dark ochraceous in Melzer's, smooth, walls slightly thickened. **Basidia** 30-40 x 10-12 µm, hyaline, clavate, four-Spored. *Hymenial cystidia* 48-67 x 5-10 µm, often inconspicuous, hyaline, thin-walled, often deeply embedded in the hymenium, fusoid-ventricose, often narrowed and with tapered, elongated apices.

Specimen examined On soil, Dhulikhel 1450m, 28.09.2001 PN 21114, TUCH.

Edibility *Edible*, excellent mostly used by Tamang ethnic castes.

Previously reported Kakani (Pandey, 1976); Syabru (Cotter, 1987) and Suryabinak (1540m) (Adhikari *et al.,* 1996). Commonly found in *Pinus* and mixed forest.

Distribution Worldwide.

Note: The description of other species found in new report to the country.

Agaricaceae; Flesh of fibrous texture, cap and stipe more or less separable. Gills at first white, then pink and turning black upon maturity.Spore print brownish black.

Key to genera

1. Membraneous ring present on stipe at subternimal position…….....……..*Agaricus*

2. Membraneous ring, stipe cylindrical slowly widening from top to buttom.Spore print white or creamish in color…….....……*Lepiota*

Key to species

Flesh changing to yellow or reddish brown when bruished…….…….A

Cap yellow-brown, stalk long and slender…… *A. Augustus*

Cap gray,staining yellowish then slowly reddish brown…….*A.placomyces*

Cap gray wih brown scales,staining yellowish then slowly reddish brown……...*A preclaresqamous*

Flesh not changing when bruished…….……B

Cap very large, veil single, gills bright pink…….*A.campestris*

Agaricus campestris (Linn.)Fr *Flora Suecia* 1745-1755, *Elenchus Fungorum.*,1828.- Rea *Biblo. Mycol*. 87. (1922) Syn *Psaliota campestris*

Local name Gobre chyau, Chate chyau, Koper shymo (T).

Cap Hemispherical at first, then convex, and finally expanded. 4-8 cm in diameter. The margin stays curved under towards the Gills for a long time and back when fully expanded.White or off white with brownish scales. **Gills** they are free first pink in color later changed into tobacco brown. **Stipe** It is cylindrical white or slightly pink in color. **Ring** Simple, thin, white and fragile. **Flesh** Solid and white, it turns pink when exposed to the air.

Spore print Chocolate brown. **Spore** 5.6-9 **x** 4.5-5.5 µm elliptical smooth**.**

Specimen examined On soil, grass lawn Kirtipur 1310m, 21.06.2004 PN.24536, TUCH. **Edibility** *Edible* Excellent.

Previously reported Sold in the Kathmandu market (Singh, 1966); Manichur (Adhikari 1976) and Manang (Bhandari, 1985).

Distribution World wide.

Amanitaceae :-Members of this family characterized by free gills, presence of annulus and a volva; although annulus of some species disappear early and volva may sometimes buried and difficult to see or may slough off. They bear white spore prints. Most members are mycorrhizal.

Key to genera

1. Stipe with volva or rudiments of volva, annulus present,in some may be absent, clamp present or absent, spores amyloid or inamyloid …….....…….....…..*Amanita*
2. Pileus viscid, lamellae free to subfree, spores inamyloid, rarely slightly pseudoamyloid, small…….....…….*Limecella*

Key to Species

1. Pileus greyish, margin striate, stipe fibrillose…….....……..,*A.chepangiana*
2. Pileus grayish, annulua absent, volva saccate, stipe scaly…….....……*A.vaginata*.
3. Pileus orange or orange red, flesh remaning unchanged, stipe smooth…… …...…..*A.ceasarea*
4. Pileus orange or orange red, flesh remaning unchanged, stipe scaly……...…...*A.hemibapha*

Amanita chepangiana Tull. and Bhandary - Tull. and Bhandary, *Mycotaxon* XLL- III: 25-31,(1992) .

Local name Gobre chyau, Gobre musa (Che.)

Cap 3-6cm, convex at first later umbrella like white in color .**Gills** free white in color. **Ring** White in color found just 1cm below the cap. **Stipe** Cylindrical white 3-5cm long.

Spore print white. **Spores;** 10-14µm globose.

Specimen examined On soil, Amrit Dharapani Samudayak Ban Chitwan 200m, 21.07.2002 PN. 22219 TUCH.

Edibility Edible prefered by Chepang excellent.

Previously reported Jugedi, Chitwan (Tullons and Bhandari 1992).

Distribution Nepal.

Amanita vaginata (Bull.: Fr.) Vitt. Roze. Gonn and Rebenti.t.7,-.Rea *Biblo. Mycol*. 92,(1922)

Local name Chate chyay, Tahar shyamo (T)

Cap 5-9cm broad, yellow-brown, viscid, striate margin, without warts, **Gills** white, free; **Stipe** 9-14cm long, grayish white, oval or club shaped basal bulb, volva thick, white, saccate. **Flesh** fragile, crumbly, white. **Spore print** white Spores 9-11µm globoss non – amyloid.

Specimens examined On soil Sundarijal, 1500m, and 07.20.2002. PN. 22225, Champadevi PN .22180, Chitwan PN. 22225, Dhulikhel 22255, Champadevi PN. 23403, Matatirtha PN. 24609, Suryabinayak PN. 24626, Kirtipur PN. 25673 TUCH.

Edibility Edible good.

Previously reported from Manichur, Suryavinayak, Dakshinkali, Kakani, Nagarkot, Bajrayogini, Kathmandu valley (Adhikari, 1976 – 1996a) Sundarijal (Singh and Nisha, 1976c; Pandey, 1976)

Distribution Australia, Europe, North America, Japan, India, China, Nepal.

Amanita Caesarea (Scop.Fr.)Pers. *Flora Cartiolica*. 1772

Local name Suntale chyau, Salle chyau, Phul chyau, Dhar shyamo (T).

Cap 8-20 cm, hemispherical to flat, orange red, washing out to yellow, cuticle separable sometimes with evident membranous remains of white veil, margin striate. **Gills** free, crowded, yellow; **Stipe** 8-15 x 2-3 cm, narrowing at the top, hollow when mature, with yellow falling ring, slightly swollen at the base, with large white membranous vovla. **Flesh** whitish, yellowish beneath cuticle. Without evident odor; **Spore print** white. **Spores**; 8-14 x 5-8.5 µm.White, elliptical, smooth.

Specimen examined On soil Sundarijal 1400m, 21.09.2001.PN.21093, TUCH. In the market of Ason (2003, 2004).

Edibility Edible Excellent.

Previously reported Sold on Ason, Kathmandu market(Adhikari 1976, 1984, 1994, 1996); Tokha (1670m); Kakani (1790m); Kathmandu market (Bhandari 1984; Singh 1966 ; Pandey and Budathoki 2002), Swayambhu and Chautara (Cotter, 1987).

Distribution North Americana, Japan, Europe, India and Nepal.

Amanita hemibapha (Berk. and Broome.) Sacc, *Syllog. Fungo*. (1887)

Local name Salle chyau, Suntale chyau, Phul chyau, Dhar shyamo(T)

Cap 50-130mm, cylindric – Campanulate, fuscous – olivaceous, innately streaked, glabrous, Gills crowded, pale yellow; **Stipe** cylindrical white with some black dots that is not smooth 10-18cm long, 0.6-1.cmm wide, annulate, sheathing volva. **Spore print** white. **Spore**

8-12 x 5-8µm, white, elliptical smooth.

Specimens examined On soil, under the shade of Pinus forest, Sundarijal, 1425m, 07.03.2003. PN. 23366, TUCH.

Edibility Edible good.

Previously reported From Katmandu market (Adhikari, 1996b; Adhikari *et al.* 1996).

Distribution Java, Borneo, Singapore, Malaysia, Japan, India and Nepal

Coprinaceae: The members are bell shaped, cap movable, gills free, gill deliquesces leaving inky fluid. Spore print black. Gills becomes black upon maturity. Side of the lamellae parallel or subparallel. This family have only one genus *Coprinus.*

Key to species

Cap narrowly conical, white with light reddish brown recurved scales……..…….*C.comatus*

Cap gray-brown, scaly just over the center, usually in grass…….....….*C.atramentarius*

Cap reddish brown, covered over center with glistering particles…….....….*C.micaceus*

Cap brownish black, stipe long, whole fruiting very delicate but spore large…….....*C.lagopus*

Coprinus comatus (Müll: Fr.) Pers. Cke.Illus 644, t.658. , -Rea, *Biblo. Mycol*. 499. (1922)

Local name Gobre chyau, Koper shyamo, Mang shyamo, Chyapu shyamo, Chyapi shyamo (T).

Cap narrowly cylindric, expanding to bell-shaped cap, 5-10cm long with may flatten scales, dry; white to pale brown. **Gills** notched, crowded, almost free, white then pink then black to black becoming inky in age (dissolved from margin until almost entire cap is gone). **Stipe** 8-20cm long, dry, white, smooth, inferior ring which easily movable. **Spore print** Blakish .**Spores** 13-14 x 7-9 µm, elliptical.

Specimens examined On the gravel soil Battisputali 1290m, 24.07.2001 PN 21029.On the gravel soil, Sundarijal, 1400m, 09.21.2001 PN 21185, TUCH.

Edibility Edible in young stage. Dried powder of this species is given to the child with rice or milk to induce good sleep.

Previously reported from Chima gaun (Balfour- Browne, 1998), Godavari (Singh and Nisha, 1976c), Khumal (Pandey, 1976), Manichaur, Godavari and Phulchowki (Adhikari, 1976, 1987) and Lumle (Devkota *et al.*, 2005).

Distribution Worldwide.

Schizophyllaceae: Fruiting body (pileus) confluent with the eccentric or lateral, stem dimidiate or sessile or resupinate. It is not membraneous nor tough and woody.

Spores white, gills edge longitudinally split ……...*Schizophyllum.*

Schizophyllum commune Fr. : Fr. Grev. *Scot. Crypt*. Fl.t.61. –Lind, *Am. Jour.Bot*. 20:555(1933).-Rea *Biblo.Mycol*. 452.(1922).-Saccardo, *Syllog. Fung*. 655, (1897).

Local name Mizu cyau, Kathe bagale chyau.Pankha chyau.

Carpophore Gregarious, 1-3cm broad, fan shaped, dry, gray, hairy,whitish gary when dry to brownish gray when moist.,margin lobed and hairy; **Gills** fuscous grey then purplish or whitish well separated; **Stipe** absent.,**Flesh** tough leathery ,gray.**Spore print** white.,**Spore** 3-4 x 1-1.5 µm

Specimen examined;On the logs, stumps and sticks of *Alnus nepalensis*. Sundarijal, 1440m, 09.21.2001. PN. 21088, Sundhara (Kath) PN 21026, Swayambhu PN 22164, Champadevi PN 22184, Bishalnagar (Kath) PN 22200, Namobudha (Kavre) PN 22285, Nagarkot PN 25641 TUCH.

Edibility Edible. It is used to eat mixing with other things eg cereals. Mostly used by the Newars during their marriage ceremony as sagun (better happening).

Previously reported In growing on decayed wood, Ranipauwa, Kaligandaki (Balfour-Browne, 1968); Bagarchhap (Bhandary, 1991); Pokhara (Adhikari, 1996a; Adhikari *et al.,* 1996) and Lumle (Devkota *et al.*, 2005).

Distribution Worldwide.

Tricholomataceae :-It is a Very large family.The members bears white spores with attached gills.

Key to genera

They are found on root and dead stump, serious parasite on hard wood and conifer……..*Armillaria*

They are found on grass or leaves. They are small, rather tough mushrooms with thin stalks The entire fruiting body will revive and regain fresh appearance when placed in water...…….*Marasmius*

They have thick, fleshy, pink to violet, adnate to short decurrent gills extending down ward ……..……*Laccaria*

They have attached oradnexed (notched) but never decurrent gills,flat or covex cap, flesh quite thin, fruiting body not revive when moistened, spore smooth .....*Collybia*

Key to species

Cap brown or pinkish brown, gills thick,well separated, pink…….....…….*L.laccata*

Cap dull white to purple, gills purple fruiting body dep violet overall …….....…….*L. amethystine*

Cap brown or pinkish brown, gills swollen and widely spaced, stipe deeply furrowed and blunt lower end…….....…….*L.proxima*

Armillaria mellea (Vahl.) Fr.Grev. Scot.*Crypto. Fl* t.332. -Rea, *Britih basidiomycetes* 108. (1922)

Local name Todke chyau

Cap 3-6cm broad convex yellow ; **flesh** thin, white, with brown to rusty brown discoloration in age.**Gills** adnate to extending partially down stalk in age, fairly well separated, brown, white to dingy cream color with rusty brown to pinkish brown stains in age; **Stipe** 4-15 cm long, 6-20 mm thick, nearly equal, enlarging slowly toward apex, dry, white with downy flattened hairs above ring; **veil** cottony, with clusters of hairs, white to buff or mustard – yellow often has a viscid margin; **Spores** 7-9 x 5-6 µm, ellipsoid-ovoid, colourless.

Specimen examined On wood in clusters, Godavari, 1500m,13.06.2004,. PN. 24515, TUCH

Edibility Edible good.

Previously reported Host not mentioned, Lele (Pandey, 1976); Arun valley (Balfour- Browne, 1968); Phulchowki (Singh and Nisha, 1976c);Kutungsang and Kolopani (Cotter, 1987) and growing on decayed log moist shady place in afforested area of pine (exotic), Kakani (1780m) (Adhikari et al., 1996).

Distribution Worldwide

Laccaria amethystina (Vaill) Berk. and Br.622, (1889)- Rea, *Britih basidiomycetes* 290,. (1922)

Local name Budhi chyau, Jhari chyau, Kukhure chyau, Chin mmhukan.

Cap dark violet color, 1.5-8 cm broad, initially convex and fairly umbilicate then expanded, depressed, margin thin, somewhat irregular when mature, **Gills** distant, violet adnexed-decurrent, **Stipe** 4-10 long 0.4-1 cm thick,dry smooth, cylindrical in young then compressed fistulate **Spore print** white **Spore** 6.5-9 x 6-7-10µm slightly elliptical and spiny.

Specimen examined Growing on soil. Champadevi, 1600m.13.07.2002. PN 21188, on soil Suryabinayak 1425m. 22.06.2002 PN 22152, on soil Sundarijal , 1475m. 03.07.2003 PN 23385 TUCH.

Edibility Edible fair.

Previously reported On soil, Hetauda (Pandey, 1976) and Suryavinayak(Bhandary, 1980) ; in *Pinus* forest, Kakani (1980m); Brajayogini (1680m) ; in mixed forest Suryavinyak (1540m) ; Matatirtha (1620m) and Sundarijal (1780m) (Adhikari and Adhikari, 1997).

Distribution Europe, North America, Japan and Nepal.

Laccaria laccata (Scop.: Fr.) Cooke –Saccardo, *Syllog. Fung* **14**: 8, (1899) -Berk. and Br.622, (1889)- Rea, *Britih basidiomycetes* 290,. (1922).- Singer, *The agaricales in Modern Taxonomy*, 233.(1986). –Imazeki *et al.,Fungi of Japan,*61,(1988).

Local name Budhi Chyau, Jhari Chyau, Kukhure Chyau, Chin mmhukan.

Cap pinkish brown, 2-8cm broad, convex, smooth, without hairs; flesh pinkish orange; **Gills** well separated; **stalk** 2-8cm long 4-8 mm thick nearly equal, dry, colored like cap, smooth.

Spore print white **Spore** 7.5-10 *7-8.5 µm broadly elliptical to almost round ,minutely spiny

Specimen examined On soil in moist place. Sundarijal, 1450m. 21.09.2001 PN 21090, 1500m. 03.07.2003 PN 23361, 1450m. 25.09.2001 PN 21101, Pulchowki, 21058m. 15.09.2001 PN 21058, Matatirtha 1425m, 28.09.2003 PN 23468, Dakchinkali, 1450m. 23.08.2005 PN. 25683, TUCH . Also found in the market of Dakchinkali and Sundarijal.

Edibility Edible fair, sold in the local market.

Previously reported From Arun valley (Balfour-Browne, 1968); Bajrabarahi, Nagarjoon (Pandey, 1976); Godavari (Singh and Nishsa, 1966c); growing in moist shady place in *Pinus* forest, Kakani (1760m); Tokha (1680m); Bajrayogini (1600m); Lele (1600m); Nagarkot (1680m); in mixed forest, Sundarijal (1700m); Suryavinayak(1540); Matatirtha (1620m) and Pokhara (980m) (Adhikari *et al.* 1996).On soil in moist place. Syaniswara, Lumle (Devkota, S 2003).

Distribution Worldwide.

Oudemansiella radicata (Rehl.: Fr.) Singer [=Collybia radicata]-Kummer, *Fuhr. Pilzk* ;26.(1871)

Local name Kagkhutte chyau, Tang shyamo(T).

Cap 3-15 cm, olive brown, brownish gray, first campanulate then expanded, slimy in wet weather and smooth when dry. **Flesh** has no specific smell or taste**. Gills** white, sub decurrent,broad and distant .**Stipe** 10 -20 cm long and 5-10 mm thick , characteristic feature is the presence of long rooting appendage. **Spore print** white **Spores** 12-16 x 9-11 µm broadly ellipsoid,colourless, smooth.

Specimen examined On soil , Kirtipur, 1320m, 02.07.2003. PN 23359, on soil Suryabinayak, 1425m. 11.09.2004 PN 24617 TUCH.

Edibility Edible good, as vegetable as well as roasted on fire.

Previously reported From Manichaur, Godavari, Lele, Matatirtha, Sundarijal, Kakani, Nagarkot, Suryavinayak (1520m); Lele (1600m); Kakani (1780m) (Adhikari, 1976 and pers. Obs.), Nagarjoon, Chautara, Pathibhanjyang and Ghorepani (Cotter, 1987) and Maipokhari (Adhikari, 2000e). Common species.

Distribution Worldwide

Pleurotaceae: The member grows on wood (except *Pleurotus erynghi*). Stipe is rudimentary or absent, lateral or eccentric, fruit body not umbrella like,dorsally flattened, variable in color white, violet grey or yellowish. Gills are thick.Spores are white or offwhite.

Key to genus

Pileus and lamellae yellow, simple spore3-4x3µm…….....*Lentinellus*

Pileus creamy white to pale, spore 6x3µm …….....…….....*Pleurotus*

Lentinellus ursinus (Fr.: Fr) Kuhner –Millar, *Mushroom of North America* 96. (1984). Imazeki *et al. Fungi of Japan* 30.(1988).

Local name Pahelo chyau

Carpophore 3-6cm long, non stipitahe, pure yellow and crowded; **cap** up to 5.5cm across, convex to nearly flat, flesh pure yellow, smooth; **Gills** up to 4.5cm long, Coarsly toothed, pure pale yellow. Species of *Lentinellus* are usually pleurctoid and genereally lignicolus, flesh pure yellow colourdonot change after drying.**Spore print** cream **Spores** 3-4 x 3µm almost round very minute spines, amyloid

Specimens examined On Populus tree Kirtipur 1320m 13.06.2002 PN 22140, on Populus tree Kirtipur 17.07.2003 PN 22209, on tree Chitwan 200m, 21.07.2002 PN 22214.

Edibility Edible, delicious, mostly preferred by local people

Previously reported On tree stump, Lele, Kathmandu Valley (Kharel, 1999).

Distribution Europe, Japan, North America and Nepal.

Pleurotus cornucopiae (Paul) Rooland - Wakefidd and Dennis. *Common British Fungi* 163. (1981).- Saccardo, *Syllog. Fung*. 348.(1897) - Krieger, *The Musroom Handbook* 530.(1983).

Pleurotaceae

Local name Kanney chyau,

Carpophore 5-10 cm in diameter, growing in large clusters on the trunks or stumps of various trees (deciduous) and shrubs,clusters of caps situated on above the other,they are off white in colour and becomes paler with age. **Flesh** has a mild taste .Older fruit bodies are rather tough **Gills**; white, lateral **Stipe** 2-5 cm long, central or eccentric, short or long (2-5 cm) .**Spore print** brownish or lilac. **Spores** 7.5-8.5 x 3-3.5 µm subcylindrical, colourless, smooth.

Specimens examined On trunk of *Populus*, Sundarijal, 1560m, 09.28.2001. PN 21116, Tistung Palung 1820m, 17.04.2007 PN 24569, Chitwan PN22234.

Edibility Edible

Previously reported Sold at Kathmandu market (Adhikai, 1996 a; Adhikari and Adhikari, 1997; Adhikari *et al.*, 1996). Sold in perungo mixed with P. *pulmonarius* (Fr.) Quel. and *Lentinellus* sp.
Distribution Europe, N. America, Australia, Japan, India and Nepal

Aphyllophoromycetideae: This order includes fungi of various shapes and with hymenia formed of pleats, spines, tubes, alveoli, scales and which can be smooth, etc

Cantharellaceae: Hymenium inseparable from the pileus, spread over the surface of narrow, obtuse gills or folds or quite smooth. Spore white orocharaceous.
Receptacle fleshy, stipitate, gills forked, spores white…….....…….*Cantharellus*

Cantharellus cibarius (Fr.: Fr.) Fr. L.: Fries *Syst. Mycol.* 1: 318. (1821)
Local name Kukhura ko phul chyau, Besare chyau, Ura shyamo.
Cap Egg-yellow cap funnel shaped; margin inrolled, then wavy and irregular; smooth, fleshy. Undersurface bears a series of irregular, blunt **gill** like wrinkles and folds, decurrent, orange in colour. **Stipe;** 2.0-8.0cm long somewhat smaller at base, dry, solid colour as cap. **Flesh** thick, fragrance of apricots when fresh. **Spore print** cream. **Spore 8**-10 x 5-6µm, elliptical.
Specimens examined: On soil gregarious, in *Pinus roxburghii* forest, Sundarijal, 1550m, 07.03.2003. PN 23386, Surybinayak, Chitwan PN 23338 TUCH.
Edibility Edible excellent. Best delicious edible species. (Geoffery Kibby 1979).
Previously reported from Bajrayogini (Adhikari, 1976); Manang (Bhandary, 1991); Sundarijal and Kathmandu market (Adhikari and Adhikari, 1997; Adhikari *et al.* 1996b); Lumle (Devkota *et al.*, 2005).
Distribution Worldwide.

Cantharellus subcibarius Corner- Liou, S.C.: *Trans. Mycol. Soc*. ROC.1:2,(1985)
Local name Pahelo mashino chyau, Ura shyamu (T).
Cap 2-4 cm, egg-yellow, funnel shaped, **Flesh** very thin dull yellowish.**Gills** blunts orange, small in size. **Spore print** white **Spores 8**-10 x 6-8µm, elliptical, thin walled.
Specimen examined On soil, gregarious. Suryabinak, 1450m, 17.08.2003. PN 22313, Surybinayak PN 24629, on soil gregarious Matatirtha 1430, 15.08.2004 PN 24606, Nuwakot Tigaun PN 23423 TUCH.
Edibility Edible good.

Previously reported On soil under Castanopsis indica tree, Godavary (Adhikari, 1988 b)
Distribution Nepal and New Guinea.

Cantharellus tubiformis Fr. Bull: Fries *Syst. Mycol.* 1:319 (1821).Syn-*C.lutencens* Fr. *Epir. Syst.mycol* (Upsaliae): 366 (1836).
Local name Budhi chyau
Cap 2-6 cm wide, irregulary deeply funnel shaped.convex, yellow –brown with raised small brown scales. F**lesh** very thin dull yellowish; **Gills** blunt, grey or yellowish gray.they are running down the stipe like wrinkles. **Stipe** 3-5 cm long, 3 to 6 mm thick yellowish grey, the full body is hollow (down to the stipe base).**Spore print** white. **Spore 9**-10 x 5-8µm, broadly ovoid to subglobose, smooth, colourless thin wall.
Specimens examined: On soil, in *Pinus roxburghii* forest, Sundarijal, 1651m, 07.03.2003. PN 23371, TUCH.
Edibility Edible fair
Previously reported From Sundarijal (Adhikari, 1996a, Adhikari *et al.* 1996).
Distribution Europe, N. America, Japan and Nepal

Hydnaceae: Spines, granules or warts under the cap. Flesh not gelatinous, receptacle fleshy, coracious or waxy.

Key to genus
Receptacle simple, stipitate, sessile or dimidiate, fleshy, coriaceous or corky. Spines subulate. Spores white or colored ……*Hydnum*
Hydnum repandum (Linn) Fr-Fries, *Epicr, Syst .Mycol*. 506,(1836-1838)- Linneaus, *Sp.plant*.2:1178.-Rea. *Biblo. Myol.* 630, (1922)
Local name Daatey chyau, Chwali shyamo, Ura shyamo. (T)
Carpophore 5-10cm, fragile, convex, often irregular, Variable in color pale buff to rusty brown.Teeth whitish to cream coloured. **Gills** replaced by short, pendant spines or pegs called teeth. **Flesh** thick, white, with a pleasant smell. **Spore** 7-8 x 6-7µm white slightly elliptic.or subglobose.
Specimen examined On wood. Nagarjun, 1500m. 09.08.2003. PN 23445, TUCH
Edibility Edible good, mostly collected by Tamang ethnic cast. Sometimes eaten raw

Previously reported In *pinus roxburghii* forest, on soil, Damak, Kakani (Pandey, 1976), Kathmandu; Manichur (Adhikari, 1976); Suryavinayak (Singh andNisha, 1976c); market (Adhikari, 1987) and Tokha (Adhikari, 1996a; Adhikari and Adhikari, 1997; Adhikari *et al.,* 1996).

Distribution Worldwide (Europe, N. America, Japan and Nepal)

Hericinum erinaceus (Bull. :Fr.)Pers –Corn. *Fung. clav*.159, (1979). Syn-*Hydnum erinaceus* Bull.*Herb,* 34.(1791).Sacc. *Syllog.Fung*.**12,** 20 (1872).

Local name Thokre chyau, Thakre chyau

Basidiocarps 10-25cm broad, fleshy, white and large, many branches with delicate long 5-8cm, white teeth and hang downward(spines arising independently,unbranched), attached to wood by a stout, thick stalk.**Stipe** 2x4.2 cm thick pure white when fresh.**Spore mass** whitish. **Spore** 6-7µm, white globose,amyloid.

Specimens examined On log of *Alnus nepalensis* Sundarijal, 1550m, 07.03.2003. PN 23387**,** TUCH. Sold on Perungo in Baneshwor (Kath 2004).

Edibility Edible fair

Previously reported From Sauwala Khola and Chima gaun (Balfour- Browne, 1968); Phulchowki (Singh and Nisha, 1976, 1987, 1996a; Adhikari and Adhikari, 1997; Adhikari *et al.,* 1996) and Lumle (Devkota *et al.*, 2005).

Distribution Worldwide.

Polyporaceae; Members of this family are called polypores because of the porous nature of the hymenium in most of species.The fruiting body may be of various shape and size. They are soft, leathery, corky or woody, dimidiate or hoof shaped.They are generally wood inhabiting and grow either on trees or timber, some may be soil inhabiting.The wood inhabiting polypores cause serious decay in wood and so are generally called "Wood rotting fungi"

Key to genera

1. Spores ovate to cylindric- ovate with the wall not uniformly thick, apex always thicker, truncate or rounded …… ……..…….*Ganoderma*
2. Pores hexagonal, sporophore sessile……..…….……..*Hexagonia*
3. Pores circular to angular
    a. Pore tubes sunk into an even depth into context forming a distinct stratum, their bases forming an unbroken straight line…….……..…….…… ……*Polyporus*

b. Pore tubes sunk to unequel depth into context not forming a distinct stratum, their bases do not form a straight line……..…….……..*Trametes*

c. Sporephore pileate or sessile, pore tube isolated, free from each other, spores colored ……..……..……*Fistulina.*

Ganoderma applanatum (Pers.) Pat, Rea, *Biblo. Mycol*. 597,(1922).

Local name Kathey chyau

Carpophore 10-40cm, flat bracket shaped, rarely hoof shaped, sessile, first white, when matured reddish brown. The fruit body margin is white at first, then grayish to brown, rounded. **Tubes** are white or whitish, 8-25mm long; the pores are minute, rapidly staining brown where handled. The **flesh** is relatively soft but firm, light cinnamon brown, fibrose-tomentose when cut. **Spore mass** cream colour. **Spores** 7-9 x 5.5-6.5µm, oval almond shape, reticulates.

Specimen examined On Maitidevi 1275m, 21.06.2002 PN 22141**,** on Maitidevi 1275m**,** 10.01.2003 PN 23485**,** on rotten tree, Matatirtha, 1450m, 29.09.2003. PN 23479, Kirtipur PN 25644, Langtang Lama Hotel PN 25650 TUCH.

Edibility Inedible but used in medicine.

Previously reported On rotten tree, Dharan (Balfour-Browne 1968);on rotten tree trunk, Bakhri Kharka (North of Pokhara) Taglung (Kali gandaki) (Balfour -Browne 1968); Hetauda(Pandey 1976); on *Quercus* sp Daman (Singh 1976); on stump, Pulchowki (Lalitpur dist.) (Singh and Nisha 1976c); on tree trunk, Namrung (Gorkha dist.) (2460m) (Adhikari, 1988a) and wood of Betula *utilis,* Nilgatti Odar (Bajhang Dist.) (3500m) (Adhikari 1988a). In tropical to temperate belts (Adhikari 1996a)

Distribution Worldwide.

Ganoderma lucidium (Fr.) Karst. Grev *.Scot .Crypt*. *Fl.* t.245, -Rea *Biblo. Mycol.*597, (1922).

Local name Kathey chyau, Dadu chyau, Dhi shymu (T)

Carphopore 5-28cm, **cap** circular or kidney shaped, covered with a shiny crust. In comparision to *Ganoderma appalanatum*; *G.lucidium* has an intensely shiny cap, as if varnished and it has a long Stipe. **Spore mass** cream colour. **Spores 8** x 5 - 6.5µm, oval almond shape.

Specimen examined On rotten trunk, Nagarjun, 1550m, 09.08.2003. PN 23432 TUCH.

Edibility Medicinal, to remove evil spirit, for used in decorative purpose.

Previously reported From, Kenja Likhu khola (Ryv, 1979); on rotten trunk, Bakhri Kharka (north of Pokhara) (Balfour-Browne, 1968); on tree trunk, Lele (Kathmandu valley) (Singh and Nisha, 1976c)

and on trunk of *Rhododendron arboreum* and *Quercus,* Manichaur (Adhikari, 1988); on stump, between Seti Khola Bagar and Agra gaun (Bajhang Dist.) (1700m) (Adhikari, 1988); in root crevices of stump, Phulchowki (1800m); on tree stump (Thapa, 1990); Suryavinayak (1540m) (Adhikari *et al.,* 1996) and very common in *Dalbergia sissoo* and *Acatia catechu* plantations of Terai belts (Hetauda, Chitawan, Bara, Parsa, Rautahat, Siraha, Saptari, Dhanusha, Mahottari, Udayapur, Rajbiraj etc. (Between 70 and 500m). Found infecting mango plantations have been recorded. Wide spread in tropical to temperate belts (Adhikari, 1996a; Parajuli *et al.,* 1999ab).On *Quercus semecarpifolia* trunk Thulakharka, Lumle, (Devkota, S).

Distribution: Worldwide.

Grifola frondosa (Dicks. : Fr.) S.F. Gray- ,1821 *Nat. Arr British Plants* 1:643 Overholts, *The poly poraceae of united state, Alaska and Canada*,246 (1967)- Wakefield and Dennis, *Common British Fungi* 167 (1981).Syn- *Polyporus frondosus* Dicks; Fries *Epicri syst .Myc*. **1**:355 (1821)

Local name Bhalu chyau, Nangrey chyau, Sulsing marmo, Nagroom, Chyapki,

Carpophore annual, with more branched Stipes, pileus flabelliformis, gregariously imbricate, upper surface grey white, pore surface white. The whole fruit body resembles a fleshy and dark colour cauliflower. It consists of a stout primordial **Stipe** gradually separating into numerous branches ends a round cap. **Flesh** thin coriaceous. **Spore** 8-10 x 2-4µm cylindrical, smooth, colourless, obliquely contracted at base.

Specimens examined Sundarijal, Local tea stalls 1450m, 09.21.2001. PN21098, TUCH

Ediblility Edible and also found selling in local market of Sundarijal. highly preferred by Local people.It is also used to relief for muscle pain in Sundarijal.

Previously reported From, Pokhara market (Bhandary, 1980) on *Quercus glauca* tree, Manichaur (Kutung Sang) (Adhikari, 1988) and sold in the market, Sundarijal (1780m) Kathmandu. On *Quercus semecarpifolia* trunk. Thulakharka, Lumle (Devkota s 2003)

Distribution N. America, Australia, Japan, Europe, India and Nepal.

Polyporous arcularis Batsch.Fr.-Fries, *Epicr. Syst. Myco*.440.(1836-1838). –Rea,-*Biblo .Mycol*.577.(1922).-Bakshi, *Indian Poly*. 117, (1971)

Local name Soli chyau

Carpophore 2-5cm in diameter, Solitary or gregarious, small, centrally stipitate, soft when fresh, infundibulifom, upper surface biscuit coloured, concentrically furrowed, small brown scales, a row of hairs on the margin.**Flesh** thin ,white , tough.**Pores** large 1-2 mm wide white , extend downward

.**Stipe** 2-6 cm long,2-4 mm broad ,central ,dry hairless,yellow to dark brown. **Spore prints** White. **Spore** 7-11 x 2-3 µm cylindrical, smooth.

Specimens examined On soil.Godawari 1400m, 07.07.2001 PN 21013, Sundarijal, 1425m, 09.28.2001. PN 21099, Langtan Ghodatabela 2690m. 15.08.2003 PN 23457.

Edibility Edible

Previously reported Sold at Kathmandu market (Adhikari, 1996a; Adhikari and Adhikari, 1997; Adhikari *et al.,* 1996).Sold in perungo mixed with *P.pulmonarius* (Fr.) Quel. And L*entinellus* sp.

Distribution Europe, Japan, China, N. America, India and Nepal.

Laetiporus sulphureus *(*Bull. ex Fr.) Murrill, Syn *Polyporus sulphureus* Bull: Fries *Syst. Mycol*.1:357(1821).- Torrey, *Bot. Club Bull.* 31:607,(1904). -Rea, Biblo, Mycol, 581,(1922). Saccardo, *Syllog. Fung* .VI 104,**12**(1897).

Local name Sulsing marmo, Wala marmo, Sulsing wala marmo, Rato chyau, Phengi thenga Flash light yellowish, Then white, soft cheesy, often exuding a aulpur yello milk when broken and quite fresh. (T Langtang).

Carpophore 10-40cm wide Sulphur yellow to orange Stipeless in color latterly attached, stout, juicy and fleshy, with wavy margins. The clumps are situated almost horizentaly one above the other. Fruit bodies of individual clumps coalesce to form one whorl;**Flesh** light yellowish, then white, soft, cheesy, often exudating a sulphur yellow milk when broken and quite fresh.**Spore print** is yellowish; **Spores** 5-7 x 3.5-4.5µm broadly ellipsoid, smooth, colourless.

Specimens examined Langtang 3250m. 25.06.06 PN 24541

Edibility Young fruit bodies are edible and excellent.It is used as vegetable, suppose to care cancer in Langtang.

Previously reported On tree in forest, Arun valley (Balfour-Browne, 1968); on tree, Chima goan (Kaligandaki) (Balfour-Browne, 1968); on trunk of Quercus semicarpifolia, Phulchowki (Lalitpur Dist.) (Sing, 1966; Singh and Nisha 1976c); Hetauda (Pandey, 1976); on Q. *semicarpifolia* tree, Manichur (2145m) (Adhikari, 1988); on stump, Shivapuri (2180m) (Adhikari, 1988); on dead tree trunk, Dhotbas (Jumla Dist.) (Balfour-Browne, 1955) on Q. semicarpifolia tree, Naya Odar Dhuli (Bajhang Dist.) (40m) (Adhikari, 1988a) and Kathmandu market (Adhikari, 1996a; Adhikari *et al*., 1996).

Distribution Worldwide.

Pycnoporus cinnabarinus (Jacq. Fr.) Karst., *Epicri.Systs. Mycol*.429, (1836)

Local name Rato kathey chyau, Raktey chyau, Sindurey chyau.

Basidiocarp 3.9 x 1.5-7 x 0.5 – 2.2 cm,sessile to substipulate,dimidiate, hard on dryin annual, zonate, thinning from base to pheripheryupper surface reddish to almost blackish red at maturity.**Himenial surface** waxy,deep red.**Pores** irregular ,angular to somewhat daedaloid 2-4 per mm.**Spore print** Orange. **Spores** 5.3-7 x 3.5-3.9 µm hyaline, ablong or short cylindric, smooth, and apiculate.

Specimen examined On dead wood of *Alnus nepalensis.* Sundarijal, 1500m, 09.28.2001. PN 21110, Chitwan 200m. 21.07.2002 PN 22210, Ranipauwa 1600m. 17.07.2003 PN 23420, Langtang 2200m. 25.06.2004 PN 24543 TUCH.

Distribution Worldwide.

Edibility Inedible, medicinally used for relief from ear problem.

Previously reported On dead wood, place not mentioned (Berkeley, 1984); Khand Bari (Pandey, 1976); on *Betula* sp., Chheti gaon, Darchula Dist. (Adhikari *et al.,* 1996); Pokhara (900m) (Adhikari, 1996) and Lamjung (Adhikari and Adhikari, 2003). On bark of stump of *Alnus nepalensis.* Jhakrey, Lumle, (Devkota, S.2003).

Distribution Worldwide.

Coriolus hirsutus (Fr.) Quel CM-151 *Ferm* 2711,(1974)

Local name Rau bhako chyau

Basidiocarp annual, imbricate, fan shaped, coriaceous, upper surface yellowish, coarsely hirsute, concentrically Zonate; hymenial surface white. Pores white or cream colour, small. **Spore print** white. **Spores** 6-8 x 2-3µm elliptical long.

Specimens examined On stump Dhulikhel 1350m, 29.07.2001 PN 21031, on stump Pulchowki 1600m,15.09.2001 PN 21071, on stump Kirtipur 1320m, 30.05.2001 PN 21137, on decayed log Langtang, Thulo Barku 2030m, 04.06.2005 PN 25645, on decayed log Langtang Lama Hotel 3000m, 07.06.2005 PN 25656. Growing on dead stump of *Schima wallichi*, Sundarijal, 1310m, 05.27.2002 PN 21137, TUCH.

Edibility Inedible But use in medicinal purpose. But in Lantang area young specimen were used for culinary purpose for making pickle.

Previously reported From Thodung, Khumbu, Chialsa, Gompa, and Likhu Khola (Ryverden, 1979); Dhankuta (Balfour – Browne, 1968); Kakani (Pandey, 1976); Baitadi (Adhikari, 1988) and Pokhara (Maharjan and Budhathoki, 2003).

Distribution: Worldwide.

Trametes versicolor (L. : Fr.) Llyod [= *Coriolus versicolor* (Fr.) Pilat; *Polyporus versicolor* L. : Fr., *Polystictusl versicolor* (Fr.) Cooke; *Polyporus pictilis* Berk]

Local name Kathey chyau, Mudhey chyau, Rekhey chyau.

Carpophore 3-8cm wide, flattened or slightly depressed at the attachment, thin, in superpose brackets or joint together to form a roselike structure, sessile, smooth or velvety, with variously colored zonation; **Spore print** white; **Spores** 4.5-8 x 1.5-3µm white cylindrical smooth.

Specimen examined On stump, Sundarijal 1400m. 21.09.2001 PN 21094, on stump, Chandagiri 1500m.01.10.2001 PN 21127, on stump Chitwan , 240m. 30.06.2003 PN 23342, Langtang Barbal, 2300m. 04.06.2005 PN 25647 TUCH.

Edibility In edible because of texture, medicinally used to stop bleeding in cuts.

Previously reported on wood, Nangki (Berkeley, 1854); Hatier (Arun valley),Sanghu and Mewa Khola (Balfour-Browne,1968); Jiri, Chialsa, Thodung, Junbesi and Khumbu (Ryu.,1979);on dead birch, place not mentioned (Berkeley,1854); on tree stump, Dhulikhel (Singh and Nisha,1976c); Ranipauwa and Lete (Kaligandaki), Bakhri Kharka (Pokhara) (Balfour-Browne,1968); on stump, Manichur (2160m) (Adhikari,1988a); on dead tree stump, Hurikot, Jumla Dist. (Balfour-Browne,1955); on stump, Shree Bhabar Lekha, Bajhang Dist. (2400m) (Adhikari,1988a) Lamjung (Adhikari and Adhikari, 2003) In tropical to temperate belts (Adhikari, 1966a) On dead trunk of *Alnus nepalensis.* Gobaney, Lumle, (Devkota, S.2004).

Distribution Worldwide.

Ramariacae: Fruiting body erect, dendroid, coralloid, branched never pileate, hymenium more or less amphigenous.

Key to genus:

This fungus look like a tiny bush with tightly packed, vertical forked branches ……..*Ramaria*

Ramaria botrytis (Pers. : Fr.) Ricken –Svrek,*The Hamlyn Book of Mushroom and Fungi,* 219. (1975). – Corner, *Supplement to a monograph of Clavaria and allied Genera*, 265, (1970)

Local name Thokre Chyau, Kawali Chyau.

Carpophore 15cm high and 20cm wide bush shaped, cauliflower like robust with thick numerous branches arising from a large fleshy base, whitist to tan. Branches tips are occasionly red or puple.**Flesh** somewhat brittle, white, odour pleasant. **Stipe** stout, narrowing at base white, pale yellow

when mature.**Spore prints** Orange brown. **Spores** 12-30 x 4-6 µm smooth with line; longitudinal striations. The thick trunk gives it its characteristics cauliflower appearance

Specimen examined On soil Sundarijal 1450m. 28.09.2001 PN 21120, on soil Godawari 1500m. 31.07.2002 PN 22293.

Edibility Edible good.

Previously reported On Rigmo (Balfour–Browne, 1968); Kakani (Pandey, 1976), Pisang (Bhandary, 1991) and Kathmandu market (Adhikari, 1996a; Adhikari and Adhikari, 1997; Adhikari *et al.,* 1996). On ground on the base of *Aurandaria* sp. Dakshinkali, Lalitpur, (Devkota S.2004).

Distribution Europe, N. and S. America, Australia, Japan, India and Nepal.

C.Gasteromycetideae: Differing from the precedent group, the hymenium of these species is protected or enclosed inside fruiting-bodies. This group includes "puffballs" (*Lycoperdon, Calvatia*). They can be hypogeous or epigeous.

Lycoperdaceae: Fruiting body superficial globose, peridium two or many layeres, dehiscing by an apical aperture. Inner mass called gleba with fine threads called capillitium. Sometimes a columella present. Exoperidium contains a pseudoparenchymatous layer.

Key to genus

Capillitium threads attached to the peridum in the columella, not consisting of a distinct stem or branches ……..…….....*Lycoperdon*

Lycoperdon mammiformе Pers. Pers.- Saccardo, *syllg. Fung,* 7:106 (1888).- Rolland, *Champ*.t.log, no.247.

Local name Nasalu chyau

Carpophore 2cm high, 2.5 broad white ,finally greyish yellow,subglobus,attached by a white cord like mycelium at the base ,slightly scaly.**Pore** small single apical.**Spore mass** yellowish brown. **Spore** 5 µm in diameter globus, echinulate verrucose.Capillitium **3**-5 µm in diameter, yellow **olive**, wall darker.

Specimen examined On soil, Langtang Gumna chowk 2850m. 06.06.2005 PN 25652 TUCH.

Edibility Inedible but use in hallucinogenic purpose,at Langtang Gumna chowk, with cigarette or bedii (tobacco wrapped in a leaf)

Previously reported Kyanging, Langtang National Park area (Central Nepal) (Adhikari, 1988).

Distriution North America, China, Europe and Nepal.

Lycoperdon perlatum Pers Syn *L.gemmatum* Batsch.- Saccardo, *Syllg. Fung.* 7:106 (1888) Rolland, *Champ*.t.log, no.247.

Local name Phusphuse chyau (Nep), Nagala phum shyamo (T)

Carpophore 2cm high, 2.5 broad white ,finally greyish yellowclub separate, covered at top with 1-2mm conical spines surrounded by warts glaba at first white later ochre brown; **Spores** 3.5-4.5µm yellowish brown, globose **Specimen examined** On soil Langtang, Thulosyabru 2130m. 16.08.2003 PN 23462.

Edibility Young specimen edible.

Previously reported On soil Kyanging, Langtang (Adhikari 1988); and between Kandhe and Seti khola bagar, Bajhang district (2420m) (Adhikari 1996) Lohar (Bhandary, 1991).

Distribution China, Europe, India, Japan, North America, Tasmania, Africa, Australia and Nepal.

Lycoperdon pyriforme Schaeff. : Pers. Grev. *Scot. Crypt*. Fl, t 304

Local name Phusphuse chyau (Nep), Nagala phum shyamo (T)

Carpophore Densely gregarious, 2-3cm high, pear shaped, outer skin smooth, attached to the substratum by long white, mycelial strands. **Stipe** often has mycelial cords at base penetrating the wood. **Spore mass** white then greenish yellow. **Spore** spherical 4µm, very finely warty.

Specimen examined On buried wood, under the shade of *Alnus nepalensis*. Sundarijal, 1425m, 09.28.2001. PN. 21119, Kyangin, Langtang PN 23453, Phulchowki PN 21084, Godawari PN 24521.

Edibility Inedible medicinally used to cure wounds. Its Spores also used for hallucinogenic purposes in cigeratte in different sites of study area.

Previously reported From Sulighadh (West Nepal) (Balfour –Browne, 1968); Thodung, Lamjura and Junebeshi (Kreisel, 1969); Phulchowki and Sundarijal (Singh and Nisha, 1976c) ; Kakani (Pandey, 1976); Kaligad, Surmasarowa Lekh, Dhuli, Simen, Langtang valley (Kreisel, 1976); between Syabru besi; Langtang National Park (Adhikari, 1996b); Kakani and Pokhara (Adhikari, 1996 and Adhikari *et al.,* 1996) and Lumle (Devkota *et al.*, 2005).

Distribution Europe, Japan, North America, Australia, Africa, India and Nepal

Sclerodermatace: Fruting body subterranean or superficial. It is globose sometimes prolonged into a stem like base. Gleba traversed by sterile veins. Capillitium rudimentary. Peridium simple, rarely double.

Key to genus

Superficial peridium leathery or corky, one or two layers, sharply separated from the gleba …….....*Scleroderma*

Key to species

Fruit body without pseudostipe,it is small 1-2cm. Spores 6-10µm, echinulate……...*S. polyrhizum*

Fruit body without pseudostipe,it is large, more than 3cm, spores reticulate……....*S. citrinum*

Fruit body without pseudostipe,it is large, more than 3cm, spores spiny……..*S. cepa*

Fruit body with pseudostipe,spore large and verrucose…….*S. verrucosum*

Scleroderma polyrhizum: J. F. Gmel. : Pers – (=S. texense Berk.),Persoon, *Synopsis Methodica Fungorum* 156, (1801).

Local name; Kudaki, Kutaki chyau, paduke chyau, pakamu musa (C)

Fruit body 1-2 cm. Exoperidium yellowish grey to mouse grey, globose to semiglobose, smooth to slightly scaly. **Gleba** purplish brown. **Spore mass** brown, **Spores** 6.25-10µm, echinulate

Specimen examined; On the soils of tropical forest, Chitwon,Tikauli.200m, 09.06.2003. PN. 23337. TUCH

Previously reported; Growing buried or on soil in *shorea robusta* forest, Hetauda, Nepalgunj, Bardia. New to Nepal. Sims, Walting and Jeffries (1995) have treated S. *polyrhizum* and S. *texense* as distinct species.(Adhikari 2000).

Edibility; Edible, used by terai belt people as raw as well as roasted in fire or cooked as vegetable

Distribution – Mainly in tropical Dipterocarp forest. Nepal (East to west: tropical belt of *shorea robusta* forest), Europe, India and Thailand.

Scleroderma citrinum (Pers.:Pers.).- Sims, Walting and Jeffries, *A revised key to the genus Scleroderma, Mycotaxon* LVI.403-420 (1995) [=*S. aurantium* (Pers.)*, S. vulgare* Horneum.:Fr).]

Local name Phus phuse chyau, Dalle chyau, Til chyau, Alu chyau, Pattun chyau, Shankan chyau.

Carpophore Upto 12 cm diameter, subglobose, peridium very thick bright yellow, split into polygonal scales, coarse in texture especially at the top, where it opens out irregularly. Odor and flavor strong and acrid.

Spore mass First white then purplish black; **Spores** 8-13µm, globose with a fine rediculate network on the surface.

Specimens examined On soil under Pinus forests. Sundarijal, 1450m, 09.28.2001 Pandey, N. PN 21124,on soil Nuwakot Tigaun 1100m. 17.07.2003 PN 23412 TUCH.

Edibility Often eaten raw by local people, sometimes cooked it causes gastric disorders or acute indigestion. So not suggested to eat (Geoffrey kibby 1979 not edible, poisoning recored)

Previously reported From Pokhara (Balfour – Browne, 1968); Nagarjoon (Pandey, 1976); Godavary (Singh and Nisha, 1976); Manichur, Sybrubeshi (Adhikari, 1987); Sundarijal, Matatirtha, Pokhara (Adhikari *et al.,* 1996).

Distribution Europe, North and South America, Australia, Japan, India and Nepal.

Scleroderma verrucosum (vaill.) Pers Gerv.*Scot.Crypt*.Fl.t. 48. –Rea, *Biblo.Mycol.* 50 (1922).

Local name Alu chyau, Dalle chyau, Til chyau.

Carpophore 2.5cm high, 3.5cm in diameter, gregarious, globose, cinnamon-coloured, finely warted, cracks irregular. Base with **Stipe** like rooting base which binds together a mass of soil. **Spore mass** Olive brown; **Spores** 10-14µm with spines and ridges.

Specimens examined On soil under Pinus forest. Sundarijal, 1450m, 09.28.2001. PN 21126, Surybinayak 1675m. 11.09.2004 PN 24631, Chandagiri 1800m. 01.10.2001 PN 21129 TUCH.

Edibility Edible fair, only few people use for culinary purpose due to its texture.

Previously recorded From Bajhang; Bajrayogini and Manichur (Adhikari, 1996a)

Distribution Worldwide.

Phragmobasidiomycetes: The basidia have membranous septa orientated transversally or longitudinally. They are of gelatinous or ligneous consistence. They can produce secondary spores from the basidiospores.

Auriculariaceae: Fruiting body brownish reddish, rubbery or gelatinous fungus growing on wood. Basidia transversally septate, cylindrical, straight or curved.

Key to genus

Fruiting body dimidiate, cupshaped, sessile or substipitate, gelatinous, coracious. Hymenium smooth, reticulate or ribbed.Basidia cylindrical, transversally three septate, spores white,cylindrical… ……..……*Auricularia*

Auricularia auricula - judae (Bull.: Fr.) Wettst. [=*Hirneola auricula – judae* (Linn.) Berk .] Berk.*Outl*. *Brit.Fung.* t..18, *Biblo.*-Rea *Mycol*. 727, (1922).

Local name Kane chyau, Musakane chyau, Chipley chyau, Nalele, Naladi, Kukhura ko sir chyau, Narvyang shyamo

Basidiocarps 10 cm in diameter, thin, elastic, gelantionous, concave, more or less ear shaped, smooth, reddish –brown, smooth on the top but often ribbed, dries very tough and hard.. **Spore print** white **Spores** 17-23 x 5-8 µm, sausage shape (cylindrically curved) smooth, colourless.

Specimens examined Growing on dead stumps of *Alnus nepalensis*. Sundarijal, 1400m, 07.03.2003. PN.23372, on stump Lele 1350m,19.07.2001 PN.21023, Lele, PN.21015, Pulchowki PN.21072, Baneshwor PN. 23424, Baneshwor PN. 24506, on stump Chitwan Amrit Dhara Pani 225m 22.07.2002 PN. 22226, TUCH.

Edibility Edible, used to prepare soup.

Previously reported From Manichaur (Adhikari, 1976, 1991c); Kathmandu market (Adhikari, 1987); Kalleitar (Bhandary, 1991) and on stump of *Grevellia robusta,* in front of Narayanhity, Kathmandu (Adhikari, 1996b; Adhikari et al., 1996b); Lumle (Devkota *et al.*, 2005)

Distribution Worldwide.

Auricularia polytricha (Mont.) Pat..(=*Hirneola polytrichia,*Mont.)Jungh.*Fl..Crpt.Jav.Ins*.t.13,-Rea, *Biblo. Mycol*. 728, (1922).

Local name Kane chyau, Musakane chyau, Chipley chyau, Nalele, Naladi, Narvyang shyamo.

Basidiocarps leathery-gelatinous, smooth,groups of cup like structure arise, plicate near the place of attachment, reddish brown, tined with purple, lower surface hairy.

Specimen examined: On tree trunk, gregarious. Suryabinak, 1450m.11.09.2004. PN 24636, on stump Swayambhu 1350m. 24.06.2002 PN 22165,Baneshwor PN 22139, Shivapur PN 23479, Baneshwor PN 24505, on stump Champadevi 1400 m, 13.07.2002 PN 22174, TUCH.

Edibility *Edible* used to prepare soup. **Spore print** white **Spores** 10-14 x 4-5 µm, sausage shaped, smooth.

Previously reported On tree branch, Tamrang khola (Balfour- Browne, 1968).

Distribution Worldwide (China, N. America, Japan, Nepal).

Ascomycotina Ascomycetes are characterised by sac-shape fruiting body of relatively big size (up to 400 micros) which are called “asci”, with spores inside, the “ascospore”. They are called “higher fungi” Their reproductive cells are surrounded by sterile ones, the “paraphyses”, both are part of the hymenium. The most interesting species from a gastronomic and commercial point of view are from the following genera *Morchella, Helvella, Tuber, Terfezia.*

Clavicipitaceae: The family is characterized by a small flask shaped perithecia with light or bright colored wall.Perithecia gregarious, more or less immersed in a common stroma.

Key to genera

1, Stroma stalked, arising from the body of mummified insect or from a fruitification of an elaphomyces. Ascospores breaking up into their individual cell ……*Cordyceps.*

Cordyceps sinensis (Berk.) Sacc., *Michelia* **1**(no.3): 320 (1878). –(Fries) Link,Handbuch. *Zur Erkennung; Gewachse* **3:** 347 (1833).Current name *Ophiocordyceps sinesis*. (Berk.) G.M.Sung, J.M.Sung,Hywel_Jones and Spatafora 2007.web site Index Fungorum.

Local name Yer tsa gumba

Stromata up to 10cm high elongated spherical mainly solitary Stipe yellowish pubescent, solid, gradually enlarging into a fertile cylindrical elongated head. Asco Spores colorless.peritheicia 150-550 x 100-230 µm. **Ascospore** 120-190 x 0.6-1.3µm, liner, filamentous. Obscurely, multiseptate. secondary ascosopore not common on larve of *Hepialus armorianus*.

Specimens examined On insect body Langtang Kyamn 4000m 14.08.2003 PN 23455, on insect body Langtang Kyamn 43000m 09.08.2002 PN 25666 TUCH.

Edibility In edible but use in other purpose –it increases immunity power and stamina; aphrodiasic. The local people of Langtang, Kyangin use this mushroom, making paste drink along with milk. They believe that consumption of this mushroom increase the immunity power to fight against the disease. Hence they never fall sick. The doases for adult is one Yer tsa gumba per a week while for children half per a week. Grinding powder was made and drinks mixing with milk.

Previously reported Chakhure Lekh (Balfour- Browne, 1955); Jumla (Adhikari *et al.,* 1992; Adhikari andDurrieu, 1996) ;(Bull. Dept. Med.Plant, 1992) and Dhauligadh, Jumla (Adhikari)

Distribution Himalaya (China, India and Nepal).

Morchellaceae This family is characterized by its smooth ascospores, without prominent internal oil drops but bearing a number of small external granules on each end of the spore

Key to genus

Hymenium lining numerous hollow broad pits, separated by sterile ridge , hymenophore stalked, club shaped, only separated from the stalk by a shallow furrow…… *Morchella*

Morchella conica. Pers.ex.St Amans, *Flore Agenaise* : 591 (1821)

Local name Guchi chyau, Chora chyau ,Muguding shyamu (T)

Carpophore 4-8 cm high and 4cm wide; **cap** conical, with honey comb like pits and ridges aligned vertically darken are hollow and fragile. Stipe short, stout, tapered, brittle and hollow. **Spore mass** Yellowish **Spores** 20-24 x 12-14µm elliptic yellowish.

Specimens examined On soil in laws Langtang Rimche 2500m 16.08.04 PN 23461

Edibility Edible excellent It has nice flavor, hence mixed 2 or 3 fruiting body in other vegetable. Paste is also use to care wounds.

Previously reported Nagarjun hills (Singh and Nisha, 1976c); Manichur (Adhikari, 1991) and Jumla (Adhikari and Durrieu, 1996; Adhikari and Pokharel, 1999).

Distribution Europe, Japan, China, India, Nepal and America.

Morchella esculenta pres.ex. St. Amans *Flore Ageraise*: 591(1821)

Local name Khoya chyau, Guchi chyau, Chora chyau. ,Muguding shyamu (T)

Carpophore Distinguished into Cap and Stipe; **cap** is ovoid – ellipsoid, 4-8cm high and 4cm wide, ochre- yellow, brownish or grayish; **Stipe** white, hollow, often irregular. **Spore mass** very faint **Spores** 18-22 x 10-14 µm ellipsoid, colourless, smooth.

Specimens examined On soil in lawns Langtang Barbal 1950m 13.08.03 PN 23451.

Edibility Edible excellent, one of the most delicious of all edible fungi. Use in similar way as *M.conica.*

Previously reported Place not mentioned (Singh. 1966); Manichur (Adhikari, 1991) and Jumla (Adhikari and Durrieu, 1996; Adhikari and Pokharel, 1999).

Distribution Europe, Japan, China, India, Nepal, America and Australia.

Xylariaceae The sphaeriaceous genera with dark colored, non septate ascospores produced in smooth perethecia embedded in a stroma.

Key to genus

Stroma sessile, hemispherical, flesh of stroma concentrically zoned…….……*Daldinia*

Daldinia concentrica (Botton ex Fries) Cesati and de Notaris, op.Cit.t.198 (1863),-Dennis *British Ascomycete*s 284, (1968).

Local name Dalley chyau, Kalli chyau.

Cap Convex, carbonaceous black or deep chocolate brown grows on dead or dying decidious tree 1-5cm diameter, 1-2cm thick, solitary or coalescing, and entostroma dark brown and concentrically zoned. **Spore mass** black. **Spore** 11-17 x 6-8µm, black, elongate.

Specimens examined On stump Lele 1400m, 18.07.2001, PN 21014. On log of *Alnus nepalensis,* Sundarijal, 1475m, 09.28.2001. PN 21115, on stump Chitwan Amrit Dhara pani 200m, 22.07.2002 PN 22228, TUCH.

Edibility Inedible, but it is found to be used in cuts and bleeding

Previously reported From Kathmandu valley (Adhikari, 1997); Pokhara (Adhikari *et al.,* 1996); Hetauda, Tamagadhi and Siraha (Adhikari, 2000) and Lumle (Devkota *et al.*, 2005).

Distribution Worldwide.

4.3 Addition of Recorded Mushroom Species new in the context of Nepal

Agaricus augustus *Psaliota auguta* Fr.Bres.*Fung.Trid*.t.60.-Rea *British Basidiomycetes* , 82 (1980).Syn *.A.abruptibulus* Peck Imazeki *et al. Fungi of Japan,*191.(1979). Syn *Psalliota augusta* Pacioni. *Guide to Mushrooms*,202.(1989).- Geoffery. *Mushroom and Toad stooi,*70.(1979).

Cap-: 18-16 cm, initially subglobose, flat at top, then convex and eventually flattened, cuticle dry and detachable, broken up into small fibrillose scales, adpressed, reddish brown on a yellow-cream background; **Flesh** white, turning yellow then brown when exposed to air, reddish at end of stipe. Odor of almonds, flavour sweet. **Gills** crowded, free white then gray, pink and eventually chocolate-brown; **Stipe** 18-16 x 2-3 cm, cylindrical, enlarged at base, solid then slightly hollow, white with floccosiy turning yellow, pinkish above ring, which is large, membranous, and double with brownish enlargement in lower part;

Spore print-: dark brown .

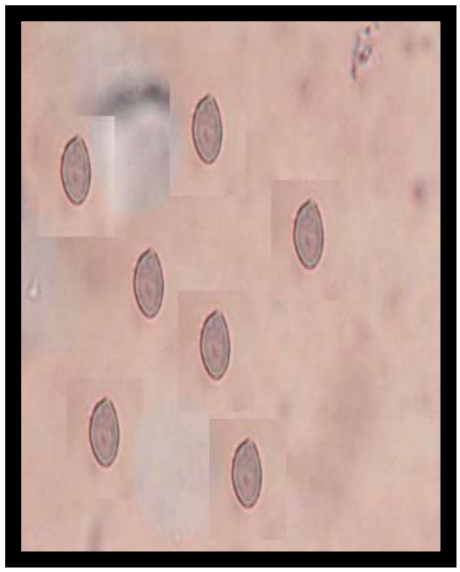
Microscopic observation-:Basidiospore 7.5-9 x 5-5.5µm, brown smooth.

Specimen examined On soil grassy area near conifers Langtang, Ghoda tabela 2800m. 08.06.2005 PN 25661 TUCH.

Ediblility-: Excellent.

Distribution-: North America, Japan and Nepal.

Agaricus augustus 1cm
Photo Plate 5



Spore of *Agaricus augustus* 10µm
Photo Plate 6

Agaricus placomyces Peck Orson and Miller.*Mushroom of North America*193. (1984).-Geoffrey, *Mushrooms and Toad stools* 70.(1979).

Cap 6-14cm , at first convex to umbrella shaped, then broadly convex or flat; "covered with flattened inky-gray to grayish-brown or blackish fibrils or fibrillose scales, fine scales about 0.1-0.2cm long, pointed, **Flesh** thick, white, **Gills** free at maturity, close, at first pallid, then grayish or light pink turning reddish brown to chocolate brown. **Stipe** 6-15cm x 1-1.5cm, white but often discoloring reddish-brown to dingy brown **Veil** membranous, white, thick, felt-like, somewhat rubbery.**Odour** unpleasant, phenolic, ink like, Taste- unpleasant metallic.

Spore print-: chocolate-brown.

Microscopic observation-: Basidiospores 6-7 x 3-4µm, elliptic,double walled,outer smooth, thick,inner thin,some Spores are vaculated, basidia 18x7-8µm, clavate, sterigmata 2-3µm 4-Spored, chelocystidia 20-23 x 7-8µm.

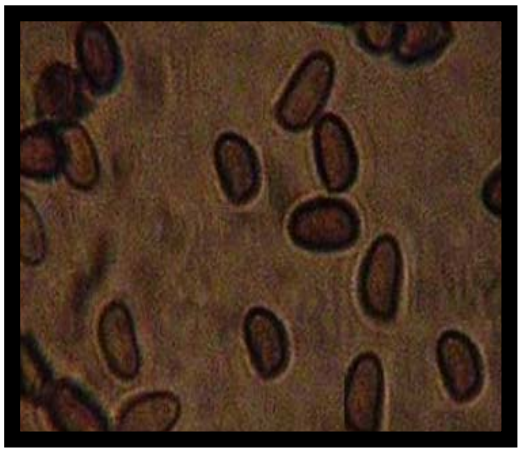
Specimens examined-: Growing on soil Kirtipur, Kathmandu 1320m, 15.06.2004. PN 24513, TUCH.

Edibility-: Inedible, poisonous.

Distribution-: U.S.A., China and Nepal.

A.placomyces is virtually identical to *A.praeclaresquamosus* but in *A.placomyces* the scales on pileus are brownish and located centrally, while gradually thinner at peripheri but in *A. praeclaresquamosus* the scales are not show distinct. Another notable difference is brownish to yellowish droplets on the underside of its partial veil, which can be seen when the veil is still covering the gill.

Agaricus placomyces 1cm
Photo Plate 7



Spore of *Agaricus placomyces* 5µm
Photo Plate 8

Agaricus praeclaresquamosus Freeman, *Mycotaxon* 8:90 (1997),Syn *Agaricus melegars* (J.Schaeff) Imbach , Koneman, *The encyclopedia of Mushrooms* ,1161,(1999).

.**Cap** 5-15cm, at first convex to somewhat marshmallow shaped, then broadly convex or flat; "covered with flattened inky-gray to grayish-brown or brown fibrils or fibrillose scales, fine scales about 0.1-0.4cm long, pointed, **Flesh** thick, white. **Gills** free at maturity, close, at first pallid, then grayish or light pink turning reddish brown to chocolate brown; **Stipe** 7-15cm x 1-3cm, stuffed, white but often discoloring reddish-brown to dingy brown either when old or upon handling. **Veil** membranous, white, thick, felt-like, somewhat rubbery. **Odour** Unpleasant, phenolic, ink like, **Taste** unpleasant metallic (Arora). The mushroom are solitary or in groups base of the tree.

Spore print -: chocolate-brown.

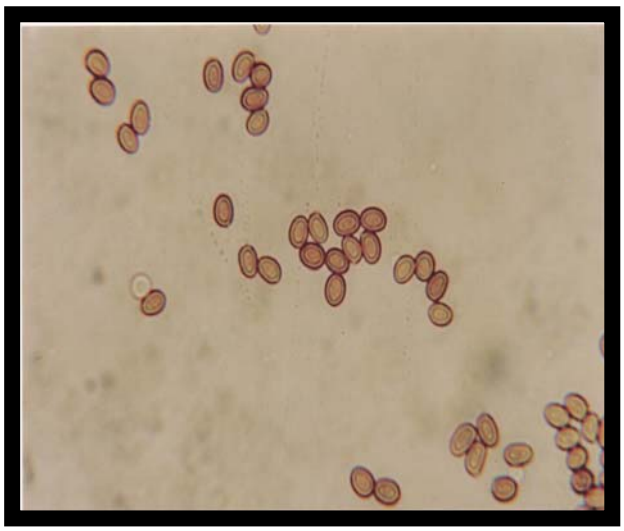
Microscopic observation-: Basidiospores 4-6 x 3-5 µm, elliptic, smooth, **Basidia** 20 x 7-8 µm, clavate, **Sterigmata** 2-3 µm Spored, **Chelocystidia** 18-23 x 7-9 µm.

Specimens examined-: Growing on soil. base of *Ficus religiosa* (Peepal*)* Matatirtha Kathmandu 1400m, 15.08.2004. PN24590, TUCH.

Edibility-: Inedible, poisonous to many with vomiting and diarrhiza.

Distribution-: U.S.A, China and Nepal.

Agaricus praeclaresquamosus 1cm
Photo Plate 9



Spore of *Agaricus praeclaresquamosus* 10 µm
Photo Plate 10

Boletellus emodensis (Berk.) *Hook.J.Bot.kew Gdn Misc*.**3**.(1851) 48. Singer, *Annls. Mycol.* 40 (1942) Corner. 1972 *Boletus in Malaysia* pp.96,(1972).- Imazeki *et al. Fungi of Japan,* 350.(1979).

Cap 4.5- 8cm plano-convex dry, purple dull crimson to rose – red. Often fading to pale fawn drab, finely tomentose then craking into large and small floccose scales. **Flesh** 8-10 mm thick in the center of the cap, 4-5 mm half way to the margin yellow, quickly cyanescent as the tubes and pores on bruising, firm and hard in the Stipe.**Pores** Large and covering them with a false veil, then splitting radially stellately, appendiculate tubes 7-15 mm, deeply sinuate, ventricose, yellow; pores 1 -2 mm, angular, simple, yellow then brownish olive cyanescent.**Stipe** 5-11cm x 6-12mm at the apex, 5-7 mm below subcylindric, the base often enlarge with thick white mycelium, smooth fibrous concolorous with the cap.

Spore deposit -: olivaceous brown.

Microscopic observation-: Basidiospores 16-20 x 8µm boletoid elongate, longitudinally striate in the hyaline. Yellow brown in KOH.**Basidia:**46-53 x 14-16µm.**Sterigmata,** 6µm long **cystidia** 55-10x12-16µm.Ventricoso with obtuse apex. **Hyphae** 28µm wide in the Stipe, without clamp.**Tube** Trama more or less phylloporoid, not gelatineous.

Species examined-: Gregarious in moist soil under Pine forest of Sundarijal .Generally found from May to July at an altitude of 1500-1600m. 28.06.2004, collection no 24546 TUCH, Pandey N.

Edibility-: Inedible

Distribution-: China, Japan, North America, India and Nepal.

Boletellus emodensis
Photo Plate 11 1cm

Spore of *Boletellus emodensis*
Photo Plate 12 10 µm

Cantharellus lateritius (Berk) Singer.-Singer, *The Agaricales(Mushrooms) In Modern Taxonomy,Lilloa*,**22**;721,(1951).- Smith and Weber, *How to know the non gilled mushrooms* (Second Edition), 99 (1979) –Singer, *The Agaricales in Modern Taxonomy*, 840.(1986).

Cap 2-5cm, Egg yellow changes to pale yellow on drying funnel shaped, margin undulate and ached, **Flesh** White, soft, composed of compactly arraned hyphae, pale presence of sphaerocystl. **Gill** Poorly developed. **Stipe** 10cm long; .5-2.5 cm thick; tapering to the base; colored like the cap or paler.**Taste** Not distinctive; odor fragrant and sweet.

Chemical Reactions-: Flesh pinkish gray to gray with iron salts; undersurface dark gray with iron salts.

Spore print-: Pale pinkish yellow.

Microscopic observation-: Basidiospores 7-10 x 5-7µm, broadly elliptic, hyaline, apiculate non amyloid. **Hymenium** upto 35µm broad, pale, **Cystidia** none. **Basidia** 4 Spored, 10-15 x 2.5-6.25 µm. **Sterigmata** long 5-7.25 x 1-1.5 µm. **Hyphae** 1-2.5µm diameter,

Specimen examined-: On soil of coniferous forest of Dakchinkali; 1425m, 23.08.2005. PN 25680, TUCH.

Edibility-: Edible

Distribution-: Australlia, U.S.A and Nepal.

Cantharellus lateritius
Photo Plate 13

Spore of *Cantharellus lateritius*
Photo Plate 14

Coprinus atramentarius (Bull).Fr. Fr. [= *Coprinus fuxexens*.(Schaeff.) Quel] Cke.Illus.no 648.t. 662.- Rea, *Mycol. Biblo*.501,(1922).-Pacioni, Simon and Schuster's *Guide to Mushrooms*. 223.(1989).-Frieden. *Mushroom of the world* 29.(1969).-Singer *The Agaricales in Modern Taxonomy* 493,(1975).- Svrcek *The Hamlyn Books of Mushroom and Fungi* 221.(1983).-Kibby,.*Mushroom and Toadstool*, 76,(1979).

Cap 5-8cm, soot-brown, lead-gray, adpressed scales, persistently marked, brown or brown-ochre,silky and shiny, ovate, obtuse then campanulate with lengthwise grooves and ribs, soft to touch, minutely pruinous when young, often squarmulose at disc, darker, margin recurved when mature. **Flesh** gray- brown, parting radially in cap, fibrous in Stipe. No special odor or flavor. **Gills** white then blakish brown, deliquescent, free, ventricose up to 1.5 cm long, edge floccose. **Stipe** 7-20 x 0.8-1.8 cm, white, initially ventricose, fusiform, narrowing in lower part slightly, more at top, sulcate, lengthwise fibrillose, smooth at apex, with small brown scales at base, hollow.

Microscopic observation-: Basidiospores 7-11 x 5-6.5µm, black.elliptical,smooth.

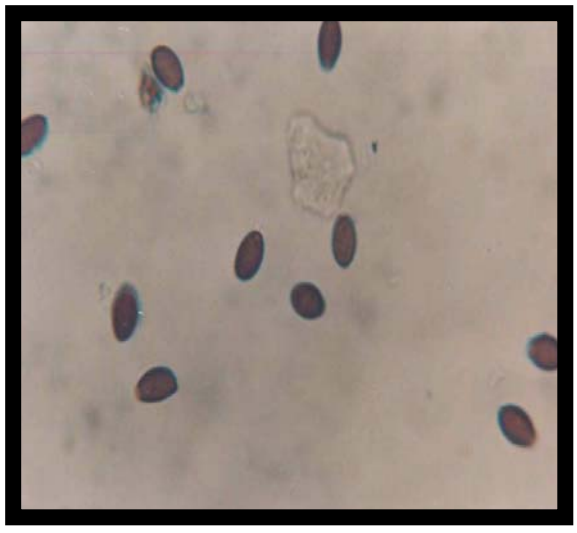
Specimen examined-: In grassy areas, often tufted, usually associated with buried woods or roots.

Edibility-: Edible, good, but avoid alcohol.

Distribution-:USA, America and India.

Coprinus atramentarius
Photo Plate 15

1cm



Spore of *Coprinus atramentarius*
Photo Plate 16

10 µm

Coprinus lagopus Fr. ;Saud and Sm. *Myc.IU*.t.19. –Rea, *Biblo. Mycol*. 510. (1922). *Coprinopsis lagopus* (Fr.:Fr.) Redhead, Vilgalys and Moncalvo,-Konemann,.*The Encyclopedia of Mushrooms* 159,(1999).- Kibby. *Mushrooms* and *Toadstool,* 76.(1979).

Cap 1-4cm when expanded, at first oval and tiny when young expanding to broadly convex more or less flat ;gray to black covered with a dense coating of slivery hairs which break up into patches as the mushroom grows and may eventually disappear; the finely lined margin splittingas the Gills dissolve. **Flesh** grayish to black ,thin and membranous. **Gills** attached to the Stipe; crowded ; pale at first, but soon gray,then blackish; deliquescing (turning black ink) or merely deterioting and collapsing in dry weather. **Stipe** 2-6cm long 1 -2cm thick, equal hollow, fragile, white, densely hairy at first (especially near the base) but sometime nearly smooth on maturity. **Veil** Composed of elongated, often inflated, sausage- shaped elements.

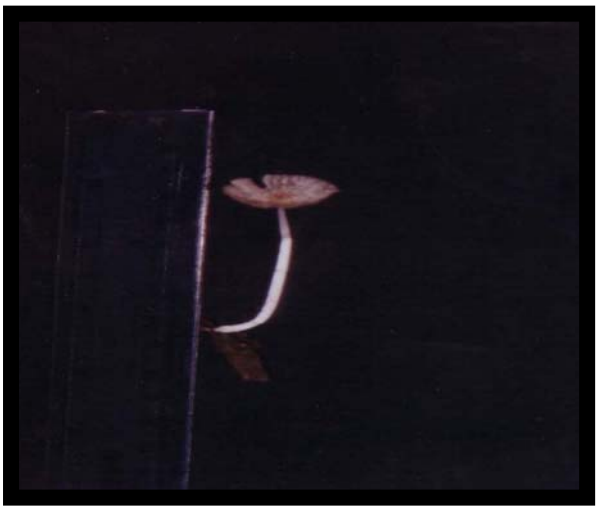
Spore print – Black or blackish.

Microscopic observation-: **Basidiospore** 15-20 x 10-12µm, elliptical, smooth, dark- dextrinoid with a wide pore 1.5 -2µm. **Pleurocystidia** 50-100 x 20-40µm, enormous, variously shaped , **Cheilocystidia** 30-65 x 25-45µm

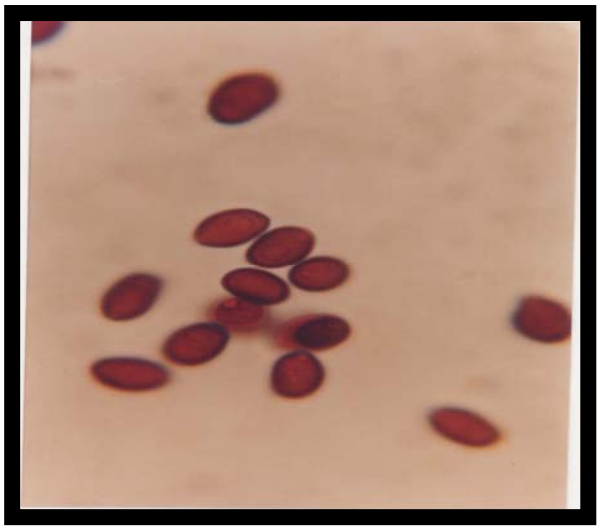
Specimen examined-: On decaying wood and woody debris (sometimes appearing terrestrial) in forest or, rarely urban area. Lele 1450m, 19.07.2001 PN 21024, Pulchowki 2700m 15.09.2001 PN 21067, Baneshore 1290m 16.08.2002 PN22303, Baneshore 1290m 17.05.2003 PN 23329 TUCH.

Edibility-: Inedible

Distribution-: Cosmopolitan.



Coprinus lagopus 1cm
Photo Plate 17



Spore of *Coprinus lagopus* 10 µm
Photo Plate 18

Coprinus micaceus (Fr.) Fr.; *Coprinellus micaceus* (Bull.:Fr.) Vilgalys, Hopple and Johnson,- Konemann, *The Encyclopedia of Mushrooms* 157,(1999).- Orson and Miller *Mushroom of North America*,190, (1984).- Krieger *The Mushroom Handbook,*313,(1984).- Kibby, *Mushroom and Toadstool*, 76,(1979).- Pacioni , Simon and Schuster's *Guide to Mushrooms* 226,(1989).-Svrcek *The Hamlyn Books of Mushroom and Fungi* 222, (1983).

Cap 1.5-5cm when expanded, 2-4cm high when young, at first oval, soon bell-shaped, then expanded, yellow-brown to ochre, buff, becoming paler with age, especially to wards the margin, glistening whitish particles which often disappear when old, striate at least half way to center, margin usually tattered or split at maturity ,flesh thin, soft; pallid or white.**Gills** attached to the Stipe or free from it, pale becoming brown, then black, deliquescing (turning to black "ink" to partly or completely). **Stipe** 3-8cm x 3-6mm, more or less equal, fragile, hollow, smooth, white or discoloring buff.**Veil** sometimes slight basal ring presumably formed by universal veil as partial veil absent or rudimentary.

Spore print -: dark brown to black.

Microscopic observation-: **Basidiospores** 6.5-9 x 3.9-5 x 4.9-6.3 µm, elliptic, smooth, often flattened somewhat, almond –shaped with a germ pore. **Basidia** 4-Spored, 22-31 x 6-10µm, clavate, without basal clamp; **Pleurocystidia** 70-100 x 50-70µm, vesicular to elliptic, **Cheilocystidia** 20-90 x 20-75 µm, vesicular to clavate.

Specimen examined -:In clusters on wood or woody debris, around stumps on roots and buried wood.,Lele (Lalitpur) 1375m 19.07.2001 PN 21021, Shivapuri (KATH) 1500M, 20.10.2003. P.N 23494, TUCH.

Edibility -: Edible

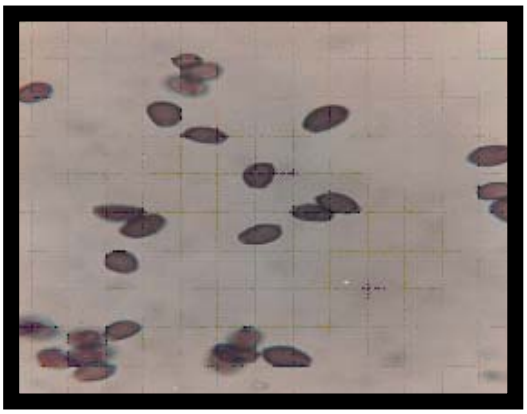
Distribution -: North America, Europe, Asia, North Africa, Australia

The word 'mica', Latin for "crumb" It is similar some what like smaller *disseminatus* but not translucent; like *atramentarius* but *atramentarius* is fleshier with thicker, stipe, grayish, with gills turning lavender-gray then black.

Coprinus micaceus

1cm

Photo Plate 19



Spore of *Coprinus micaceus*

10 µm

Photo Plate 20

Dictyophora duplicata (Bosc) E. Fischer 1888,- Philips, *Mushrooms of North America.* 290.(1981).Orson and Miller, *Mushroom of North America,* 170, (1984).- Teng, *The Higher Fungi of China*, 518, (1988).- Friden, *Mushroom of the world,*158.(1969).- Lincoff *Simon and Schuster's guide to Mushrooms,* 356.(1989).-Krieger, *The mushroom handbook*,218. (1967).

Mature Fruiting Body Spike-like, 12-17 cm. high, 2-4 cm thick; with a "cap" area that is ridged, and covered with a slimy, malodorous, olive-brown substance that eventually wears off (or is carried away by flies), leaving a light brown coloring; with a white Stipe that arises from a white, sack-like volva, the Stipe being 7-12 cm long and 3.5-4.5 cm thick, white, chambered, hollow and projecting from the large oval (egg) from which the fruiting body expands ; with a laced, white "skirt" hanging 3-6 cm from the bottom edge of the cap (sometimes collapsing against the Stipe).**Immature Fruiting Body** Like a flesh-colored to whitish "egg" 4-7 cm high; when sliced revealing the stinkhorn-to-be encased in a gelatinous substance.

Microscopic observation-: **Basidiospores** 3.5-4 x 1.5-2 µm, elliptical or flattened, smooth and colorless.

Specimen examined -: It was spotted in a solitary state near a tree stump, on tropical forest. Found June to September at an altitudeof 225 to 300m 29/06/2003, Collection No. 23356 TUCH, Pandey N. et al.

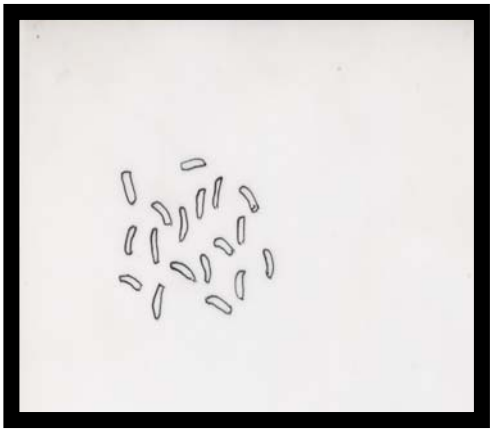
Edibility -: Edible in young egg stage.

Distribution -: North America, Japan, China and Nepal.

The brownish olive, chambered head and the netted shirt-like veil (indusium) form a most beautiful fungus, hence called "Queen of Mushroom" as long as one posses an insensitive nose.*Dictyophora indusiata* (Vent).Ed. Fischer differs from the present species in having veil extending to about 10cm .Below the pileus, made up of slender tubular threads, with polygonal meshes 5-7 mm.diameter.

Dictyphora duplicate
Photo Plate 21

1cm



Spore of *Dictyphora duplicate*
Photo Plate 22

3 µm

Ganoderma tsugae Murr. Hongo.- Orson and Miller *Mushroom of North America*,230, (1984).- Pacioni, *Simon and Schuster's Guide to Mushroom* 264. (1989).

Cap 5-30 cm; at first irregularly knobby or elongated, but by maturity more or less fan-shaped; with a shiny, varnished surface often roughly arranged into lumpy "zones"; red to reddish brown when mature; when young often with zones of bright yellow and white toward the margin; occasionally with bluish tints. **Flesh** Whitish; fairly soft when young, but soon tough.**Pore Surface** White, becoming dingy brownish in age; usually bruising brown; 4-6 tiny (nearly invisible to the naked eye) circular pores per mm; tubes to 2 cm deep. **Stipe** Sometimes absent, but more commonly present; 3-14 cm long; up to 3 cm thick; twisted; equal or irregular; varnished and colored like the cap; often distinctively angled away from one side of the cap.

Spore print Brown.

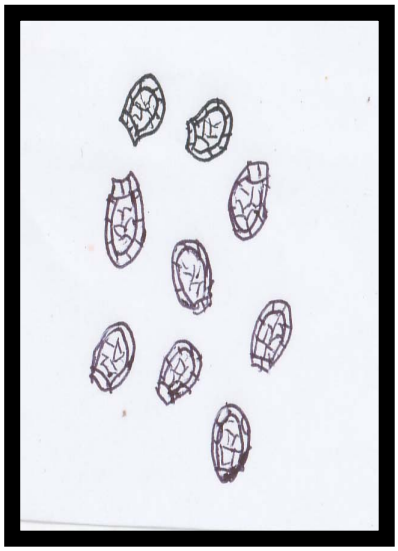
Microscopic Observation -: **Basidiospores** 9-11 x 6-8 µm; more or less elliptical, sometimes with a truncated end; usually appearing roughened even at lower magnifications.

Edibility-: Inedibel due to, too tough and woody.

Distribution-: Cosmopolitian.

Polyporus tsugae is a former name. This mushroom is closely related to *Ganoderma lucidum* and is virtually indistinguishable from that species. However, *Ganoderma tsugae* is partial to conifers. Additionally, it has whitish, rather than brownish flesh. Otherwise it is recognized, like *Ganoderma lucidum*, by its varnished, reddish cap and Stipe.

Ganoderma tsugae 1cm
Photo Plate 23



Spore of *Ganoderma tsugae* 10 µm
Photo Plate 24

Gyroporous atroviolaceus,(Hoehn.) Gilvert, *Les Bolets,*102, (1931).- Singer, *Farlowia* **2** 239,(1945).*Suillus atroviolaceus* Hoehn,- Fragmenta *Myk.*16 39,n.835(1914), *Boletus atroviolaceus* (Hoehn.) Chiu, *Mycologia,* 40, 20(1948), Corner , 1972 *Boletus in Malaysia* 53.(1972).

Cap 5-7cm, finely granular verrucose, dry, dark purple violet. **Flesh** soft. Pale violet. **Stipe** 5cm x 10-15mm, finely granular filamentous, hollow, concolorous. Dark brown color with slightly bulbous base.**Tube** 2-3mm, adnate, white then wine red, pores 0.5mm, concolorous,

Spore print-: Pale yellowish.

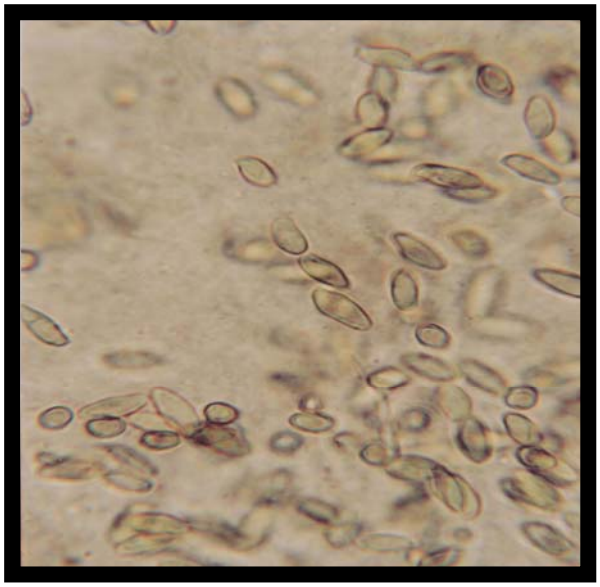
Microscopic observation-:Basidiospores 8-10 x 5-6.5 µm, hyaline, obtuse. Surface of the pileus with fascicles of smooth, obtuse, violet, unicellular hairs -140 x12- 25µm. **Basidia** 20-25 x 12-16µm, 4 Spore, **Cystidia** 140 x 25µm. **Hyphae** with clamps at many septa.

Specimen examined: Solitary on soil in Pines forest of Gadavari. Generally found from June to September at an altitude of 1450-1500m 11.09.2004, collection no 25627 TUCH, Pandey N.

Edibility-: Unknown

Distribution: China, Japan, Malaysia, North America, India and Nepal

Gyroporous atroviolaceus 1cm
Photo Plate 25



Spore of *Gyroporous atroviolaceus* 10 µm
Photo Plate 26

Gyroporus castaneus (Fr.) Quel., Ench,161(1886).-Singer, *Die Rohrlinge* 142,(1965). -McNabb, N.Zeal. *J. Bot.* **6** 141(1968). Syn. *Boletus castaneus* Corner, *Boletus in Malaysia* 35 (1972).-L akhanpal, *Mushrooms of India, Boletaceae*, 65, (1986).- Pacioni, *Simon and Schuster's Guide to Mushroom*, 247.(1989).- Konemann, 1999 *The Great Encyclopedia of Mushrooms* 18.(1999).

Cap 5-10cm wide, convex- plano, dry, wholly fibrilloso- fasciculate and subsquarrose, becoming subtomentose, fawn brown with darker centre. Cuticle detachable from edge, thin dry at first velvety, then smooth.**Stipe** 5-7cm x 13mm at the apex, 20- 30mm at the clavate base, becoming some what hollow, not fissile, fibrillose- subtomentose as the pileus, often some what peronate, concolorous; mycelium white, base of Stipe is blunt and broad. Stipe easily detachable from cap. The flesh is white, unchanging friable.**Tubes** 9 mm, free, subventricose, -12mm thick, white, brown and hard in a layer 1-1.5mm thick on the Stipe ie tube always shorter towards Stipe, pores roundish.

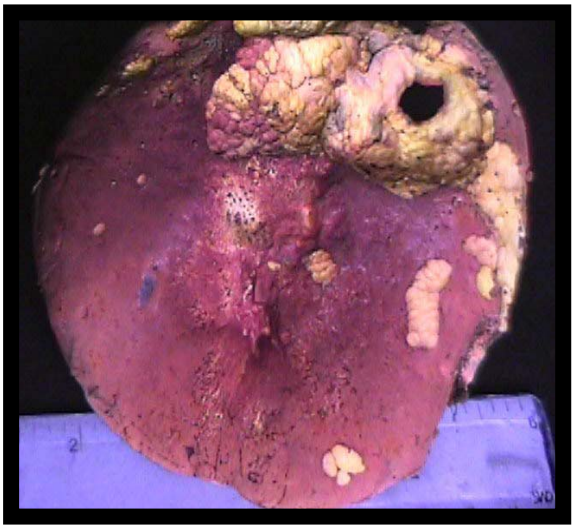
Spore print-: Brownish faint.

Microscopic observation-:Basidiospores 8-10 x 5.5 -7µm ellipsoid to subcylindric, obtuse, smooth.**Basidia-:** clavate 35-42x11-13µm, **Sterigmata** 4,4-5µm long.**Cheilocystidia** 12-20µm wide,clavate to more or less ventricose, forming a sterile edge to the pore**. Pleurocystidia** 55 x 7-9µm ventricose with short alttenuate apex 2-3µm wide, thin walled, mostly near the pore.

Specimen examined: Solitary or in small group in moist soil under Pine forest (*Pinus wallichina*) of Godawari. Generally found from June to July at an altitude of 1400-1500m. 28.06.2004, PN 24525 TUCH.

Ediblility-:Edible very good when young.

Distribution: China, Japan, Malaysia, North America, India and Nepal.



Gyroporus castaneus
Photo Plate 27

1 cm

Spore of *Gyroporus castaneus*
Photo Plate 28

10 µm

Hypholoma capnoides (Fries) Kumm Syn-*Naematoloma capnoides* Fr. Icon .t. 133.- Rea*, British Basidiomycetaceae* 261, (1922).- Philips, *Mushrooms and other Fungi of Great Britain and Europe.*159, (1981). -Orson, *Mushrooms of North America*, 207. (1984).-Purukayastha and Chandra, *Manual of Indian Edible Mushrooms,* 84, (1985).-Svreck, *The Hamlyn Book of Mushrooms and Fungi*, 234, (1983).,

Cap 2-7cm broad, convex, soon broadly convex, nearly flat in age, moist but not viscid, smooth, without hairs, orange to cinnamon, margin inrolled at first and pale yellow with buff patches of adhering veil remnants. **Flesh** thick, white to pallid. **Gills** attached, close, white to grey finally purple-brown. **Stipe** 5-10cm long, 4-10mm thick, equal, dry scattered hairs to hairy at base, yellowish above a faint ring, tan to rusty brown below. **Veil** hairy, white to buff, leaving a thin to obscure, superior ring zone.

Spore print -: Chocolate brown.

Microscopic observation -: **Basidiosopores** 6.5-7.5 x 3.5 –4.0µm, elliptical, smooth, with a small pore at apex. **Cheilocystidia** cylindrical, thin walled. **Pleurocystidia** broadly clavate, beaked.

Hypholoma fasciculare (Huds. Ex. Fr.) Kummer differs from present species in having p-pileus more than 3.0 cm broad; ovoid Spores and very bitter taste.

Specimens examined: On stump of Pinus sp. Langtang, Ghoda tabela, 2835m, 07.06.2005. PN 25653, TUCH.

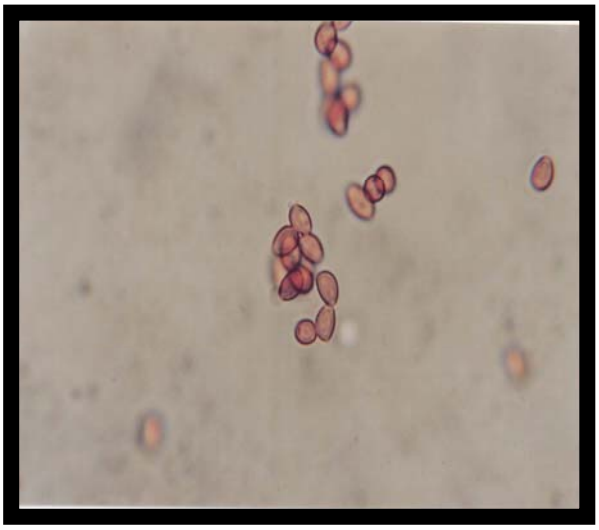
Edibility-: Edible

Local Name-: Siltu Shyamu (Tamang)

Distribution-: China, India and Nepal

Hypholoma capnoides

Photo Plate 29 1cm



Spore of *Hypholoma capnoides*

Photo Plate 30 6 µm

Laccaria proxima (Boudier) Maire Orton. *Boud*. *Icon*.t. 60.- Rea, *British Basidiomycetes*, 290, (1922).- Singer, *The Agaricales in Modern taxonomy,* 231, (1975). Koneman,. *The Encyclopodia of Mushroom,* 83, (1999.).- Svrcek**,** *The Hamlyn book of Mushrooms and Fungi* 139, (1983).

Cap 3-7 cm, convex at first, gradually spread along with circular, central furrow light grey a flesh color with fine scales.**Gills** are thick, swollen and widely spread. **Stipe** Long 5-12 cm, flesh in color selender, sinuous with a fragile appreance. It soon becomes fibrous and is very persitant deeply furrowed and lower and blunt.

Spore print-:white

Microscopic observation-:Basidiospore 8-10 µm, globose densily covered with spines.

Specimens examined-: On soil, Phulchowki 1600m, 15.09.2001. PN 21060, on soil, suryabinayak 1425m, 11.09.2004. PN 24618 TUCH.

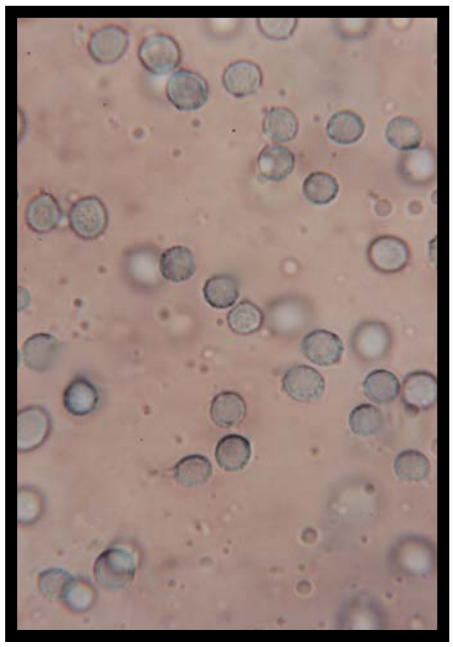
Edibility-: Edible

Local Name-: Budhi, Jhari

Distribution-: Cosmopolitan

The mushroom occurs later after the emergency of *L. laccata* and *L. amethystena*. It is found less wetted place and less fragile. The cap is covered with fine scales which reveal themselves in dry weather.

Laccaria proxima 1cm
Photo Plate 31



Spore of *Laccaria proxima* 5µm
Photo Plate 32

Leucocoprinus fragilissimus [Rav]Pat, Imaze *et al., Fungi of Japan*. 423, (1988)

Cap 2- 4 cm, oval when young, dark yellow upper and light yellow lower. Matured are umbrella like, flat, dry, whitish pale yellow. **Flesh** Very thin, yellow. **Gills** free from the Stipe; yellow to pale yellow; crowded **Stipe** 4-8 cm long; 1-1.5 mm thick; more or less equal, or tapering to apex; dry; smooth with a fragile, yellow ring distinct, flesh-thin and yellow; **Veil** yellow, forming a small, superior, collar like cottony-fibrous ring on Stipe. **Odour**- not distinctive. **Taste**- not distinctive.

Spore print-: white.

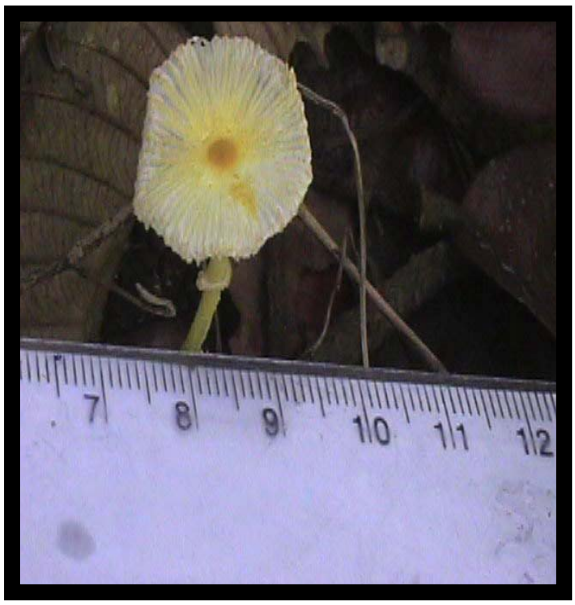
Microscopic observation-:Basidiospore 9-12 x 6-8µm, oval-elliptic, with apical germ pore, thick-walled, smooth **Basidia** 4-Spored, clavate.

Specimens examined -: Growing on soil, Godawary, Lalitpur 1480m, 13.08.2004.

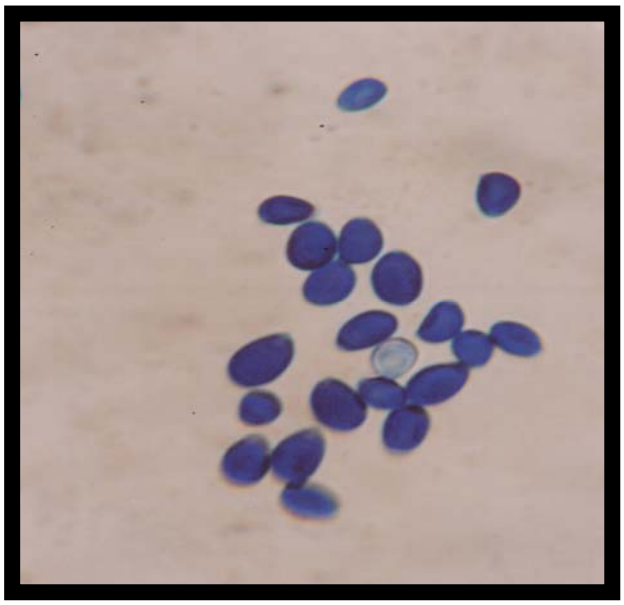
PN 24529, TUCH

Edibility -:Inedible

Distribution-: Japan and Nepal.



Leucocoprinus fragilissimus 1cm
Photo Plate 33



Spore of *Leucocoprinus fragilissimus* 10 µm
Photo Plate 34

Marasmius maximus Hongo. Imaze *et al. Fungi of Japan,*126, (1988).

Cap 3-10cm, convex, umbrella like expanded cream or flesh colored, circular dark spot at center.

Gills widely separated, expanded one third from circumference, pinkesh in color.

Stipe 5-9cm, stiff cylindrical, enlarged slightly of base brownish in color, solid flesh orange yellow in color.

Spore print-: Creamish.

Microscopic observation-:Basidiospores 4-4.5µm, small, almost spherical yellowish in colour wall thick and smooth cystidia present.

Specimen examined-: Growing on soil along with grasses on temperate forest of Palung 1820m, 17.07.2004 PN 24572 TUCH.

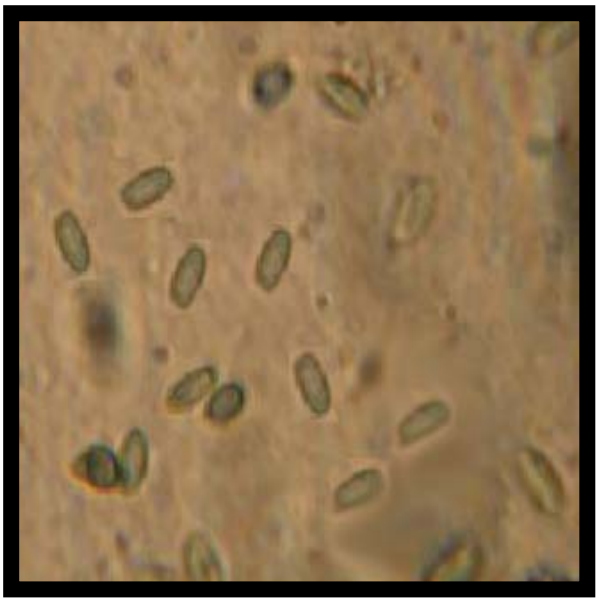
Edibility-: Edible, taste- meat like. Due to stiff nature of Stipe, Stipe are discarded during cooking.

It is medicinally also used in cold and cough locally it is known as Budhi chyau due to its wrinklings of pileus.

Disribution-: Japan(Tokyo), China and Nepal.

Marasmius maximus
Photo Plate 35

1cm



Spore of *Marasmius maximus*
Photo Plate 36

5 µm

Pluteus thomsonii (Berk. and Br.) Dennis Trans. *Brit. Mycol. Soc.* **31**: 204.(1948).Syn *Pluteus cinereus* Quelet.

Cap 1-3.5 cm; convex becoming broadly convex with a central bump; blackish brown, fading to dull brown; smooth overall but with a wrinkled or veined center. **Flesh** Insubstantial; pale. **Gills** Free from the Stipe; close or nearly distant; whitish or grayish at first, becoming pinkish. **Stipe** 2-4.5 cm long; 1.5-6 mm thick; equal; silky-streaked; pale solid.

Taste -: Not distinctive, or slightly radish like to bleach like; odor similar.

Spore print -: Pink.

Microscopic observation-:Basidiospores 6-8 x 5.5-6 µm, elliptical; smooth. **Cystidia** 39-61 x 8-18 µm, without horn-like projections.

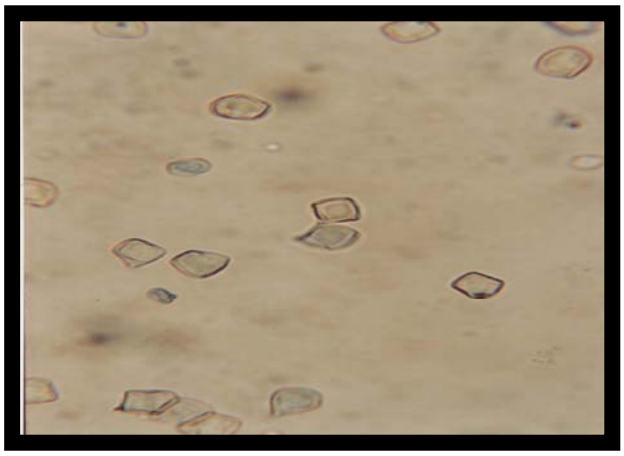
Specimen examined-: Growing on soil in Pinus forest, Namobuddha Kavre 1650m 28.7.2002 PN 22270 TUCH.

Edibility-: Unknown

Distribution-: North America and Nepal.

Pluteus thomsonii
Photo Plate 37

1cm



Spore of *Pluteus thomsonii*
Photo Plate 38

6 µm

Polyporus gramsocephalus Berk. Hooker's London .*Bot.,* **1:** 148,(1842).-.Bakshi 1966 *Indian polyporaceae,*107, (1966).

Sporophore Annual, stipitate or nearly sessile, solitary or imbricate, soft and fleshy, drying rigid, fan shaped, obovate or reniform, 3-17 cm across, 0.3 cm thick, Stipe lateral, expanding into pileus above, up to 2 cm long and broad, upper surface white when fresh , ochraceous or reddish brown when dry, usually with fine striations, smooth or minutely scaly, evident under hand lens, margin smooth, entire or wavy; context light buff, corky, up to 2 mm thick; hymenial surface which when fresh, yellow to brown , usually with a silky, margin fertile.

Pores round , regular or irregular, sometimes the adjacent ones join to form large ones, 4-5 per mm, pores wall thin, pre tubes concolorous, up to 1 mm long.

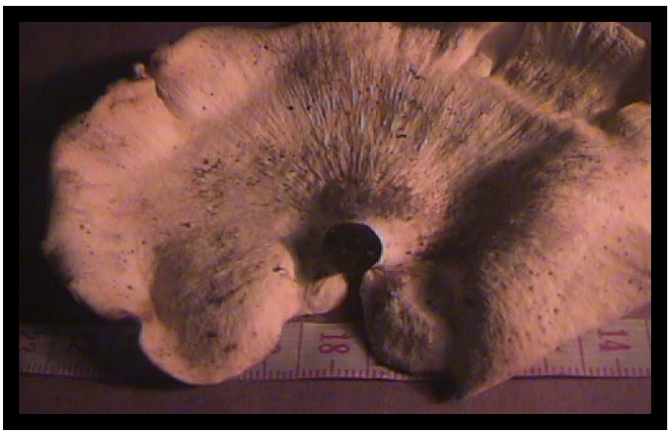
Spore print-: Creamish

Microscopic observation-:Basidiospores 4.0-7.5 x2.2-3.0 µm, hyaline, round, diameter; **hyphae** (1) hyaline, thick- walled with narrow or little lumen, flexuous, unbranched, 3-5 µm, broad, common and (2) hyaline, thin-walled, branched with occasional clamp connections, often collapsing , 2-3.5 (-5) µm broad, less common. **Basidia -:** broadly clavate, 12-14 x5.7-6.4 µm.

Specimen examined-: On bamboo log Baneswore 1290m, 09.07.2004 PN. 24575, TUCH.

Edibility-: Inedible

Distribution -: The East including the Pilippines, India, and Ceylon. Also Australia, New Zealand, Cuba , New Guinea and Brazil.



Polyporus grammocephalus 1cm
Photo Plate 39

Spore of *Polyporus grammocephalus* 5µm
Photo Plate 40

Resupinatus applicatus (F r.) S. F. Gray, Orsan and Miller**.** *Mushroom of North America,* 99, (1984).

Cap 2-6 mm broad, minute, dry, cuplike to convex, grayish blure to grayish black, covered with fine, minute hairs. **Flesh** firm, gelatinous.**Gills** fairly well separated, broad, whitish at first to gray sometimes very dark. These fungi are scattered or often in great numbers on hardwoods including vines and shrubs. A cross section reveals a gelatinous flesh and the gill edges are sterile. This along with the combination of grayish blue to grayish black are the distinguishing characteristics of this minute but common fungus.

Spore print-: White

Microscopic observation-:Basidiospores 4-5 µm, round, smooth.

Specimen examined-: On bamboo log Baneswore 1290m, 24.06.2002 PN. 22160, TUCH.

Edibility-: Edibility unknown/Common

Distribution:U.S.A and Nepal.

Resupinatus applicatus 1cm
Photo Plate 41

Enlarged Photo Plate 42

Spore of *Resupinatus applicatus*
Photo Plate 43

Rhizina undulata Fries, op. cit. 2:33,(1822).-Svrcek, Hamlyn book of *Mushrooms and Fung,* 52, (1983).- Pacioni. Simon and Schuster's *Guide to Mushrooms.* 413.(1989).

Fruit body The fruit body with dark brown to black hymenium and tuft brown flesh attached soil, and occassionally to wood by numerous cylindrical branched root-like structured called rhizoids. **Flesh** reddish brown, tuft, fibrous; under surface pale ochraceous bearing numerous cylindrical branched whitish root like structures.Measurement of rhizoid is 1-2 mm thick.

Microscopic observation-:Ascospore 22-40 x 8-11 µm, Fusiform with two or more oil drops with a hyaline spiculate at each end. **Asci** about 400 x 20 µm. **Hymenophore** flat or convex, often irregularly lobed, hymenial surface undulating, dark brown to black with a paler margin, **Paraphysis** slightly clavate, hyaline but with their tips covered by a thin amorphous brown crust.

Specimen examined-: The specimen is found on debris in coniferous wood, especially in clearing and after fire in bare areas, but said to be parasitic on seedling pinus and they are generally found from July to October at Champadevi, 1500m 15.7.2002. PN. 220794 TUCH.

Edibility-: Inedible

Distribution -: North America, Europe, Japan, India, Nepal.

Rhizina undulate
Photo Plate 44

1cm

Spore of *Rhizina undulate*
Photo Plate 45

10 µm

Strobilomyces mirandus Sp.nov.Malaya [typus, Corner s.n. 2 April (1934),CGE].. Corner, *Boletus in Malaysia*,.61, (1972).

Cap 5-7cm, plano convex, dry,golden tawny, covered with erect conial acute librous- floccose scales or warts-3mm altis ornatus. **Stipe** It is 5-8 cm x 9-12mm at the apex. 6-7mm towards the base, attenuate downwards, golden oranage, covered with rather irregular elongate shallow reticulations more or less thinly floccose-squamulose especially near the pallid white apex: ring none. **Tubes** 9 mm long, adnexed, ventricose, pallid white. Blackening at maturity: **Pores** -: 0.5mm, white then blackening Flesh 9mm thick in the center.

Spore deposit-:Fucous purple- brown.

Microscopic observation-:Basidiospores 8.5-9.5 x 7.5-8.5µm, reticulate, hyaline.

Basidia-: 28-37 x 11-30µm, **Sterigmata** 4, **Cheilocystidia** 12-20µm, **Pleurocystidia** 65 x 12-18µm, Ventricose with subacute apex.

Specimen examined-: Solitary on soil in Pines forest of Gadawari generally found from June to September 1450-1500m 15.08.2004, PN 25602 TUCH.

Edibility-: Unknown.

Distribution-: China, Japan, Malaysia, North America and Nepal.

Strobilomycess mirandus 1cm
Photo Plate 46

Spore of *Strobilomycess mirandus* 10 µm
Photo Plate 47

Thelophora fuscella Lloyd. Myc. Notes 1288, f. 2544 (1923).-Corner, *A Monograph of Thelephora (basidiomycets)*. 31, (1968).

Fruit bodies 7-12 cm high, pluropodial, palmately divided from a common trunk.**Stipe**0.5 – 5 cm x 2 – 5 mm, consisting a compact dark core, 0.8 – 1.3 mm thick and a loose tomentous layer 0.5 – 3 mm thick; branches flattened, broad 10 mm or narrow (2 – 5 mm), becoming spiculose or digitate, acute or obtuse, often fimbriate, the upper side more or less strigose or appressedly spiculose fibrillose pale dirty yellowish, grey to pale yellow livide bristre; hymenium inferior, smooth, fuscous purple, inclining to umber; F**lesh** dry, floccose – coriaceous, tough, smell none or slightly rotten.

Microscopic observation-: Basidiospore 6 – 8 x 4.8 – 6 µm, fuscous, umber, irregularly ellipsiod to subglobose, angular, nodolus, not echinulate. **Basidia -:** 3.5 – 4.5 x 6– 7 µm, with fucous brownish cytoplasm, sterigmata 2 – 4, 5 µm long. **Hymenium thickening** 200 µm, **subhymenium** 30 µm, deep, composed of loosely interwoven hyphae, **Cystidia** none. **Hyphae** 2.5 – 5 x 6 µm.

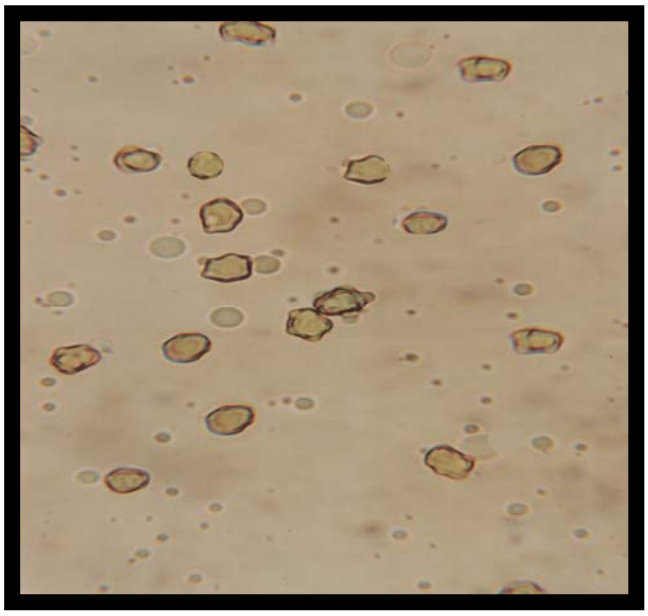
Specimen examined-: found in cultivated pine forest, especially in swampy areas along with other herbacious plants. They are generally found from June to October, 1300 – 1350m 7.7.2002 PN 22204 TUCH..

Edibility-: Inedible

Distribution -: North America, Europe, Japan, India and Nepal.

Thelephora fuscella
Photo Plate 48

1cm



Spore of *Thelephora fuscella*
Photo Plate 49

7 µm

Tylopilus nigerrinum *(*Heim) Hongo et Endo (Syn *Boletus nigerrinum* Heim, *Rev.mycol.Paris* **28** 281(1963).- Corner, *Boletus in Malaysia* 159.(1972).

Cap 6-8 cm convex then plane and repand, finely villous, dry sooty black often with purplish tinge, paler on expansion. **Tubes**4-6mm, adnate, adnexed, not ventricose, dingy whitish then pale grayish pink; **Pores** 0.3-0.5mm, subangular, fuliginous then pale fuliginous pink. **Flesh** 7-13mm in the center of the pileus 4-6mm halfway to the margin, firm, almost tough, becoming spongy in the cap, greenish white to pallid olivaceous, olivaceous green in the Stipe, then purplish in the pileus, especially over the tubes , on exposure slowly dull pink or purplish and then fuliginous, as the pores and tubes on bruising, **Stipe** 7-10cm x 8-12mm above and 17mm below,cylindric or subclavate with fusiform base, flexuous or straight, olive to olivaceous, buff wholly black scurfy pruinose reticulate, the reticulate, the meshes elongate downwards and 0.2-0.3mm deep;mycelium white.

Spore print-: Pale grayish pink to grayish cinnamon drab or cinnamon vinaceous.

Microscopic observation-:Basidiospore 10-13 x 4-5 µm, Oblong ellipsoid subfusiform, yellow or yellowish brown in KOH.

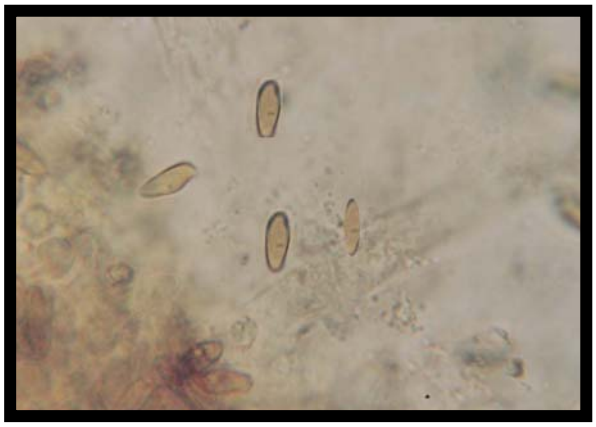
Specimen examined-: Solitary in moist soil under Pine forest of Matatirtha.Generally found from June to July at an altitude of 1400-1500m. 15.08.2004, PN 24588 TUCH.

Edibility-: Inedible

Distribution-: Japan, Malaysia, North America and Nepal.

Tylopilus nigerrinum 1cm

Photo Plate 50



Spore Print of *Tylopilus nigerrinum* 10 µm

Photo Plate 51

Volvariella bombycina (Schaeff. ex Fr.) Singer *Volvaria bombycina* (Berk. Sec Barb), Philips, *Mushrooms and other Fungi of Great Britain and Europe*. 112, (1981).- Orson and Millar, *Mushrooms of North America*,170, (1984). - Purukayastha and Chandra, *Manual of Indian Edible Mushrooms*, 127, (1985).- Saccardo, *Sylloge de fungorum* vol**.5**, 656, (1887).- Konemann, *The Encyclopedia of Mushrooms*, 121, (1999),- Krieger, *The Mushroom Handbook*,453, (1967).-Rea, *British Basiodiomycetaceae*, 94, (1922).-Koneman .*Mushroom of Japan,*122, (1999).

Cap 5-20 cm; oval becoming bell shaped to broadly convex to nearly plane; whitish or tinged yellowish; margin not lined; dry covered with silky hair, so they are commonly known as silky agarics. **Gills** Free from the Stipe; whitish becoming pink or flesh color, very ventricose, becoming toothed .**Stipe** 6-20 cm long; 1-3 mm thick; more or less equal but usually tapering somewhat to apex often curved in order to set the cap straight due to the growth on wood; dry; white; smooth; without ring; the base was bulbous, encased in a thick white to yellowish sac-like volva, outer cuticle often with yellowish brown or brownish markings, persistent, free, wide, large and membranous. **Flesh** Pure white, thin in cap, gill and Stipe. **Smell and taste** fruiti ,pleasant.**Spores print-:**salmon to pink, inamyloid.

Microscopic observation-: Basidiospores 6.5-10.5 x 4.5-6.5 μm, elliptical, smooth. Hymenophoral trama inverse.Basidium with 4-Spored. **Pleurocystidia** 44 μm and **Cheilocystidia** abundant. **Hyphae** without clamp connection.

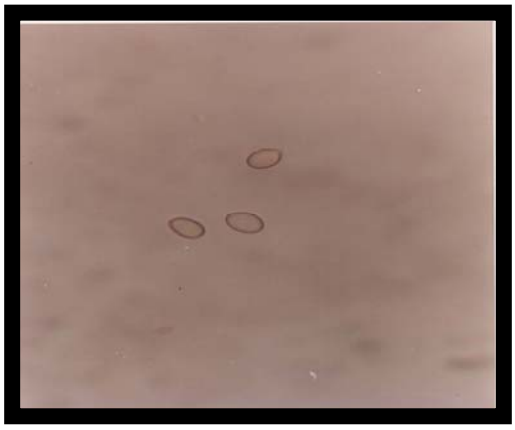
Volvariella volvacea (Bull.Ex Fr.) Sing. differ from present species in having large size, dirty spotted volva and silky cap.

Specimen examined -: On wound (groove of Poplos, trees), Kirtipur from July to October an 1320m, 02.08.2002, PN 22296 TUCH, Kirtipur 1320m, 15.09.2004 PN 25637 TUCH.

Edibility-: Edible but not recommended for eating due to close resemblance with *Amanita* species. In *Amanita* species, Spore print is white, but here Spore print is pink in color.

Distribution -: Europe, North America, India and Nepal

Volvariella bombycina 1cm
Photo Plate 52



Spore of *Volvariella bombycina* 10 μm
Photo Plate 53

Xerocomus subtomentus (L.ex Fr.) quel. Konemann, *The Encyclopedia of Mushrooms*, 26, (1999).- Svreck, *The Hamlyn Book of Mushrooms and Fungi*, 234, (1983).- Corner, *Boletus in Malaysia,* 210, (1972)-. Lakhanpal, *Mushrooms of India, Boletaceae,* 38.(1986).

Cap 4-10 cm wide without any cracks. The context layer underneath the cuticle does not contain any purplish red pigment. The cuticle can be removed. **Tubes** Curve yellowish 5-10mm deep, through finger nail, adnexed to sub decurrent. **Stipe** 4-5 x 1.5 µm usually cylindrical solid light yellowish near the apex and narrowing downwards ridged but not reliculative.

Sporeprint-: Olive brown.

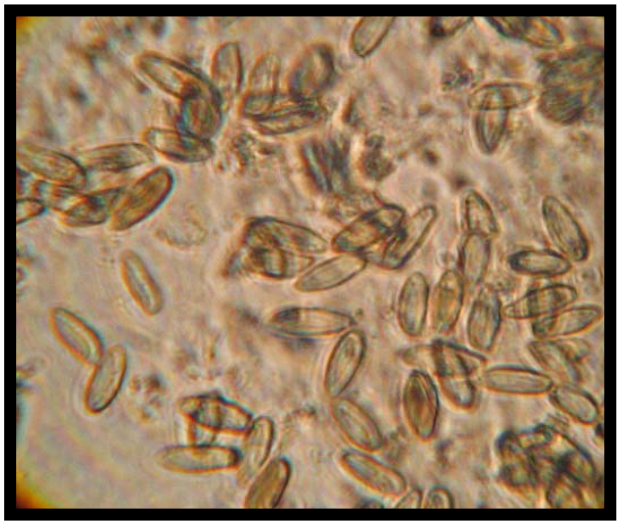
Microscopic observation-:Basidiospores 12-14 x 5-6µm, smooth, oblong ellipsoid fusiform, pale yellow. **Basidia** 24-32 x 8-12 µm. Clavate, 4 Spored. **Pleurocystidia**Scattered 30-63 x 8-15 µm smooth, thin walled. **Cheilocystidia** Clavate to subfusoid 45-60 x 9-13 µm. **Tube trama** Bilateral.

Edibility-: Edible according to literature but local people have no idea. They never eat them.

Specimen examined-: On soil Suryabinayak 1450m, 17.08.2002, PN 22309 TUCH, **Distribution-:**U.S.A, Malaysia, India and Nepal.

Xerocomus subtomentus is similar to *Xerocomus chrysenteran* but in this case the pileus is smooth and not cracked as well as the Spores are also wide and short (ellipsoid) in comparision to *Xerocomus chrysenteran*.

Xerocomus subtomentus 1cm
Photo Plate 54



Spore of *Xerocomus subtomentus* 5 µm
Photo Plate 55

4.4 Ethnomycological Survey

From the study area, 127 collectors were interviewed. Of them, only 6 collectors were above 60 years of age and they were all male; 105 collectors were in the age range 20 to 50, among which 56 were male while 49 were female; and the rest 16 were the kids below 11 years of age. The kids have no idea about edible and poisonous mushrooms, but they know where mushrooms are found. Among the adult members, hardly 36 people shared their knowledge on mushrooms.

Ethno mycological information was collected using Anthropological field techniques PRA and RRA (Participatary Rural Appraisal and Rapid Rural Appraisal) respectively; involving direct interviews and discussion with local people and through direct observation of the ways of collection and use of different mushrooms. The documented information was verified by cross questionnaire, by consulting relevant literatures and by gathering key information from village elders. The gathered ethnomycological data was authenticated by cross questionings with other groups of the same or other localities by referring the same questionnaire and samples as well as by relevant reference and herbaria consultation. The survey was done at the following three sites:

- Langtang National Park
- Kathmandu Valley
- Chitwan Tikauli & Amritdharapani Samudayak Ban

4.4.1.1 Ethnomycological Survey on Langtang National Park

S.N	Ethnic Group	Mushroom sp	Local Name	Use	Remarks
1	Sherpa, Lama, Tamang, Newar	*Agaricus augustus*	Karpu shyamu (T)	Edible	Good
2		*Cordycep sinensis*	Yer-sa-gumba (S)	Medicinal , Tonic	
3		*Coriolus hirsutus*	Teku shyamu (T)	Young vegetable, Pickle	
4		*Coltricia cinnamonia*	Patrey chyau (L)	Young edible	
5		*Ganoderma sp*	Kathey chyau (L)	Decorative purpose- hoteliars	
6		*Ganoderma sp*	Kathey chyau (L)	Hang in door to remove evil power	
7		*Gaeastrum triplex*	Cheracher shyamu (T), Tarey chyau (L)	Hallucinagenic	
8		*Hypholoma capnoides*	Siltu shyamu (T)	Edible	Good
9		*Laetiporous sulphureus*	Phengy thenga (L)	Young used as vegetable	Good
10		*Lycoperdon pyriforme*	Nagla-phum shyamu (T)	Hallucinagenic	
11		*Marasmius sp.*			
12		*Morchella conica*	Chohara (N), khoya (L), Muguding syamu(T)	Edible	Excellent
13		*Morchella esculenta*	Guchi (N), Khoya (N),Muguding syamu(T)	Edible	Excellent
14		*Ramaria botrytis*	Thokre chyau (L), Kawali chyau (N)	Edilble	Good
15		*Schizophyllum commune*	Pankey chyau (N)		
16		*Trametes versicolor*	Teku shyamu (T)	Young used as vegetable, Pickle, Medicinal to heal cut & wounds	

- N=Nepali name
- L=Local name
- T=Tamang name
- S=Sherpa name

4.4.1.2 Ethnomycological Survey on Kathmandu valley & Adjoining area

Place	Ethnic group	Mushroom sp	Local Name	Use	Remarks
Champadevi		*Laccaria amethystine*	Budhi, Jhari, Bagale (N)	Edible	Good
	Gurung	*Laccaria laccata*	Budhi, Jhari, Bagale (N)	Edible	Good
	Tamang, Newar	*Russula aurora*	Raktey chyau (N)	Edible	Good
		Russula cyanoxantha	Bhatemase chyau (L), Raktey chyau (N)	Edible	Excellent
		Russula virescens	Dhidey chyau, Maili chyau (N)	Edible	Excellent
Dakchinkali		*Cantharellus lateritius*	Pahelo chyau, Besare chyau (N)	Edible	Fair
	Gairey	*Lactarius volemus*	Dudhey chyau (N)	Edible	Excellent
	Newar	*Laccaria laccata*	Budhi chyau, Jhari chyau (N,L)	Edible	Good
		Russula virescens	Wangu bukacha (Newar)	Edible	Excellent
Dhulikhel		*Amanita vaginata*	Tahar shyamu (T)	Edible	Good
	Newar	*Boletus edulis*	Pho shyamo (T), Ghadey chyau (N)	Edible	Excellent
		Boletellus ananas		Edible	Good
		Scleroderma cepa	Dalley chyau, Aalu chyau, Kodey chyau (L)	Edible	Fair
Godawari		*Armillaria mellea*	Todke chyau (L), Ura shyamu (T)	Edible	Good
		Auricularia auricula-judae	Kane chyau (L), Navyang shyamu (T)	Edible	Good
	Newar	*Gyroporus castaneus*	Rato chyau	Edible	Good
		Helvella crispa	Seti chyau	Edible	Good
		Helvella elastica	Seti chyau	Edible	Good
Kalanki	Gurung, Magar	*Coprinus atramentarius*	Bagaley chyau (L)	Edible	Good
Kirtipur		*Agaricus campestris*	Seto chaatey chyau (L)	Edible	Excellent
		Volvariella bombycina	Seto chaatey chyau (L)	Edible	Excellent
Lele	Tamang	*Daldinia concentrica*	Dalley chyau (N)	Medicinal	
		Auricularia auricula	Thalathele chyau (N)	Edible	Fair

		Pleurotus cornucopiae	Kanne chyau (L)	Edible	Good
Matatirtha		*Laccaria amethystina*	Budhi chyau, Jhari chyau (L)	Edible	Good
		Laccaria laccata	Budhi chyau, Jhari chyau (L)	Edible	Good
	Dharti, Newar	*Pleurotus cornucopiae*	Patrey chyau, Kanne chyau (L)	Edible	Good
		Russula cyanoxantha	Raktey chyau (N)	Edible	Good
Nagarjun	Tamang	*Hydnum repandum*	Daate chyau (N), Ura shyamu (T)	Edible	Good
Nagarkot		*Schizophyllum commune*	Mizu chyau (L), Pankey chyau (N)	Culture	Sagun
Namaboudha		*Coriolus hirsutus*	Patrey chyau (N)	Medicinal -cut & wounds	Fair
		Laccaria amethystina	Budhi, Jhari (N)	Edible	Good
	Tamang	*Pleurotus sp.*	Kanney (L)	Edible	Good
		Scleroderma verrucosum	Dalley, Aalu (N)	Edible	Fair
		Suillus lutens	Chipley chyau (N)	Edible	Good
Shivapuri		*Coprinus micaceus*	Bagaley chyau (N)	Edible	Good
	Tamang	*Scleroderma verrucosum*	Dalley, Aalu (N)	Edilble	Fair
	Newar	*Auricularia polytrichia*	Thalathele chyau (N)	Edible	Good
		Gyanodorma tsugae	Kathey chyau (N)	Medicinal	Cough & cold
Sundarijal		*Amanita caesarea*	Salley chyau, Suntale (N)	Edible	Excellent
		Amanita hemibapha	Suntale (N) , phul (N), Dhar shyamo (T)	Edible	Excellent
		Amanita vaginata	Suntale(N) , phul (N) , Dhar shyamo (T)	Edible	Good
		Auricularia auricula-judae	Tahar shyamo (T), Chhate (L)	Edible(Soup)	Good
		Cantharellus cibarius	Besare chyau (N), Ura shyamu (T)	Edible	Excellent
		Coprinus comatus	Gobre chyau (L), Koper shyamo (T), Chywpu shyamo (S)	Edible	Excellent
		Griflola frondosa	Kane chyau (N), Chipley chyau (N),Narvyang shyamo (T), Kande chyau (L), Sulshing shyamo (T)	Edible	Good
	Shahi,	*Hericium erinaceus*	Thankre chyau (N), Chamarey chyau (L)	Edible	Good
	Thapa magar,	*Laccaria amethystina*	Budhi, Jhari (L)	Edible	Good
	Magar,	*Laccaria laccata*	Budhi, Jhari (L)	Edible	Good
	Tamang,	*Lactarius piperatus*	Dhudhey chyau (N)	Edible	Good

	Newar	*Lactarius volemus*	Dhudhey chyau (N)	Edible	Good
		Lycoperdon pyriforme	Phusphuse chyau (N), Nagala phum shyamo (T)	Medicinal -cut & wounds	Hallucinogenic
		Pleurotus cornucopiae	Kanney chyau (L)	Edible	Good
		Pycnoporus cinnabarinus	Rato kathey chyau, Raktey chyau, sindurey chyau	Medicinally used for treating sore ear	
		Ramaria botrytis	Thokre chyau (L), Kwali chyau (N)	Edible	Good
		Ramaria formosa	Thokre chyau (L)	Edible	Fair
		Russula aurora	Raktey chyau (N)	Edible	Good
		Russula virescens	Mailini chyau, dhide chyau (L)	Edible	Excellent
		Schizophyllum commune	Mizu chyau (L), Pankey chyau (N)	Culture	Sagun
Suryabinayak	Tamang	*Cantharellus cibarius*	Ura shyamu (T), Pahelo chyau (N), Besare chyau (N)	Edible	Excellent
	Newar	*Laccaria laccata*	Thari chyau, Budhi chyau, Bagale chyau	Edible	Good
		Lactarius piperatus	Dudhey chyau, Ngheshyamo (T)	Edible	Fair
Tigaun	Magar	*Cantharellus subcibarius*	Pahelo chyau (N)	Edible	Good
	Newar	*Laccaria laccata*	Battai chyau (L)	Edible	Good
	Gurung	*Russula nigrecense*	Chaatey chyau (N)	Edible	Fair
	Rai	*Scleroderma citrinum*	Kodey chyau (N)	Edible	Fair
Tistung Palung		*Marasmius maximum*	Budhi chyau (L)	Edible	Excellent
		Lactarius sp.	Huduley dangey chyau (L)	Edible	Excellent
	Tamang	*Lactarius sp.*	Pahelo chyau (N)	Edible	Excellent
		Lactarius volemus	Dudhey chyau (N)	Edible	Excellent
		Pleurotus sp.	Kanney chyau (L)	Edible	Excellent
		Russula sanguinea	Rakti chyau (N)	Edible	Excellent

- N=Nepali name
- L=Local name
- T=Tamang name

4.4.1.3 Ethnomycological Survey on Chitwan -Tikauli & Amrit Dharapani Samudayak Ban

S.N	Ethnic group	Mushroom sp	Chepang name + Local name	Use:Edible/Medicinal/other	Remarks
1	Chepang, Tharu, Rai, Kami, Sarki etc	*Amanita chepangiana*	Chaatey chyau (N)	Edible	Excellent
2		*Amanita vaginate*	Chaatey chyau (N)	Edible	Good
3		*Auricularia auricala -judae*	Dhudha musa (Che)	Edible -Making soup	
4		*Cantharellus cibarius*	Pahaelo chyau, Chapi musa (Che)	Edible	Excellent
5		*Coriolus hirsutus*	Chaimu musa (Che)	Edible young,Medicinal -To heal cuts & wounds	
6		*Daldinia concentrica*	Kale dallae chyau, kanney chyau, Yamu musa (Che)	Medicinal -stop bleeding	Medicinal -stop bleeding
7		*Dictyophora duplicate*	Hardi musa (Che), Gauhney (N), Ramro (N)	Young edible	Good
8		*Lactarius sp*	Khakauraee musa (Che),Dhudey chyau (N)	Edible	Excellent
9		*Lentinellus ursinus*	Ghompa musa (N)	Edible	Fair
10		*Pleurotus sp*	Kanney chyau (N),Yamu musa (Che)	Edible	Good
11		*Pleurotus sp*	Kanney chyau (N), Yamu musa (Che)	Edible	Good
12		*Pycnoporus cinnabarinus*	Rato, Sindurey (N), Yaroning musa (Che)	Medicinal -To cure ear problem	
13		*Pycnoporus sanguineus*	Rato (N), Sindurey (N), Yaroning musa (Che)	Medicinal -To cure ear problem	
14		*Scleroderma polyrhizum*	Dallae (N), Padakey, Pakamu musa (Che)	Edible	Fair
15		*Scleroderma citrinum*	Alu (N), Til (N), Kodey (N), Waybhum musa (Che)	Edible	Fair
16		*Termitomyces eurhizus*	Dhamire chyau (N), Kadum musa (Che)	Edible	Excellent
17		*Trametes versicolor*	Chaimu musa (Che), Dharkey (N)	Edible young,Medicinal -To heal cuts & wounds	

- N=Nepali name
- L=Local name
- T=Tamang name
- Che=Chepang name

4.4.2 Ethnic information-:

4.4.2.1 Culinary Mushroom-:

- *Lactarius volemus* is rather more delicious in the raw form than when it is cooked (Dakshinkali).
- *Russula delica* are eaten raw, but most species are roasted on fire or boiled in soups with other ingredients (Dakshinkali).
- *Laetiporus sulphureus* and *Hericium erinaceus* are found to be good only in their immature stages (Sundarijal).
- Thalthaley shyamo(*Auricularia* spp) is used to prepare soup in the Langtang area.
- *Cantharellus cibarius, Grifola frondosa, Hericium erinaceus, Laccaria laccata, Lactarius volemus, Laetiporus sulphureus, Oudimansiealla radicata, Pleurotus cornucopiae, Ramaria botrytis, Russula delica, Russula virescens, Scleroderma cepa, Termitomyces spp,* and *Schizophyllum commune* have found to be regularly and traditionally consumed by local inhabitants.
- The species with apparent commercial value include *Laetiporus sulphureus*, *Hericium erinaceus*, *Laccaria laccata*, *Lactarius volemus*, *Grifola frondosa*, *Scleroderma cepa*, *Termitomyces spp, Cantharellus cibarius*, *Cordyceps sinensis*, *Ramaria botrytis*, *Russula delica,* different species of *Agaricus* and *Amanita caesarea, A. hemibapha etc*.
- *Schizophyllum commune* is prepared with rice flour in Langtang.
- *Morchella* species is used as delicious vegetable dish in Langtang.
- *Coriolus hirsutus*, *Daldnia concentrica, Lycoporden pyriforma, Pycnoporus Cinnabarinus and Schizophyllum commune* are found to be useful in curing wounds.
- The species like *Grifola fondosa* and *Ramaria botrytis* are found to be useful in relieving muscle pain.
- *Laetiporous sulphureus* is used as a vegetable in Langtang.

4.4.2.2 Medicinal Mushrooms-:

- *Grifola frondosa* & *Ramaria botrytis* are supposed to cure backache in Sundarijal.
- *Morchella* species, in addition to being a delicious vegetable dish, is also used medicinally to treat burns. The paste is made by grinding with water and applied externally for pain relief in Langtang. Similarly, *Morchella* is given to heart patients by boiling with milk.

- Tamangs of Sudarijal, Langtang and Dakshinkali use *Laetiporus sulphureus* for prevention of cancer.
- Tamangs dwelling in different areas believe that *Pleurotus cornucopiae* promotes good health and vitality, thus increasing body's adaptive abilities.
- *Cordycep sinensis* is used as tonic and sexual stimulant for both sexes (aphrodisiac). The people of Kyanjin (Langtang) believe that continuous use of this species along with milk increases the immunity power and its regular users never fall sick.
- *Trametes versicolar* is found to be used to stop bleeding from wounds in Chitwan, Champadevi, Sundarijal and Langtang areas.
- In Sundarijal and Chitwan, *Pycnoporus cinnabarinus* is dried, grinded, mixed with mustard oil, kept for few hours till the oil becomes red in color which then is filtered with muslin cloth and the result is used as ointment for the treatment of ear infections of a child.

4.4.2.3 Ornamental and religious value of Mushroom-:

- Beautiful Polypores fungi are used ornamentally by some hoteliers of Langtang area. They mainly use *Ganoderma lucidium* for this purpose.
- *Schizophyllum commune* is an important species of mushroom among the Tamang community for its religious values. It is necessary during their marriage ceremony.
- People of Langtang area hang some Polyporaceae mushrooms outside their doors with the belief that it helps to chase away witches and end devils' power.

4.4.2.4 Domestic use of Mushroom-:

- Some species of mushrooms were found to lock the crevices of the wooden pot (Theki) called "Theki talney chyau". The species of *hymenochetae, Trametes* and *Coriolus* are used for such purposes. They grind these species with mortar and pestle to make a paste and do apply the paste in the cracked area of the pot to make it reusable. (Chitwan, Tiguan- Nuwakot and other places).
- Some mushrooms (*Clavaria* species) can be used for lighting cigarettes.
  (Tiguan, Khole gaun - Nuwakot).

4.4.2.5 In case of Mushroom Poisoning and causes of poison

- Tamangs used *Parish poryphylla* (Satuwa), *Xanthoxylum armatum* (Aakhen Timur), *Allium sativum* (Lasun) to minimize possible poisoning along with vinegar.
- In Sundarijal, bamboo tender shoots are used to minimize poisoning.

- Local people of Champadevi, Tigaun and Kholegaun (Nuwakot) think that mushrooms growing in black soil are poisonous.
- People of different collection sites believe that if a snake touches a mushroom then it becomes poisonous.
- Addition of vinegar is a worldwide method to minimize mushroom poisoning. Many mycologists such as Rinaldi and Tyndalo (1985), Purukayastha and Chandra (1985), Chaube (1995) and Adhikari (2000) mentioned about the uses of vinegar. My observation in the study area was found to be consistent.
- Bandhaniya and Bantimur are used to minimize possible poisoning of mushroom (Langtang).
- According to local people of Bhaktapur, beaten rice (Chiura) can be used to ensure whether mushrooms are poisonous or not. If the beaten rice turns black or dark in color, then the mushroom is considered poisonous. This is the new idea that comes as different from the previous testing methods mentioned by other researchers.

4.4.2.6 Poisoning and Death cases due to consumption of wild mushroom

The researcher found the following poisoning and death cases, in areas other than the study area, during her study period:

- 2001 June 6, at Ilam, consumption of wild mushroom was responsible for the death of 14 people.
- 2002 June 10, at Lamjung, 3 members of a Pariyar family lost their lives after the consumption of wild mushroom.
- 2003 July 17, at Narayanghat, consumption of wild mushroom took the lives of 3 members of a Pariyar family.
- 2003 July 22, at Dang, consumption of wild mushroom took the lives of 3 people.
- 2004 June 16, at Rasuwa, a person fell sick due to the consumption of wild mushroom.
- 2005 June 20, at Tanahun, mushroom took the lives of 4 members of the same family of the ages of 12, 15,18 and 20.
- 2005 July 29, at Palpa, 6 people were killed due to consumption of wild mushroom.
- 2005 Aug 20, at Palpa, due to the consumption of wild mushroom, besides the death of 14 people, 41 people were admitted in the mission hospital among which 29 returned back after few hours of treatment.
- 2007 June 3, at Tanahun, due to the consumption of wild mushroom, 22 persons of the same village got severely sick.

- 2007 July 28, at Arghakhanchi, consumption of wild mushroom, collected from the jungle, took the lives of 3 children of ages 6, 8 and 11.
- Note: The detail of above facts are provided (paper cuttings) in Appendix XXI.

These poisoning and death cases were reported by the daily radio news and the national news papers; hence, they are only the publicly documented cases of mushroom poisoning. Besides these, other sporadic poisoning cases may occur in local mycophagus area, but such case/s remain un-publicised. From the study, it was confirmed that poisoning incident occur more in hilly region, less in plain and almost none in high altitude area. According to the ethnic information, this is due to the fact that the local people in high altitude are more conscious of the things they consume and are more likely to identify poisonous species compared to the people in Tarai and Hilly region.

4.4.2.7 Comments upon the proverb

There is a proverb "Bahun ko babule chyau khawos na swad pawos" i.e. had the Brahmins eaten mushrooms, they would have known the real taste of mushrooms. The reason behind the proverb is found to be almost the same in every study area (while inquired with the local people) i.e. due to the delicious taste of wild edible mushrooms, the mycophagus group teased the Brahmin children because the Brahmins were forbidden from eating mushrooms (a tradition strictly followed widely).

4.4.2.8 The reasons behind why Brahmin didn't eat mushrooms in earlier times are as follows:

Five reasons are listed below:

1. Mushrooms used to grow in jungles and both edible and poisonous species are morphologically very similar in some cases which are known as "look-alike species". On occasion, the traditional mycophagus groups also got confused on edibility leading , sometimes, to critical situation - even death. As such, it is believed that Brahmins, using their wisdom, preferred non-use of mushrooms (as confusion on edibility could lead to even loss of life).

2 There is a traditional anecdote about farmers. Farmers were very busy in July, planting rice. In the same season, once there was a sick elderly person found dead in one morning when all members were just moving out towards the field. Having no time to cremate him, his corpse was kept wrapped within a mat and it was left in a moist corner of the ground. Because of the busy schedule, they forgot about the deceased person and his corpse during the entire course of their work. Only after completion of their plantation, they remembered about the corpse. On return,

they found that mushrooms had grown all over the body of the corpse. Since that event, Brahmins started to discard mushroom in the form of food.

3 According to the Hindu religious book "Mahabharat", mushrooms began to grow in such places where the blood of the devil Britasur began to flow after getting killed by God Indra. Thus, Brahmins don't eat mushroom with the thought that it came into existence out of the blood of the devil.

4 Mushroom, being saprophytic, grows in dirty places like cow-dung, rotten vegetables, rotten hay, excreta of different animals, rotten logs etc. Brahmins, during those days, firmly believed that one's wisdom had direct relation with the consumed food; hence, if you consume things that grow in rotten places then your knowledge will also be rotten. Thus, no mushrooms!

5 During earlier times, Brahmins were prohibited from drinking whisky and alcohol, as spirits were thought to destroy the power of thinking. Mushrooms were considered as hallucinogenic substance and thus Brahmins were prohibited from consuming mushrooms.

4.4.3. Local Mushroom receipe

Mushroom pickle:

The people of Langtang prepared pickle of young *Laetiporous sulphureus* and young species of *Trametes* & *Coriolus*. For this, first of all the young specimen were washed with water and then dried in sun for 3 to 4 hours. After drying, they thoroughly mixed ground spices (whatever they found) along with salt and oil into the same and kept in a bottle for 1 or 2 weeks , thus producing a bottle of tasty pickle.

Mushroom Vegetable:

Young species of *Laetiporous sulphureus*, *Hypholoma capnoids, Agaricus augustus,* and different edible species of *Agaricus, Russula, Lactarus, Cantharellus*, and *Ramaria etc.* were used as vegetables by local people at different places during on season (mainly four months).

Mushroom Soup:

Auricularia species are used to prepare soup. For this, adequate amount of water along with available ground spices with proper amount of salt and mushrooms (*Auricularia* species) are cooked for one or two hour on low flame. Then the soup will be ready to serve.

Mushroom Pakauda:

For this, fleshy large edible mushrooms are cut into pieces and they are dipped in paste of flour of either of wheat, corn, buckwheat etc. with necessary amount of salt and available ground spices. They are then fried on Tapakey or Karahi (local names for pan/s) , and the mushroom pakauda is ready to serve.

Mushroom Pulau:

Edible mushrooms are chopped into pieces and slightly fried with salt and pepper. Plenty of this is added to fried rice. They are mixed thoroughly and are ready to eat with some hot pickle or hot soup. In Langtang, due to the flow of tourists, the hoteliers prepare mushroom soup, mushroom pulau and mushroom pakauda in on season.

Chepang Recipe:

The Chepang cook wild edible mushroom in an earthern pot which is known as "Gwa". They only boil the mushroom with salt, chilli and available ground spices. The edible species of mushroom, according to their mother tongue, are: Chetan musa, Yamu musa, Dhudha musa, Cheimu musa, Kadum musa, Baum musa, Hardi musa, Pankamu musa, Khaukarey musa, Lisa musa, Phuli musa, Chapi musa, Gobrey musa, Chamrey musa, Gosaydunge musa, Raktey musa, and Thokpa musa (Pandey & Budathoki 2007 Journal of NAST).

They also eat some wild edible mushrooms by wrapping the same within either the leaf of Bhorla (*Bauhinia vahlii*) or leaf of Churi (*Bassia butyraceae*) and roasting it on fire. The leaf will get dried and fall down and the mushroom will be ready to eat.

Dried Mushroom for Vegetable:

At times of vigorous growth of edible species, the people there dried mushrooms (enough leftovers after consumption) against the sun or through placing the same on the sides of the mouths of their local food-burners. The stored mushrooms could be used during off season.

4.4.3.1 Modern Mushroom Receipe

Mushroom Soup

Fresh mushrooms	500 g
Oil (any)	50 g
White flour (*Maida*)	2 tablespoons full
Salt	to taste
Ground spices(cardamom, red chillies, cinnamom & pepper)	4 g
Milk	1 liter

Clean and chop fresh mushrooms. Melt butter in a pan and sauté the mushrooms in it. Add milk and let the mixture boil for five to seven minutes. Dissolve maida (flour) in a little cold water and add to the boiling milk and mushroom mixture to thicken it. Give two boils and add salt and spices. Serve while hot.

Mushroom Pulao

Mushrooms	250 g

Rice (Basmati)	100 g
Onion	1 small
Cumin seeds	½ tablespoon
Cardamom	1
Cloves	1-2
Black pepper	2-3
Ghee (cooking fat)	2 tablespoons
Salt	according to taste

Wash mushrooms, cut and chop lengthwise. Clean and soak the rice for 10 minutes. Heat ghee and fry mushrooms lightly. Keep them aside. In the same ghee add cumin, cardamom, cloves, black pepper and bay leaves. When cumin seeds begin to crackle add onion. Brown then lightly. Add rice and double the quantity of water and salt to taste. After rice begins to boil, add mushrooms to the rice. Cook on a slow fire, till the pulao is ready.

Mushrooms Pakoras

Medium sized mushrooms (without stem)	6
Egg	1
Gram flour (*Besan)*	10 g
Baking powder	a pinch
Salt and red pepper	according to taste
Fine white bread crumbs	
Oil to fry	Sufficient

Beat the egg and add flour, baking powder, salt and red pepper and make a batter. Add little water if needed. Dip mushrooms in a batter and roll in bread crumbs. Heat the oil and fry few mushrooms pakoras at a time till they become brown.

Mushrooms on Toast

Mushrooms	50 g
Onion	1 small
Tomato	1 small
Butter	10 g
Bread slices	3
Salt and pepper	to taste

Take 50gm of mushrooms with their gills showing an attractive deep pink color. Remove the stem and mince with a little parsley and a small onion (optional). Add salt and pepper and cook in butter or ghee. Beat up an egg, add a pinch of bread crumbs, and stir into the simmering mushroom stalks. As soon as the mixture is thickened place the mushrooms caps and bake for four to five minutes and serve on crisp hot toasts.

Mushroom Omelet

Eggs	2
Small mushrooms	3
Butter	25 g

Chop mushrooms and place them in a pan. Add butter, little salt and pepper and simmer the mushrooms. Make up and fry the omelet mixture and when ready add the simmered mushrooms, fold over and cook for another few seconds, then serve piping hot.

Mushrooms Pickle (1)

Fresh mushrooms	500 g
Salt	20 g
Ginger (ground)	5 g
Onion (chopped)	2 g
Mace (ground)	10 g
Fenugreek (*Methi* seeds) (ground coarsely)	10 g
White pepper (powdered)	20 g
Red chillies	10 g
Glacial acetic acid (conc. Vinegar)	10 g
Ripe seed oil	100 g

Use button mushrooms. Immerse them in cold water for a few minutes and drain. Put clean mushrooms in a pan and mix with salt, pepper, mace, fenugreek, red chillies. Fry onion and ginger in oil to a light brown color and mix with mushrooms. Add vinegar and cook for ten minutes. Pour the whole mixture into small glass jars, taking care that all the spices are divided equally in the jars. Leave it for a few days.

Mushroom Pickle (2)

Mushrooms	250 g
Onion	50 g
Ginger	1 inch piece
Garlic	2-3 cloves
Mustard oil	100 g
Salt	1 teaspoon full heaped
Red chilli powder	½ teaspoon full
Garam masala	½ teaspoon full
Gud	100 g
Vinegar	¾ cup
Mustard seeds	10 g (coarsely ground)

Wash mushrooms, cut the larger mushrooms lengthwise and leave the smaller mushrooms uncut. Heat oil in a pan and fry the mushrooms lightly. Take them out in the same oil fry chopped onion, ginger and garlic to golden brown. Side-by-side dissolve gud (sugar) in vinegar in a separate pan. Mix the mushroom and gud syrup with the fried onion, ginger and garlic. Take the pan off the fire. Bottle the pickle.

Mushrooms and Paneer

Mushrooms	200 g
Paneer	250 g
Onion	100 g

Tomatoes	100 g
Ghee	2 tablespoon full
Salt	to taste
Garam Masala	1 teaspoonful

Wash mushrooms and cut into two halves lengthwise. Dice paneer (milk product) into 2" cubes. Chop onions and cut tomatoes into small pieces. Heat ghee in a pan, put chopped onion in it and let it brown, add tomatoes to it. Simmer it for 5 minutes. Add mushroom, paneer and salt. Cook at slow fire till water of mushroom dries up. Add garam masala (ground spices)and serve hot.

Mushroom Samosa

For stuffing:	
Mushroom	200 g
Onion (chopped)	1 big or 2 small
Green chillies (chopped)	1 tablespoon full
Coriander leaves (chopped)	1 tablespoon full
Salt	to taste
For covering :	
White flour (Maida)	250 g
Ghee	3 desert spoon
Salt	½ teaspoon

Cut mushrooms in small pieces, chop onion. Heat ghee in a pan and add mushroom, chopped onion, green chillies and salt. Put off fire when water dries up and add coriander leaves. Use this for stuffing.

Sieve white flour, out ghee and make a soft dough by adding water. Make small balls with dough and roll them into small chapaties (local breads). Cut each into two halves and take one part of it. Fill the samosa with the stuffing. Heat the ghee and deep fry. Serve hot with tomato sauce or green chutney.

Mushrooms Fried (snacks)

Mushrooms (without stem)	6 medium sized
Egg	1
Flour	2 tablespoons
Baking powder	a pinch
Salt and pepper	to taste
White bread crumbs	required
Oil	sufficient to fry

Beat the egg and add flour, baking powder, salt and pepper and make batter. Add little water if needed. Dip mushrooms in the batter and roll in bread crumbs. Heat the oil, fry the prepared mushrooms a few at a time till golden brown.

Peas and Mushrooms

Peas shelled	½ kg
Mushrooms (button size)	250 g
Onions	2
Clove garlic	1
Ginger	little

Tomatoes	2 big
Ghee	2 tablespoon
Salt	1 teaspoon
Termeric	½ teaspoon
Chillies	½ teaspoon
Garam masala	½ teaspoon
Finely chopped coriander (green)	few

Grind the onions, garlic and ginger and fry in ghee till golden brown and add salt and cut- up tomatoes. When masala (ground spices) is ready add the shelled peas and fry them nicely with little water. When all the water dries up add whole mushrooms and fry them also. Put garam masala and green coriander before serving. If you need curry, add little water; cook for 5 minutes and serve with boiled rice.

Baked Tomatoes with Mushrooms

Tomatoes (ripe)	2 large
Mushrooms (finely chopped) and onions (medium size & finely chopped)	200 g
Egg yolk	1
Fresh lemon juice	1 teaspoon
Freshly grated cheese	1

Cut and slice the tomatoes in halves and sprinkle with salt. Turn upside down and drain for an hour or so. Gently remove the seeds. Melt the butter in a pan, add mushrooms and onion and fry lightly. Stir the lemon juice and salt. Cook till all water is absorbed. Remove, cool and add the egg yolk. Fill this in the halved tomatoes sprinkle with cheese and bake till ready.

Mushroom Loaf

Fresh Mushrooms	2 lbs
Onion (thinly sliced)	1 large
Butter	2 lbs
Dry bread crumbs	½ cup
Egg (lightly beaten)	2
Butter or Margarine (melted)	¼ lb
Salt	½ tablespoon
Pepper	a dash

Saute half of the onion in 2 lbs butter until golden brown. Save several large mushroom caps for garnish. Chop remaining mushrooms, including stems and remaining onion and mix with bread crumbs, salt, pepper and remaining butter. Stir in eggs and the sautéed onions.

Press entire mixture in a well greased loaf pan. Arrange mushroom caps on top and press lightly. Bake in 350^{o} Oven for 1 hour. Let stand several minutes, slice and serve with mushroom gravy.

Mushroom Sauce

Butter	50 g
Flour	50 g
Milk or stock or its mixture	1 pint
Mushrooms	50 g

Heat the butter and stir in the flour into the fat over general heat. Allow to cook a little and then add milk and stock. Gradually cook till creamy. Fry the cut up mushroom in 10 g of butter for a little while, and then add them to the above with its juice. You may serve this on toast as a snack or with meat or chicken.

Note: Mainly cultivated mushroom are used in these recipes. Besides cultivated mushrooms, wild edible mushrooms (whenever available) such as *Agaricus, Polyporous, Grifola frondosa, Puffballs, Russula,Lactarius, Laccaria, Armillaria mellea* and other edible species contribute their own special flavor and taste.

In Japan, wild *Grifola frondosa,* are served only at top class restaurants because of its good flavour,crisp texture and excellent taste.

5. Chemical Analysis of Mushroom

Wild edible mushrooms are one of the important non timber forest products (natural resources) of the country which have high nutritional and economic value. They grow vigorously during rainy season. The mycophagus group , besides consuming them, also sell them in the local markets, while some ethnic people dry them for consumption in the off season. Most of the analysis were done in cultivated common edible mushrooms such as *Pleurotus ostreatus, volvariella volvacea,Agaricus bisporous* , *Lentinula edodes* etc. Here, the analyses were focused on wild mushroom.

During the analysis of mushroom samples, eleven parameters such as amino acid, crude protein, soluble protein, moisture, ash acid insoluble ash, sugar, calcium, phosphorus, iron, SDS PAGE were accomplished. Each parameter was repeated thrice and mean of them was considered as the final result. The results are shown in the tables, indicating the highest and lowest data by double and single (*) mark respectively. Graphic representation of all analysis are appended in Appendix-XIX.

5.1 Result of percentage of Moisture

Highest percentage of Moisture was obtained in *Russula spp* (Salle chyau) 95% and the least was found in *Ganoderma lucidium* and *G. tsugae* 40% , the detail of which is shown in the table 5.1.

Table 5.1 Result of percentage of Moisture

S.N	Name of the species	% of Moisture
1.	*Amanita caesarea*	93
2.	*Auricularia polytrichia*	85.75
3.	*Cantharellus cibarius*	94
4.	*Coprinus comatus*	94
5.	*Ganoderma applanatum*	44
6.	*Ganoderma lucidium*	**40 ***
7.	*Ganoderma tsugae.*	**40 ***
8.	*Laccaria amethystina*	85
9.	*Laccaria laccata*	86.40
10.	*Oudemensiella radicata*	85
11.	*Pleurotus cornucopie*	88
12.	*Lentinellus ursinus*	85
13.	*Polyporous picipes*	70
14.	*Pycnioporous cinnabarium*	60
15.	*Ramaria botrytis.*	89
16.	*Russula chlorides*	92
17.	*Russula cyanoxantha*	93
18.	*Russula nigricans*	94
19.	*Russula sp* (Salle chyau*)*	**95 ****
20.	*Scleroderma cepa*	78
21.	*Scleroderma citrinum*	80
22.	*Scleroderma verrocosum*	80
23.	*Volvariella bombycina*	85.52

5.2 Result of Ash and Acid in soluble ash.

Highest percentage of Ash was found in *Volvariella bombycina* 18.75, and the least was found in *Grifola frondosa* 5.174. Similarly, highest percentage of AIA was found in *Cantharellus cibarius* 10.44, and the least was found in *Pleurotus cornucopiae* 0.058 , the detail of which is shown in the table 5.2.

Table 5.2 Result of Ash and Acid in soluble ash.

SN	Name of Species	Ash%Dry basis	AIA Dry basis %
1	*Agaricus augustus*	18.33	6.38
2	*Agariicus bisporous*- (cultivated)	9.96	0.77
3	*Agaricus placomyces*	14.91	0.19
4	*Agaricus compestris*	21.417	4.0140
5	*Armillaria mellea*	11.109	4.01
6	*Auricularia polytrichia*	9.13	0.758
7	*Cantharellus cibarius*	18.58	**10.44****
8	*Grifola frondosa*	**5.174***	0.319
9	*Laccaria laccata*	15.8	6.36
10	*Pleurotus cornucopiae*	9.8	**0.058***
11	*Pleurotus sp*	9.8	0.1065
12	*Pleurotus sajorkaju*-(cultivated)	60.29	0.2871
13	*Russula cyanoxantha*	8.59	0.721
14	*Russula virescens*	7.86	0.52
15	*Scleroderma citrinum*	5.57	0.278
16	*Volvariella bombycina*	**18.75****	0.2392

5.3 Carbohydrate Determination (Reducing sugar determination)

During the estimation of carbohydrate, only reducing sugar was determined, and the results are negative. Thus, mushrooms are free from sugar.

5.4 Quantitative Determination of Amino Acid by Ninhydrin Method

During this determination of the free amino acid, the higher amount of the total amino acid was detected in *Coprinus comatus* (13.80 mg/ml) followed by *Amanita caesarea (*13.67 mg/ml) and *Agaricus bisporous (*13.39 mg/ml). The detail is illustrated in Table 5.4.

Table 5.4: Free amino acid content (mg/ml) of isolated mushroom sample observed

S. N.	Name of the species	Free Amino acid content (mg/gm)
1	*Agaricus bisporous*	13.39
2	*Amanita caesarea*	13.67
3	*Auricularia polytricha*	6.87
4	*Cantharellus cibarius*	4.64
5	*Coprinus comatus*	**13.8 ****
6	*Ganoderma applanatum*	7.74
7	*Ganoderma lucidium*	6.7
8	*Ganoderma tsugae*	2.19
9	*Laccaria amethystina*	4.25
10	*Laccaria laccata*	6.33
11	*Oudemansiella radicata*	11.87
12	*Pleurotus cornucopiae*	12.77
13	*Pleurotus sajorkaju*	11.74
14	*Pleurotus sp.*	4.51
15	*Polyporous picipes*	**3.35***
16	*Pycnioporous cinnabarinus*	9.91
17	*Ramaria botrytis.*	8.38
18	*Russula chlorides*	9.44
19	*Russula cyanoxantha*	12.9
20	*Russula nigricans*	11.22
21	*Russula sp*	8.38
22	*Scleroderma cepa*	9.03
23	*Scleroderma citrinum*	6.03
24	*Scleroderma verrocosum*	11.33
25	*Volvariella bombycina*	12.51

5.5 Qualitative Determination of Amino Acid by Chromatography Result

One dimensional paper chromatography was performed for the qualitative detection of the amino acid of the mushroom samples which revealed several types of the amino acid. In reference with the Rf of standard amino acid (Appendix XI), spot was detected as far as possible. The involving amino acids of 2-6 different types (distinctly separated) were observed. Six different amino acids were isolated from *Pleurotus sajorkaju* (Cys, Asp, Glu, Try, Val, Gly,), *Russula cyanoxantha* (Asp, Gly, Glu, Pro, Trp, Val) , *Russula nigricans (*Cys, His, Glu, Pro, Trp, Val) and so on. The chromatogram thus revealed have fused spot and are not distinctly separated. The detail of the same is illustrated in Table 5.5.

Table 5.5: Different types of amino acid obtained from the one dimensional paper chromatography.

Serial No.	Name of the species	Types of Amino Acid content *
1	*Agaricus bisporous*	Lys, Asp, Gly, Met
2	*Amanita caesarea*	Lys, His, Ser, Val
3	*Auricularia polytricha*	Asp, Glu, Pro
4	*Cantharellus cibarius*	Lys, Gly, Val
5	*Coprinus comatus*	His, Gly, Ser, Tyr
6	*Ganoderma applanatum*	Arg, Ser, Tyr, Met, Theo
7	*Ganoderma lucidium*	Asp, Ser, Trp, Val
8	*Ganoderma tsugae*	Asp, Glu, Theo
9	*Laccaria amethystine*	Asp, Pro, Glu
10	*Laccaria laccata*	**Arg, His***
11	*Oudemansiella radicata*	Arg, Ser, Val
12	*Pleurotus cornucopiae*	Asp, Gly, His, Theo
13	*Pleurotus sajorkaju*	**Cys, Asp, Glu, Try, Val, Gly ****
14	*Pleurotus sp.*	Glu, Pro, Tyr
15	*Polyporous picipes*	Glu, Lys, Gly, Pro
16	*Pycnioporous cinnabarinus*	Arg, His, Glu
17	*Ramaria botrytis.*	Arg, Glu, Trp, Val
18	*Russula chlorides*	Gly, Glu, Trp, Val
19	*Russula cyanoxantha*	**Asp, Gly, Glu, Pro, Trp, Val ****
20	*Russula nigricans*	**Cys, His, Glu, Pro, Trp, Val ****
21	*Russula sp*	Glu, Trp, Val, Asp
22	*Scleroderma cepa*	Gly, Thr, Tyr, Val, Asp
23	*Scleroderma citrinum*	Glu, Gly, Asp, Pro
24	*Scleroderma verrocosum*	Asp, Glu, Pro
25	*Volvariella bombycina*	His, Gly, Thr, Met

Abbreviation of Aminoacid:

*Iso-Isoleucine, Leu-Leucine, Lys-Lysine, Met-Methionine, Cys-Cysteine, Tyr-Tyrosine, Thr-Threonine, Try-Tryptophan, Val-Valine, Arg-Arginine, His-Histidine, Ala-Alanine, Asp-Aspartic acid, Glu-Glutamic acid, Gly-Glycine, Pro-Proline, Ser-Serine, Trp-Trypsine

5.6 Kjeldahl Method Result

Micro-Kjeldahl method was applied for the determination of the Nitrogen and its protein content was determined. It was found out that *Amanita caesarea* (34.44%) had highest percentage of the protein and list in *pleurotus* species (8.01). Details of all is illustrated in the Table 5.3.6.

Table- 5.6: Percentage of protein determined :Micro-Kjeldahl method.

Serial No.	Name of the species	Percentage of protein
1	*Agaricus bisporous*	22.74
2	*Amanita caesarea*	**34.44 ****
3	*Auricularia polytricha*	13
4	*Cantharellus cibarius*	18.71
5	*Coprinus comatus*	21.98
6	*Ganoderma applanatum*	9.4
7	*Ganoderma lucidium*	11.26
8	*Ganoderma tsugae*	13.67
9	*Laccaria amethystine*	9.95
10	*Laccaria laccata*	26.03
11	*Oudemansiella radicata*	16.07
12	*Pleurotus cornucopiae*	12.32
13	*Pleurotus sajorkaju*	12.57
14	*Pleurotus sp.*	**8.01***
15	*Polyporous picipes*	20.12
16	*Pycnioporous cinnabarinus*	9.84
17	*Ramaria botrytis.*	12.24
18	*Russula chlorides*	15.52
19	*Russula cyanoxantha*	25.11
20	*Russula nigricans*	12.35
21	*Russula sp*	14.89
22	*Scleroderma cepa*	14.36
23	*Scleroderma citrinum*	21.21
24	*Scleroderma verrocosum*	19.14
25	*Volvariella bombycina*	23.19

5.7 Lowry method result

During the study, protein concentration of the mushroom varied not only from species to species but even in the same species found in various different geographical locations. The concentration of protein ranged from 13.6 mg/gram in *Amanita caesarea and Ganoderma lucidium* to 1.76mg/gm in *Volvariella bombycina,* the detail of which is illustrated in Table 5.7.

Table 5.7 : Protein concentration in each gram of mushroom sample through Lowry method

S. No.	Name of the species	Optical Density Lowery method	Protein (0.05ml) from Cal. Curve	Protein Conc in 1ml. Of sample (mg)	Protein Conc in 1 gm Of sample (mg)
1	*Agaricus bisporous*	0.2	41	82	5.56
2	*Amanita caesarea*	0.42	85	170	**13.6****
3	*Auricularia polytricha*	0.28	57	114	8.8
4	*Cantharellus cibarius*	0.05	11	22	1.76
5	*Coprinus comatus*	0.23	47	94	7.52
6	*Ganoderma applanatum*	0.25	51	102	8.16
7	*Ganoderma lucidium*	0.42	85	170	**13.6 **
8	*Ganoderma tsugae*	0.13	27	54	4.32
9	*Laccaria amethystina*	0.4	80	160	12.8
10	*Laccaria laccata*	0.29	59	118	9.44
11	*Oudemansiella radicata*	0.13	27	54	4.32
12	*Pleurotus cornucopiae*	0.26	53	106	8.48
13	*Pleurotus sajorkaju*	0.07	15	30	2.4
14	*Pleurotus sp.*	0.15	31	62	4.96
15	*Polyporous picipes*	0.24	49	98	7.84
16	*Pycnioporous cinnabarinus*	0.32	65	130	10.4
17	*Ramaria botrytis*	0.36	72	144	11.52
18	*Russula chlorides*	0.1	21	42	3.63
19	*Russula cyanoxantha*	0.12	25	50	4
20	*Russula nigricans*	0.07	15	30	2.4
21	*Russula sp*	0.06	12	24	1.92
22	*Scleroderma cepa*	0.2	41	82	6.56
23	*Scleroderma citrinum*	0.33	67	134	10.72
24	*Scleroderma verrocosum*	0.23	47	94	7.52
25	*Volvariella bambycina*	0.05	11	22	**1.76***

5.8 Bradford's Method Result

In thirtyfive species of mushrooms proteins were determined through Bradford's method. Among them, thirty three species were wild mushrooms and the remaining two species *Agaricus bisporous and Pleurotus sajorkaju* were cultivated samples from Balambu farm. The highest amount of protein (1.567mg/ml) was found in C*antharellus subscibarius* and the least (0.131 mg/ml) was found in C*ordycep sinensis*. The detail on them is illustrated in Table 5.8.This result has already been published in journal of Ministry of Enviorment, Science and Technology, "Scientific World" 2006(Pandey N and U. Budathoki).

Table 5.8. Protein concentration through Bradford's method

Sample	Coll.No	Place of coll.	Abs(600nm)	Conc. in 30µl	protein mg/ml
Agaricus bisporous	Market	Baneshwor	0.1	19.22222	0.509
Agaricus campestris	24536	Kirtipur	0.18	23.38889	0.779
Amanita vaginata	24609	Matatirtha	0.1	12.27778	0.27
Cantharellus cibarius	24630	Suryabinayak	0.24	31.72222	1.057 3
Cantharellus subcibarius	24606	Matatirtha	0.35	47	**1.567 4****
Clavaria rosea	24584	Sundarijal	0.07	8.111111	0.27
Coprinus comatus	21108	Langtang	0.11	13.66667	0.456
Cordycep sinensis	23455	Langtang	0.04	3.944444	**0.131***
Coriolus hirsitus	25645	Matatirtha	0.07	8.111111	0.27
Ganoderma tsugae	23440	Langtang	0.08	9.5	0.316
Hypholoma capsonoid	25653	Langtang	0.18	23.38889	0.779
Laccaria laccata	25629	Suryabinayak	0.16	20.61111	0.687
Laccaria laccata	24598	Matatirtha	0.19	24.77778	0.826
Laccaria laccata	24526	Godawari	0.14	17.83333	0.594
Lactarius piperatus	22158	Suryabinayak	0.31	41.44444	1.38
Lactarius volemus	24570	Tistung Palung	0.09	10.88889	0.27
Laetiporous sulphureus	24541	Langtang	0.16	20.61111	0.687
Marasmius maximus	24572	Tistung Palung	0.09	8.111111	0.27
Morchella conica	23461	Langtang	0.14	17.8333	0.594
Mycena Sp	25651	Langtang	0.16	20.61111	0.687
Omphalotus olearis	24576	Baneshwor	0.16	20.61111	0.687
Oudemensiella radicata	24617	Baneshwor	0.14	17.8333	0.594
Pahelo chyau	24573	Baneshwor	0.1	12.27778	0.409
Pleurotus sajorkaju	Market	Tistung Palung	0.15	12.27778	0.64
Pleurotus Cornucopiae	23469	Matatirtha	0.16	20.61111	0.687
Pleurotus sp	24569	Tistung Palung	0.07	8.111111	0.27
Russula aurora	24601	Matatirtha	0.08	13.66667	0.456
Russula cyanoxantha	24605	Matatirtha	0.32	42.83333	0.594
Russula delica	24571	Tistung Palung	0.11	13.66667	0.456
Russula sp	24604	Matatirtha	0.14	17.83333	0.594
Russula virescens	25681	Dakchinkali	0.32	42.83333	1.427 2
Scleroderma citrinum	23412	Nuwakot Tigaun	0.14	17.83333	0.594
Scleroderma verrucosum	24631	Suryabinayak	0.1	12.27778	0.409
Thelephora fuscella	22204	Kirtipur	0.12	15.05556	0.501
Trametes versicolor	25665	Langtang	0.1	12.27778	0.409

Abbreviations : Sp= Species Conc=Concentration Coll=Collection No=Number

5.9 Determination of Calcium, Phosporus and Iron.

The micronutrient i.e. Calcium, Phosporus and Iron of 16 mushroom samples have been determined. Among the 16 samples, highest amount of phosphorus was found in *Agaricus augustus* 806.32; while highest amount of calcium was found in *Agaricus placomyces* 1850.36 and highest amount of Iron was found in *Pleurotus sajorkaju* 176.81. The detail of the results are given in the table 4-9; and the same is also presented in the graph. This result has already been published in Mycological Research and Mushroom Production in Nepal, MAPSON 2007(Pandey N and U. Budathoki).

Table 5.9 : Determination of Calcium, Phosporus and Iron

S.N	Name of Species		Minerals (mg/ 100 gm)	
		Ph. Dry basis	**Ca. Dry basis**	**Fe Dry basis**
1	*Agaricus augustus*	**806.32****	656.08	10.78
2	*Agaricus bisporous* (cultivated)	357.73	189.93	13.42
3	*Agaricus placomyces*	710.84	**185036****	11.032
4	*Agaricus campestris*	755.2	400.77	97.87
5	*Armillaria mellea*	435.06	669.93	47.113
6	*Auricularia polytrichia*	259.5	242.92	108.9
7	*Cantharellus cibarius*	409.1	198.28	147.53
8	*Grifola frondosa*	316.4	395.44	25.05
9	*Laccaria laccata*	462.06	395.5	177.69
10	*Pleurotus cornucopia*	**186.3***	262.94	19.01
11	*Pleurotus sp*	495.17	199.22	**4.39***
12	*Pleurotus sajorkaju*-(cultivated)	270.76	**163.05***	**176.81****
13	*Russula cyanoxantha*	487.77	269.77	133.81
14	*Russula virescens*	290.06	267.92	90.54
15	*Scleroderma citrinum*	709.5	312.34	35.03
16	*volvariella bombycina*	917.68	345.713	25.41

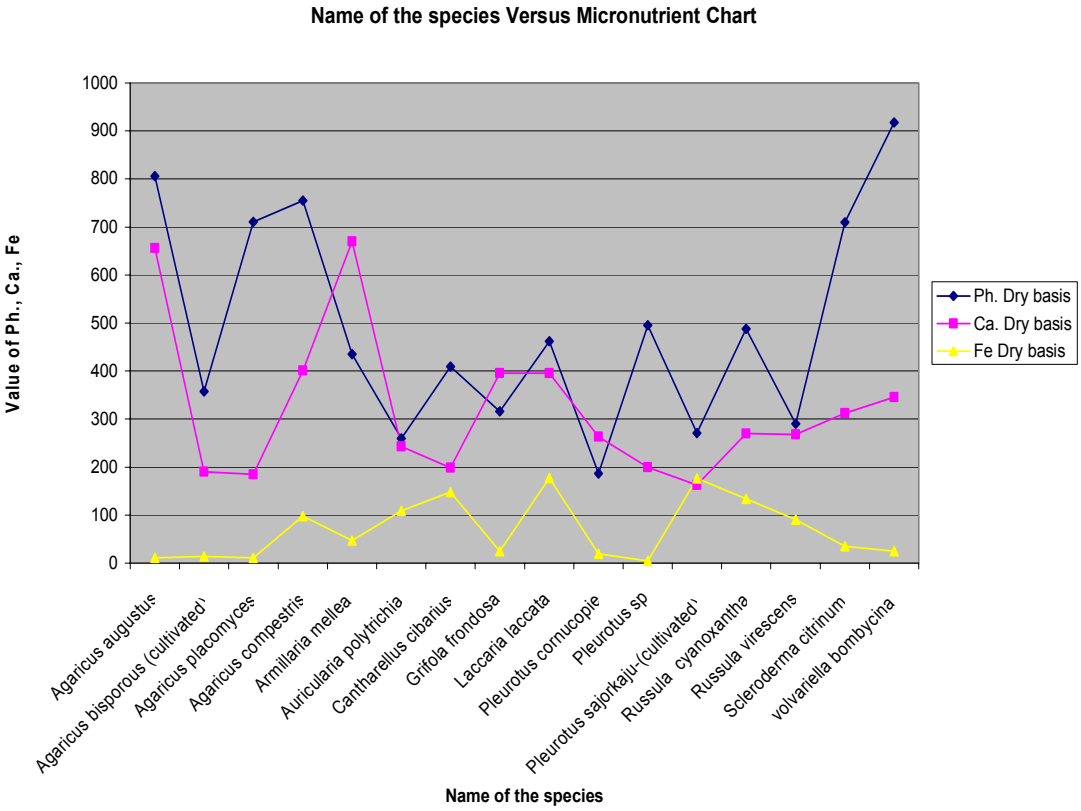


Figure 5.1 Name of the species Versus Micronutrient

5.10 SDS –PAGE

Twenty three (23) species of mushrooms were subjected to SDS PAGE, whose protein contents were already determined. During storage, the protein inhibitor like PMSF (Phenyl Methyl Sulphonyl Floride) were not used initially due to which some samples were found to be of low protein content than the original and the profile was not optimum. During profiling, the same sample was repeated twice and the profile band were cross-matched to one-another. The loaded amount, resolved band and the probable molecular weight of the band is illustrated in Table 4-8a, 4-8b, 4-8c and 4-8d. Altogether, excluding the repeated sample, the result is as follows: *Flammulina velutipes* was found to contain five major bands (molecular weight ranges from 38 to 51.8 KD), *Marasmius maximuswas* found to contain some major bands (Mol.Wt. range from 10.0 to 63.0 KD) and *Russula virescens* was found to contain five major bands (Mol.Wt. ranging from 12.0 to 76.0 KD). The bands in some lanes are not seen clearly in the photographs. The four photographs illustrate the result of four tables. The

result of these SDS PAGE of mushroom samples were already published in International journal "Plant Archieves" 2006 (Pandey N and U. Budathoki).

Result of SDS PAGE 5.10a:

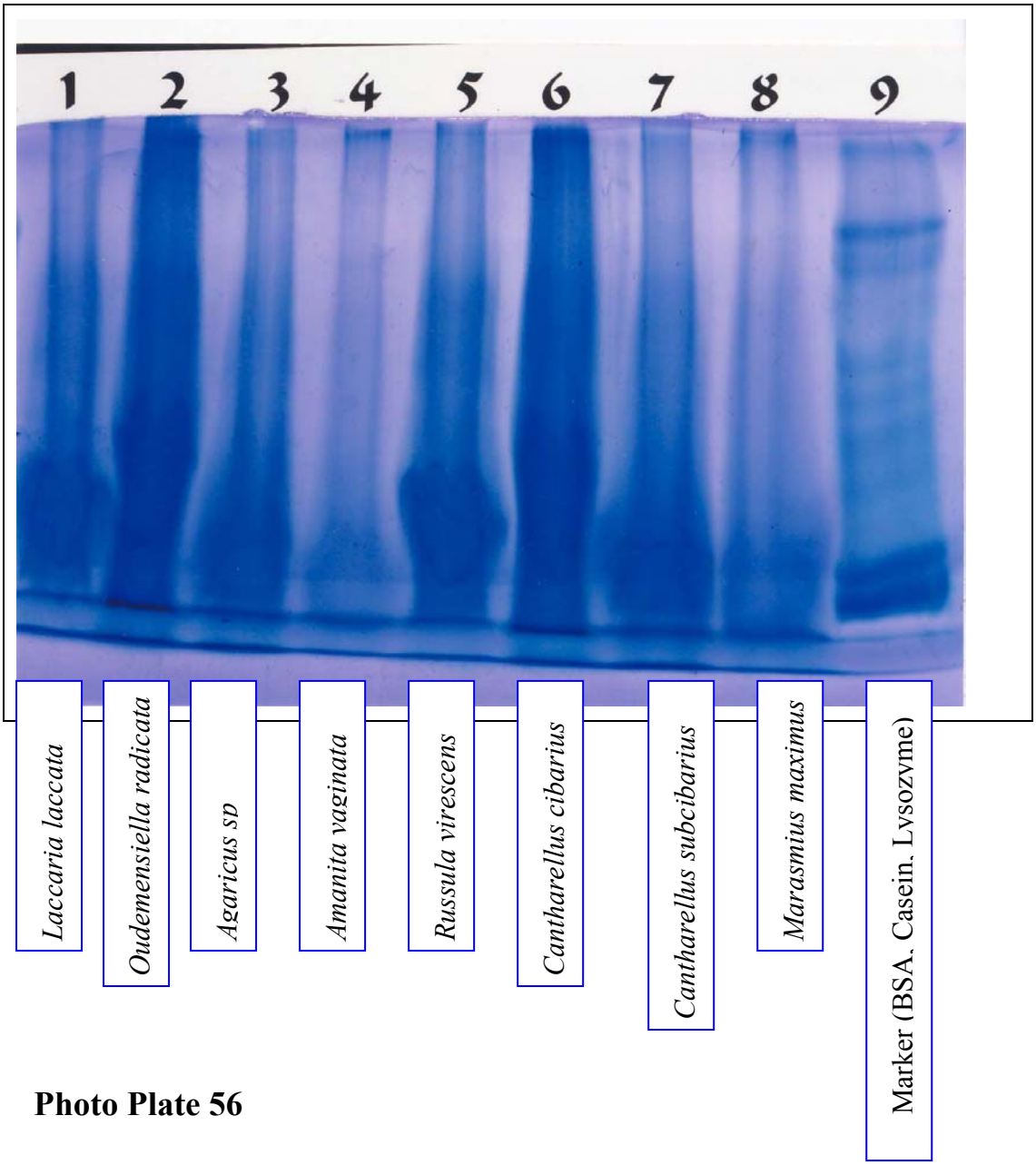


Photo Plate 56

Table 5-10a Result of SDS PAGE 5-10a

Lane	Protein from Mushroom	No. of bands obtained	Rf values= Distance moved by resolved band/ Distance moved by tracking dye	Molecular weight (Determined by calibration curve of Rf vs. log of M.W.)
1	*Laccaria laccata*	2	0.25, 0.92	63, 12
2	*Oudemensiella radicata*	3	0.25, 0.83, 0.92	63, 19, 12
3	*Agaricus sp.*	Not Obtained		
4	*Amanita vaginata*	4	0.25, 0.42, 0.83, 0.92	63, 50, 19, 12
5	*Russula virescens*	5	0.08, 0.33, 0.5, 0.77, 0.92	76, 57, 44, 24, 12
6	*Cantharellus cibaricus*	3	0.08, 0.75, 0.92	76, 25, 12
7	*Cantharellus subcibarius*	5	0.25, 0.5, 0.77, 0.83, 0.92	63, 44, 24, 19, 12
8	*Marasmius maximus*	7	0.25, 0.28, 0.5, 0.59, 0.83, 0.92, 0.95	63, 61, 44, 37, 19, 12, 10
9	Marker(BSA,Casein,Lysozyme)	3	0.22, 0.75, 0.93	66, 25, 11

Result of SDS PAGE 5.10b:

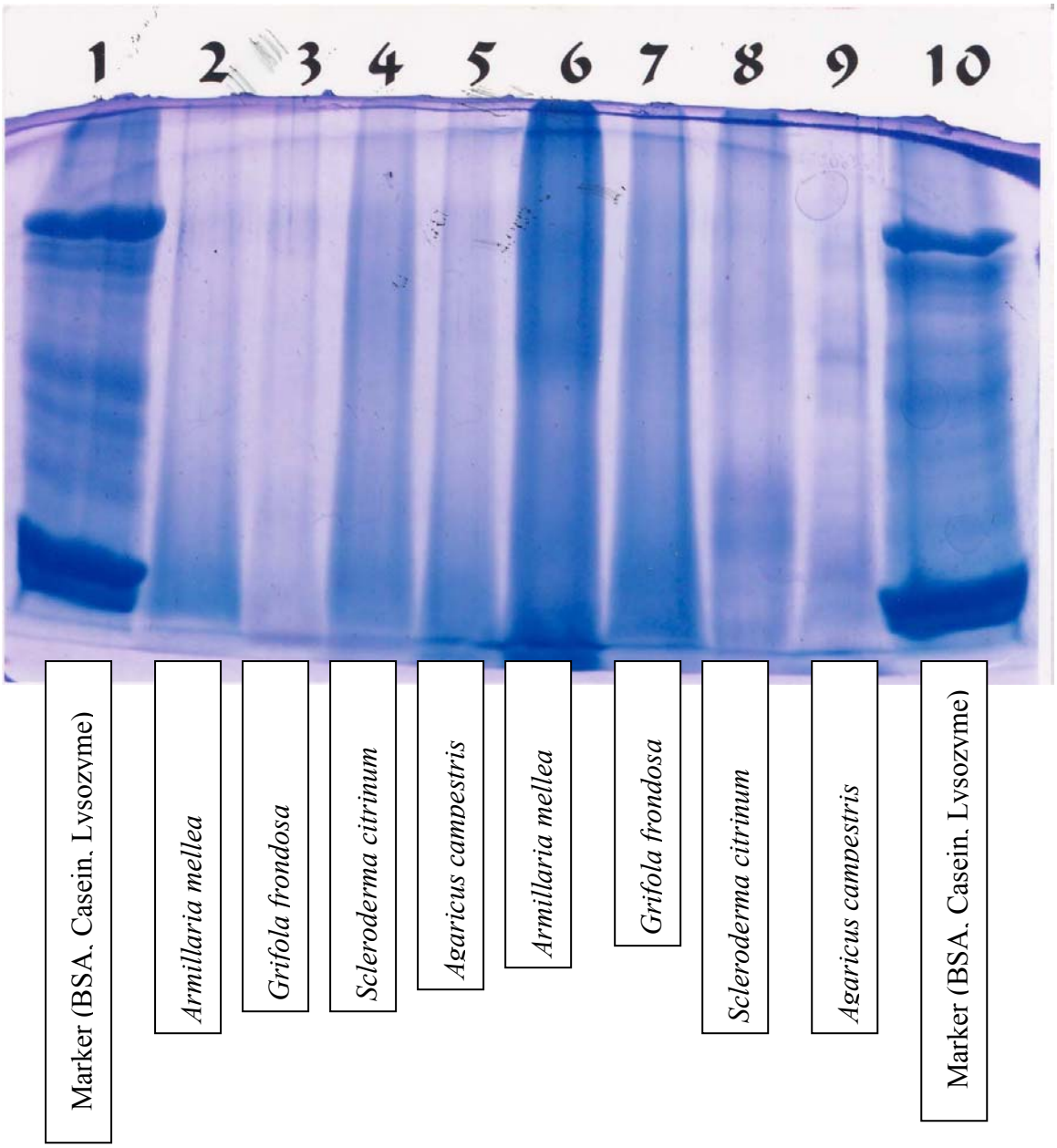


Photo Plate 57

Table 5-10b Result of SDS PAGE 5-10b

Protein from dry mushroom samples	No. of Bands obtain	Rf values= Distance covered by resolved band/Distance covered by tracking dye	Molecular weight (Determined by calibration curve of Rf vs. log of MW)
Armillaria mellea	3	0.28, 0.43, 0.77	51, 35, 16
Grifola frondosa	4	0.66, 0.28, 0.67, 0.81	High mol. Wt, 51, 20, 15
Sceroderma citrinum	2	0.06, 0.63	High mol. Wt, 22
Agaricus sp.	2	0.06, 0.63	High mol wt, 11
Armillaria mellea	3	0.28, 0.43, 0.77	51, 35, 16
Grifola frondosa	3	0.06, 0.28, 0.67, 0.81	High mol. Wt, 51, 20, 15
Sceroderma citrinum	2	0.06, 0.63	High mol. Wt, 22
Agaricus sp.	2	0.06, 0.92	High mol wt, 11
Marker (BSA/Casein/Lysozyme)	3	0.22, 0.55, 0.93	63, 25, 10

Result of SDS PAGE 5.10c:

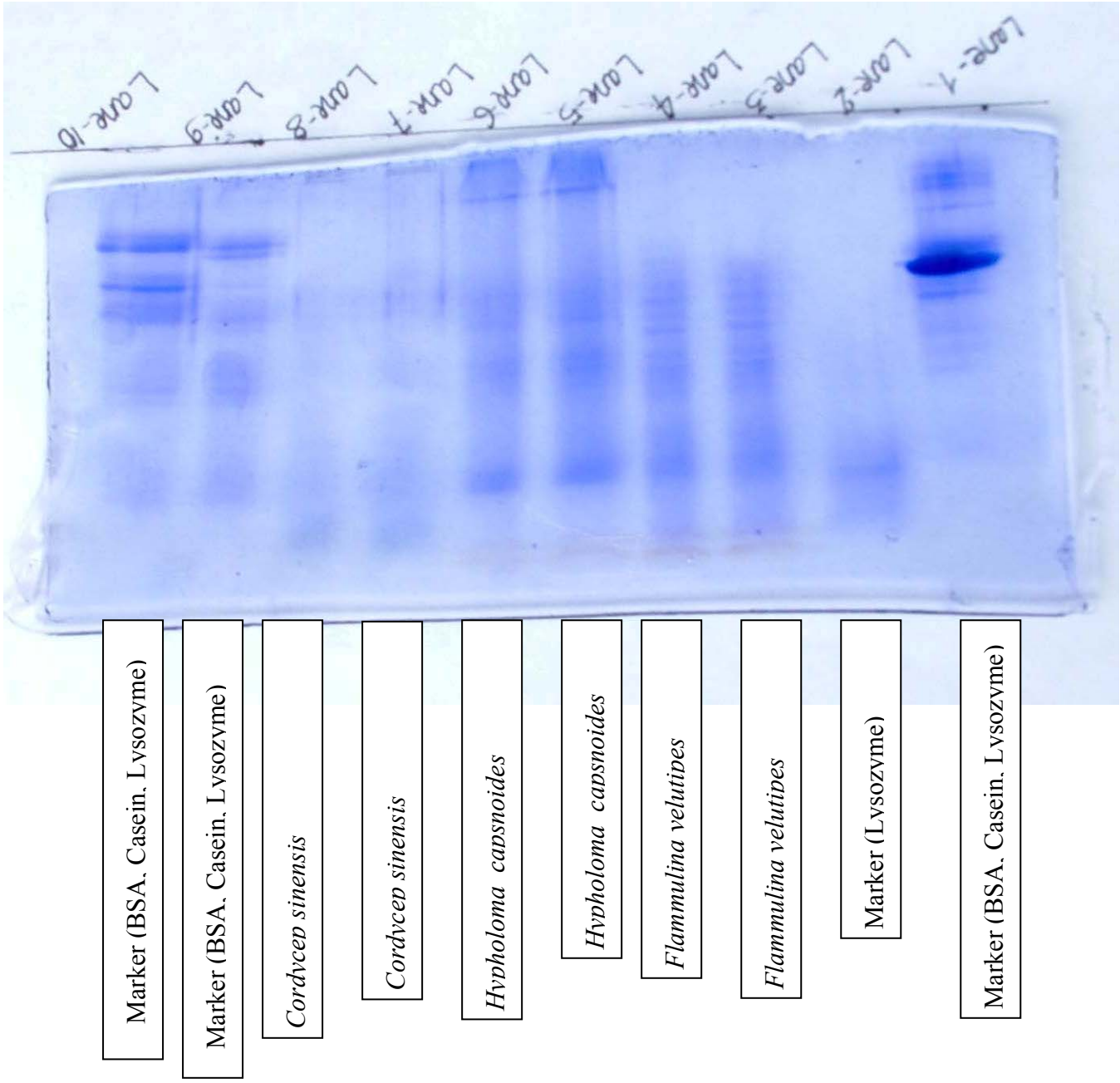


Photo Plate 58

Table 5-10c Result of SDS PAGE 5-10c

Lane	Protein from mushroom sample	No. of bands obtained	Rf values = Distance covered by resolved band/Distance covered by tracking dye	Molecular weight (Determined by calibration curve of Rf vs. log of M.W.
1	Marker (BSA/Caesin/Lysozyme)	3	0.22, 0.75, 0.93	66, 25, 11
2	Marker (Lysozyme)	1	093	11
3	*Flammulina velutipes*	5	0.4, 0.44, 0.48, 0.54, 0.58	51.8, 48.8, 45.7, 41.2, 38.1
4	*Flammulina velutipes*	5	0.4, 0.44, 0.48, 0.54, 0.58	51.8, 48.8, 45.7, 41.2, 38.1
5	*Hypholoma capsnoides*	3	0.1, 0.44, 0.88	74.7, 48.8, 15.2
6	*Hypholoma capsnoides*	3	0.1, 0.44, 0.88	74.7, 48.8, 15.2
7	*Cordycep sinensis*	2	0.38, 0.4	53.4, 51.8
8	*Cordycep sinensis*	2	0.38, 0.4	53.4, 51.8
9	Marker (BSA/Caesin/Lysozyme)	3	0.22, 0.75, 0.93	66, 25, 11
10	Marker (BSA/Caesin/Lysozyme)	3	0.22, 0.75, 0.93	66, 25, 11

Result of SDS PAGE 5.10d:

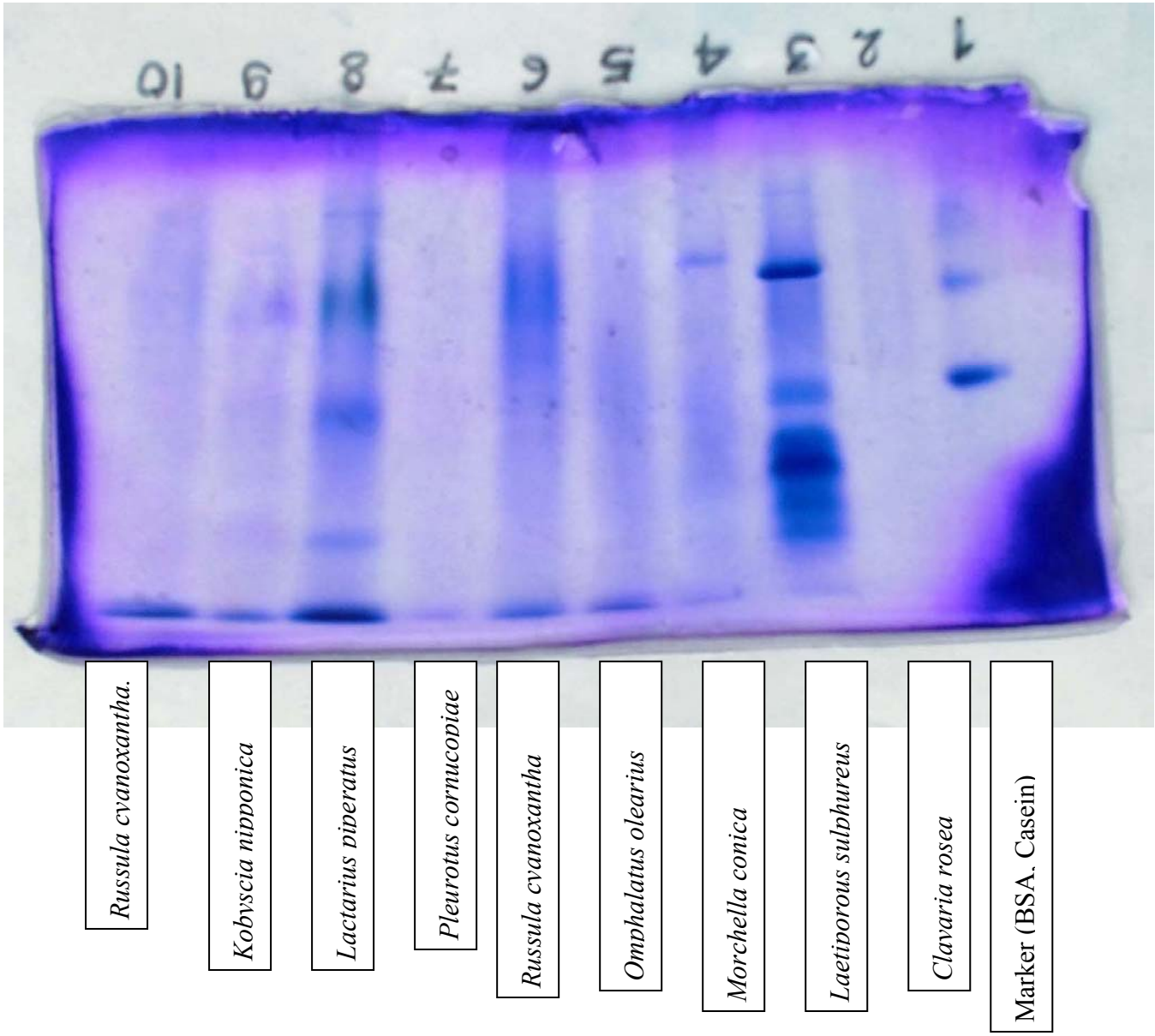


Photo Plate 59

Table 5-10d Result of SDS PAGE 5-10d

Lane	Protein from mushroom sample	No. of bands obtained	Rf values = Distance covered by resolved band/Distance covered by tracking dye	Molecular weight (Determined by calibration curve of Rf vs. log of M.W.)
1	Marker (BSA/Caesin)	2	0.22,0.75	66,25
2	*Clavaria rosea*	2	0.26, 0.5	62.5, 44.2
3	*Laetiporous sulphureus*	5	0.28, 0.6, 0.68, 0.74, 0.84	61, 31.6, 30.5, 25.9, 18.3
4	*Morchella conica*	1	0.26	62.5
5	*Omphalatus olearius*	Not Clear		
6	*Russula cyanoxantha.*	Not Clear		
7	*Pleurotus cornocopiae*	Not Clear		
8	*Lactarius piperatus*	4	0.06, 0.1, 0.6, 0.9	76.3, 74.7, 36.6, 13.7
9	*Kobyasia nipponica*	Not Clear		
10	*Russula cyanoxantha*	Not Clear		

6. Discussion

6.1. Background

Nepal, although being a small country, has distinct phyto-geographical zones related to altitude and other factors. The western part is hotter and drier than the Eastern and Central parts. North facing slopes are wetter and cooler than South facing slopes. Thus, the vegetation varies greatly from East to West and from North to South. These varied phyto-geographical elements have given Nepal a rich and economically important mycoflora. Thus, the dominant or mixed or pure forest types (*Shorea - Pinus - Quercus - Abies - Rhododendron - Betula - Juniperus*) from tropical to alpine zones with their ecological environment provide different micro-ecological conditions suitable for the origin, development and growth of diverse and specific mycotaxa such as saprophytes, parasites and mycorrhizal associates (Adhikari, 2000).

In Nepal, mushroom collection and consumption have been continuing since time immemorial by different ethnic groups. Wild edible mushrooms are one of the important minor forest products, which are traded in local markets of the country. Due to the lack of scientific knowledge among the ethnic groups, they only utilize few species that could be identified from their own traditional knowledge. Various mycophagous groups like Tamang, Sherpa, Gurung, Tharu, Danuwar, Rai, Limbu, Chepang and Newar etc. can be traced with the collection and consumption of mushroom for a long time because of the delicious taste of mushrooms as well as due to their vigorous growth during rainy season in appropriate habitats in the forests of the country. From the study area, 127 collectors were interviewed. Among them only 6 members were above the age of 60 and all of them were male. 105 members were in the age group of 20 to 50, among which 56 were male, and 49 were female. The remaining 16 were kids below the age of 11. The kids could not distinguish between the edible and poisonous mushrooms, but they knew where mushrooms were found. Among the adults, only about 36 persons shared their knowledge on mushrooms.

6.2 Ethnic groups of Nepal

Ethnic groups are the groups of people who have their own distinct culture and language. Nepal is a multi lingual, multi religion and multi ethnic country. The ethnic groups in Nepal are distributed in all the 75 districts of the country. The population Census of 2001 has listed 102 Ethnic and Caste groups (CBS, 2001). Among them, the ethnic groups which are still found to depend heavily on the collection and consumption of wild mushrooms for food and medicine include Chepang, Tharu,

Danuwar, Raute, Newar etc. in the Tarai Plain; Tamang, Gurung, Magar, Rai, Newar etc. in the hilly areas and Bhote, Sherpa, Lama etc. in the high altitude areas. These ethnic groups are the traditional collectors. Their knowledge on mushrooms and fungi are quite distinct. However, due to urbanization, social factors, the displacement and migration, it is becoming more and more difficult to point out or localize the exact origin of these groups (Adhikari, 2004).

6.3 Mycological Studies in Nepal

In Nepal, mushroom collection and consumption have been continuing since time immemorial by different ethnic groups. The mycological collections from Nepal started with the works of Lloyd (1808) (with one *Ganoderma* species) and Berkeley (1838) (with one *Polystictus* species). J.D. Hooker (1848-1854) explored east Nepal in a botanical survey, (Flora of Nepal). His collection was studied and reported by Berkeley (1854). Thereafter, many Nepalese and foreign mycologists have contributed in this field.

Since then, many authors (Adhikari, 1976, 1984, 1987, 1988, a, b and c, 1990, 1991c, 1995, 1996a and b, 1999c and d, 2000, and 2001; Adhikari and Adhikari, 2003; Adhikari and Manandhar, 1986, 1996a, 1998, 2004a and b; Adhikari and Parajuli, 1993 and 1996; Adhikari *et al.* 1994; Balfour – Browne, 1955 and 1968; Bhandary, 1980, 1984 and 1991; Cotter, 1987; Cotter and Bhandary, 1985; Devkota *et al*, 2005a and b; Hjortstam and Ryavarden, 1984; Imazeki *et.al* 1966; Joshi and Joshi, 1999; Kharel, 1999; Kobayashi, 1965; Kreisel, 1964, 1967 and 1969; Maharjan and Budhathoki, 2003; Manandhar and Adhikari, 1988, 1995a, and b and 2003; Manjula, 1983; Otani,1982a and b; Pandey, 1976; Pandey and Budhathoki, 2003; Pandey and Budhathoki, 2006; Pandey and Budhathoki 2007; Parajuli *et al.*(1999a and b) Pegler, 1977; Poelt, 1969; Ranjitkar and Bhatt, 1976; Ryvardan, 1977; Sacherer,1979; Sharma, 1983a and b; Shrestha, 1985; Singh, 1966 and 1968; Singh and Adhikari, 1977; Singh and Nisha, 1974, 1976a, b and c; Singh and Upadhya, 1978; Thapa, 1990; Thind and Sharma, 1983; Tullons and Bhandary, 1992; Waraitch and Thind, 1977a, b and c) have contributed through their knowledge on Nepalese mycoflora.

Most of the reports on mushrooms collection and study cover the western (Jumla, Darchula and Baitadi district areas), central (Pokhara, Langtang, Kathmandu valley areas) and eastern zones (Jiri - Junebeshi and Ilam) (Adhikari, 1991). Few places like Solu (Solukhumbu), Melamchi (Helambu), Lele, Phulchowki, Shivapuri (Kathmandu), Singh Gompa (Gosaikunda), Ghorepani (Myagdi) etc. are the best sites for Himalayan fungal flora. Besides these places, there are other favourable areas too, but information is scant as they are virtually unexplored (Bhandary, 1984). Giri and Rana (2007) for

the first time described 69 species of higher fungi from Sagarmatha National Park and its adjoining areas.

The present study has attempted to study three perspectives of wild mushrooms. The first major objective was to collect, identify and enumerate the mushrooms of central development region of Nepal; the second objective was to gather the ethnomycological knowledge from the study area and the third objective was to perform chemical analysis on certain mushroom samples found in the study area.

6.4 Enumeration of Mushrooms species

Among the collected samples from the study area in between the years 2001-2005, five hundred seventy five samples were identified (Appendix –XIII). Among them, one hundred seventy four samples were identified to the species level while two hundred and fifty three samples were identified to the generic level. Out of the 174 species recorded in the present study, 50 species were enumerated which are important ethnomycologically and 25 newly recorded species (identified for the first time in Nepal) were described in detail. Among all the collected species, ten species can be added in the list of edible mushrooms in Nepal. According to the literature review and in addition from this research the list of edible mushroom has increased to one hundred and eighty(Appendix XV).

6.5 Exploration of Ethnomycological knowledge

Ethnomycology is a branch of Ethnobotany. The word ethnobotany was coined by an American botanist John W. Harsberger in 1895, originally for the study of plants used by primitive and aboriginal people. The word is derived from two Greek words: *ethnos,* referring to the human aspects in biological relationship and *botanicos,* denoting to the study of plants. Ethnobotany is a multidisciplinary science embracing botany, ecology and anthropology. Ethnobotanical knowledge can be obtained under two categories: the one acquired at schools and universities, and the other acquired from local experience and folkore, which is usually communicated verbally. In Nepal, it is the traditional knowledge acquired from experience and observation which is communicated orally, forming the basis of Nepalese ethnobotany.

About 90% of people residing in rural areas in Nepal have association with the natural resources of their surroundings and possess knowledge about the various uses of plants that they need. Nevertheless, this knowledge is scattered, communicated orally, and confined to certain elder members of the village. Therefore, this bulk of knowledge has not reached all who would benefit from the knowledge. Due to the communication gap existing between different communities and

different parts of the country, some of this traditional knowledge has been permanently lost. As a sub field of ethnobotany, "Ethnomycology" is especially dedicated to mushrooms, which have 'consciousness expanding qualities' embedded in the religious traditions, writing and indigenous knowledge of mankind (http://www.ethnomycology.com/James Arthur)**.** "Dictionary of the fungi" defines Ethnomycology as a branch of Ethnology in which edible mushrooms and religion is closely inter-related. Gordon Wasson (1969) is also credited with coining the term "Ethnomycology". His studies concentrated on the use of mushrooms by Mesoamerican, Russian, English and Indian cultures.

In Nepal, focus on different aspects of wild mushrooms has not yet been considered as compared to higher plants, even though they are very important non timber forest products for the livelihood. Thus, further detailed study has therefore become a collective concern of local people, government, research organizations and other concerned authorities for the better understanding of wild mushrooms. The ethnomycological knowledge is mainly based on the information available from the questionnaires asked to the local people, the type of mushroom consumed by the locals and through interaction with the mushroom collectors of the study area. The information was also verified by cross checking with previous literatures and interviewing the experienced village elders.

In Nepal, ethnobotanical study gained importance with occasional publication of papers on edible and medicinal plants. It is only in 1970's and afterwards that the studies of ethnomycological importance progressed (Singh 1968 a, 1968 b).

6.6 Ethnomycological Studies in Nepal

In the initial stages of research on mycological specimens in Nepal, there were no specific intentions of ethnomycological investigations. However mushrooms were collected and reported as edible or inedible according to human uses (Singh 1966,1973,1974; Adhikari 1976). Ethnomycological studies and ethnobotanical studies including mycological species were later undertaken by several workers with regard to those consumed by selected ethnic tribes or those used by people in selected geographic areas in Nepal.

Some ethnic groups covered in ethnomycological studies include Chepangs (Tullons and Bhandari, 1992), Pandey and Budathoki 2006; Sherpas (Sacherer, 1979); Tamangs (Kharel 1999), Pandey *et al* . 2006 and Thakali (Bill and Cotter, 1989). The geographical areas covered by ethnomycological studies in Nepal include Kathmandu (Singh,1966,1974); Kathmandu valley and adjoining areas (Pandey and Budathoki 2002), (Pandey and Budathoki 2006 a,b,c); Manichur (Adhkari, 1976); Dumre, Pokhara,

Mustang, Manang (Bhandari,1991); Pokhara and Kathmandu valley (Joshi and Joshi 1999); Rolwaling (Sacherer, 1979) and Western Central region of Nepal (Adhikari *et al.* 2005).

Nepal is an excellent repository for cultural heritage for diverse ethnic groups of Mongolian, Australoid and Aryan stocks differing in language, race, religion, custom and cultures. The different ethnic groups are traditionally linked to resources available in forest (Siwakoti and Siwakoti 1998). Biodiversity in Nepal have supported the livelihood of indigenous tribal people who live in inaccessible remote areas of Nepal. Their myths and rituals as well as their traditional environmental practices depict a close relation between human beings and nature. These people traditionally acquired diversity of knowledge regarding the utilization of plant resources of the surrounding area. Collection of wild mushrooms is very common in Nepal and is important for livelihoods in rural areas (Adhikari 2000, FAO 2004, Christensen and Larsen 2005, Christensen *et al.* 2006,). Except for some of the Brahmins, the mycophagous Nepalese and the other castes are enthusiastic amateurs and collectors of mushrooms, which are edible and traditionally used. The cooking and consumption of mushrooms are frequently observed to be associated with the following three castes: the Khetriya and particularly Baisya and Shudra. The Tamang, Newar, Sherpa, Bhote, Gurung, Rais, Limbu, Thakali, Danuwar, Chepang and Tharu are the traditional mycophagous groups in Nepalese society (Adhikari 2000). Tamangs are also famous for their delivery of fresh mushroom to the urban markets (Adhikari and Adhikari 1996-1997, Joshi and Joshi 1999, Adhikari 2000, Kharel and Rajbhandary, 2005). Tamangs are the fifth largest ethnic group representing 5.64% of the total population of Nepal (CBS 2001).The Tamangs are not only one of the important ethnic minorities but also a major Tibeto-Burman speaking community of Nepal. They maintain a belief that they did originally come from Tibet as they do speak “Bhotia” tongue and follow “Lamaism”; erstwhile they were called as “Bhote” meaning highlander or Tibetans. Tamangs are of Mongoloid stock as can be clearly seen from their facial features, their strong and well built physique, broad smiling faces and pronounced slit eyes (Bista 1980). Majority of the Tamangs live in the hilly regions of Nepal, adjoining sides of Kathmandu valley, the capital of Nepal as well as on the Lekh portion of the Rasuwa, Nuwakot, and Sindhupalchowk districts respectively lying North, North-East and North-West of Kathmandu. Adhikari (1996, 2000) and Adhikari and Durrieu (1996) have reported previously the use of mushroom for lighting the cigarettes. The same conception was also found in Tigaun and Kholegaun of Nuwakot that some mushrooms were used for lighting the cigarettes. Actually, the Tamangs’ lives gravitate around the forests and retain primeval forest, culture rooted in the old beliefs, taboos, folklores and traditional attitudes (Bista, 1980, Khadka *et al.* 1982, Shrestha, 1988). Agriculture is

their main occupation followed by animal husbandry. The Tamangs are largely dependent on forest resources for various needs. Tamangs in remote areas, therefore, supplement their food stocks by gathering wild edible species from natural habitats.

Despite the fact that a number of papers have appeared on this subject in the past three decades (Adhikari 1976, 1987, 1988, 1991, 1999a, 1999b, 2000; Adhikari and Adhikari 1996-1997; Bhandary 1999; Joshi and Joshi 1999; Kharel and Rajbhandary 2005), there are still areas and locations that remain to be studied and assessed with regard to the potential of wild mushrooms.

Armu Shyamo, Balaa Shyamo, Bena Shyamo, Bhkhulo Shyamo, Canling Shyamo, Chey Shyamo, Chung ping Shyamo, Chyapu Shyamo, Dhwang Shyamo, Ghising Shyamo, Gho Shyamo, Goida Shyamo, Myala Shyamo, Nyhyo Shyamo, Oomi Shyamo, Phusphusey Shyamo, Plem Shyamo etc. were the Tamang names for mushrooms, which were found to be used by the local people. For the Tamang local names of mushroom, refer the paper "Use of wild mushrooms among the Tamangs of Nepal," Pandey *et al.* 2006, *Nepal Journal of Science and Technology* Vol.**7** Pp 97-104.

As all these mushrooms could not be found or collected in natural habitats during the collection phase, having the mere knowledge of the local names in those areas will help for further research. Local names provide important clues to the uses and importance of edible fungi to people and there is much to be gained from this study. Local names allow researchers to learn about collecting practices, to analyze markets and to talk with forest managers and others who lack formal training in science and are unfamiliar with genera and species names.

The ethnomycology study of the Chepang communities was also done. Chepangs are the mycophagous group. This paper highlights the different species of mushrooms consumed by these groups along with the names in their mother tongue. Chepangs (Praja) refer to mushrooms as "Musa". Chepangs collect several species of edible Mushrooms from the forest through their traditional experience during the period of monsoon for their own consumption. Mushrooms collection was done early in the morning because there was competition for gathering the best species among them. Tullons and Bhandari, 1992 reported *Amanita chepangiana*, a new species used by Chepang community in Nepal. Besides this report, there are no prior reports about the use of wild mushroom by the Chepangs. According to Chepang of Chitwan, 17 Species of mushrooms are edible. (Chetan musa, Yamu musa, Dhudha musa, Cheimu musa, Kadum musa, Baum musa, Hardi musa, Pankamu musa, Khaukarey musa, Lisa musa, Phuli musa, Chapi musa, Gobrey musa, Chamrey musa, Gosaydunge musa, Raktey musa, and Thokpa musa).

Yaroning musa (*Pycnoporus cinnabarinus, P.sanguineus*) is inedible. It is used medicinally for score ear (Pandey N and Budathoki U 2007c).

There were no reported mortality cases resulting from the consumption of wild mushrooms among the Chepangs because Chepangs consumed mushrooms according to their traditional expertise. People used to consume only those species, which were suggested by elderly people as harmless. In Chitwan, there is no trade of wild mushrooms. *Dictyophora duplicate* (Bosc) Ed. Fishcer, is the new species recorded for Nepal. The local Chepangs used to consume it in young stage only and they referred to it as Hardi musa.

Wild edible mushrooms are one of the most important minor forest products, which are locally traded in local markets of different parts of Nepal (Kharel and Rajbhandary, 2005).

In various Nepali languages, mushroom is known as chyau (Nepali), Bammhukan (Newari), Shymo or Shyamu (Tamang), Shamu (Sherpa), Chyabo (Gurung), Mugan (Magar), Pat (Limbu), Chhani (Tharu) and Kukurmutta (Hindi) (Adhikari, 2000). The aforementioned names were noticed by the researcher in the ethnomycological enquiry during the field visit. Besides these, the researcher also found that the new names for mushrooms being used in Nepal are Musa (Chepang "Praja"), Timu (Thakali), Kacchu (Danuwar), and Beemti (Tharu) (Pandey, 2006). The local people also named the particular mushrooms according to their shape, color and substractum in national language as Chate, Dallae, Nangre, Surilo, Masino, Patpate, Rato, Pahelo, Sindhure, Phusphuse, Dhudey Seto, Kalo, Gobre, Parale, Sallae, Thalathale, Chipple, Bagale, Dhamere etc. So far, the recorded mushrooms are: 110 – Edible, 13 – Medicinal, 45 – Toxic and 6 – Others (Adhikari, 2000). According to a literature review, the current list of edible species contains 180 species after the addition of 10 species from this research, which were mentioned in (Appendix XV). Similarly, the current list of identified medicinal mushrooms contains 20 species and the toxic mushrooms contains 66 species as of 2007 (Appendix XVI, XVII).

Edibility of mushrooms are recorded from local mycophagus group, literature review and through chemical tests (Svreck, 1998; and Kuo, 2004). In the present condition, the trade of wild edible mushroom is decreasing due to cultivated mushroom trade in local market, fear of mushroom poisoning as well as policies of forest conservation. In the midst of the controversy, the trade of the highly priced mushrooms eg. *Cordycep sinensis* and different species of *Morchella* is in the peak because they are exported in the international market.

6.7 Documentation of Traditional Knowledge

While lack of good documentation system stood as a serious problem, interagency communication in this respect is still very poor. Documentation of the information on types, habitat, status, chemical constituents, trade, ethnobotany of mushrooms is important for the formulation of policy (Joshi *et al.,* 1996). As the local people of the study areas have got lots of interesting indigenous knowledge on the different variables of wild mushrooms, their knowledge should be documented properly. As mushrooms have good nutritional value with high vitamin contents and have high inhibition power, they could be used either as food or source of medicine. With the help of local knowledge, more information can be gathered on different types of mushrooms. Some species of mushrooms were used to lock the crevices of the wooden pot (Theki) referred to as "Theki talney chyau". The species of *Hymenochetae*, *Trametes* and *Coriolus* are used for this purpose by grinding these species with mortar and pistle and making a paste, which can be applied to the cracked area of the wooden pots for reuse (Chitwan, Tiguan- Nuwakot and other places).

Addition of vinegar is a worldwide method to minimize mushroom poisoning. Many mycologists such as Rinaldi and Tyndalo (1985), Purukayastha and Chandra (1985), Chaube (1995) and Adhikari (2000) mentioned about the uses of vinegar. The research found that besides vinegar, *Parish poryphylla* (satuwa), *Xanthoxylum armatum* (Timur), *Allium sativum* (Lasun), Bandhaniya, Bantimur are also used to minimize possible mushroom poisoning. According to the local people of Bhaktapur, the beaten rice (Chiura) also helps to minimize the poisoning effect of mushrooms, which is one of the outcomes of this research –as the first ever mentioned.

6.8 Mycotoxin

The mycotoxin from Nepalese mushrooms is not yet analytically screened and studied. They need to be phytochemically screened. The Phytochemical screening of mushrooms in modern literature has revealed that different species contain different chemicals (acid and alkaloids – Amatoxin, Psilocybine, Coprin, Helvellic acid, Muscarin, Muscimole, Ibutenic acid) which are toxic to human health. Toxicity may be for short or long duration. There are two types of intoxication caused by fungi – one is mycetisme (after the ingestion of higher fungi) and another is mycotoxicoses (after the ingestion of lower fungi) (Adhikari 2005).

In Nepal, fatality due to the consumption of poisonous mushroom has been found to occur 15-20 times annually (Adhikari, 2004). Almost similar data was obtained from this research (the paper cuttings have been provided in Appendix XXI).

6.9 Mushrooms and its application

Medicinal mycology has deep and firm roots in fungi's traditional uses in the medicine of the far East. For centuries, Chinese and other healthcare practitioners employed mushrooms to treat various diseases. They valued the power of some mushrooms as divine. Mushrooms are also considered a symbol of happy augury and good future, good health, longevity, and even life with the immortals. The use of medicinal mushrooms has gone beyond medicine itself: different schools of Taoism employed mushrooms as purifiers and promoters of mind and spirit.

In Japan, China, Russia, and Korea, several different polysaccharide anti-tumor drugs have been developed from the fruiting bodies, mycelia, and culture media of various medicinal mushrooms, such as Shiitake (*Lentinus edodes* (Berk.) Sing.), Reishi (*Ganoderma lucidum* (Curt.:Fr.) P. Karst.), Turkey tail (*Trametes versicolor* (L.:Fr.) Lloyd), Split gill (*Schizophyllum commune* Fr. : Fr.), Mulberry yellow polypore (*Phellinus linteus* (Berk. et Curt.) Teng.,), and Chaga or Cnder conk (*Inonotus obliquus* (Pers.:Fr.) Pilat,). The potential of medicinal mushrooms is enormous but mostly untapped. It could and should evolve into a successful biotechnological industry for the benefit of humankind (Wasser and Weis, 1999)b.

Dr. Lim Siow Jin, founder of DXN (Dynamic Excellence Network), has taken a keen interest in mushrooms and their relationship with human health since his younger days. After graduation from the Indian Institute of Technology, he dedicated his life to the research on human health at home and abroad for more than ten years. In 1997 Dr. Lim was conferred Ph.D in Holistic Medicine by the Indian Board of Alternative Medicine. Dr. Lim's organization DXN has been promoting the use of *Ganoderma* to cure different kinds of diseases worldwide. However, in the context of our country, there are only few reports on the use of *Ganoderma* species. Artificial cultivation of this particular species has started in a minor scale at NARC and at some private mushroom growers in Nepal. In China, Japan and Korea, *Ganoderma* is known as "**herbal king**" because of its ability to cure different kinds of diseases.

Extracts from many medicinal mushrooms have long been used for a wide range of ailments in traditional Chinese medicine. Modern scientific and medical studies are increasingly supporting many of these health claims. While the role of medicinal mushrooms in immunomodular and anti-cancer activities represent the dominating theme of this report, it is important to recognize that many of these mushrooms also show other quite significant medical properties, such as blood pressure-lowering, cholesterol lowering, liver protective, antifibrotic, anti-inflammatory, anti-diabetic, anti-

viral and other anti-microbial activities (Ooi and Liu, 1999; Ooi; 2000, Wasser and Weis, 1999a, b, Hobbs, 1995; Gunde-Cimerman, 1999).

The study of medicinal mushrooms, through the last three decades, has provided many beneficial outcomes , followed by the rapid development of manufacturing business dealings and commercial cultivation of mushrooms. In 1999, world production of mushrooms amounted to US$18 billion, roughly equal to the value of coffee sales (Chang, 1999 and Wasser *et al*., 2000). For example, *Grifola frondosa* is a culinary - medicinal mushroom found in some parts of Europe, North America, and Asia. It usually grows naturally on and around the roots of various kinds of deciduous trees. In Japan, it was found in the northern part, and wild *G. frondosa* was served only at top-class restaurants because of its good flavor, crisp texture, and excellent aroma. Since mid-1980s, the development of successful cultivation methods has led to its availability in large-scale production and extensive research. The main research on *G. frondosa* has been conducted in anti-tumor, anti-HIV, anti-hypertension, anti-diabetes, anti-hyperlipemia, and anti-obesity, and the results demonstrated that *G. frondosa* is one of the most bioactive and safe mushrooms.

6.10 Analysis of Chemical constituents of mushrooms

During the analysis of chemical constituents of mushrooms, different parameters were studied such as the percentage of moisture, ash, acid insoluble ash, and reducing sugar. Similarly, qualitative and quantitative analysis was done on 25 wild mushrooms to determine their amino acid, total protein and soluble protein composition. SDS PAGE of protein molecules on some wild mushroom was also determined.

The key point is that whatever method is adopted as the 'gold standard' for a given protein, this method needs to be used routinely for calibration. The determination of exact protein concentration frequently requires the use of the Kjeldahl procedure, which is both time-consuming and sample-consuming (Young 1963). This procedure is therefore infrequently used in research laboratories but

has increased application in the biopharmaceutical industry; it is used primarily as a method for the validation of a more facile analytical process for the determination of protein concentration. This review considers four commonly used methods: the biuret method (Gornall, *et al*, 1949), the Lowry method (Lowry O.H *et al*, 1951), Coomassie Blue (CB) G-250 dye-binding (Bradford M.M, 1976) and the bicinchoninic acid (BCA) assay (Smith, 1985) for the colorimetric determination of protein concentration in solution. The Lowry method was developed approx. 47 years ago (Lowry O.H *et al*,

1951). To obtain the homogenate form of the protein from the mushrooms, mortar and pestle is sufficient enough to grind – because of its softness.

Different studies have been done in the nutritional perspective of mushroom as well. It is well known that mushrooms can be supplemented as a rich source of protein. It is also a rich source of vitamins and different minerals. Carbohydrates of different forms are in least concentration in the mushrooms, but they have very specific importance in therapeutic process and other regulatory vital processes with pharmaceutical significance.

6.10.1 Moisture

Moisture is the most variable component in the proximate analysis of mushroom and is significantly affected by environmental factors such as temperature and relative humidity during growth and storage as well as by the relative amount of metabolic water which may be produced during storage (Crisan and Sands ,1978).

In the present study, the moisture contents of the fresh mushroom varies between 85-95% in fleshy mushroom and 40-50% in woody mushroom. In *Ganoderma applanatum,* the moisture content in dry weight basis was recorded which fell in between 10-13%.

6.10.2 Ash and Acid insoluble Ash.

The quantity of ash and acid insoluble ash in different mushrooms vary. In this regard, highest percentage of Ash was found in *Volvariella bombycina* 18.75, and the least was found in *Grifola frondosa* 5.174. Similarly, highest percentage AIA was found in *Cantharellus cibarius* 10.44, and the least was found in *Pleurotus cornucopiae* 0.058.

6.10.3 Amino acids, Crude protein and soluble protein

Mushrooms are rich sources of protein and amino acids. Most of the types of amino acids are found in mushrooms (Kurtz man 1978). In the result, 6 amino acids (among twenty amino acids) were found in *Russula nigricans, Pleurotus sajorkaju, Russula cyanoxantha* qualitatively. In quantitative analysis, amount of the amino acids found *were: Coprinus comatus* (13.80 mg/ml), *Amanita caesarea (*13.67 mg/ml) and *Agaricus bisporous (*13.39 mg/ml). There is no previous report of analysis of amino acid of mushroom.

Protein is an important component of dry matter of mushrooms and they constitute more than half of the total nitrogen, and their content depend, among other things, on the composition of the substractum, size of pileus, harvest time and species of mushroom.

Dried mushroom ,in general , contain 19-40% crude protein (Kurtzman 1978). In this regard, this study has found the following : *Amanita caesarea* (34.44%), *Laccaria laccata* (23.03%) ,Russula cyanoxantha (25.11%) etc. The results of crude protein show values comparable to some cultivated mushroom like *Agarics bisporus* (26.3%), *Pleurotus ostreatus* (10.5%) *Lentinula edodes* (17.5%) and *Volvariella volvacea* (29.5%) – Crisan and Sands (1978).

6.10.4 Carbohydrate

Forest mushrooms differ greatly with one another in terms of their carbohydrate content. A considerable proportion of the carbohydrate compounds occur in the form of polysaccharides with particles of different size. Fungal polysaccharide are represented by glycogen and such indigestible forms as dietary fibers, cellulose, chitin, mannans and glucans (Manzi *at al*.2000). In the present study, test of sugar was done and found nil; hence it is recommended that mushrooms are good source of protein for diabetic patient.

6.10.5 Micronutrient (Calcium, Phosphorus and Iron)

In the present study, the micronutrient i.e. Calcium, Phosphorus and Iron of 16 mushroom samples have been determined. Among the 16 samples, highest amount of phosphorus was found in *Agaricus augustus* (806.32), while highest amount of calcium was found in *Agaricus placomyces* (1850.36) and highest amount of Iron was found in *Pleurotus sajorkaju* (176.81).The range of mineral content in these mushrooms are similar to cultivated species (Crisan and Sands,1978).

The value of the protein determined through different methods within the same mushroom species sometimes varied from one other. As described by Christine *et al.,* 1999, the environmental influences, geographical locations and the techniques implemented for the determination of protein can vary the protein concentration within the same species of mushrooms. In this research, the same species of mushroom*, Laccaria laccata* collected from three different sites viz. Godawari, Matatirtha and Suryabinayak, had the protein concentration of 0.594, 0.862 and 0.687 mg/ml respectively. This result shows that the amount of protein also varies according to ecological factors.

6.10.6 Protein Profiling by SDS PAGE

As we know, **SDS PAGE** are used to monitor the extent of purification and to determine the molecular mass and sub-unit composition of the purified protein. It is an electrophoretic method for separating protein subunits after they have been denatured by heating under reducing condition and bound by anionic detergent Sodium Dodecyl Sulphate (SDS). In the present study, the result shows that various species of mushroom samples(23) were found to contain similar bands for some major protein (Pandey and Budathoki 2006b).

In this connection, it has been suggested that, once the electrophoregram has been normalized, several protein profiles may be compared for taxonomic classification.

6.11 Nutritional value of Mushrooms

The use of mushroom as food can be traced back to the beginning of human civilization itself. Mushrooms have been a delicacy since ancient times. The Egyptians regarded them as food for Pharaohs. The Greeks and Romans described them as "food for the Gods", and were served only during celebrations. Reference to mushrooms is found in Vedas (Chube, 1995; Adhikari, 2000, 2003). Mushrooms can be used as food to solve the malnutrition problem (Manandhar, 2003).

6.11.1. As source of 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. The protein content of fresh mushroom is 3.7%, as stated by FAO publication (1978). They have a high percentage of all essential amino acids. The protein content in mushrooms is almost equal to that of corn and milk and is more than either potato or cabbage. Mushrooms are also low in cholesterol. They are still inferior in protein to such standard protein sources as meat, fish, eggs, and cheese; but their protein content is twice as high as that of most vegetables, with the exception of peas and other legumes (Sohi and Sharma, 1997). *Clavaria coralloides* and *Boletus loyus* are the best protein sources but are deficient in the amino acids methionine and cysteine (Schmeda *et al.,* 1999). In the present study , the mushrooms were found to contain as low as 8.01% of proteins to as high as 34.44% on a dry weight basis. Most of the genera and species were found to contain higher protein content, analogous to previous works (Adhikari *et al.* 1996) showing the nutritional status of the wild mushrooms from Nepal. Except for *Omphalotus olearius*, a non-edible

mushroom, most of the wild species studied from various regions of Nepal seem to be consumable from the viewpoint of protein content.

6.11.2. As source of Vitamins

Mushrooms are excellent sources of many B Vitamins such as thiamine (B1), riboflavin (B2), nicotinic acid and pantothenic acid. Vegetables are reportedly poor source of Vitamin B12. This requirement can be met with by taking as little as 3g of fresh mushrooms (Hayes and Hand, 1981). Mushrooms also contain Vitamin C (Ascorbic acid) and Vitamin K. Vitamins A, D and E appear to be present only in very low amounts (Sohi and Sharma, 1997).

6.11.3. As source of Minerals

Like most vegetables, mushrooms are good sources of minerals and are reported to be rich in potassium, sodium and phosphorus. Together with calcium and magnesium, these constitute 56-70% of the total ash content. Iron is present in appreciable amounts. *Agaricus bisporus* is reported to contain considerable amounts of potassium, phosphorus, copper and iron. The highest phosphorus content is found in *Lepista nuda* in comparison to wood destroying fungi (Veter, 1994). In the research, highest amount of phosphours was found in *Agaricus augustus* (806.32) while highest amount of calcium was found in *Agaricus placomyces* (1850.36) and highest amount of Iron was found in *Pleurotus sajorkaju* (176.81). The detailed results are provided in Table 4-9.

6.11.4. As source of Carbohydrates

Carbohydrates constitute the main component of mushrooms. It ranges between 3 and 28 % (on a fresh weight basis) in various species. A higher value (46.6 to 81.8 %) on dry weight basis is found in different species of *Pleurotus* (Bano and Rajarathnam, 1982). In this research, for carbohydrates only sugar was tested and the result was negative. Hence, mushroom can be consumed by diabetes. Similar results were also found from literature review.

7. Summary

Biodiversity or Biological diversity is the variability among living organism from all sources. It includes diversity within species, between species and in ecosystem. Nepal offers a wide spectrum of habitats and ecosystem due to diverse bio-geographic setting, horizontal and vertical dissimilarities, climatic contrasts and altitudinal variations; hence this country is rich in biodiversity. Mycodiversity is the branch of biodiversity, which reflects the fungi diversity. Larger fungi of the divisions Ascomycotina and Basidiomycotina are called mushrooms. Edible species are called "Mushroom" and "Poisonous" ones as "Toadstools" (Pacioni 1985).

Nepal is a multi lingual, multi religion and multi ethnic country. The ethnic groups in Nepal are distributed within all 75 districts of the country. The population Census of 2001 has listed 102 Ethnic & Caste groups (CBS, 2001). In Nepal, mushroom collection and consumption have been continuing since time immemorial by different ethnic groups. But the first exploration and collections of Nepalese fungi was done along with higher plants by J.D. Hooker in between 1848-1854, who explored East Nepal in botanical study. His collections were studied and reported by Berkely (1854). Thereafter, many Nepalese and foreign mycologists have contributed in this field.

In the initial stages of research on mycological specimens in Nepal, there were no specific intentions of ethnomycological investigations. However, mushrooms were collected and reported as edible or non edible according to human uses (Singh 1966, 1973, 1974; Adhikari 1976). Ethnomycological studies and Ethnobotanical studies including mycological species were later undertaken by several workers with regard to those consumed by selected ethnic tribes or those used by people in selected geographic areas in Nepal.

The major objectives of the present research is to explore and document wild Mushrooms; find out and present associated ethnomycological knowledge of local people and carry out chemical analysis of those mushrooms which were consumed by mycophilic ethnic groups.

Central Development Region of Nepal is the main Study Area of the thesis. The study was limited to Langtang National Park (Dhunche to Kyanginj ghumpa), Kathmandu Valley and adjoining areas (Sunadrijal, Dhulikhel, Surya-binayak, Champadevi, Nagarjun, Matatirtha etc.) and Chitwan (Tikauli Samudayik Ban, Amrit Dharapani Samudayik Ban). The collection of mushrooms started from the year 2001 to 2005 mainly during the months of May, June, July, August, September and October.

During the collection of samples, geographical information of the area, i.e. Latitude, Longitude, Altitude, Soil-type, Forest type, Habitat, Climate, Temperature along with Date, Collection Number and Place of Collection were recorded.

While conducting field trips in the sites, a professional mushroom hunter and some other friends were accompanied. The mushrooms were photographed in their natural habitat before they were collected. The broken, rotten and insect eaten species were discarded and only healthy basidiocarps were picked up. All morphological characters were recorded. Spore prints were obtained. Each specimens of same species or different species collected from the same locality or different localities were cleaned with the help of brush. They were placed in separate wax paper bags to prevent mixture of spores. Bamboos baskets and paper bags were used for the collection of specimens in the field.

The specimens were preserved in dry condition (as done in case of higher plant) i.e. blotting the water through different means (sun drying, placing near the fire place etc.), since the dried preserved samples only could be utilized for microscopic study and for chemical analysis. The liquid preservation was done only for Museum specimen, and jelly fungi , since the liquid preservation would be useless for any study because the preservation is done with the mixture of distilled water, alcohol and formalin in the ratio 70:25:5 or only distilled water, alcohol and formalin in the ratio 95:5 concentration- following Ainsworth.

The specimens were brought to the laboratory for the microscopic studies. The specimens were identified with the help of standard literatures. After identification, they were filed and stored each with a Label Tag. Napthalene balls and Para-dichlorobenzene were used as insect repellents in the storage Cabinet. The Cabinet was kept in dry, well aerated and sunny room

The identification of the specimens were done through the application of different criteria – 1. Habit, Habitat, Visible Morphological characters and Spore print (Appendix – III.); 2. Chemical test and microscopic observation (Appendix – IV); 3. Consulting different relevant literatures, monographs, reviews, and recently published research papers, which are mentioned in the references. Macroscopic features are based on the original description of the sample in the field. Features of the cap, hymenium, gill, stipe, flesh, odor and taste were recorded whenever possible. In the microscopic observation, the specimen were observed on 15 x 10 and 15 x 40 magnification. Spore shape was determined at the length, width ratio of 20-30 randomly selected spores. Microscopic photograph of spores were taken on some samples, while in some Camera lucida drawing was done. For spore ormentation, the SEM (Scanning Electron Microscopy) was done on some samples at IIT (Indian

Institute of Technology) in New Delhi, knowing that SEM helps for proper identification of the particular species of a *genus* and between *genus*.

During identification, focus was made to identify those species which have ethnomycological importance and which can be added as a new entry to the list of identified mushrooms in Nepal. Ethno mycological information was collected using Anthropological field techniques, PRA and RRA (Participatory Rural Appraisal and Rapid Rural Appraisal) respectively. The techniques involved direct interviewing and discussing with the local people and observing the collection and use of different mushrooms by the locals. The documented information was verified by cross questionnaire, by consulting relevant literatures, and by interviewing the experienced village elders. The gathered ethnomycological data were authenticated by cross questioning other groups of the same or other localities. All the groups were asked the same questions and given same samples for identification and was later verified with literature and herbaria.

Edibility of mushrooms was recorded from the versions of the local people, through chemical tests as well as through consultations of the previous literatures. It was also determined through the interviews with collectors, sellers and buyers. The toxicity test was not performed due to constraint of laboratory in the country. The ethnomycological information were obtained from the use of questionnaire (Appendix –V).

Chemical Analysis

Determination of moisture, ash, acid insoluble ash, as well as minerals like Calcium, Phosphorus and Iron were performed in the Department of Food Technology and Quality Control in accordance with AOAC (1995). Carbohydrate determination - for reducing sugar - was done by the Fehling's test. The Quantitative estimation of total free amino acid content in mushrooms was done by using the Ninhydrin Reaction (colorometric method). Qualitative determination of amino acids in mushroom was done by ascending paper chromatography . Quantitative Determination of Crude Protein was done by Micro – Kjeldahl's Method. Determination of soluble protein of mushroom was done by Lowry Method and Bradford Method. These analysis were performed in Central Department of Microbiology,TU. Determination of Protein profile by SDS-PAGE was performed in RLABB.

From the study area, 127 collectors were interviewed. Among them, only 6 members were above the age of 60 and all of them were male. Of the total interviewees, 105 members were in the age between 20 to 50, among which 56 were male, and the rest were female. The remaining 16 were kids below the age of 11. The kids could not distinguish between the edible and poisonous mushrooms, but they

knew the locations where mushrooms could be found. Among the adults, only about 36 persons shared their knowledge on mushrooms.

In Nepal, various mycophagus groups like Tamang, Sherpa, Gurung, Tharu, Danuwar, Rai, Limbu, Chepang and Newar etc. can be traced with the collection and consumption of mushroom for a long time because of the delicious taste of mushrooms.

Five hundred seventy five samples belonging to fifty-four families were identified (Appendix-XIII), of which two hundred fifty- one samples were up-to genus and three hundred twenty four were up-to species level. Fifty Ethnomycologically important species were enumerated.

Twenty- five recorded species are added in the mycoflora of the country, viz. *Agaricus augustus* Syn.*A. abruptibulbus* Peck, *Agaricus placomyces* Peck, *Agaricus praeclaresquamosus* Freeman, *Boletellus emodensis* Berk., *Cantharellus lateritius* Berk, *Coprinus atramentarius* Bull. Ex Fr.,*Coprinus lagopus* Fr.,*Coprinus micaceus* Fr, *Ganoderma tsugae* Hongo,*Gyroporous atroviolaceus*, Hoehn., *Gyroporus castaneus* Fr, *Hypholoma capnoides* Fries, *Laccaria proxima* Boudier , *Leucocoprinus fragilissimus* Rav, *Marasmius maximus* Hongo, *Pluteus thomsonii* Berk. and Br, *Polyporus gramocephalus* Berk., *Resupinatus applicatus* F r. , *Rhizina undulata* Fries, *Strobilomyces mirandus* Corner, *Thelophora fuscella* Lloyd.,*Tylopilus nigerrinum* Heim, *Volvariella bombycina* Schaeff. Ex Fr. and *Xerocomus subtomentus* L.ex Fr.

Among the identified species, ten species are added in the list of edible species of the country,viz. *Agaricus augustus* Peck, *Cantharellus lateritius (*Berk.) , *Coprinus atramentarius, Coprinus micaceus* (Fr.) Fr., *Dictyophora duplicata* (Bosc) E. Fischer, *Gyroporus castaneus* (Fr.) Quel. Ench, *Hypholoma capnoides* (Fries) Kumm, *Laccaria proxima*(Boudier) Orton Singer, *Marasmius maximus* (Hongo) and *Volvariella bombycina* (Schaeff. Ex Fr.) Singer.

According to the literature review, this research has increased the list of Edible mushrooms in Nepal to one hundred and eighty, Toxic sixty-six, Medicinal nineteen and Other seven (Appendix-XV,XVI,XVII respectively).

Ethnomycological knowledge are mainly focused on Tamang and Chepang, because they are the traditional mycophilic groups besides others. Different Tamang and Chepang use local names for particular mushrooms which have been described, viz Chetan musa, Yamu musa, Dhudha musa, Cheimu musa, Kadum musa, Baum musa, Hardi musa, Pankamu musa, Khaukarey musa, Lisa musa, Phuli musa, Chapi musa, Gobrey musa, Chamrey musa, Gosaydunge musa, Raktey musa, and Thokpa

musa (all edible mushrooms) ; and Yaroning musa (inedible mushroom) which are the Chepang names for various mushrooms.

Similarly, Bhkhulo Shyamo, Ghising Shyamo, Gho Shyamo, Goida Shyamo, Myala Shyamo, Nyhyo Shyamo, Oomi Shyamo, Phusphusey Shyamo, Plem Shyamo Armu shyamo, Balaa shyamo, Bena shyamo,Bhaise plemo,.Budi shyamo Cheracher shyamo(*Aster* species), Chudy shyamo, Chung ping shyamo, Chwali Ura shyamo, Chyapu shyamo,Dhai shyamo,Dhar shyamo(*Amanita hemibapha*) Dhwang shyamo, ,Kan shyamo (*Russula.delica*), Koper shyamo (*Coprinus comatus)*, Mang shyamo,Marmo shyamo,Nagi shyamo (*Lactarius deliciosus*),Navyang shyamo(*Auricularia auricula*) ,Nghe shyamo etc. were the Tamang names for mushrooms, which were found to be used by the local people.

In practical, in various Nepali languages mushroom is known as chyau (Nepali), Bammhukan (Newari), Shymo or Shyamu (Tamang), Shamu (Sherpa),Ghyabo (Gurung), Mugan (Magar), Pat (Limbu), Chhani (Tharu) and Kukurmutta (Hindi) (Adhikari, 2000). The author recorded new names for mushrooms which are being used in Nepal : Musa (Chepang "Praja"), Timu (Thakali), Kacchu (Danuwar), Beemti (Tharu) (Pandey, 2006).

The local people also named particular mushrooms according to their shape, color and substractum in national language as Chate, Dallae, Nangre, Surilo, Masino, Patpate, Rato, Pahelo, Sindhure, Phusphuse, Dhudey Seto, Kalo, Gobre, Parale, Sallae, Thalathale, Chipple, Bagale, Dhamere etc.

Different uses of mushrooms were described. Methods to minimize mushroom poisonings were described. Mycophilic groups were trained to select the edible species as far as possible. In high altitude as well as in Terai region (study area), no poisoning and mortality cases were found. The reason behind this was the locals' ability to identify the edible mushrooms from the poisonous ones.

Mushroom poisoning and death case was not found during the study period in the study area , since the local people only used to consume those mushrooms which were familiar to them; but , however, incidents may happen due to the consumption of "look-alike species" i.e. some species are so similar that morphologically they cannot be separated exactly. Such species can be identified with spore print and microscopic observations which are far from imagination of a layman.

The five reasons behind the proverb "Bahun ko babu le chyau khawos na swad paos" and the forbiddance of the use of mushroom by Brahmins in the ancient times were also mentioned (compiled from questionnaire from different ethnic groups). The mushrooms used for various purposes (food,

medicine, poison, mycorrhiza, decoration and others) were also mentioned. Ethnic as well as modern recipes of mushroom were provided.

Biogeographic distribution of mushrooms in the study area was also provided. *Morchella* species, according to the literature review , are found at high altitude at spring seasons; it was also found in the field of Kuleshore (Kathmandu) at an altitude of 1300m where wild plants such as *Desmodium concimonum , Delegans , D heterpan, D podocarbon, Indigera bracteata and Crotolaria cysoides* were found growing during the research study. From this, it can be concluded that if habitat is maintained, there will be no significance of altitude while growing *Morchella* species.

Chemical analysis of each result were shown in tables and graphs. The value of the protein determined through different methods within the same mushroom species sometimes varied from one another. As described by Christine et al., 1999, the environmental influences, geographical locations and the techniques implemented for the determination of protein can vary the protein concentration within the same species of mushrooms. In this research, the same species of mushroom, L*accaria laccata* collected from three different sites Godawari, Matatirtha and Suryabinayak, has the protein concentration of 0.594, 0.862 and 0.687 mg/ml respectively. This result shows that the amount of protein also varies according to ecological factors.

The profiling of protein bands by SDS PAGE were also incorporated, which is not mentioned in any literature. This technique is used to monitor the extent of purification and to determine the molecular mass and subunit composition of purified protein.

Thirteen research articles were published in different journals and proceedings. Two reports were also submitted to UGC and DNPWC

The highly prized wild edible mushrooms are *Coprinus commatus*, *Amanita caserea, Cantharellus cibarius, Laccaria laccata, Russula chlorides, R. cyonoxantha, Scleroderma species, Oudemensiella radicata,Volvariella bombycina etc*. These mushrooms are suggested for artificial culture in laboratory and mass commercial production technology should be developed.

8. Conclusion and Recommendation

8.1 Conclusion

Despite being a small country, diversity of mushroom is magnificent in Nepal due to topographic and climatic variation. Only few localized mushrooms are found at particular altitude and ecological habitat; otherwise they are cosmopolitan at favorable habitat. Temperature, rainfall, appropriate habitat and moisture are the main determining factors for fungal growth.

Cordyceps sinensis is found at high altitude (3800-4500 m), *Scleroderma polyrhizum* and *Termitomyces* e*urhizus are* found at low altitude i.e. Terai belt and different species of *Amanita, Agaricus, Russula, Lactarius, Laccaria, Catharellus* etc, are found in Subtropical, Temperate and Sub-temperate zones.

Five hundred seventy five samples belonging to fifty four families and eighty two genera were identified. Twenty five recorded species are added in the mycoflora of the country. Enthnomycologically important 50 species of mushrooms (being used by different ethnic groups) were also enumerated , which come under : Ascomycotina-4 spp, and Basidiomycotina-46 spp (they are under, Phragmobasidiomycetes-2 spp, Agaricomycetideae-23 spp, Aphyllophoromycetideae-14 spp and Gasteromycetideae 7 spp). From this data, it can be concluded that the members of Agaricales are used widely in comparison to others.

Among the identified species, ten species are added in the list of edible species of the country.

Mushrooms are also important non timber natural forest products supporting local economies of the region. Local people in the study area collect prized mushrooms from different forests and localities for consumption as well as for trade. The main Mycophagus groups in the study area are Tamang, Gurung, Sherpa, Lama, Chepang, Danuwar, Tharu, Rai, Limbu, Newar etc. Wild edible mushrooms play important roles in the local ecosystem in terms of decomposition of organic materials and formation of ectomycorrhize with forest trees.

In the present condition, the trade of wild edible mushroom is decreasing due to cultivated mushroom trade in the local market, fear of mushroom poisoning as well as conservation policies of the Government. In contrast to the above fact, the trade of highly prized mushroom eg. *Cordyceps sinensis* and different species of *Morchella* is on the peak because they are exported in the international market. Wild mushroom contains protein, vitamin, minerals and it is an ideal food.

However, before consumption, the collected mushroom should be submitted to a knowledgeable person for a careful scrutiny.

Morchella species, which are found at high altitude at spring seasons according to the literature review; was also found, during the research study, in the field of Kuleshore (Kathmandu) at an altitude of 1300m where wild plants such as *Desmodium concimonum , Delegans , D heterpan, D podocarbon, Indigera bracteata and Crotolaria cysoides* were found grown. From this, it can be concluded that if habitat is maintained, there will be no significance of altitude while growing *Morchella* species.

SDS PAGE was also performed in some mushrooms. Once the electrophoregram has been normalized, several protein profiles may be compared for taxonomic classification. It was very suggestive that the protease inhibitor like PMSF should be added during the storage of the mushroom samples so that the stored protein content can be stable.

The value of the protein determined through different methods within the same mushroom species sometimes varied from one other. As described by Christine et al., 1999, the environmental influences, geographical locations and the techniques implemented for the determination of protein can vary the protein concentration within the same species of mushrooms. In this research, the same species of mushroom*, Laccaria laccata* collected from three different sites Godawari, Matatirtha and Suryabinayak, had the protein concentration of 0.594, 0.862 and 0.687 mg/ml respectively. This result shows that the amount of protein also varies according to ecological factors.

8.2 Recommendation

The increasing deforestation and continuing urbanization have left severe impact upon many of the mushroom species leading them to endangerment or putting them almost at the verge of extinction. If no attention is paid to conserve such species in time, many of them will disappear before documentation.

Based on the present study, the following points have been recommended for consideration :

a) Ethnomycological knowledge existing in the country is still far from getting completely recorded. Documentation of Ethnomycological information preserved with different ethnic groups of different geographic belts should be done.

b) Students and Botanists should be attracted and inspired to study and conserve mushrooms in the country. Especially, graduate students should be encouraged towards mycological research for their dissertation work.

c) The mycotoxins from Nepalese mushrooms should analytically screened and studied.

d) Research should be a regular program (promoted continuously). Funds and institutional support should be made available for such research so that mycologists can play vital roles in the related aspects.

e) International researchers should be permitted and encouraged to conduct their research on mushrooms of Nepal. This may help to come up with new technologies for the exploration and conservation of mushrooms.

f) Local communities should be educated on the over-all significant values and aspects of mushrooms so that they will be able to know more than what they already know.

g) Government and Private Institutions should promote to 'develop the culture in the laboratory' and go forward with 'mass commercial production technology' of the most prized wild edible mushroom which have good nutritive value viz *Amanita caesarea, Cantharulleus cibarius, Coprinus comatus, Laccaria laccata, Russula cyanoxantha,* etc.

h) Conservation organizations like WWF, IUCN, Department of Forest etc. should take initiative to determine the status of mushrooms and develop suitable conservation measures based on community levels. Native expertise of this country should be mobilized in this work. Funds and institutional support should be made available for such research.

i) Besides the above mentioned analysis, other analysis based on the type of vitamin, other mineral, heavy metal and radioactive substance etc. are recommended to further the depth study of these mushrooms.

j) Improper harvesting of mushrooms can damage forest habitat; leading gradually to excessive food traffic, forest compaction, damaged fungal mycelium and thereby affecting the mushroom production. Effective conservation method and proper harvesting techniques are needed in order to ensure continued production of these wild edible mushrooms from their natural habitat.

k) In the present study, test of sugar was done and found nil, hence it is recommended that mushrooms are good source of protein for diabetic patient.

References

Adhikari, K.S. and Adhikari, M.K. 1996-1997. Collection and consumption of wild edible mushrooms sold in Kathmandu valley, Nepal. *The Geographer's Point.* 1-2: 1-9.

Adhikari, M.K. 1976. Chyau ek charcha (= Mushrooms: a discussion). *Gorkhapatra.* (Kathmandu) 76: 6 (in Nepali) (2033.8.10).

Adhikari, M.K 1981-82. Chyau: Ayurvediya vishleshan ek vivechana (Mushrooms: An Ayurvedic concepts). *Jour. Nep. Pharm. Asso.* **9**. 17-21 (In Nepali).

Adhikari, M.K. 1984. Note on *Asterophora parasitica* (Fr.) Sing. and *Russula densifolia* (Secr.) Gillet from Nepal. *Jour. Nat. Hist. Mus.* **8 (1-4)**: 123-126.

Adhikari, M.K.1987. Nepalma chyauko upabhoga ra upabhokta: prarambhik sarbhekshan ek chhoto janakari (= Consumers and consumption of mushrooms in Nepal: a preliminary survey). *Naya Aawaj*. **6 (16)**: 3-4 (in Nepali).

Adhikari, M.K. 1988a.Polypores (wood rotting fungi) of Nepal. *Banko Janakari.* **2(1)** : 9-20.

Adhikari, M.K. 1988b. New records of fleshy fungi from Kathmandu valley. *Cryptogams of the Himalayas.* 1: *The Kathmandu valley.* Eds. by M. Watanabe and S.B Malla. National Science Museum, Tsukuba, Japan. 133-139.

Adhikari, M.K 1988c. The genus *Russula* from the Kathmandu valley. *Ibid*.141-146.

Adhikari, M.K 1988d. Some higher fungi from Langtang and its adjoining area. *Proceeding of the papers National Conference on Science and Technology* organized by RONAST, Kathmandu: BSNS la: 1, 237-241.

Adhikari, M.K. 1990a. History of mycological explorations in Nepal. *Cryptog. Mycol.* **11(2)** : 111-128.

Adhikari, M.K. 1990b The genus *Russula* from Nepal (II). *Cryptograms of the Himalayas.* 2. *Central and Eastern Nepal.* Eds. by M. Watanabe and S.B Malla. National Science Museum, Tsukuba, Japan. 101-112.

Adhikari, M.K. 1991a. Hunting wild mushrooms in Nepal. Presented at the training on the study, collection and preservation on Natural History of Nepal. Organized by Natural History Museum, Goethe Institute and King Mahendra Trust for Nature Conservation. p.12.

Adhikari, M.K. 1991b. Nepalka Jangali Chyauharu: Chhoto Jankari (= Wild Mushrooms of Nepal: Brief Introduction). *Kalpavriksha.* **1(4)**: 4-5. bb.-Idem. 2. *Ibid*. **1(5)**: 6-8. bc-Idem 3. *Ibid*. **1(6)** : 6-7. bd – Idem. 4. *Ibid*. **1(7)** : 5-7.

Adhikari, M.K. 1991c. Notes on some higher fungi from Nepal. *Jour. Nat. Hist. Mus.* **12 (1-4)**: 9-18.

Adhikari, M.K. 1991d. Research trends on Nepalese mycoflora. *Jour. Inst. Agric. Ani. Sc.* **12** : 17-27.

Adhikari, M.K. 1994. First wild mushroom series stamps. *Philatelic news*, Nepal. **2 (1)** : 5-6.

Adhikari, M.K. 1994-95. Mycodiversity in Nepal: a glimpse. *Bull. Nat. Hist. Soc. Nep.* 3- **4 (1-4)** :4-6.

Adhikari, M.K.1995a. Toxic and medicinal mushrooms from Nepal. *Network* APINMAP/ SCAMAP, Nepal. **1 (1)** : 1-2.

Adhikari, M.K. 1995b. New records of fleshy fungi from the Kathmandu valley.2 *Green World.* **6 (1)** : 37-38.

Adhikari, M.K. 1996a. Biodiversite des Basidiomycetes au Nepal. Etdue systematique et biogeographique. Specialite Ecologie-Mycoloique. 1996. These du Doctorat de l'Universite present devant l'Universite Paul Sabatier, Toulouse, France. No. d'ordre 2309, p. 205.

Adhikari, M.K.1996b. New records of fleshy fungi from the Kathmandu valley.3 *Nat. Hist. Soc. Bull.* **5-6 (1-4)** : 13-15.

Adhikari, M.K. 1998. New records of some Teliomycetes from Nepal. *Nat. hist. Soc.nep. Bull.* **8(1-4)** : 2-8

Adhikari, M.K. 1999a. Wild relatives of some arable mushrooms found in Nepal. *In Proceedings on National Conference on Wild relatives of Cultivated plants in Nepal.* June 2-4, 1999. Organized by Green Energy Mission / Nepal, Kathmandu, Nepal. pp. 149-156.

Adhikari, M.K. 1999b. Status of wild potential mushrooms in Nepal. In abstracts of Third *National Conference on Science and Technology.* Organized by RONAST, Kathmandu: BSNS Abs: BSC069: 104.

Adhikari, M.K.1999c. Gasteromycetes from Nepal. *Nepal's Nature Paradise*. Eds. by T.C. Majupuria and R. Kumar. M. Devi, Gwalior, India. pp. 642-654.

Adhikari, M.K. 1999d Global affinity of Nepalese mycoflora. *Scientific World.* **1(1)** L105-112.

Adhikari, M.K. 1999e. The Genus *Russula* (Basidiomycota, Agaricales) from Nepal (3). *Nat. Hist. Bull. Ibaraki.* Uni. **4**: 3-13.

Adhikari, M.K. 1999f. Diversity of Fungal resources in Nepal and its sustainable utilization or socio-economic growth in context to patenting intellectual property rights. *Bull. Nat. Hist. Soc. Nep.* **9 (1-4)** : 5-13.

Adhikari, M.K 2000. *Mushrooms of Nepal.* Edited by G.Durrieu, P.U. Printers, Battisputali, Kathmandu, Nepal. pp. 236

Adhikari, M.K. 2000a. *Mushrooms of Nepal.* P.U. Printers, Kathmandu, Nepal.

Adhikari, M.K. 2000b. A preliminary study on the mycodiversity of Maipokhari, east Nepal. *Bull. National Science Museum*, Tokyo, Ser. B**26 (2)** : 67-74.

Adhikari, M.K. 2001. New record of fleshy fungi from Kathmandu Valley, Nepal- 4. *Green World.* **7(1)** : 3-7.

Adhikari, M.K. 2004a. Mushroom poisoning and its state in Nepal. In: *Plant Resources Bulletin* No. 25, Department of Plant Resources Kathmandu, Nepal. pp. 56-58.

Adhikari, M.K. 2004b. Nepalma Jangali Chyauharuko Sankalan ra Byapaar. (Wild Mushrooms Trade in Nepal). *Prakrit.* **2 (3**) :27-31. (In Nepali).

Adhikari, M.K. 2004c. Flora – trainiana. In *Proceedings of the 2nd Training Workshop on the flora writing.* 8-9 July, 2003, Organized by HMG/MoFSC, DPR, Nepal Flora Implementation Project, Thapathali, Kathmandu, Nepal. pp. 13-28.

Adhikari, M.K. 2005. Daadu Chyau (*Ganod* Adhikari *erma lucidum*). *Prakrit* (In press)

Adhikari, M.K. 2007 Mushroom diversity in Nepal; A glimpse. Mycological Research and Mushroom Production in Nepal published by Mycological and Phytopathologocal Society Nepal. 20-36.

Adhikari, M.K. and Adhikari, K.S. 1999. Wild edible mushrooms. *The Rising Nepal.*, XXXIV (94): Friday supplement (March 19).

Adhikari, M.K. and Durrieu, G. 1996. Ethnoimycologie nepalaise *Bull. Soc. Myc.* France. **112**: 31-41.

Adhikari, M.K. and Manandhar, V. 1986 A new *Passalora* species from Nepal. *Cryptog. Mycol.* 7 (4) : 327-330.

Adhikari, M.K and Manandhar, V. 2004b. Populus trees and their diseases in Nepal. In: *Plant Resources Bulletin* No. 25, Department of Plant Resources Kathmandu, Nepal.

Adhikari, M.K. and Manandhar, V. 1993a. Khetiyogya kehi jangali aushdhopayogi chyauharu: Chhoto jankari (= some arable wild medicinal mushrooms: a brief introduction). *Kalpavriksha*. **2 (23)** : 10-12 (in Nepali).

Adhikari, M.K. and Manandhar, V. 1996. Trios nouvelles Russules du Nepal, Bull.Soc.Mycol.Fr.**115 (2)**. 187-193

Adhikari, M.K. and Manandhar, V. 1996a. The genus *Lactarius* in Nepal. *Advances in Botany*. **21**: 387-395, India.

Adhikari, M.K. and Manandhar, V. 1998. New record of *Clavatia gigantea* from Kathmandu valley, Nepal. *Nat. Hist. Soc. Nep. Bull.* **8 (1-4)** : 10.

Adhikari, M.K. and Manandhar, V. 2004a. Some fungi collected from Nepal. In: *plant Resources Bulletin* No. 25, Department of Plant Resources Kathmandu, Nepal. pp. 5-10.

Adhikari, M.K. and Parajuli, P. 1993. The genus *Amaita* au Nepal. *Banko Janakari.* **4 (2)** : 130-134.

Adhikari, M.K. and Parajuli, P. 1996. Mycorrhizal fungal diversity in the pine forests of Kathmandu valley, Nepal: an ecological approach. *Environment and Biodiversity: In the Context of South Asia*. ECOS, Kathmandu, Nepal. pp. 182-197.

Adhikari, M.K. and Parajuli, P. and Durrieu, G. 1994. Le genere *Amaita* au Nepal. *Bull. Soc. Myc. France.***110 (1):** 29-33.

Adhikari, M.K. and Pokhrel, N. 1999. Nepalka khoya chyauharu: eke sarbhkshan. *Kalpavriksha.* **9** (96-97): 13-18. (=Morels of Nepal: a survey)

Adhikari, M.K. and Shrestha, T. 1990-92. A report on the natural occurrence of *Claviceps purpurea* on a hither-unknown host *Helictotrichon virescens* in Nepal. *J. Nep. Pharm. Asso.* **17**: 7-11.

Adhikari, M.K., Adhikari, K.S., Joshi, A.R., Bhandary, R.C., Gyawali, M.B. and Pradhan, B. 1996. Studies on food value and mycotoxic wild mushrooms of Nepal submitted to APINMAP / SCAPMAP/ UNESCO Committee of Nepal, Ministry of Education, Nepal. p. 92.

Adhikari, M.K., Bhattarai, N.K. and Shah, K.B. 1992. Yarsagumba: ek anautho dhusi (= *Cordyceps sinensis* : an interesting fungi). *Kalpavriksha,* **2**: 5-9.

Adhikari, M.K., Shrotriya, J.N and Durrieu, G. 2003. Does the plant soma exist? *Banko Janakari*.**13 (2)** :54-62.

Adhikari, S. and Adhikari, M.K. 2003. Some higher fungi from Lamjung Nepal. *Botanical orientalis.* **3**:133-134.

Afyon, A.; Yagiz, D. and Konuk, M. 2004. Macro fungi of Sinop Province. *Turkish* Journa*l of Botany.* **28** (4): 351-360.

Ainsworth, G.C.1971. *Ainsworth & Bisby's Dictionary of Fungi.* CMI, Kew Surrey, England.

Ainsworth, G.C. 1973. *The Fungi: An Advanced Treatise*; IV (B).pp 1-7. Academic press.

Akpaja, E.; Omoanghes, S.and John, A. 2003. Ethnomycology and usage of edible and medicinal mushrooms among the Igbo people of Nigeria. Journal of *Medicinal Mushrooms.* **5**(3): 313-319.

Alexopoulos, C.J. and Mims, C. W. 1963. *Introductory mycology* (First edition) WEL New Delhi, India.

Alexopoulos, C.J. and Mims, C. W. 1979. *Introductory mycology* (Second edition) WEL New Delhi, India.

Alexopoulos, C.J. and Mims, C. W. 1993. *Introductory mycology* (Third edition) WEL New Delhi, India.

AOAC .1995. Official methods of Analysis (16^{th} edition) .Association of Official Analytical Chemists,Arlington,Varginia,USA

Arora, D.1986 . *Mushroom demystified ,a comprehensive guide to the fleshy fungi.* Brekley Ten speed press. pp.159

Arnolds, E. 2001. Hope for the Chanterelle. *Coolia*. **44** (1): 48-56.

Bano, Z. 1976.The nutritive value of mushrooms. In Indian Mushroom Science I :(Eds) C.K.Atal, B.K.Bhat and T.N.Kaul. *Indo American Litrature House*, Globe-Arizona.473-487.

Bakshi, B.K. 1971. *Indian Polyporaceae.* ICAR, New Delhi.

Balfour-Browne, F.L. 1955. Some Himalayan fungi. *Bull. Brist. Mus. (Nat. Hist.)* Ser. Bot. 1: 189-218.

Balfour-Browne, F.L. 1968. Fungi of recent Nepal expedition. *Ibid*. **4**: 99-141.

Barbour, M.G.; Burk, J.H.; Pitts, W.D.; Gilliam, F.S. and Schwartz, M.W. 1999. *Terestrial Plant Ecology.* Addison Wesley Longman, Inc. pp. 257-267.

Barnes, D. B., Pierce, G. F., Lichti, D., Landt, M., Koenig, J. and Chan, K.-W. (1985) *Clin. Chem*. 31, 2018–2019

Bauhin, G. 1623. *Pinax Theatri Botanici.* Basel, Ludovicus.

Bedenko, E.P. 1988. Edible and poisonous mushrooms in the Central Russian Plain. *Rastit Resur*. **24** (3): 449-456.

Berkeley, M.J. 1838 Description of exotic fungi in the collection of Sir W.J. Hooker from memories and notes of J.F. Klotsch with addition and correction. *Ans. Nat. Hist.* 3: 375-401

Berkeley, M.J. 1854a. Decades XLI- XLII. Indian fungi. *Hooker's Jour. Bot.* Kew. Gard. Misc. Jour. **6**: 129-143. b- Decades XLIV – XLVI. Indian fungi. *Ibid.* **6**: 161-174. c- Decades XLVII-XLVII. Indian fungi. *Ibid.* **6**: 204-212. d- Decades XLIX – L. Indian fungi. *Ibid.* **6**: 225-235. (Reprint 1969, Decades of fungi 1-62, Amsterdam, Asher Co. 280).

Bessey,E.A. 1950. *Morphology and Taxonomy of Fungi.* The Blakistom Co. Pvt. Ltd.

Beug, H.J. & Miehe, G. (1999) Vegetation history and human impact in the eastern central Himalaya (Langtang and Helambu, Nepal). *Dissertationes Botanicae Band 318*. Gebrüder Borntraeger, Berlin, Stuttgart, Germany.

Bhandary, H.R. 1980. Notes on some macrofungi on Nepal. *Jour. Nat. Hist. Mus.* 4: 23-32.

Bhandary, H.R. 1984. Mushrooms. 33. In T.C. Majupuria (Eds.), *Nepal Nature's* Paradise, Bangkok, White Lotus Comp. Ltd. pp.235-246.

Bhandary, H.R. 1985. Nepalka Chyauharu: ek Charcha (= Mushrooms of Nepal a discussion). *Bull. Nat. Hist. Mus.* **1**: 17-19 (In Nepali).

Bhandary, H.R. 1991. Some edible and medicinal fungi from Dumre to Manang, Mustang and Pokhara. *Jour. Nat. Hist. Mus.* **12** : (1-4): 47-60.

Bhatt, D.D. 1966. Preliminary list of plant diseases recorded in Kathmandu valley. *J.Nat. His. Mus.,* **2** : 13-20.

Bhattarai, K.R. and Vetaas, O.L. (2003). Variation in plant species richness of different lifeform along a subtropical gradient in the Himalayas, east Nepal. *Global Ecology and Biogeography.* **12**: 327-340.

Bills, G.F. and Cotter, H.V.T. 1989. Taxonomy and ethnomycology of *Lactarius* Sec. Dapetes (Russulaceae) in Nepal. *Memoirs of New York Botanical Garden*. **49** : 192-197.

Bista, M.S.1980. *People of Nepal.* Ratna Pustak Bhandar, Kathmandu.

Bista, M.S., Adhikari, M.K. and Rajbhandary, K.R. 2001. *Flowering Plants of Nepal (Phanerogams)*. His Majesty's Government of Nepal, Ministry of Forest and Soil Conservation, Department of Plant Resources, Kathmandu, Nepal.

Boa,E. 2004. Wild edible fungi. A globalOverview oftheir use and importance to people. In : *Non-wood forest products series* 17. FAO,Rome.

BPP (Biodiversity Profile Project). 1995. *Biodiversity profile of high mountains and high Himal physiographic zones.* BPP Technical Publication No. 14. HMG Nepal, Ministry of Forests and Soil Conservation; Government of Netherlands.

Bradford, M. M. 1976 *Anal. Biochem*. **72 :** 248–254

CBS. 2001. Statistical yearbook. Central Bureau of Statistics, National Planning Commission Secretariat, His majesty's government of Nepal, Kathmandu.

Chamber, R, 1992. Institute of development Studies Discussion paper, *Rural appraisal : Rapid, Relaxed and participatory*. 311

Chang ST.1999 Global impact of edible and medicinal mushrooms on human welfare in the 21st century: nongreen revolution. *International Journal of Medicinal Mushrooms* 1:1-8.

Chang ST.1999. Recent trends in world production of cultivation mushroom. Mush J.584;15-18.

Chang, S.T. and Miles, P.G 1993. Mushrooms-trends in production and technological development. *Genetic Engineering. Bio-tech. Monitor* **41/42 :** 73-84

Chaudhary, R.P. 1998. *Biodiversity in Nepal*: *Status and Conservation.* Craftsman Press, Bangkok.

Chou, S.C. and Goldstein, A. (1960*) Biochem*. J. **75:** 109–115

Christensen, M, Devkota, S. and Bhattarai, S. 2006. The use of wild edible mushrooms in Annapurna Conservation Area. *Forestry (Institute of Forestry, Nepal)* 14 **(in press).**

Cooker, W. C. 1973 The Clavariaceae of the United States and Canada. *Bib. Mycol. Band 39 Verlag von J. Cramer.*

Corner, E. J. H. and Bas, C. 1962 the genus Amanita in Singapore and Malaya. *Persoonia*. 2 (3) : 241-304.

Corner, E. J. H. 1966 A monograph of *Cantharelloid* fungi. *Oxford University Press, London.*

Corner, E. J. H. 1968. A manograph of *Thelephoraceae (Basidiomycetes). Nova Hedwigia.* ***27*** Verlag von J. Cramer.

Corner, E.J.H 1970. Supplement to a monograph of *Clavaria* and allied genera. *Nova Hedwigia.* **33** Verlag von. J Cramer

Corner, E.J.H 1972. Boletus in Malaysia, *Published under the auspices of the Botanic Garden* ,Singapore.p.263.

Cotter, H. V. T. and Miller, O. K. 1987. Ectomycorrhizal association of the Bolete genus *Suillius* in Nepal. Proceeding Seventh North American conference in mycorrhizae, Ganeaville, Fl. U.S. A. p. 5.

Cotter, H.V.T. 1987. The systematics and ecology of boletes with special reference to the genus *Suillus* and its ectomycorrhizal relationship in Nepal. Dissertation submitted to the faculty of the Virginia Polytechnic Institute and State University in Partial fulfillment of the requirement for the degree of Ph.D. in Botany, Blacksburge, Virginia, U.S.A. p. 175.

Cotter, V.T. and Bhandary, H. R. 1985. *Cavimalum indicum* (Clavicipitaceae) on *Arundinarium* in Nepal. *Jour. Nat. Hist. Mus*. **9** : 115-120.

Courtecuisse, R and Duheum, B. 1994. guide des champiognons de france et d' Europe Delechaue and Niestle. WWF. pp. 476.

Das, A.K. 1984 Ethnobotany of East Siang District *Arunchal Pradesh*, Ph.D thesis.

Das, A.K. 2001. A note on wild edible mushrooms of East Siang District of Arunanchal Pradesh. *Ethnobotany*.**13**: 126-128.

Das, N.; Mahapatra, S.C. and Chattopadhya, R.N. 2002. Wild edible mushrooms: Non-wood forest products for livelihood generation. *Indian forester***. 128** (4): 445-455.

Deacon, Jim, 2006. Fungi Online: Home> Introduction to fungi > Classification of fungi

Devkota, S. 2004. **"**Mushroom diversity in Lumle (kaski) and study of Clavariales from Lumle and vicinity of Kathmandu valley, Nepal" Dissertation submitted to Central Department of Botany, Tribhuvan University, Kirtipur, Kathmandu, Nepal.

Devkota, S.; Tiwari, R.D.; Manandhar, V.K. and Adhikari, M.K. 2005a. Some wild mushrooms collected from Lumle, Kaski, Nepal. In abstract, *Third National Botanical Conference.* Organized by Nepal Botanical Society, Kathmandu, Nepal. p. 50.

Devkota, S.; Tiwari, R.D.; Manandhar, V.K. and Adhikari, M.K. 2005b. Some wild mushrooms collected from Lumle, Kaski, Nepal. In: *Plant Resources Bulletin* No. 26, Department of Plant Resources Kathmandu, Nepal. pp. 10-15.

Devkota, S.; Tiwari, R.D.; Manandhar, V.K. and Adhikari, M.K. 2005d. Clavariales from the Nepal Himalayas In abstract, *Biodiversity Conservation in Asia: Current Status and Future Perspectives*, Organized by The Society for Conservation Biology, Asia section. P. 21.

Devkota, S. 2006 Yarsagumba [*Cordeceps sinensis* (Berk.) Sacc.]; Traditional Utilization in Dolpa District, Western Nepal. Journal Our Nature 4:48-52

Devkota, S.; Tiwari, R.D.; Manandhar, V.K. and Adhikari, M.K. 2006. A new record of *Ascobolus magnificus* Dodge. from Lumle, Nepal *Botanica Orientalis* 5.

Dickinson, C. and Lucas, J. 1979. *Encyclopedia of Mushrooms.* Orchid Publication, London.

Dobremez, J.F. 1971.*Carte Ecologique du Nepal,*Annapurna / Dhaulagiri. Doc. Carte Veg. Alpes, IX.

Dobremez , J. F. 1972. Mise au Point d'une Methode Cartographique d'Etude des Montagnes Tropicales. Le Nepal, Ecologie et Phytogeographic. These, Universite Scientifique et Medicale, Grenoble.

Dobremez , J. F. 1976. Exploitation and prospects of medicinal plants in eastern Nepal. *In* Mountain Environment and Development. Swiss Associations for Technincal Assistance in Nepal, Kathmandu.

DPR. 2001. *Flowering Plants of Nepal (Phanerogams),* His Majesty's Government, Ministry of Forests and Soil Conservation, Department of Plant Resources, Kathmandu, Nepal.

Fisher, W. and Hagen, D. 2003. Verhandulungen des Botanischen Vereins von Berlin and Brandenburg (136):. Contributions to the knowledge of the mycotic flora of the Prignitic region, NW Brandenburg, Germany. pp.269-320

Folin, O. and Ciocalteu, V. (1927) J. *Biol. Chem.* 73, 627–650

Frature, A. 1997. Mushrooms collected by J. Leonard in the Libyan Desert and at Lake Chad (1968). *Bulletin du Jardin Botanique National de Belgique.* **66** (1-2): 163-174.

Fries, E.M. 1838. *Epicrisis Systematis mycologici.* Upasala.

F. H., Provenzano, M. D., Fujimoto, E. K., Goeke, N. M., Olson, B. J. and Klenk, D. C. (1985) *Anal. Biochem.* 150, 76–85.

Flegg. P.B.1995. speciality mushroom recent publication, Mush. J.543:20.

Garchha ,H.S., P.K.Khanna and G.L. Son. 1993.Nutrional Importance of mushroom. In:*Mushroom Biology and Mushroom products* .Chinese University of Hong Kong Press, Shatin, Hong Kong, China. pp.227-337

Gecan, John, S. and Stanley, M. 1993. Toxic mushroom contamination of wild mushrooms in commercial distribution. *Food Prot.* **56** (8): 730-734.

Giovanni Pacioni 1981. Guide to Mushrooms. Edited by Garry H. Lincoff, *Published by Simon & Schuster inc. New York, London* pp. 511

Goos, R.D. 1962. The occurrence of *Sphaerostilbe repens* in Central American soils. *Am. J. Bot.* **49** : 19-23.

Gornall, A. G., Bardawill, C. J. and David, M. M. (1949) J. *Biol. Chem*. 177, 751–766

Granetti, B.1991. The role and importance of mushrooms in the natural ecosystem of Rieti(Italy). *Ann Fac Agrar Univ Stud Perugia.* **43** (0): 581-590.

Gunde-Cimerman, N., Plemenitas, A. and Cimerman, A. 1993. Pleurotus fungi produce mevinolin, an inhibitor of HMG CoA reductase. *FEMS Microbiology Letters* 113, 333-338.

Gwynne-Vaughan.H.C.I, and Brnes, B.1937.*The Structure and Development of the Fungi*. Cambridge University Press, Cambridge.

Hames, B. D (1981): An introduction to polyacrylamide gel electrophoresis. In gel electrophoresis of protein. A practical approach. Vol II, 1-91, *edited by Hams B.D. and Rickwood D., Oxford , CRC press.*

Hara, H., W.T. Stearn and L.H.J. Williams.,1978. *An enumeration of flowering plants of Nepal.* **1**. British Museum (Natural History) London

Hara, H. and Williams, L.H.J. 1979. *An enumeratuin of the flowering plants of Nepal.* 2. Trustees British Museum (Nat. Hist.) London. p. 220.

Hara, H., A.O. Chater and L.H. J. Williams., 1982. *An enumeration of flowering plants of Nepal.* **3**. British Museum (Natural History) London.

Harkonen, M.; Bart, B.; Tiina S. and Leonard, M. 1993. Tanzanian mushrooms and their uses 1. *Russula. Karstenia* **33** (1): 11-50.

Hawker, L.E. 1996. *Fungi.* Hutchinson & Co. Ltd. London.

Hawksworth, D.L. 1974. *Mycologist's Handbook.* Commonwealth Mycological Institute, Kew Surrey, England.

Hawksworth, D. C., Sutton, B. C. and Ainsworth, G. C. 1983 Ainsworth & Bisby's Dictionary of fungi. *CMI. Kew, Surrey, England.*

Henry, P. J. (1964) Clinical Chemistry, Principles and Practice, *Harper and Row*, *New York pg175*

Hjortstam, K. and Ryvarden, L. 1984. Some new and noteworthy Basidiomycetes (Aphyllophorales) from Nepal. *Mycotaxon*. **20** : 133-151.

HMGN/MFSC 2002. *Nepal Biodiversity Strategy,* Ministry of Forests and Soil Conservation, Kathmandu, Nepal.

Hobbs, C. 1995. Medicinal Mushrooms: An exploration of Traditional, Healing and Culture. Santa Cruz, CA., *Botanica Press*

Hooker, J.D. 1854. *Himalayan Journals.* 1-2. J. Murray, London.

Hsu, T.H., L.H. Shiao, C.Hsiea and D.M.Chang 2002. A Comparison of the chemical composition and bioactive ingredients of the Chinese medicinal mushroom DongChongXiaCao, its counterfeit and mimic, and fermented mycelium of *Cordyceps sinensis*. Food Chem, 78: 463-469.

Illieveska,B.P. and Petrivsja, B.B.2000. Amino acid analysis of some Macedonian edible wild mushroom. *Acta Pharmaceutica*. 50: 141-149.

Imazeki, R., Kobayashi, Y. and Aoshima, K. 1966. Fungi. *The flora of eastern Himalaya.* Ed. H. Hara. University of Tokyo, Japan. pp. 611-626.

Imazeki, R., Otani, Y. and Hongo, T. 1988 *Coloured Illustration of Fungi of Japan.* YAMA-KEI Publishers Co. Ltd. Tokyo, Japan.

Izard, D., C. Ferragut, F. Gavini, K. Kersters, J. De Lay, and Leclcere, H. (1981): *Klebisella terrigena*, a new species from soil and water. *International Journal of Systematic Bacteriology,* **31**, 166-127

Jackman, P. J. H. (1985): Bacterial taxonomy based on electrophoretic whole cell protein patterns. In clinical methodology in bacterial systematic, *edited by M. Goodfellow and Minnikin. D. E., New York and London academic Press.115-129*

Jacob. 1976. Chemical analysis of food and food products.

Joshi, A.R. and Joshi, K. 2005. *ethnobotany and Conservation of Plant Diversity – Status, Bibliography and Agenda for Sustainable Management,* RubRick, Kathmandu, Nepal.pp, 168

Joshi, A.R., Adhikari, M.K., Joshi, K. and Adhikari, K.1996. A study of food value and toxin of wild mushrooms of Kathmandu and Pokhara Valley. *A newsletter of APINMAP / SCAMAP,* Nepal. pp. 47-56.

Joshi, K. and Joshi A.R. 1999. Ethnobotanical study of some mushrooms of two valleys (Kathmandu and Pokhara) of Nepal. *Ethnobotany* .**11**: 47-56.

Kanaujia. R, M.sc (Botany) 2007. studies on edible on mushroom of Eastern uttar Pradesh and possibilities of their cultivation in Faizabad. Thesis submitted to PHD in Botany. K.S. Saket post Graduate college Ayodhya- Faizabad-224123.

Kendrick, B .1985.*The Fifth Kingdom* .Waterloo Mycologue Publication pp.364

Kersters, K. and Ley, D.J. 1975.Identification and grouping of bacteria by numerical analysis of their electrophoretic protein patterns, Journal of General microbiology **87**: 333-342.

Kersters, K. and Ley, D.J. 1980: Classification and identification of bacteria by electrophoresis of their protein. In Microbiological Classification and identification. *The Society for Applied Bacteriology Symposium Series*. Edited by Goodfellow, M. and Board R. G. New York and London Academic Press.273-279

Kharel, S. 1999. New record of *Lentinellus ursinus* (Fr. : Fr.) Kuhner. In abstracts of Third *National Conference of Science and Technology*. Organized by RONAST, Kathmandu, *Abs*. : BSC003: 64.

Kharel, S. and Rajbhandary, S. 2005. Ethnomycological knowledge of some wild edible mushrooms in Bhardeo, Lalitpur, Nepal. *Nepal Journal of Plant Sciences*. 1: 45-49.

Kibby, G. 1979. *Mushrooms and Toadstools.* Oxford University Press, London.

Koba, H., Akiyama, S., Endo, Y. and Ohba, H. 1994. *Name list of the flowering plants and gymnosperms of Nepal,* 1. The University Museum, University of Tokyo, Japan.

Kobayashi, Y. 1965. Himalayan *Calostoma* and *Isaria. Jap. Jour. Bot.* **40** : 228-229.

Konemann.V. 1999. The Great Encyclopedia of Mushrooms. Neue Stalling, *Oldenburg, Germany.* pp. 240

Korner, C.(1999) *Alpine Plant Life.* Springer Verlag, Berlin.

Kreisel, H. 1964. Vorlaufige obersicht der Gattung *Bovista. Feddes Report*. **69**: 191-211.

Kreiger, H. 1967. *The Mushroom Handbook.* Dover, New York.

Kreisel, H. 1967. Taxonomisch-Pflane-zengeographische Monographie der Gattung *Bovista. Nova. Hedwigia.* 25: 62.

Kreisel, H. 1969. Gasteromyzeten aus Nepal. *Khumbu Himal*. **6 (1)** : 25-35.

Kreisel, H. 1969. Gasteromyzeten aus Nepal. II. *Feddes Reportorium*. **87 (1-2)** : 83-107.

Krieger, L.C. 1967. *The Mushroom Handbook.* Dover, New York.

Kuhner, R. 1975 Agaricales de la zone alpine genre Lactarius DC. : S. F. Gray. *Bull. Soc. Mycol. France*. 91 (1): 5-69.

Kumar, A., Bhatt, R.P. and Lakhanpal, T.N. (1990) *The Amanitaceae of India.* Bishen Singh Mahendra Pal Singh, 23-A, Deharadun, India.

Kuo, M. (2004, December). *Pluteus thomsonii*. Retrieved from the *MushroomExpert.Com* Web site: http://www.mushroomexpert.com/pluteus_thomsonii.html

Kurtzman,R.H,Jr. 1978. *Coprinus fimetarius.* The biology and Cultivation of edible Mushrooms. Academic press Inc, London. pp. 393-406.

Kuyper and Thomas, W. 2002. Ethnomycology in Africa. *Coolia.* **45** (4): 191-197.

Lakhanpal, T.N 1993. The Himalayan agaricales.Status of systematics, *Mushroom Resourc* .**2**(1):1-11.

Levenberg, B. 1964. Isolation and structure of agaritine, a glutamyl substituted arglmhydrazine derivative from Agaricaceae *J. Biol. Chem.* 239, 2267

Lincoff, G. H. 1981 The Adubon society field guide to North America Mushrooms. *Alfred A. Knoff Inc. USA*.

Linder, D.H. 1933 The genus Schizophyllum. The species of western hemisphere-*Amer.Jour.Bot* **20**:552-564.

Linnaeus, C. 1753. *Species Plantarum* **2**: 561-1200. Holmiae.

Lloyd, C. G. 1808 *Mycological notes. No. 1 75.*

Lof, A.-L., Gustafson, G., Novak, V., Engman, L. and Mikaelsson, M. 1992 Vox *Sang* 63, 172–177

Lowy, B.1974. *Amanita muscaria* and thunderbolt legend in Gutemala and Mexico. Mycologia. **66**: 186-190

Lowry, O. H., Rosebrough, N. J., Farr, A. L. and Randall, R. J., (1951*) J. Biol. Chem*. 93, 265–275

Maharjan, P. and Budhathoki, U. 2003. Some polypores of Raniban, Pumdibhumdi VDC of Kaski District. *Botanica Orientalis*. **3**: 116-117.

Malayi, L.P. 1987. Edible mushroom reserves in the Belorussian SSR (USSR) and the possibility of their effective use. *Rastit Resur*.**23**(4): 532-536.

Malla, S.B., Rajbhandary, S.B., Shrestha, T.B., Adhikari, P.M., Adhikari, S.R, and Shakya, P.R.1986. *Flora of Kathmandu Valley.* HMG / MoFSC, Department of Medicinal Plant. Thapathali, Kathmandu.

Manandhar, K.L. 1994. Mushroom cultivation in Nepal. *IInd National conference on science and technology*. 992 - 996

Manandhar, V. and Adhikari, M.K. 1988. Three agarics new to Nepal. *Proceedings of National Conference of Science and Technology*. Organized by RONAST, Kathmandu, Nepal. BSNS 28: 31.

Manandhar, V. and Adhikari, M.K. 1995a. *Lepiota* and its allied genera in Nepal. *Proceedings of Second National Botanical Conference.* Organized by Nepal Botanical Society. Kathmandu, Nepal. pp. 79-86.

Manandhar, V. and Adhikari, M.K. 1995b. *Lepiota* and its allied genera from Nepal 2. *Nat. Hist. Soc. Bull.* **3-4**: 2-3.

Manning, K.1985. Food Value and chemical composition .*The biology and technology of Cultivated Mushroom*. John Wiley and Sons, new York. pp.211-230.

Manjula, B. 1983. A revised list of agaricoid and boletoid Basidiomycetes from India and Nepal. *Proc. Indian Acad. Sci.* (Pl. Sci.) **92**: 81-213.

Manzi ,P., aguzzi, A. and Pizzoferrato, L. 2001. Nutrtional value of Mushrooms widely consumped in Italy. *Food Chemistry* **73(3):** 321-325

Marques, G.; Mota, S.; Pereira, L. and Lourenco, J. 2001. Using GIS for monitoring and ecological studies of edible macrofungi in Parque Natural do Alvao*. Revista de Biologia (Lisbon).*

Mckenenny,M. 1971.*The savory wild mushroom* University of Washington press,USA

Melnick, J. L. and Stern, K. G. (1940): Study on carboxylase. *Enzymologia*, **8**, 129-151.

Micheli, P.A. 1729. *Nova Plantarum Genera Juxta Tournefortii Methodum Disposita.* Firenze. p. 234.

Miller, O.K and Cotter, H.V.T. 1988. Observation of tissue morphology and spore ultrastructure of *Calostoma junghuhnii* (Gasteromycetes). *Can. J. Bot.,* **66** : 2470-2473.

Miller, O.K. 1984. *Mushrooms of North America.* E.P. Duttom Publishing Company Inc. NewYork.

Minari, O. and Zilversmit, D. P. (1963) Anal. Biochem. 6, 320–327

Moore, David, Siu Wai Chiu, Hatit Umar, M. and Sanchez, C. 1998. In the midst of death, we are in life: Further advances in the study of higher fungi. *Botanical Journal of Scotland.* **50**(2): 121-135.

Moreno,F.; Angel, Cifuentes. J.; Bye, R. and Valenzuela, R. 1996. Kuto- mo'ko-a: An edible mushroom of the Raramuri Indians of Mexico. *Revista Mexicana de Micologia* .**12**(0): 31-39.

Mattila, P., Konko, K.,Eurola,M., Pihlara,J.M.,Astola, J.,Vahteristo,L.,Hieoniemi,V., Kumpulainen,J., Valtonen,M. and Piironen,V. 2001. Contents of Vitamins,minerals elements and some phelolic compounds in cultivated mushrooms.*Journal of Agric.Food Chemistry.* **49(5):** 2343-2348

Natour, R.M.; Salhab, A.S.; El-moumani, A.R. and Saba, E.F. 1992(1993). Wild mushrooms in Jordan. *Dirasat Ser B Pure Appl Sci.* **19**(2): 47-60.

Onsburg, P. 1973. *Lycogala fuscoviolaceum* sp. Nov. and *Diderma niveum* from Nepal. *Bot. Tidskr.* **76**: 159-162.

Ooi, V.E.C. 2000. Medicinally important fungi. In: Science and Cultivation of Edible Fungi. *Van Griensven (ed*).2000 Balkema, Rotterdam. 41-51

Ooi, V.E.C and Liu,E 1999.A review of pharmacological activities of mushroom polysaccharides. *International Journal of Medicinal Mushrooms* **1**. 195-206

Otani, Y. 1982a. Cup fungi collected in Nepal. 1. *Reports on the Cryptogamic study in Nepal.* Ed. Y. Otani, National Science Museum, Tokyo. pp. 75-91.

Otani, Y. 1982b. *Engleromyces* goetzii P. Henn. Collected in Nepal. *Ibid.* 93-96.

Pacioni, G. 1985. *The Mcdonald's encyclopedia of mushrooms and toadstools.* Mcdonald & Co. Ltd., London.

Pandey, B.D. 1976. Survey, collection, preservation and identification of the mushrooms in Nepal. *Nep. Jour. Agri.* **6-11**: 115-129.

Pandey, N & Budathoki, U**.** 2002, Mushrooms in Relation to Different Ethnic groups of Kathmandu Valley and its adjoining Area*, Journal of Basic and Applied Mycology* **1(2):** 191-193

Pandey, N. and Budhathoki, U. 2003a. New record of fleshy fungi from Kathmandu Valley. *Botanica Orientalis* **3**: 111.

Pandey, N. and Budathoki, U. 2003b, Edible Wild Mushrooms as a source of income, Proceedings of International Conference on Women, Science & Technology for Poverty Alleviation. 68-70.

Pandey,N. 2004. Chemical analysis of mushrooms of Kathmandu valley. A report submitted to University Grants Commission (UGC), Kathmandu. pp. 59.

Pandey , N. 2006, Preliminery Study on the Mushroom's Diversity of Langtang National Park-Submitted to Department of National Park and Wildlife Conservation

Pandey, N and Budhathoki, U 2006a Mushrooms in the Langtang Area, Gosainthan, a sacred wetland in Nepal, Wetland studies series No.3 pp. 62.

Pandey, N and Budhathoki, U 2006b *Profiling of Major Proteins in Wild Nepalese Mushrooms by SDS Page*. Plant Archives 6 No.2 pp. 465-469.

Pandey, N. Adhikari M.K and Budhathoki U.2006 The New Record of Fleshy Fungi from Kathmandu valley proceeding of Fourth National Conference on Science & Technology. **1:** 429.

Pandey N, Devkota,S., Christensen, M. and Budhathoki, U. 2006, Use of Wild Mushrooms Among the Tamangs of Nepal, *Nepal Journal of Science and Technology* 7 pp. 97-104.

Pandey N. and Budhathoki U. 2007a. Status of Ethnomycology in Nepal. Mycological Research and Mushroom Production in Nepal, published by The Mycological and Phytopathological Society, Nepal (MAPSON) 53-60.

Pandey, N**.** and Budhathoki U. 2007b Protein determination through Bradford's method of Nepalese mushroom *Journal Scinetific World* **5 (5)** 85-88.

Pandey, N**.** and Budhathoki U. 2007c. Ethnomycology of Chepang Community in Chitwan. *Nepal Journal of Science and technology*. **8**: 75-79

Pandey, N**.** and Budhathoki U. 2007d. Three New records of *Agaricus* from Kathmandu Valley, Nepal. *Journal of Basic and Applied Mycology*. **6(I& II):** 5-7

Pandey, N**.** and Budhathoki U. 2007e. Four New records of *Agaricus* from Kathmandu Valley, Nepal. *Journal of Basic and Applied Mycology*. **6(I& II):** 8-10

Pandey, N**.** and Budhathoki U. 2007f. Three New records of *Agaricus* from Kathmandu Valley, Nepal. *Journal of Basic and Applied Mycology*. **6(I& II):** 110-113

Pandey, S.N., Dash, S.K. and Mohapatra, R. 2001. The Vedic Soma plant, how much ethnobotanical ? An introspective review. *Ethnobotany.***13** : 45-59.

Pegler, D. N. 1977. *Pleurotus* (Agaricales) in India, Nepal and Pakistan. *Kew Bull.* **31 (3)**: 501-510.

Pegler,D and Spooner. *1997.The mushroom identifier.*Grange Books London pp144.`-

Peterson, G. L. (1977) *Anal. Biochem.* 83, 346–356

Peterson, G. L. (1979) *Anal. Biochem.* 100, 201–220

Philips, R. 1981. *Mushrooms and other Fungi of Great Britain and Europe.* Pan Book Ltd. London.

Pielou, E. C. 1984. *The Interpretation of Ecological Data: A Primer on Classification and Ordination.* Wiley, New York.

Poelt, J. 1965. Myxomycetes aus Nepal. *Khumbu Himal.* **1**: 59-70.

Press, J.R., K.K. Shrestha and D.A. Sutton. 2000. *Annotated checklist of the flowering plants of Nepal.* The Natural history Museum, London.

Przybylowicz, A. and Donoghue,J. 1988.Nutritional and health aspects of Shiitake.*Shiitake Growers Handbook*. Kendall Hunt Publishing.Dubugue,USA.

Purkayastha, R.P. and Chandra, A. 1985. *Manual of Indian Edible Mushrooms.* Jagendra Book Agency, New Delhi, India.

Rajbhandary, K.P. 2001.*Ethnobotany of Nepal.* Ethnobotanical Society of Nepal, Kathamandu.,Nepal. pp189.

Rajbhandary, S. (1999). Mushrooms of Nepal: A brief Introduction. *Botanica Orientalis.* **1**: 72-75.

Ramsbottom, J. 1954. *Mushrooms & Toadstools.* Collins 14 ST James's Place London.

Rana,P. Giri,A. and Shrestha,S.K. 2006 New Record of Fleshy Fungi from Khumbu Region, Nepal.*Journal Scientific World* **4(4)**

Rana, P and Giri, A. 2007. Nutritional value of some wild edible Mushrooms collected from Sagarmatha National National Parks and it's adjoining area. *Journal of Nepal Academy of Science and Technology* **8: 93-98**

Ranganna, S. 1995. Handbook of analysis and quality control for Fruit and Vegetable products.

Ranjitkar, H.D. and Bhatt, D.D. 1976. A note on *Craterellus cornucopioides. Ind. Phytopath.* **29**: 305-306.

Rea, C. 1922. *British Basisiomycetae*. *Biblio. Mycol.* 15 J Cramer.

Rinaldi, A. and Tyndalo, V. 1972. *The Complete Book of Mushrooms.* Crescent Book, New York.

Ryvarden, L. 1977. Some wood inhabiting Aphyllophoraceous fungi from Nepal. *Khumbu Himal.* **6**: 379-386.

Saccardo,P.A.1887.*Sylloge de Fungorum.* 7.Pavia

Sacherer, J. 1979. The high altitude Ethnobotany of the Rolwaling Sherpas: a contribution of Nepalese studies. *Jour. Res. Cen. Nep. Stud.* CNAS **6 (2):** 46-64

Sawhney, S.K. and Singh, Randhir 2000. Introductory Practical Biochemistry. *Narosa Publishing House New Delh.i* pp. 452.

Seigel, A., S. J. Singer and Wildman, S. G.(1952): A preliminary study of the high molecular weight component of normal and virus infected *E. coli*. *Arch.Biochem.Biophys*, **41**, 278-293.

Seiter, J. A. and Jay, J. M. (1980): Application of polyacrylamide gel electrophoresis to characterization and identification of *Arthrobacter species. International Journal of systemic Bacteriology*, **30**, 460-465.

Shah ,H., Iqtidar,A.K. and Shagufta,J.1997.Nutritional Compostion and protein quality of *Pleurotus* Mushroom. *Sarhad Journal of Agriculture.***13(6):** 621-626

Shankar, K. and Shrestha, P. P. 1999. Climate. *Nepal's Nature Paradise*. Eds. by T.C. Majupuria and R. Kumar. M. Devi, Gwalior, India. pp. 39-44.

Sharma, O.P.1989. *Textbook of Fungi*. Tata McGraw Hill. New Delhi, India.

Shrestha, K. 1985. *Cordyceps nutans* Pat. From Lato Manang. *Jour. Nat. Hist. Mus.* **9**: 111-114.

Shrestha, P. 1988.Contribution to ethnobotany of the Tamangs of Kathmandu valley. *Contributions to Nepleasese Studies.* **15(2):** 247-266

Simon and Schuster, 1981.*Guide to Mushrooms.* Simon and Schuster Inc. New London, Toronto, Sydney, Tokyo.

Singer, R. 1932 Monographie der gattung Russula. *Bein. Bot. Gentgallbl*. **49 (11):** 205-380.

Singer, R. 1951a. The "Agaricales" (mushrooms) in modern taxonomy .*Lilloa* **22:** 5-832.

Singer, R. 1951b. Type studies on Basidiomycetes V. Sydowia, annals Mycologici **5:** 445-475

Singer, R. 1955. Le genre Melanomphalia Christiansen,*Revenue de Mycologie* **20:**12-17

Singer, R. 1961 Type studies on Agarics IV. Sydowia, Annales Mycologist Ser. II **15 :** 133-151.

Singer, R. 1962. *The Agaricales in Modern Taxonomy.* 2nd ed. J.Cramer,Weinheim, Germany.

Singer, R. 1971. A revision of the genius *Melanomphalia* as basis of the phylogeny of the Crepidotaceae. *In* R.H. Petersen [ed.}, Evolution in higher basidiomycetes, 441-474. The University of Tennessee Press, Knoxville, Tennessee, USA.

Singer, R. 1975 Tropical Russulaceae. *Nova Hedwigia.* **26 :** 897-901.

Singer, R. 1986. *The Agaricales in Modern Taxonomy.* Koeltz Sc. Germany.

Singer, R. 1986. *The Agaricales in Modern Taxonomy* (4th edition) Bishen singh Mahendra Pal singh Dehradum (India). pp. 981.

Singh, S.C. 1966. Mushrooms. *Deorali.* **4**: 15-31.

Singh, S.C. 1968. Some parasitic fungi collected from Kathmandu valley (Nepal). *Ind. Phytopath.* **21**: 23-30.

Singh, S. C. 1971 One Myxomycetes from Kathmandu valley.*Nat. Hist. Mus* : 18.

Singh, S. C. 1971 Additions to the parasitic mycoflora of Nepal. *Nep. Sc. Mag.* **1 :** 18.

Singh, S. C. 1973a. Investigations on Wild edible mushrooms and other fungi of Kathmandu. Research. Report. T.U. loop.

Singh, S. C. 1973b. Fleshy Fungi of Nepal. Extracted from Tech. Research. Report. TU.

Singh, S. C. 2007. Status of mushroom cultivation in Nepal with reference to world production and consumption trends. Mycological research and mushroom production in Nepal, Published by the mycological and phytopathological society, Nepal. pp. 1-19.

Singh, S.C. and Adhikari, M.K. 1977. Some fleshy fungi from Kathmandu (Nepal). *Jour. Nat. Hist. Mus.* **1(1):** 49-57.

Singh, S. C. and Joshi, A. R. 1973a. Notes on some *Cercosporae* of Nepal. *Journal of Tribhuvan University* .**8:** 91-99

Singh, S. C. and Joshi, A. R. 1973b. Experimental cultivation of pleurotal in Nepal. *Journal of Tribhuvan University* **8:** 82-85

Singh, S. C. and Joshi, A. R. 1977 Bibliography on fungi of Nepal. *Ibid.* **1 :** 240-245.

Singh, S.C. and Nisha 1973a. Notes on some cercosporae of Nepal. 2. *Jour. Tri. Uni.* **8**: 91-99.

Singh, S.C. and Nisha 1973b. Experimented cultivation of Pleurotus in Nepal. *Ibid* .**8**: 82-85.

Singh, S.C. and Nisha 1974. *Exobasidium butleri* in Nepal. *Ind. Phytopath.* 27: 387-389.

Singh, S.C. and Nisha 1976b. A contribution to the parasitic mycoflora of Nepal. *Ibid.* **6**: 11-14.

Singh, S.C. and Nisha 1976c. Some fleshy fungi of Nepal. *Ibid.* **6(1)**: 73-88.

Singh, S.C. and Upadhyaya, B.N. 1978. Notes on some fungi to Nepal. *Ibid.* **2**: 51-53.

Siwakoti, M and Siwakoti, S. 1998. Ethnobotanical uses of plants among the Limbu of Morang District, Nepal. *Ecoprint.***59 (1)** 79-84

Smith, G.M. 1955. *Cryptogamic Botany.* I. (2nd Ed.) McGraw- Hill Book Company, New York.

Snell, W.H and Dick, E.A. 1971. *A Glossory of Mycology.* XXXI Harvard University Press, Cambridge. pp. 181.

Sohi, H, S. and Sharma, S.R. 1997. Mushroom Cultivation Technology: An overview. *Recent Researches in Ecology, Environment and Pollution.* XI: 473-491.

Solomon P. Wasser, .G. Kholodny Institute of Botany, National Academy of Sciences of Ukraine, Kiev, Ukraine; International Centre for Cryptogamic Plants and Fungi, Institute of Evolution, University of Haifa, Mt. Carmel, Haifa, Israel

Stainton, J. D. A. 1972. *Forests of Nepal.* John Murray, London.

Stearn, W. T. 1960. Allium and Milula in the central and eastern Himalaya. Bulletin of the British Museum (Natural History), Botany 2: 161-191.

Stevenson, G.B. 1970. *The Biology of Fungi, Bacteria and Viruses*. (2nd edn.) Edward Amold, London.

Straatsma,G. and Greilhuber, I. 2003. Assemblage structure, species richness, abundance and distribution of fungal fruit bodies in a Seven year Plot – based survey near Voenna. *Mycological Research.* **107(5):** 632-640.

Svreck, M. 1975. *A colour guide to Familiar Mushrooms.* Octopus Book Company.

Swan, L. W., and A. E. Leviton .1962. Herpetology of Nepal. Proceedings of the California Academy of Science **32(60):** 103-142.

SzweyKowska,A. and SzweyKowska,J. 2003. *Botanika Systematyka* (Botany Systematics). PWN Warszawa Press, Poland.

Thapa, F. 1990. Die back threatening *Dalbergia sissoo. Farm. Forest. News.* FRED Project, WINROCK Int. USA **3 (4)**: 8.

Thind, K. S. . 1961 The Clavariaceae of India. ICAR. New Delhi.p. 197.

Thind, K.S. and Sharma, M.P. 1983. The Nepal Helotiales. Fungi of Indian subcontinent: a collection of papers. *Biblio. Mycol.* **91**: 265-279.

Tiwari, R.D. 2007. Diseases and pests of cultivated mushroom. Mycological research and mushroom production in Nepal, Published by the mycological and phytopathological society, Nepal. pp. 37-47.

Tullons, R.E. and Bhandary, H.R. 1992. *Amanita chepangiana;* a new species from Nepal. *Mycotaxon*. XLLIII: 25-31.

Tullons, R.E., Hongo, T. and Bhandary, H.R. 1992. *Amanita neoovoidea*- Taxonomy an distribution. *Mycotaxon*. XLLV **(1)**: 235-242.

Udagawa, S. and Horie, Y. 1982. Two new species of terrestrial Ascomycetes from eastern Nepal. *in Y. Otani, ed. Reports on the Cryptogams of the Himalayas: Central and eastern Nepal. National Science Museum, Tokyo.* **2**: 73-84

Upadhyay, R.C, Kaur Amanjeet & Gulati, A 2005 Dark spored agarics from North Western Himalaya *Journal of mycology and plant pathology* **35**(1) April 2005 .Pg 15-20.

Vera Cruz, C.M., F. Gossele, K. Kersten, P. Sagers, Van Den Mooter, J. Swings and De Lay J. (1984): Differentation between *Xanthomonas compasteris pv.oryzae*, *Xanthomonas compasteris*

pv.oryzicola and the bacterial 'brown blotch' pathogen on rice by numerical analysis of phenotypic features and protein gel electrophoretogram. *Journal of General Microbiology*, **30**, 2983-2999.

Verheesen, P. 1995. How beautiful it was around Sevenum and what types of marsh mushrooms were found there in barley a workweek. *Coolia.* **38**(4):177-180.

Vetter,J. 1994. Phosphorous content of edible wild mushrooms of Hungary. *Acta Alimentaria* **233 (3):** 316 -336

Vrinda, K.B., Pradeep C.K, Mathow S. and Abraham T.K. 1997. Agaricales from Western ghats.V.*Mushroom Resource*., 6(1):7-10.

Vyshchepan, S.L.1992. Macromycetes of Virgin Steppes in the Azoz Sea area of Rostov oblast *Mikol Fitopatol* .**26**(2): 83-87.

Wakefield,E.M andDEnnis,R.W.G. 1981.Common British Fungi(2nd revised edition) Publishing Co.Ltd.,RoyaleparadeHindhead Survey, England.

Walting, R. 1973. *Identification of larger fungi.* Hulton group Key, Hulton, Educ. Pub. Ltd. Bucks.

Watling. R. 2004.*New combination in boletaceae and Gomphidiaceae(Boletales).* Edinburg journal of Botany 61(1):41- 47.

Waraitch, K.S. and Thind, K.S. 1977a. Fungi of Nepal (Pezizales). *Jour Nat. Hist. Mus.* **1**: 21-34.

Waraitch, K.S. and Thind, K.S. 1977b. Pyrenomycetous fungi from Nepal. *Ibid.* **1**: 203-206.

Waraitch, K.S. and Thind, K.S. 1977c. Idem. 2. *Ibid.* **1**: 207-214.

Wasser, S.P. and Weis, A.L. 1999a. Medicinal properties of substances occurring in higher Basidiomycete mushrooms: current perspective. International Journal of Medicinal Mushrooms 1, 31-62.

Wasser, S.P. and Weis, A.L. 1999b. Therapeutic effects of substances occurring in higher Basidiomycete mushrooms: a modern perspective. Critical Review of Immunology 19, 65-96.

Wasson, R.G. 1969. Soma: Divine mushroom of immortality. *Brace and World, Inc.* New York.

Wasson, R.G. 1971. The Soma of the Rig Ved: What was it ? Journal.Amer.Orein.soc **91(2):** 169-187

Watling, R. 1973 Identification of larger fungi. Hulton Group Key, Hulton, Educ. *Pub. Ltd. Bucks.*

Watling, R. 1978 The study of Indian Agarics. *Ind. Jour. Mushrooms* 16 (2) : 30-37.

Webster, J**.** 1970 *Introduction to Fungi*, Cambridge University Press, Bently House, London.

Webster, J. 1980. *Introduction to Fungi.* (2nd Edn.) Cambridge University Press, Cambridge.

Whittaker, R.H. and Margulis, L.L. 1978. *Biosystems* **10**: 3-18.

Willard, T. 1990. Reishi Mushroom: *Herb of Spiritual Potency and Medical Wonder. Sylvan Press, Washington.*

Winkler, D.2004. Yartsa Gunbu- *Cordyceps sinensis*, Ethnomy, Ecology & Ethno-Mycology of a Fungus Endemic to the Tibetan Plateau (Eds. A. Boesi and F. Cardi). Wildlife and plants in traditional and modern Tibet: Conceptions, Exploitation and Conservation. 34(1/2).

Wong,W.C. and Cheung,P.C.K. 2001.*Food and nutritional sciences programme*. The Chinese university of Hong Kong., Shatin, New territories, Hong Kong ,China.

Wu, A. E., Wu, J. C. and Herp, A. (1978) *Biochem. J.* 175, 47–51

Wu, H. (1922) *J. Biol. Chem*. 51, 33–39.

Yongabi K.M. Agho and M..Carrera 2004.Ethnomycological studies on wild mushrooms in

Cameroon, central Africa. Micologia Applicoda International 16(2) pp 34-36.

Yorou, S.N.; Dekesel, A.; Sinsin,B. and Codjia, J.T.C. 2001. Diversity and productivity of edible mushrooms from the protected forests of Wari-Maro (Benin, West Africa). *Systematics and Geography of Plants.* **71**(2): 613-625.

Young, E. G. (1963) in Comprehensive Biochemistry, 7 (Florkin, M. and Stotz, E.H., eds.), *Elsevier, Amsterdam* 1-55.

Zamora, M.; Marisela, C. and Cecilia, N. 1995. Natural production of wild edible mushrooms in the southwestern rural territory of Mexico City, Mexico. *Forest Ecology and Management.* **72**(1):13-20.

Zang, M. and Kinjo, N.1998 Notes on Alpine *Cordyceps* of China and nearby Nation. *Mycotaxon* Vol LXVI. 215-229.

Zhu, J.S. and R. James 2004. Presented at the American Physiological Society's (APS) annual scientific Rediscovery of an Ancient Chinese herbal Medicine; *Cordyceps sinensis*. Part 1. Journal of alternative Complementary Medicine 4(3):289-303.

Zotti, M.; Zappatore, S,; Caviglia, A. and Tosa. M. 2001. A Decision Support System for the management of accidental mushroom and plant poisoning. *Formaco (Lausanne)*. **56** (5-7): 391-395.

Online Information from Net:

www.mushroomexpert.com

Agaricus praeclaresquamosus	at Mykoweb
Boletellus intermedius	in Smith & Theiers, 1971
Boletellus chrysenteroides	in Smith & Theiers, 1971
Austroboletus subflavidus	at Roger's Mushroom
Cantharellus lateritius	at Roger's Mushroom
Coprinus atramentarius	in Smith & Theiers, 1971
Coprinus atramentarius	at Kees Ulje's Coprinus site
Coprinus atramentarius	at MykoWeb
Coprinus atramentarius	at Fungi of Poland

www.emedicine.com/emerg/topic455.htm

Coprinus lagopus	at Kees Ulje's Coprinus site
Coprinus lagopus	at MykoWeb
Coprinus lagopus	at Fungi of Poland
Coprinus lagopus	at Agaricales of the Hawaiian islands
Coprinus lagopus	
Coprinus micaceus	at Kees Ulje's Coprinus site
Coprinus micaceus	at MykoWeb
Coprinus micaceus	at Fungi of Poland

Cynase's Hallucinogenic Mushroom Site

Leucocoprinus birnbaumii at MykoWeb

Leucocoprinus birnbaumii at Fungi of Poland

Leucocoprinus birnbaumii Agaricales of the Hawaiian islands

Agaricus in the Pacific Northwest

http://www.svims.ca/council/Agari2.html

http://www.svims.ca/council/Agari1.html

Boletes in the Pacific Northwest

http://www.svims.ca/council/Boletes.html

Richard Summerbell 1995-Microscopic Identification of Poisenous Mushroom

http://www.3simpatico.ca/ross.fraser/links.html

Michael w. Bellg. Poisonous and hellucinagenie Mushrooms

E.mail:begugm@evergreen.edu

www.mycosoc.dk/nepal

www.fungi.com

www.mycological.net

www.mycopia.com

www.scirus.com

www.nebi.nlm.mib.gov

www.allaboutmushrooms.com

www.fungalfungal.org

www.agaricus.org

www.fungusfun.com

www.geocities.com/voyager

www.wikipedia.com

Appendix I

Materials and Equipments

Following materials and equipments are necessary for the collection of mushrooms (Adhikari, 1991; and Brundrett, et *al.,* 1996.

Equipments

- Camera with macro (Close - up) lens
- Collecting basket or bag
- Fungus dryer
- Hand lens (10-20 x magnification)
- Compass, GPS
- Pocket knife or trowel for unearthing entire specimens
- Storage containers with lids

Stationeries

- Brush for cleaning specimens
- Envelopes for storing dried specimens
- Grey color board as background for photographs
- Maps, pens/pencils
- Reference books (field – guide type)
- Ruler for measuring mushrooms
- Small and large paper bags to keep collections from the same location
- Small notebook for recording data
- Standardized data sheet for detailed notes
- Wax paper roles, bags
- White/ black paper for spore prints

Chemical

- Sodium hydroxide 10%
- Potassium hydroxide 10%
- Ferric chloride 10%aqeous solution

Others

- First aids

Appendix II

Lacto- phenol

This mounting fluid, originally developed by Arnon in 1816, was used alone, without adding any stain, for mounting fungi having colored structures. Lacto phenol was prepared from the following composition:

- Phenol crystals - 20 g (very gently heated for melting)
- Lactic acid -20 ml
- Glycerol -40 ml
- Distilled water - 20 ml (depending upon the density of mounting)

Lacto phenol-Cotton Blue

It was employed for staining and mounting the fungi having hyaline structures. This staining cum mounting fluid was prepared by adding 0.05-0.1 percent cotton blue stain (w/v) in Lacto phenol solution, as mentioned above (Purvis et al.1966).

Melzers solution

This is the solution of chloral hydrate on water with an admixture of Potassium iodide and Iodine which is used for testing amyloidy. It was discovered and used for the first time by the Czech. Mycologist V. Melzer and is one of the most generally applied and most important reagent in Taxomomic study and for identifying fungi.

Composition:

- KI = 1.5gm
- I = 0.5gm
- Chloral hydrate =20gm
- Distilled water =20cc

Its effectiveness is based on the fact that iodine reacts with starchy substances to produce an intense dark blue-black colour. It is often used microscopically to determine if spores are "amyloid", i.e. turning into a blue-black colour.

The three reactions to material mounted in Melzer's soln. are: -

- Amyloid or positive, as above.
- Dextrinoid, a brownish to red-brown reaction.
- Inamyloid or negative, a yellow to hyaline reaction.

Melzer's soln. is very good at showing the ornamentation of Russula & Lactarius spores. It is also useful for ascomycetes as it "blues" the tips of asci.

Potassium Hydroxide & Sodium Hydroxide

These are both strong alkalis and very caustic. They are usually used as a 3-5% soln. in water; and sometimes used to rehydrate dried material and also to soften hard material, like some bracket fungi. Here again, there are some specific colour reactions with certain fungi.

Ferrous sulphate

These are the famous "iron salts" which many mycologists carry as a large crystal for use in the field. It can be described as a 10% aqueous soln., which is acidified with sulphuric acid; and it seems to work better than the crystal even if it’s not quite so handy. It is essential for *Russulas*, and it has no microscopic use.

Appendix III

Format of the macroscopic field observation sheet

Coll. No… **Date of collection ……. Altitude……**

Locality……

Latitude …… **Longitude……..**

Forest type……. **Soil type……**

Humidity……..

Common name \ Local name……..

Scientific name……..

Habitat: Saprophyte / Parasite / Mycorrhizal

Substrate: Soil / leaves / dung /humus / tree / stump / wood / branch.

Condition: moist / dry / open / dark / forest

Growth pattern: Alone / Clusters / Ring

Fruit Body: Fleshy / tough / corky / woody / leathery / membranous / cartilaginous / auricular / clavaroid/ Gasteroid / spathulate / round / convoluted or others

Clavaroid fruit body:

Size: ……cm / …….mm

Color:……..…. and color changes ……..

Nature: simple / branched / glabrous / fragile / fleshy / firm / rigid / single / caespitose / gregarious / straight / curved.

Stem: short / long / thick / thin / fleshy / brittle / firm / rigid / slender / solid / hollow / curved / straight / flattened / compressed.

Branches: irregular / regular / dichotomous / simple / coralloid / compressed / cylindrical / size / color / smooth.

Tips: size…… color…….. / acute / obtuse / fragile / tough.

Gasteroid (within the peridium) or round or puff ball allies:

Exoperidium size: ……cm / ……mm.

Color: …….color changes ……

Nature: sessile / stalked / smooth / warted / scaly / round / star like rays / outer layer falling into flakes / hygroscopic or not.

Flesh: color ……. Color changes …….. / thickness ……

Endoperidium (gleba):

Number of chambers: (single to many…..) / powdery / cell like with peridioles / (number of peridioles) with or without separating layer.

Pore: color ……. Number ……. Nature ……. Size……

Smell of fruit body: fruity / rotten / fish / anise / radish / corn / garlic …….

Pileus: Present / Absent.

Size: ……cm / …….mm

Color:……. Changed after picking ……..

Shape: Ovoid / hemispherical / conical / convex / campanulate / umbonate / umbillicate / Infundibuliform / turbinate / didiminate / resupinate / applanate or others…….

Surface: dry / viscid / sticky / smooth / powdery / granular / scaly / cracked / glabrous / hairy / wrinkled / or others……..

Margin: straight / incurved / entire / torn / wavy / striate (finely / strongly / terbecular) / extending beyond hymenial layer or others……..

Do these features change ? yes / no

Pellicle: thin / thick / semiseparable / not separable / separable / color under the pellicle is……..

Hymenial surface:

Colour: …….

Texture: lamellate / poried / smooth / spiny. corolloid / within peridium.

Lamellae colour: ……..and colour change after brushing…….

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

Poried surface:

Color :…….and colour changes…….

Size: pore size:……mm

Shape: round / angular / hexagonal / elongate / rectangular /not definite or mixed.

Texture : papillate / tubular / single layered / stratified

Attachment: free / adnate / decurrent

Thickness: … .mm ……cm

Separabilty : Easy to peel/ difficult

Stipe: Present / absent.

Size: …….cm / …….mm

Colour: ……..& colour changes…….

Shape: straight / curved / cylindrical / swollen below / tapering above/below / with or without rhizoidal strands & others…….

Surface: smooth / scaly / powdery / hairy / dotted / lined / netted / pitted & others.

Nature: cartilaginous / ridged / twisted / solid / stuffed / hollow / compressed / brittle or others……

Annulus: Skirt / pendent / sheathing / cobwebby / superior / inferior / smooth / straight / single / double / entire / lobed / color……..

Volva: Present or absent.

Size: ……..cm / …….mm

Colour: …….

Nature: entire / divided / scaly / circumsessile / friable / lobed.

Spore Print: ……Colour

Other Characteristics:

Flesh (Pileus & Stipe): thickness / softness / colour…… and colour changes…….after brushing.

Taste (Gills & Stipe): mild / acrid / pleasant / bitter / …….

Smell of fruit body: fruity / rotten fish / anise / radish / corn / garlic / ……

Latex: color …… / amount …….. / taste ……..

Chemical reactions:

$FeSo_4$: Color change on flesh of cap …….. gill ……. and stipe…….with crystals.

KOH (10%): color changes ……. in the hymenial surfaces.

Appendix IV

Format of the Microscopic details in laboratory

Spore size: …….. µm

Spore form:…….

Spore color:…….

Basidia size:…….µm

Basidium – septate / aseptate

Clamp connections: Present / absent

Cystidia:- Pleurocystidia / Cheilocystidia / Cauloystidia /any…

Size:……..**Color**:……

Fruiting body – Perithecium /Apothecium/Cleistothecium

Ascus size…….Color

Ascospore No. of Ascospore ……Size of **ascospore……Color of Ascopore**

Any Special features:

…….

…….

Appendix-V

Format of the questionnaire for ethno mycological information

Date:..... Name:..... Age:..... Sex:.....
Cast:..... Occupation:.....Locality:.....

1. Do you know about mushroom in your Locality?
2. How many types of Mushrooms are found in your locality?
3. Where you prefer to go for collection?
4. Which season is favorable for collection?
5. How do you collect mushrooms?
6. What are the plant species and their condition on which mushrooms generally grow?
7. How do you identify poisonous or edible mushrooms?
8. How can we minimize the poisonous nature of mushrooms so that they can be suitable to eat?
9. How many types are edible?
10. What are the best edible mushrooms and generally collected?
11. Do you know any mushrooms having religious / medicinal values?
12. Which variety of mushrooms is mostly found?
13. What is the local name of the particular mushroom?
14. Have you ever sold mushrooms?
15. Which species the buyer usually prefer?
16. If edible mushroom is/are collected in large quantity but not sold completely, how do you preserve them?
17. Have you seen one/some type/s of mushrooms, which existed in the past but are rare or extinct now?
18. Have you marked any type of mushrooms which are eaten by animals like monkeys or others?
19. Have you ever eaten poisonous mushrooms unknowingly? If yes, what action did you take
20. then?
21. Do you face any problem/s during mushrooms' collection?
22. Do you think that 'the mushrooms diversity should be conserved'?
23. What kind of vessel is used for cooking mushroom?
24. How do you prepare the mushroom?
25. Do you have any idea of recipe of mushroom? For example: Only boiling/ Vegetable/ Pickle/ Soup/ Pakauda/ Pulau.
26. Additional information (Regarding traditional belief):

Appendix-VI

a. Quantitative aminoacid determination by ninhydrin method

- Table centrifuge
- Water bath
- Colorimeter
- Mushroom samples (Dried)
- Mortar and pestle
- Glass powder
- Micropippette
- Glass wares – storing bottles, measuring cylinder, beakers.
- Ethanol 70%
- 0.1% glycine in 100 ml distilled water stock solution dilute (1 ml of stock solution + 9 ml distilled water) working solution
- Ninhydirn solution– 0.25 gm. of Ninhydrin on 50 ml of 70% Ethanol (wrapping the bottle by black paper in order to protect from light)

b. Qualitative Amino-acid determination by paper chromatography

- Whatman no. 1 filter paper sheet
- Micro pipette / micro syringe
- Hair drier
- Sprayer
- Oven set at 90^{o}C
- Chromatographic tank cylindrical
- Solvent - Butanol, acetic acid and water in the ratio of 12:3:5
- Ninhydrin spray reagent – prepared fresh by dissolving 0.2 gm Ninhydrin in 20 ml of acetone.

c. Quantitative Determination of Crude Protein by Micro – Kjeldahl's method

- Long- necked digestion flasks (30 – 50ml capacity)
- Digestion rack
- Micro Kjeldahl apparatus (also known as Markham distillation apparatus)
- Microburette (5 or 10 ml capacity)
- Conc sulphuric acid

- Catalyst – Mixture of Cupper sulphate and potassium sulphate in the ratio of 2:1
- 40% NaOH – 40 gm NaOH dissolved in 100 ml distilled water
- 0.1% Bromocresol green – 0.050 gm Bromocresol green dissolved in 50 ml of ethanol
- 0.1% methyl red – 0.05 gm of methyl red dissolved in 50 ml of ethanol (Both Methyl red & Bromocresol green are the indicators.
- 2% boric acid – 2 gm of Boric acid powered in a volumetric flask and added 0.4 ml of 0.1 % Bromocresol green and 0.8 ml of methyl red and total volume made 100 ml by adding distil water.
- N HCl – 0.3 ml of HCl was dissolved in 100 ml of distilled water.

d. Determination of protein by Lowry method

Phosphate buffer (0.01 M, Ph 7.6)

Alkaline Sodium carbonate reagent – Dissolved 2.0 gm Sodium carbonate in 0.1 N NaOH and made the volume to 100 ml with 0.1 N NaOH.

Copper Sulphate reagent – Prepared 0.5% Copper sulphate in 1% sodium potassium tartarate solution.

Alkaline Copper sulphate reagent – Added 1 ml of reagent 3 to 50 ml of reagent 2. to make the mixture stable it was prepared fresh.

Folin's reagent – Diluted the reagent appropriately so that it was 1 N in respect of its acid content.

20% (W/V) TCA – Dissolved 20 gm of tri-chloroacetic acid in water and made the volume 100 ml.

Acetone

0.1 N NaOH

Bovine serum Albumin (BSA)

100 mg/ml solution in distilled water

e. Determination of protein by Bradford's method

- Colorimeter.
- Sample extract: Prepare as given in Lowery method.

- Bradford reagent: Dissolve 100 mg of Coomassie Brilliant Blue G 250 IN 50 ml of ethanol, add 100ml of 85% of phosphoric acid and make the volume to 1 L with water.
- 0.1 M Phosphate buffer (Ph 7.5):
- Standard protein solution: Dissolve 5 mg of bovine serum albumin in 50 ml of 0.1 M phosphate buffer. This solution contains 100μg protein/ml.

Appendix-VII

Name of Mushroom according to different Ethnic groups:

SN	Ethnic Group	Name of Mushroom
1.	Chepang (Praja)	Musa
2.	Danuwar	Boomti
3.	Gurung	Jhyabo
4.	Limbu	Pat
5.	Magar	Mugan
6.	Newar	Bamkham, Wangubukacha
7.	Sherpa	Shamu
8.	Tamang	Shymo , shyamu
9.	Tharu	Beemti,Chhati, Kaachu
10.	Thakali	Timu

Different Names of Mushrooms in Sanskrit:

1. Kavak - General name of mushroom.
2. Chhatrak - Head with umbrella.
3. Chhatrika - with small umbrella.
4. Shilindhram - Grows on organic matter.
5. Swedajam - grows on warm & humid place.
6. Prithavi kandam - tuber like & grows on soil.
7. Bhumi chhamdan - Grows on breaking soil.
8. Bhoo phode. - Grows on breaking soil.

Appendix-VIII

Preparation of Sample for mineral analysis by ash method:

- Silica crucible
- Bunsen burner
- Muffle furnace
- Desiccator containing fused $CaCl_2$ at its bottom
- Boiling water bath
- Volumetric flasks (100 ml capacity)
- Whatman No 40 filter paper
- Dilute HCL: Prepare by adding 1 ml of conc HCL to 4 ml of water

Appendix-IX

Estimation of Calcium, Phosphorus and Iron

a. Quantitative estimation of calcium (Volumetric method):

- Hot plate or Bunsen burner
- Burette (50 ml capacity)
- Whatman No. 40 filter paper disks
- 4% ammonium oxalate solution
- Dilute ammonia solution
- 1 N H_2SO_4
- 0.01 N potassium permanganate solution
- 0.01 N oxalic acid
- Methyl red indicator

b. Quantitative estimation of phosphorus (Colorimetric method):

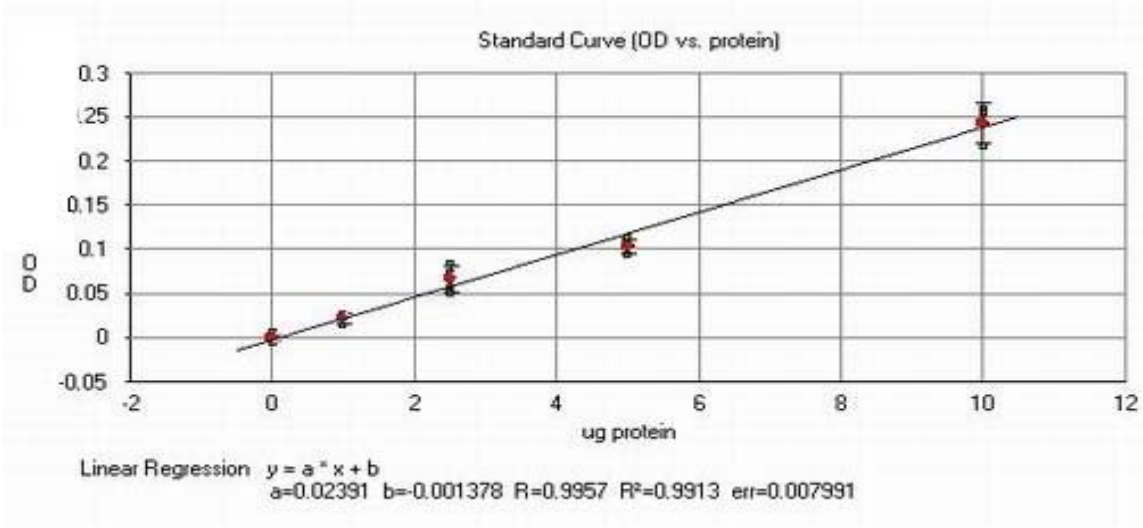
- Hot plate
- Whatman No. 1 filter paper
- Volumetric flasks
- Colorimeter or spectrophotometer
- Sulphomolybdic acid (2.5%)
- 2,4-Dinitrophenol indicator
- 4 N ammonia solution
- 2 N H_2SO_4
- Stannous chloride
- Standard phosphorus solution (50 ppm)

c. Quantitative estimation of iron (Colorimetric method):

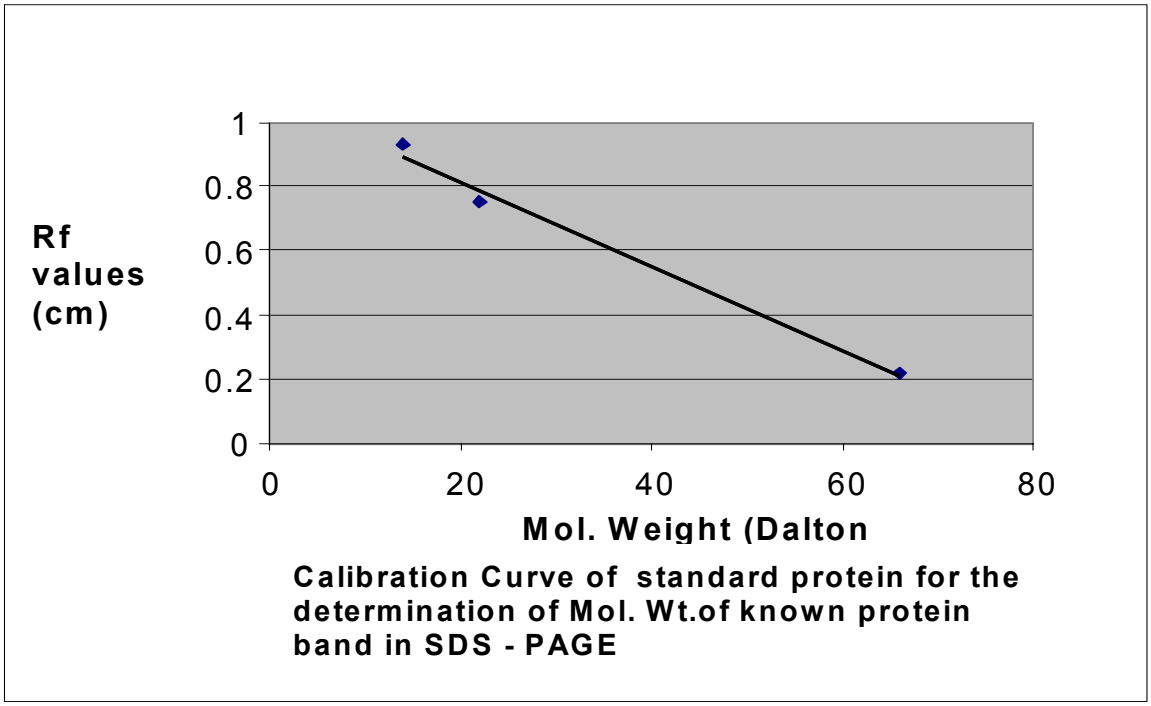
- Volumetric flasks
- Colorimeter
- a^1 , a^1 -dipyridyl (0.1 %)
- Hydroxylamine hydrochloride (10%)
- Acetate buffer (0.2 M, pH 4.7)
- Standard iron solution

Appendix-X

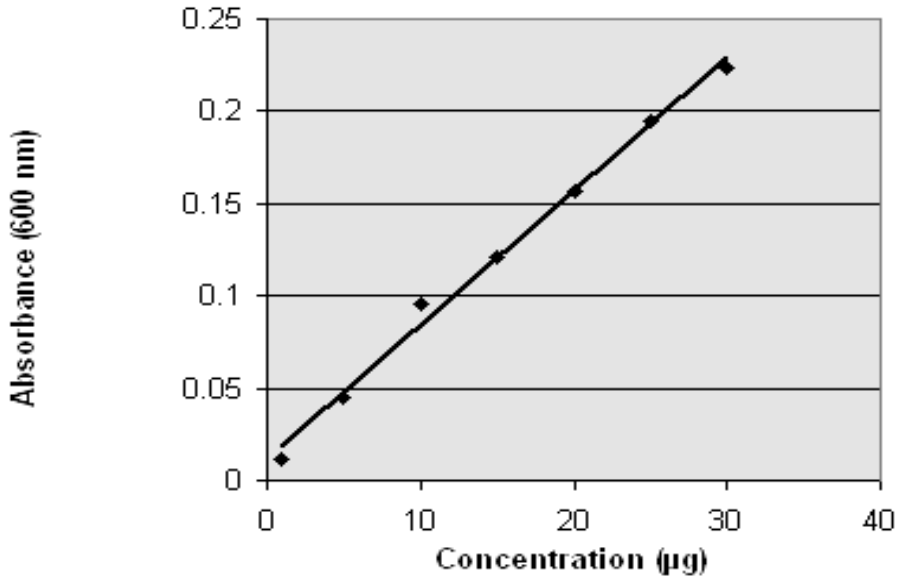
Calibration curve of BSA for Lowry Method, Bradford's Method and SDS page



BSA Calibration Curve for Lowry Method for the determination of Soluble Protein.



BSA Calibration Curve for SDS- page.



BSA Calibration curve for Bradford Method

Appendix XI

Rf Value of Standard amimoacid

Rf= a/b=Distance from the point of application to the center of specific amino acid spot./Distant traveled by the solvent.

Table Rf value of standard amino acid determined by Jcubke and Jeschkeit (1982)

Alanine	0.44
Arginine	0.20
Aspartic acid	0.19
Cystidine	0.07
Glutamic acid	0.30
Glycine	0.26
Histidine	0.20
Isoleucine	0.72
Leucine	0.73
Lysine	0.14
Methionine	0.55
Phenyl alanine	0.68
Proline	0.43
Serine	0.27
Threonine	0.35
Tryptophan	0.50
Tyrosine	0.45
Valine	0.60

Appendix XII

Determination of Protein profile by SDS PAGE

- Colorimeter
- Sample Extract (as in Lowry method)
- Bradford reagent – Dissolved 100 mg of Coosmassie Brilliant Blue G 250 in 50 ml of Ethanol, added 100 ml of 85% of phosphoric acid and made the volume to one liter with distilled water.
- 0.1 M phosphate buffer (pH 7.6).
- Standard protein solution – Dissolved 5 m of bovine serum albumin in 50 ml of 0.1 m phosphate buffer. This solution contained 100 mg protein/ ml.

Quench

- 70% sucrose 100µl
- 20% SDS 200ml
- beta-mercaptoethanol 50µl
- 0.5% Bromo Phenol Blue (BPB) 10µl

Staining solution

- Glacial acetic acid 100ml
- Methanol 200ml
- CBB 0.6 gm
- Water 200ml

Destain solution

- 10% (v/v) acetic acid

Preparation of Phosphate buffer (0.1m); (Mackie and Mackrtney, 1989)

Stock solution A – 0.2 mole/Liter of monobasic sodium phosphate (31.2 gm, NaH_2P0_4. $2H_20$ in 1000 ml D/W)

Stock solution B – 0.2 mole/Liter of dibasic sodium phosphate (28.39 gm, Na_2HP0_4. $2H_20$ in 1000 ml D/W)

X ml of A and Y ml of B was mixed, diluted to 200 ml in order to obtain buffer of required pH as shown in the following table.

X ml. A	Y ml. B	pH
92.0	8.0	5.8
87.7	12.3	6.0
81.5	18.5	6.2
73.5	26.5	6.4
62.5	37.5	6.6
51.0	49.0	6.8
39.0	61.0	7.0
28.0	72.0	7.2
19.0	81.0	7.4
13.0	87.0	7.6
8.5	91.5	7.8
5.3	94.7	8.0

Gel Concentration For SDS-PAGE

1. Separating Gels, in 0.375M Tris,pH 8.8

	10%
Distilled water	4.1 ml
1.5M Tris-HCl	2.5 ml
20% (w/v) SDS	0.05ml
Acrylamide/Bis-acrylamide (30%/0.8%)	3.3 ml
10% (w/v) ammonium per sulphate	0.05ml
TEMED	0.005ml
Total monomer	10.005ml

2.Stacking Gel, 4.0% gel, 0.125M Tr is, pH6.8

Distilled Water	3.075ml
0.5M Tris HCL, pH 6.8	1.250ml
20% (w/v) SDS	0.025 ml
Acrylamide/Bis-acrylamide (30%/ 0.8% w/v)	0.67ml
10% (w/v) ammonium persulphate	0.025ml
TEMED	0.005ml
Total stack monomer	5.05ml

Appendix : XIII

List of sample collected from the study Area

Col.No	Col. Date	Species	Local name	Family	Locality	Altitude	Uses	Substractum
21001	07.07.2001	*Termitomyces sp.*	Chaatey	Tricholomataceae	Godavari	1425		Soil
21002	07.07.2001	*Helvella elastica*		Helvellaceae	Godavari	1425		Soil
21003	07.07.2001	*Stereum hirsutum*	Jhyau	Stereaceae	Godavari	1425		Stump
21006	07.07.2001	*Xylaria polymorpha*	Aauley	Xylariaceae	Godavari	1400		Stump
21007	07.07.2001	*Helvella crispa*		Helvellaceae	Godavari	1400	Edible	Soil
21008	07.07.2001	*Stereum sp.*	Jhyau	Stereaceae	Godavari	1400		Stump
21010	07.07.2001	*Polyporus sp.*		Polyporaceae	Godavari	1400		Soil
21012	07.07.2001	*Trametes versicolar*		Coriolaceae	Godavari	1400	Medicinal	Stump
21013	07.07.2001	*Polyporus arcularis*		Polyporaceae	Godavari	1400		Stump
21014	18.07.2001	*Daldinia concentrica*	Dalley	Xylariaceae	Lele	1400	Medicinal	Stump
21015	18.07.2001	*Auricularia auricula-judae*	Kaney	Auriculariaceae	Lele	1400	Edible	Stump
21016	18.07.2001	*Fomitopsis pinicola*	Kathey	Fomitopsidaceae	Lele	1400		Stump
21017	18.07.2001	*Mycena sp.*	Masiney	Marasmiaceae	Lele	1350		Soil
21019	18.07.2001	*Mycena sp.*	Masiney	Marasmiaceae	Lele	1375		Stump
21020	18.07.2001	*Chroogomphus sp.*		Gomphidiaceae	Lele	1375		Soil
21021	19.07.2001	*Coprinus micaceus*	Chaatey	Coprinaceae	Lele	1375		Soil
21023	19.07.2001	*Auricularia auricula-judae*	Kaney	Auriculariaceae	Lele	1350	Edible	Stump
21024	19.07.2001	*Coprinus logopus*		Coprinaceae	Lele	1350	Edible	Decayed wood
21026	21.07.2001	*Schizophyllum commune*	Pankha	Schizophyllaceae	Sundhara	1275	Cultural	Stump
21028	21.07.2001	*Pleurotus sp.*		Pleurotaceae	Sundhara	1275	Edible	Dead stump
21029	24.07.2001	*Coprinus comatus*	Koper Shaymo	Coprinaceae	Baneshore	1290	Edible	Soil
21030	29.07.2001	*Coriolus sp.*	Rekhi	Coriolaceae	Dhulikhel	1350		Stump
21031	29.07.2001	*Coriolus hirsutus*		Coriolaceae	Dhulikhel	1350	Medicinal	Stump
21034	29.07.2001	*Scleroderma cepa*	Dalley	Sclerodermataceae	Dhulikhel	1400	Edible	Soil
21035	29.07.2001	*Boletus edulis*	Ghada	Boletaceae	Dhulikhel	1350	Edible	Soil

21037	07.08.2001	*Craterellus sp.*		Cantharellaceae	Dhulikhel	1400		Soil
21039	07.08.2001	*Boletellus ananas*		Boletaceae	Dhulikhel	1400	Edible	Soil
21040	07.08.2001	*Cantharellus sp.*	Soli	Cantharellaceae	Dhulikhel	1400	Edible	Soil
21042	07.08.2001	*Auricularia sp.*	Kaney, Thalthaley	Auriculariaceae	Dhulikhel	1400	Edible	Stump
21043	07.08.2001	*Stereum sp.*		Stereaceae	Dhulikhel	1400		Decayed log
21044	07.08.2001	*Peziza sp.*		Pezizaceae	Dhulikhel	1400		Soil
21045	07.08.2001	*Polyporus varius*		Polyporaceae	Dhulikhel	1400		Soil
21046	07.08.2001	*Russula sp.*		Rusullaceae	Dhulikhel	1400		Soil
21047	07.08.2001	*Thelophora terestris*		Thelophoraceae	Dhulikhel	1425		Soil
21050	07.08.2001	*Mycena sp.*		Marasmiaceae	Dhulikhel	1425		Soil
21052	15.09.2001	*Stereum sp.*		Stereaceae	Phulchowki	1425		Stump
21053	15.09.2001	*Oudemansiella longipes*		Dermolomataceae	Phulchowki	1450		Soil
21054	15.09.2001	*Boletus piperatus*		Boletaceae	Phulchowki	1500		Soil
21055	15.09.2001	*Termitomyces sp.*	Chaatey	Tricholomataceae	Phulchowki	2000	Edible	Soil
21056	15.09.2001	*Tuber sp.(Truffle)*	Dalley	Tuberaceae	Phulchowki	1525		Soil
21058	15.09.2001	*Laccaria laccata*	Budi, Jhari	Tricholomataceae	Phulchowki	1500	Edible	Soil
21059	15.09.2001	*Ganoderma sp.*	Kathey	Ganodermataceae	Phulchowki	1500	Medicinal	Soil
21060	15.09.2001	*Laccaria proxima*	Budi, Jhari	Tricholomataceae	Phulchowki	1600	Edible	Soil
21061	15.09.2001	*Helvella lacunosa*		Pezizaceae	Phulchowki	1500	Edible	Soil
21063	15.09.2001	*Boletus sp.*		Boletaceae	Phulchowki	1500		Soil
21064	15.09.2001	*Thelephora caryophyllea*		Thelophoraceae	Phulchowki	1500		Soil
21065	15.09.2001	*Aleuria aurantia*		Humariaceae	Phulchowki	1500		Decayed log
21066	15.09.2001	*Steropsis burtianum*		Podoscyphaceae	Phulchowki	1400		Soil
21067	15.09.2001	*Coprinus logopus*		Coprinaceae	Phulchowki	2700	Decayed wood	
21070	15.09.2001	*Scleroderma areolatum*	Dalley	Sclerodermataceae	Phulchowki	1550	Edible	Soil
21071	15.09.2001	*Coriolus hirsutus*		Coriolaceae	Phulchowki	1600		Stump
21072	15.09.2001	*Auricularia auricula-judae*	Kaney, Thalthaley	Auriculariaceae	Phulchowki	1600	Edible	Stump
21073	15.09.2001	*Tremella mesentrica*	Thalthaley	Tremellaceae	Phulchowki	1600		Stump
21074	15.09.2001	*Auricularia polytricha*	Kaney, Thalthaley	Auriculariaceae	Phulchowki	1700	Edible	Stump
21075	15.09.2001	*Thelophora palmata*		Thelophoraceae	Phulchowki	1600		Soil
21076	15.09.2001	*Ramaria formosa*	Sinkey	Ramariaceae	Phulchowki	1700		Soil
21080	15.09.2001	*Pleurotus sp.*		Pleurotaceae	Phulchowki	1450		Stump
21081	15.09.2001	*Thelophora terestris*		Thelophoraceae	Phulchowki	1450		Soil
21084	15.09.2002	*Lycoperdon pyriforme*		Lycoperdaceae	Phulchowki	1800		Soil

21085	21.09.2001	*Mycena sp.*	Masiney	Marasmiaceae	Sundarijal	1400		Soil
21086	21.09.2001	*Hymenochaete sp.*		Hymenochaetaceae	Sundarijal	1425		Stump
21087	21.09.2001	*Polyporus labicep*	Pattery	Polyporaceae	Sundarijal	1425		Stump
21088	21.09.2001	*Schizophyllum commune*	Mizu, Pankha	Schizophyllaceae	Sundarijal	1440	Edible/Religious	Stump (Alnus)
21089	21.09.2001	*Microporus xanthopus*	Soli	Polyporaceae	Sundarijal	1450		Stump
21090	21.09.2001	*Laccaria laccata*	Budi, Jhari	Tricholomataceae	Sundarijal	1450	Edible	Soil
21091	21.09.2001	*Scleroderma areolatum*	Til, Dalley	Sclerodermataceae	Sundarijal	1450	Edible	Soil
21092	21.09.2001	*Agaricus sp.*	Gobrey	Agaricaceae	Sundarijal	1500	Edible	Humus
21093	21.09.2001	*Amanita caesarea*	Suntaley, Salle, Phul, Dhar shyamo	Amanitaceae	Sundarijal	1550	Edible	Soil
21094	21.09.2001	*Trametes versicolar*	Rekhi	Polyporaceae	Sundarijal	1400	Medicinal	Stump
21095	21.09.2001	*Scleroderma verrucosum*	Til, Dalley	Sclerodermataceae	Sundarijal	1400	Edible	Soil
21096	21.09.2001	*Coriolus castaneaus*		Polyporaceae	Sundarijal	1425		Stump
21097	21.09.2001	*Mycena sp.*	Masiney	Marasmiaceae	Sundarijal	1425		Soil
21098	21.09.2001	*Griflola frondosa*	Nagroom	Polyporaceae	Sundarijal	1500	Edible	Stump (Quercus)
21099	21.09.2001	*Polyporus arcularis*		Polyporaceae	Sundarijal	1500	Edible	Soil
21100	25.09.2001	*Cantharellus sp.*	Pahelo	Cantharellaceae	Sundarijal	1450	Edible	Soil
21101	25.09.2001	*Laccaria laccata*	Budi, Jhari	Tricholomataceae	Sundarijal	1400	Edible	Soil
21102	25.09.2001	*Russula nigrecense*	Kalo chatey	Rusullaceae	Sundarijal	1400	Edible	Soil
21103	25.09.2001	*Boletellus embodensis*		Boletaceae	Sundarijal	1350		Soil
21104	25.09.2001	*Boletus sp.*		Boletaceae	Sundarijal	1400		Soil
21105	25.09.2001	*Russula sp.*		Rusullaceae	Sudarijal	1400		Soil
21106	25.09.2001	*Ramaria aurea*	Sinkey	Ramariaceae	Sundarijal	1400		Soil
21107	25.09.2001	*Coprinus micaceus*	Masiney	Coprinaceae	Sundarijal	1400		Buried wood
21108	25.09.2001	*Coprinus comatus*	Seto	Coprinaceae	Sundarijal	1500	Edible	Soil
21109	28.09.2001	*Stereum sp.*		Stereaceae	Sundarijal	1400		Soil
21110	28.09.2001	*Pycnoporus cinnabarinus*	Rato	Polyporaceae	Sundarijal	1500	Medicinal	Stump (Alnus)
21111	28.09.2001	*Corticium sp.*		Corticiaceae	Sundarijal	1500		Bark
21112	28.09.2001	*Corticium sp.*		Corticiaceae	Sundarijal	1500		Bark
21113	28.09.2001	*Coriolus hirsutus*		Polyporaceae	Sundarijal	1525	Medicinal	Stump
21114	28.09.2001	*Boletus edulis*	Ghadey	Boletaceae	Sundarijal	1450	Edible	Soil
21115	28.09.2001	*Daldinia concentrica*	Kaley, Dalley	Xylariaceae	Sundarijal	1475		Stump (Alnus)
21116	28.09.2001	*Pleurotus cornucopiae*	Kanney	Pleurotaceae	Sundarijal	1400	Edible	Decayed wood (Populus)

21117	28.09.2001	*Boletus sp.*		Boletaceae	Sundarijal	1425		Soil
21118	28.09.2001	*Xylaria polymorpha*		Xylariaceae	Sundarijal	1475		Stump (Schima)
21119	28.09.2001	*Lycoperdon pyriforme*	Naspati	Lycoperdaceae	Sundarijal	1425	Hallocinogenic	Soil
21120	28.09.2001	*Ramaria botrytis*	Kawali	Ramariaceae	Sundarijal	1450	Edible	Soil
21121	28.09.2001	*Ramaria formosa*	Thokre	Ramariaceae	Sundarijal	1450	Edible	Soil
21122	28.09.2001	*Phellinus igoniarius*		Phellinaceae	Sundarijal	1425		Stump
21123	28.09.2001	*Russula virescens*	Dhidey Mailini	Rusullaceae	Sundarijal	1450	Edible	Soil
21124	28.09.2001	*Scleroderma citrinum*	Dalley	Sclerodermataceae	Sundarijal	1400	Edible	Soil
21125	30.09.2001	*Polyporus sp.*		Polyporaceae	Bhaktapur	1325		Soil
21126	30.09.2001	*Fomes sp.*		Fomitopsidaceae	Bhaktapur	1325		Stump
21127	01.10.2001	*Trametes versicolar*	Rekhi	Polyporaceae	Chandragiri	1500		Stump
21128	01.10.2001	*Thelophora sp.*		Thelophoraceae	Chandragiri	1600		Soil
21129	01.10.2001	*Scleroderma verrucosum*	Dalley	Sclerodermataceae	Chandragiri	1800	Edible	Soil
21130	01.10.2001	*Agaricus sp.*		Agaricaceae	Sabha Griha	1275		Stump (Populus)
21131	01.10.2001	*Coprinus dissemanatus*	Masiney	Coprinaceae	Baneswore	1290		Stump
21132	10.10.2001	*Marasmius odoratus*	Masiney	Marasmiaceae	Baneswore	1290		Soil
21133	10.10.2001	*Hypoxylon sp.*		Xylariaceae	Baneswore	1290		Stump
21134	10.10.2001	*Hymenochaete tabicina*	Theki Talene	Hymenochaetaceae	Baneswore	1290		Bamboo log
21135	10.10.2001	*Mycena sp.*		Marasmiaceae	Baneswore	1290		Soil
21136	27.05.2001	*Lepiota castanea*		Agaricaceae	Kirtipur	1300	Poisonous	Soil
21137	30.05.2001	*Coriolus hirsutus*		Coriolaceae	Kirtipur	1320	Medicinal	Stump
21138	30.05.2001	*Macrolepiota mastoidea*		Agaricaceae	Kirtipur	1300	Edible	Soil
22139	10.06.2002	*Auricularia polytricha*	Kaney, Thalthaley	Auriculariaceae	Baneswore	1290	Edible	Stump
22140	13.06.2002	*Lentinulles ursinus*	Kathey	Pleurotaceae	Kirtipur	1320	Edible	Stump
22141	21.06.2002	*Ganoderma applantum*	Kathey	Ganodermataceae	Maitidevi	1275		Stump
22142	22.06.2002	*Coprinus sp.*	Masiney	Coprinaceae	Pashupati	1275		Soil
22143	22.06.2002	*Hymenochaete sp.*		Hymenochaetaceae	Pashupati	1300		Stump
22145	22.06.2002	*Auricularia polytricha*	Kaney, Thalthaley	Auriculariaceae	Suryabinayak	1400	Edible	Stump
22146	22.06.2002	*Russula sp.*		Rusullaceae	Suryabinayak	1420		Soil
22147	22.06.2002	*Russula sp.*		Rusullaceae	Suryabinayak	1420		Soil
22148	22.06.2002	*Fistulina hepatica*		Fistulinaceae	Suryabinayak	1425		Tree trunk (Eucalypticus)
22150	22.06.2002	*Coltricia cinnamonea*	Soli	Hymenochaetaceae	Suryabinayak	1400		Soil
22152	22.06.2002	*Laccaria laccata*	Budi, Jhari	Tricholomataceae	Suryabinayak	1425	Edible	Soil

22153	22.06.2002	*Suillus sp.*		Boletaceae	Suryabinayak	1350		Soil
22154	22.06.2002	*Hymenochaete sp.*		Hymenochaetaceae	Suryabinayak	1350		Stump
22155	22.06.2002	*Hymenochaeta sp.*	Kathey	Hymenochaetaceae	Suryabinayak	1350		Stump
22156	22.06.2002	*Boletus sp.*		Boletaceae	Suryabinayak	1360		Soil
22158	22.06.2002	*Lactarius piperatus*	Dudhey	Rusullaceae	Suryabinayak	1375	Edible	Soil
22159	22.06.2002	*Mycena sp.*	Masiney	Marasmiaceae	Suryabinayak	1375		Soil
22160	24.06.2002	*Resupinatus applicatus*		Tricholomataceae	Baneswore	1290		Bamboo log
22161	24.06.2002	*Guepinea spathularia*	Pahelo sano	Tremellaceae	Baneswore	1290		Bamboo log
22162	24.06.2002	*Fomes sp.*	Kathey	Fomitopsidaceae	Swayambhu	1400		Stump
22163	24.06.2002	*Scleroderma sp.*	Dalley	Sclerodermataceae	Swayambhu	1400		Soil
22164	24.06.2002	*Schizophyllum commune*		Schizophyllaceae	Swayambhu	1375		Bamboo log
22165	24.06.2002	*Auricularia polytricha*	Kaney, Thalthaley	Auriculariaceae	Swayambhu	1350		Stump
22166	24.06.2002	*Entoloma hirsutus*		Entolomataceae	Swayambhu	1400		Stump
22170	13.07.2002	*Russula aurora*	Raktey	Rusullaceae	Champadevi	1425	Edible	Soil
22171	13.07.2002	*Fomitopsis pinicola*	Kathey	Fomitopsidaceae	Champadevi	1400		Stump
22173	13.07.2002	*Rhizina undulata*		Pezizaceae	Champadevi	1350		Soil
22174	13.07.2002	*Auricularia polytricha*	Kane, Chipley, muskane, Thalthaley	Auriculariaceae	Champadevi	1400	Edible	Stump
22175	13.07.2002	*Thelephora palmata*		Thelephoraceae	Champadevi	1425		Soil
22176	13.07.2002	*Russula laurocerasi*		Rusullaceae	Champadevi	1425		Soil
22177	13.07.2002	*Xerocomus sp.*		Boletaceae	Champadevi	1400		Soil
22178	13.07.2002	*Russula aurora*	Chaatey	Rusullaceae	Champadevi	1500	Edible	Soil
22179	13.07.2002	*Russula sp.*		Rusullaceae	Champadevi	1400		Soil
22180	13.07.2002	*Amanita vaginata*		Amanitaceae	Champadevi	1400	Edible	Soil
22181	13.07.2002	*Russula sp.*		Rusullaceae	Champadevi	1425		Soil
22182	13.07.2002	*Russula sp.*		Rusullaceae	Champadevi	1450		Soil
22183	13.07.2002	*Tylopilus sp.*		Boletaceae	Champadevi	1425		Soil
22184	13.07.2002	*Schizophyllum commune*		Schizophyllaceae	Champadevi	1400		Stump
22186	13.07.2002	*Coltricia cinnamonea*		Hymenochaetaceae	Champadevi	1400		Soil
22188	13.07.2002	*Laccaria amethystina*	Budi, Jhari	Tricholomataceae	Champadevi	1450	Edible	Soil
22189	13.07.2002	*Russula sp.*		Rusullaceae	Champadevi	1400		Soil
22190	13.07.2002	*Panus sp.*		Pleurotaceae	Champadevi	1400		Soil
22192	13.07.2002	*Leotia viscosa*		Geogloshaceae	Champadevi	1400		Soil
22193	13.07.2002	*Russula sp.*		Rusullaceae	Champadevi	1450		Soil
22195	13.07.2002	*Clitocybe nuda*	Chaatey	Tricholomataceae	Champadevi	1450		Soil

22196	13.07.2002	*Boletus sp.*		Boletaceae	Champadevi	1500		Soil
22200	15.07.2002	*Schizophyllum commune*		Schizophyllaceae	Bishalnagar	1300		Stump
22202	15.07.2002	*Ganoderma applantum*		Ganodermataceae	Maitidevi	1275		Stump
22203	16.07.2002	*Coprinus sp.*		Coprinaceae	Maitidevi	1275		Stump (kimboo)
22204	16.07.2002	*Thelopora fuscella*		Thelophoraceae	Kirtipur	1310		Soil
22206	17.07.2002	*Agarius sp.*		Agaricaceae	Sabha Griha	1300		Soil
22207	17.07.2002	*Fomitopsis pinicola*		Fomitopsidaceae	Sabha Griha	1300		Stump (Populus)
22209	17.07.2002	*Lentinulles ursinus*		Pleurotaceae	Kirtipur	1320		Stump (Populus)
22210	21.07.2002	*Pycnoporus cinnabarius*	Sindurey, Rato, Yaroning musa(Che)	Polyporaceae	Chitawan,Tikauli	200	Medicinal	Stump
22211	21.07.2002	*Phellinus sp.*		Phellinaceae	Chitawan,Tikauli	200		Stump
22212	21.07.2002	*Hymenochaete sp.*		Hymenochaetaceae	Chitawan,Tikauli	200		Stump
22213	21.07.2002	*Hymenochaete sp.*		Hymenochaetaceae	Chitawan,Tikauli	200		Parasite (on Polyporus)
22214	21.07.2002	*Lentinulles ursinus*	Ghompa musa(Che)	Pleurotaceae	Chitawan,Tikauli	200	Edible	Stump
22215	21.07.2002	*Russula sp.*	Kishan Chyau	Rusullaceae	Chitwan, Tikauli	200	Edible	Soil
22216	21.07.2002	*Marasmius androceus*		Marasmiaceae	Chitawan,Tikauli	200	Edible	Leaf (Shorea)
22218	21.07.2002	*Russula delica*	Chaatey	Rusullaceae	Chitawan,Tikauli	200	Edible	Soil
22219	21.07.2002	*Amanita Chepangiana*	Gobre musa(che)	Amanitaceae	Chitwan, Tikauli	200	Edible	Soil
22220	21.07.2002	*Termitomyes Eurhizus*	Kadum musa(Che)	Tricholomataceae	Chitwan, Tikauli	200	Edible	Dhamira ko Gola
22221	22.07.2002	*Clavulina sp.*		Clavariaceae	Chitawan, Amrit Dhara Pani	225		Soil
22222	22.07.2002	*Lactarius sp.*	Khakaurae musa(Che)	Rusullaceae	Chitwan, Tikauli	225		Soil
22224	22.07.2002	*Polyporus picipes*		Polyporaceae	Chitawan, Amrit Dhara Pani	225		Stump
22225	22.07.2002	*Amanita vaginata*		Amanitaceae	Chitawan, Amrit Dhara Pani	226	Edible	Soil
22226	22.07.2002	*Auricularia auricula-judae*	Chipley, Dhudha musa(Che)	Auriculariaceae	Chitawan, Amrit Dhara Pani	225	Edible	Stump
22227	22.07.2002	*Microporus xanthopus*		Polyporaceae	Chitawan, Amrit Dhara Pani	250		Stump
22228	22.07.2002	*Daldinia concentrica*	Dalley	Xylariaceae	Chitawan, Amrit Dhara Pani	200		Stump
22229	22.07.2002	*Scleroderma sp.*	Kodo, Wamum musa(Che)	Sclerodermataceae	Chitawan, Amrit Dhara Pani	225	Edible	Soil
22230	22.07.2002	*Fomitopsis sp.*		Fomitopsidaceae	Chitawan, Amrit	225		Stump

					Dhara Pani			
22231	22.07.2002	*Stereum hirsutum*		Stereaceae	Chitawan, Amrit Dhara Pani	250		Stump
22232	22.07.2002	*Innonotus sp.*		Hymenochaetaceae	Chitawan, Amrit Dhara Pani	225		Stump (sal)
22234	22.07.2002	*Pleurotus cornucopiae*	Kanney, Yamu musa(Che)	Pleurotaceae	Chitawan, Amrit Dhara Pani	225	Edible	Decayed wood
22235	22.07.2002	*Pleurotus sp.*	Yamu musa (Che)	Pleurotaceae	Chitawan, Amrit Dhara Pani	225	Edible	Stump
22236	22.07.2002	*Hymenochaete sp.*		Hymenochaetaceae	Chitawan, Amrit Dhara Pani	200		Stump (sal)
22237	22.07.2002	*Gleophyllum sp.*		Fomitopsidaceae	Chitawan, Amrit Dhara Pani	200		Stump
22238	22.07.2002	*Daedolpsis sp.*		Polyporaceae	Chitawan, Amrit Dhara Pani	200		Stump
22239	22.07.2002	*Phellinus sp.*		Hymenochaetaceae	Chitawan, Amrit Dhara Pani	200		Stump
22240	22.07.2002	*Xylaria sp.*		Xylariaceae	Chitawan, Amrit Dhara Pani	240		Stump
22242	25.07.2002	*Amanita pseudoporphyria*		Amanitaceae	Dhulikhel	1600		Soil
22243	25.07.2002	*Hgrophorous sp.*		Hygrophoraceae	Dhulikhel	1600		Soil
22244	25.07.2002	*Hgrophorous sp.*		Hygrophoraceae	Dhulikhel	1400		Soil
22246	25.07.2002	*Boletus sp.*		Boletaceae	Dhulikhel	1400		Soil
22247	25.07.2002	*Inocybe sp.*		Cortinariaceae	Dhulikhel	1400		Soil
22248	25.07.2002	*Russula castanopsida*		Rusullaceae	Dhulikhel	1625		Soil
22249	25.07.2002	*Russula alboreolata*		Rusullaceae	Dhulikhel	1625		Soil
22251	25.07.2002	*Strobilomyces strobilaceous*		Boletaceae	Dhulikhel	1450		Soil
22252	25.07.2002	*Gyroporus sp.*		Boletaceae	Dhulikhel	1400		Soil
22253	25.07.2002	*Russula sp.*		Rusullaceae	Dhulikhel	1625		Soil
22254	25.07.2002	*Scleroderma cepa*	Dalley, Aalu	Sclerodermataceae	Dhulikhel	1600	Edible	Soil
22255	25.07.2002	*Amanita vaginata*		Amanitaceae	Dhulikhel	1600	Edible	Soil
22256	25.07.2002	*Russula senecis*		Rusullaceae	Dhulikhel	1600		Soil
22257	25.07.2002	*Clitocybe sp.*		Tricholomataceae	Dhulikhel	1600		Soil
22258	25.07.2002	*Russula sp.*		Rusullaceae	Dhulikhel	1650		Soil
22259	25.07.2002	*Oudemensiella sp.*		Dormolomataceae	Dhulikhel	1650		Soil
22260	25.07.2002	*Phlebia sp.*		Corticiaceae	Dhulikhel	1600		Stump
22261	25.07.2002	*Russula sp.*		Rusullaceae	Dhulikhel	1625		Soil
22262	25.07.2002	*Clitocybe sp.*		Tricholomataceae	Dhulikhel	1550		Soil
22264	25.07.2002	*Tylopilus sp.*		Boletaceae	Dhulikhel	1650		Soil
22267	27.07.2002	*Coprinus*	Masiney	Coprinaceae	Singhadarbar	1275		Stump (Juglans)

		dissemanatus						
22268	27.07.2002	*Mycena sp.*	Masiney	Marasmiaceae	Battisputali	1290		Tree trunk (Eucalypticus)
22269	28.07.2002	*Tuber sp(Truffle)*		Tuberaceae	Namoboudha, Kavre	1550		Soil
22270	28.07.2002	*Pluteus thomsonii*		Pluteaceae	Namoboudha, Kavre	1650		Soil
22272	28.07.2002	*Cortinarius sp*		Cortinariaceae	Namoboudha, Kavre	1700		Soil
22273	28.07.2002	*Boletus sp.*		Boletaceae	Namoboudha, Kavre	1700		Soil
22274	28.07.2002	*Amanita phalloides*	Bisalu	Amanitaceae	Namoboudha, Kavre	1600	Poisonous	Soil
22275	28.07.2002	*Boletus sp.*		Boletaceae	Namoboudha, Kavre	1650		Soil
22276	28.07.2002	*Suillus lutens*	Chipley	Boletaceae	Namoboudha, Kavre	1650	Edible	Soil
22277	28.07.2002	*Laccaria amethystina*	Budi, Jhari	Tricholomataceae	Namoboudha, Kavre	1650	Edible	Soil
22278	28.07.2002	*Scleroderma verrucosum*	Dalley, Aalu	Sclerodermataceae	Namoboudha, Kavre	1600	Edible	Soil
22279	28.07.2002	*Boletus sp.*		Boletaceae	Namoboudha, Kavre	1650	Edible	Soil
22280	28.07.2002	*Scleroderma sp.*	Dalley, Aalu	Sclerodermataceae	Namoboudha, Kavre	1550	Edible	Soil
22281	28.07.2002	*Coriolus hirsutus*	Patrey	Coriolaceae	Namoboudha, Kavre	1750	Medicinal	Stump
22282	29.07.2002	*Clavulina sp.*		Clavariaceae	Namoboudha, Kavre	1650		Soil
22283	29.07.2002	*Agarius sp.*		Agaricaceae	Namoboudha, Kavre	1600	Edible	Soil
22284	29.07.2002	*Lepiota sp.*		Agaricaceae	Namoboudha, Kavre	1500		Soil
22285	29.07.2002	*Schizophyllum commune*		Schizophyllaceae	Namoboudha, Kavre	1600		Fallen twig
22289	29.07.2002	*Pleurotus sp.*	Kanney	Pleurotaceae	Namoboudha, Kavre	1600	Edible	hay of straw
22290	30.07.2002	*Oudimansiella radicata*		Dermolomataceae	Kirtipur	1320	Edible	Soil
22291	30.07.2002	*Lentinus sp.*		Pleurotaceae	Kirtipur	1320		Stump (Populus)
22293	31.07.2002	*Ramaria botrytis*		Ramariaceae	Godavari	1500	Edible	Soil
22295	01.08.2002	*Coprinus sp.*		Coprinaceae	Battisputali	1300		Soil
22296	02.08.2002	*Volvariella bombycina*	Seto	Pluteaceae	Kirtipur	1320	Edible	Stump (Populus)
22297	05.08.2002	*Coprinus dissemanatus*	Masiney	Coprinaceae	Baneswore	1300		Stump
22298	05.08.2002	*Xylaria carpophila*		Xylariaceae	Baneswore	1290		On debris

22299	07.08.2002	*Thelophora sp.*		Thelophoraceae	Kirtipur	1320		Soil
22301	14.08.2002	*Bjerkandia adusta*		Polyporaceae	Kirtipur	1320		Stump (Populus)
22303	16.08.2002	*Coprinus logopus*	Masiney	Coprinaceae	Baneswore	1290		Decayed wood
22305	17.08.2002	*Russula sp.*	Raktey	Rusullaceae	Suryabinayak	1325	Edible	Soil
22306	17.08.2002	*Laccaria laccata*	Budi, Jhari	Tricholomataceae	Suryabinayak	1325	Edible	Soil
22307	17.08.2002	*Clavaria vermicularis*	Masiney auley	Clavariaceae	Suryabinayak	1340		Soil
22308	17.08.2002	*Coprinus dissemanatus*		Coprinaceae	Suryabinayak	1450		Stump
22309	17.08.2002	*Xerocomus Subtomentosus*		Boletaceae	Suryabinayak	1450		Soil
22310	17.08.2002	*Amanita virosa*		Amanitaceae	Suryabinayak	1450		Soil
22311	17.08.2002	*Russula sp.*		Rusullaceae	Suryabinayak	1625		Soil
22312	17.08.2002	*Clavulinopsis fusiformis .*	Keshari, Puju	Clavariaceae	Suryabinayak	1650		Soil
22313	17.08.2002	*Cantharellus cibarius*	Soli, Pahelo	Cantharellaceae	Suryabinayak	1400	Edible	Soil
22314	17.08.2002	*Mycena sp.*	Masiney	Marasmiaceae	Suryabinayak	1450		Soil
22315	17.08.2002	*Russula sp.*		Rusullaceae	Suryabinayak	1425		Soil
22316	17.08.2002	*Strobilomyces confuses*	Katley	Boletaceae	Suryabinayak	1440		Soil
22317	17.08.2002	*Coltricia sp.*		Hymenochaetaceae	Suryabinayak	1400		Soil
22318	17.08.2002	*Lepiota sp.*		Agaricaceae	Suryabinayak	1350		Soil
22319	17.08.2002	*Helvella crispa*		Pezizaceae	Suryabinayak	1400	Edible	Soil
22320	10.09.2002	*Pluteus sp*		Pluteaceae	Baneswore	1290		Banana stem
22323	21.12.2002	*Microporus xanthopus*		Polyporaceae	Phulchowki	1700		Stump
22324	21.12.2002	*Stereum hirsutum*		Stereaceae	Phulchowki	1600		Stump
22325	21.12.2002	*Microporus sp.*		Polyporaceae	Phulchowki	1850		Stump
22326	21.12.2002	*Microporus sp.*		Polyporaceae	Phulchowki	1750		Stump
22327	21.12.2002	*Helvella sp.*		Pezizaceae	Phulchowki	1850		Soil
23328	15.05.2003	*Lepiota castanea*		Agaricaceae	Kirtipur	1300		Soil
23329	17.05.2003	*Coprinus logopus*		Coprinaceae	Baneswore	1200		Decayed wood
23330	02.06.2003	*Hygrocybe coccineacrenata*	Rato masino	Hygrophoraceae	Chandragiri	1700		Soil
23331	28.06.2003	*Guepenia spathularia*		Tremellaceae	Baneswore	1290		Stump.(Bamboo)
23332	29.06.2003	*Ganoderma sp.*	Kathey	Ganodermataceae	Chitawan, Tikauli	250	Medicinal	Stump
23333	29.06.2003	*Pycnoporus sanguineus*	Rato, Sindurey, Yaroning musa(Che)	Polyporaceae	Chitawan, Tikauli	250	Medicinal	Fallen twig
23334	29.06.2003	*Clavaria sp.*		Clavariaceae	Chitawan, Tikauli	250		Soil
23335	29.06.2003	*Guepenia spathularia*		Tremellaceae	Chitawan, Tikauli	200		Decayed wood (sal)

23336	29.06.2003	*Hymenochaete sp.*		Hymenochaetaceae	Chitawan, Tikauli	200		Stump (sal)
23337	29.06.2003	*Scleroderma polyrhizum*	Dalley, Aalu, Kodo, Pakamu musa(Che)	Sclerodermataceae	Chitawan, Tikauli	200	Edible	Soil
23338	29.06.2003	*Cantharellus cibarius*	Soli, Pahelo, Chapi musa(Che)	Cantharellaceae	Chitawan, Tikauli	200	Edible	Soil
23339	30.06.2003	*Xylaria sp.*		Xylariaceae	Chitawan, Tikauli	200		Stump
23340	30.06.2003	*Auricularia sp.*	Chipley,Dhudha musa(Che)	Auriculariaceae	Chitawan, Tikauli	230	Edible	Stump (sal)
23341	30.06.2003	*Pleurotus sp.*	Kanney, Yamu musa(Che)	Pleurotaceae	Chitawan, Tikauli	200	Edible	Stump
23342	30.06.2003	*Trametes versicolar*	Rekhi	Polyporaceae	Chitawan, Tikauli	240	Medicinal	Stump (sal)
23343	30.06.2003	*Hymenochaete sp.*		Hymenochaetaceae	Chitawan, Tikauli	250		Stump (sal)
23344	30.06.2003	*Polyporus sp.*		Polyporaceae	Chitawan, Tikauli	200		Stump (sal)
23345	30.06.2003	*Coriolus hirsutus*		Coriolaceae	Chitawan, Tikauli	200	Medicinal	Stump (sal)
23346	30.06.2003	*Polyporus sp.*		Polyporaceae	Chitawan, Tikauli	200		Stump (sal)
23347	30.06.2003	*Lentinullus sp.*	Chaatey	Pleurotaceae	Chitawan, Tikauli	275	Edible	Soil
23348	30.06.2003	*Dictyophora duplicata*	Aandy, Hardi Musa(Che)	Phallaceae	Chitawan, Tikauli	225	Edible	Soil
23349	31.06.2003	*Marasmius sp.*	Bulaki Chyau	Marasmiaceae	Chitawan, Tikauli	200		Stump
23355	31.06.2003	*Ganoderma sp.*		Ganodermataceae	Chitawan, Tikauli	225		Stump
23356	31.06.2003	*Innonotus sp.*		Hymenochaetaceae	Chitawan, Tikauli	225		Stump
23357	31.06.2003	*Mycena sp.*	Masiney	Marasmiaceae	Chitawan, Tikauli	225		Soil
23358	01.07.2003	*Amanita sp.*		Amanitaceae	Kirtipur	1300		Soil
23359	02.07.2003	*Oudimansiella sp.*		Dermolomataceae	Kirtipur	1320	Edible	Soil
23360	02.07.2003	*Lepiota cristata*		Agaricaceae	Shantinagar	1275		Soil
23361	03.07.2003	*Laccaria laccata*	Budi, Jhari	Tricholomataceae	Sundarijal	1500	Edible	Soil
23362	03.07.2003	*Amanita sp.*		Amanitaceae	Sundarijal	1400		Soil
23363	03.07.2003	*Lactarius piperatus*	Dudhey	Rusullaceae	Sundarijal	1425	Edible	Soil
23364	03.07.2003	*Lactarius subpiperatus*	Dudhey	Rusullaceae	Sundarijal	1425	Edible	Soil
23365	03.07.2003	*Lacatrius sp.*	Dudhey	Rusullaceae	Sundarijal	1425	Edible	Soil
23366	03.07.2003	*Amanita hemibapha*	Suntaley	Amanitaceae	Sundarijal	1440	Edible	Soil
23367	03.07.2003	*Vasculum prantanse*		Lycoperdaceae	Sundarijal	1450		Soil
23368	03.07.2003	*Amanita vaginata*	Suntaley, Phool	Amanitaceae	Sundarijal	1440		Soil
23369	03.07.2003	*Boletellus sp.*		Boletaceae	Sundarijal	1450		Soil
23370	03.07.2003	*Boletellus emodensis*		Boletaceae	Sundarijal	1450		Soil
23371	03.07.2003	*Cantherllus tubiformis*	Besarey	Cantharellaceae	Sundarijal	1400	Edible	Soil
23372	03.07.2003	*Auricularia auricula-judae*	Kaney, Thalthaley	Auriculariaceae	Sundarijal	1500		Stump (Alnus)

23373	03.07.2003	*Microporus xanthopus*		Polyporaceae	Sundarijal	1500		Stump (Castanopsis)
23374	03.07.2003	*Boletus sp.*		Boletaceae	Sundarijal	1500		Soil
23375	03.07.2003	*Lactarius volemus*	Dudhey	Rusullaceae	Sundarijal	1500	Edible	Soil
23376	03.07.2003	*Russula sp.*		Rusullaceae	Sundarijal	1400		Soil
23377	03.07.2003	*Chroogomphus sp.*		Ghomphidaceae	Sundarijal	1450	Edible	Soil
23379	03.07.2003	*Boletus sp.*		Boletaceae	Sundarijal	1475		Soil
23380	03.07.2003	*Boletus sp.*		Boletaceae	Sundarijal	1475		Soil
23381	03.07.2003	*Boletus sp.*		Boletaceae	Sundarijal	1475		Soil
23382	03.07.2003	*Coprinus dissemanatus*	Masiney	Coprinaceae	Sundarijal	1475		Stump (Alnus)
23383	03.07.2003	*Thelophora terestris*		Thelophoraceae	Sundarijal	1475		Soil
23384	03.07.2003	*Thelophora palmata*		Thelophoraceae	Sundarijal	1475		Soil
23385	03.07.2003	*Laccaria amethystina*	Budi, Jhari, Nilo	Tricholomataceae	Sundarijal	1475	Edible	Soil
23386	03.07.2003	*Cantharellus cibarius*	Besarey	Cantharellaceae	Sundarijal	1475	Edible	Soil
23387	03.07.2003	*Hericium erinaceus*	Thokre, Thakre	Hericiaceae	Sundarijal	1475	Edible	Stump
23388	03.07.2003	*Xylaria sp.*		Xylariaceae	Sundarijal	1475		Stump
23389	05.07.2003	*Coprinus sp.*		Coprinaceae	Baneswore	1290		Soil
23390	06.07.2003	*Russula virescens*	Dhidey Chyau	Rusullaceae	Champadevi	1500	Edible	Soil
23391	06.07.2003	*Russula sanguinaria*	Raktey	Rusullaceae	Champadevi	1500	Edible	Soil
23392	06.07.2003	*Russula cyanoxantha*	Bhatmaas	Rusullaceae	Champadevi	1550	Edible	Soil
23393	06.07.2003	*Lactarius volemus*	Dudhey	Rusullaceae	Champadevi	1500	Edible	Soil
23394	06.07.2003	*Russula sp.*		Rusullaceae	Champadevi	1300		Soil
23395	06.07.2003	*Amanita sp.*		Amanitaceae	Champadevi	1500		Soil
23396	09.07.2003	*Boletus sp.*		Boletaceae	Champadevi	1500		Soil
23397	09.07.2003	*Boletus sp.*		Boletaceae	Champadevi	1500		Soil
23398	09.07.2003	*Chroogomphus sp.*		Gomphidiaceae	Champadevi	1500		Soil
23399	09.07.2003	*Boletus sp.*		Boletaceae	Champadevi	1450		Soil
23400	09.07.2003	*Russula senecis*		Rusullaceae	Champadevi	1400		Soil
23401	09.07.2003	*Boletus sp.*		Boletaceae	Champadevi	1400		Soil
23403	09.07.2003	*Amanita vaginata*		Amanitaceae	Champadevi	1500	Edible	Soil
23405	09.07.2003	*Amanita sp.*		Amanitaceae	Champadevi	1450		Soil
23407	09.07.2003	*Phaeolus schweinitzii*		Phaeolaceae	Champadevi	1450		Stump (Abies)
23409	09.07.2003	*Inocybe sp.*		Cortinariaceae	Champadevi	1400		Soil
23412	17.07.2003	*Scleroderma citrinum*	Kodey	Sclerodermataceae	Nuwakot, Ti gaun	1100	Edible	Soil
23413	17.07.2003	*Agarius sp.*		Agaricaceae	Nuwakot, Ti gaun	1050		Soil
23414	17.07.2003	*Pholiota sp.*		Stropharaceae	Nuwakot, Ti gaun	1050		Soil
23416	17.07.2003	*Cyathus straitus*		Nidulariaceae	Nuwakot, Ti gaun	1100		Soil
23417	17.07.2003	*Lentinellus sp.*		Pleurotaceae	Nuwakot, Ti gaun	1050		Stump

23418	17.07.2003	*Amanita fulva*	Chhate	Amanitaceae	Nuwakot, Ti gaun	1000	Edible	Soil
23419	17.07.2003	*Laccaria laccata*	Battai Chayau	Tricholomataceae	Nuwakot, Ti gaun	1000	Edible	Soil
23420	17.07.2003	*Pycnoporus cinnabarinus*	Sindurey, Raktey	Polyporaceae	Ranipauwa	1600	Medicinal	Stump
23422	17.07.2003	*Russula nigrecense*		Rusullaceae	Nuwakot, Ti gaun	1100	Edible	Soil
23423	17.07.2003	*Cantharellus subcibarius*	Pahelo	Cantharellaceae	Nuwakot, Ti gaun	1050	Edible	Soil
23424	20.07.2003	*Auricularia auricula-judae*	Kaney	Cortinariaceae	Baneswore	1290	Edible	Stump
23425	09.08.2003	*Galeriana sp.*		Cortinariaceae	Nagarjun	1550		Soil
23426	09.08.2003	*Lycoperdon lividus*		Lycoperdaceae	Nagarjun	1400		Soil
23427	09.08.2003	*Inocybe sp.*		Cortinariaceae	Nagarjun	1400		Soil
23428	09.08.2003	*Coltricia cinnamomea*		Hymenochaetaceae	Nagarjun	1400		Soil
23430	09.08.2003	*Isaria sinclairii*		Clavicipataceae	Nagarjun	1400		On insect
23431	09.08.2003	*Pleurotus sp.*	Kanney	Pleurotaceae	Nagarjun	1450	Edible	Dead stump
23432	09.08.2003	*Ganoderma lucidium*	Daadu, kathey	Ganodermataceae	Nagarjun	1500	Medicinal	Stump
23435	09.08.2003	*Boletus sp.*		Boletaceae	Nagarjun	1450		Soil
23436	09.08.2003	*Oudemensiella radicate*	Kagakutte	Dermolomataceae	Nagarjun	1450	Edible	Soil
23439	09.08.2003	*Ramaria stricta*		Ramariaceae	Nagarjun	1450		Soil
23440	09.08.2003	*Ganoderma tsugae*		Ganodermataceae	Nagarjun	1525		Stump (Juniper)
23441	09.08.2003	*Termitomyces sp.*		Agaricaceae	Nagarjun	1500		Soil
23442	09.08.2003	*Boletus sp.*		Boletaceae	Nagarjun	1400	Edible	Soil
23443	09.08.2003	*Auriscalpium vulgare*		Hydnaceae	Nagarjun	1450		On cone (Pinus)
23445	09.08.2003	*Hydnum repandum*		Hydnaceae	Nagarjun	1450	Edible	Soil
23448	09.08.2003	*Ramaria flava*		Ramariaceae	Nagarjun	1550		Soil
23449	09.08.2003	*Clavaria rosea*		Clavariaceae	Nagarjun	1400		Soil
23450	11.08.2003	*Tricholoma sp.*		Tricholomataceae	Ratnapark	1275		Soil
23451	13.08.2003	*Morchella esculenta*	Khoya, Chora	morchellaceae	Lantang, Brabal	1950	Edible	Soil
23452	13.08.2003	*Geastrum triplex*	Tarey	Geastraceae	Lantang, Brabal	2100	Poisonous	Soil
23453	14.08.2003	*Lycoperdon pyriforme*		Lycoperdaceae	Langtang, Kyanjin	4500	Hallocinogenic	Soil
23454	14.08.2003	*Lycoperdon echinatum*		Lycoperdaceae	Langtang, Kyanjin	4000		Soil
23455	14.08.2003	*Cordyceps sinensis*	Yersa gumba	Clavicipataceae	Langtang, Kyanjin	4000	Medicinal	Soil
23456	15.08.2003	*Russula sp.*		Rusullaceae	Lantang, Ghodatabela	2690		Soil
23457	15.08.2003	*Polyporus arcularis*	Soli	Polyporaceae	Lantang, Ghodatabela	2690		Stump
23458	16.08.2003	*Hymenochaete sp.*		Hymenochaetaceae	Lantang, Rimche	2500		Stump

23459	16.08.2003	*Boletus sp.*		Boletaceae	Lantang, Rimche	2940		Soil
23460	16.08.2003	*Coltricia sp.*		Hymenochaetaceae	Lantang, Rimche	2500		Soil
23461	16.08.2003	*Morchella Conica*	khoya	morchellaceae	Lantang, Rimche	2500	Edible	Soil
23462	16.08.2003	*Lycoperdon perlatum*		Lycoperdaceae	Lantang, Thulosyabru	2130		Soil
23463	16.08.2003	*Hygrocybe sp.*		Hygrophoraceae	Lantang, Thulosyabru	2000		Soil
23465	16.08.2003	*Pholiota sp.*		Stropharaceae	Lantang, Rimche	2500		Soil
23467	28.09.2003	*Polyporus sp.*		Polyporaceae	Sano Hattiaban	1350		Stump
23468	28.09.2003	*Laccaria laccata*	Budhi	Tricholomataceae	Matatirtha	1425		Soil
23469	29.09.2003	*Pleurotus cornucopiae*	Kanney	Pleurotaceae	Matatirtha	1425	Edible	Stump
23470	29.09.2003	*Coltricia cinnamomea*	Soli, Pahelo	Hymenochaetaceae	Matatirtha	1425		Soil
23471	29.09.2003	*Scleroderma sp.*	Dalley, Aalu	Sclerodermataceae	Matatirtha	1450	Edible	Soil
23472	29.09.2003	*Clavaria sp.*		Clavariaceae	Matatirtha	1425		Soil
23473	29.09.2003	*Russula cyanoxantha*	Raktey	Rusullaceae	Matatirtha	1425	Edible	Soil
23474	29.09.2003	*Russula sp.*		Rusullaceae	Matatirtha	1425	Edible	Soil
23475	29.09.2003	*Russula sp.*		Rusullaceae	Matatirtha	1425		Soil
23476	29.09.2003	*Hygrocybe sp.*		Hygrophoraceae	Matatirtha	1420		Soil
23477	29.09.2003	*Hygrophorus sp.*		Hygrophoraceae	Matatirtha	1425		Soil
23478	29.09.2003	*Strobilomyces sp.*		Boletaceae	Matatirtha	1425		Soil
23479	29.09.2003	*Ganoderma applantum*		Ganodermataceae	Matatirtha	1500		Stump
23480	29.09.2003	*Helvella sp.*		Pezizaceae	Matatirtha	1425		Soil
23482	29.09.2003	*Coltricia perennis*		Hymenochaetaceae	Matatirtha	1400		Soil
23485	10.10.2003	*Ganoderma applantum*		Ganodermataceae	Maitidevi	1275		Stump
23486	15.10.2003	*Microporus xanthopus*		Polyporaceae	Nagarjun	1450		Stump
23487	15.10.2003	*Microporus sp.*		Polyporaceae	Nagarjun	1450		Stump
23488	15.10.2003	*Microporus sp.*		Polyporaceae	Nagarjun	1460		Stump
23489	15.10.2003	*Microporus sp.*		Polyporaceae	Nagarjun	1465		Stump
23491	20.10.2003	*Hexagonium tenuis pulchella*		Polyporaceae	Sivapuri	1670		Stump
23492	20.10.2003	*Hexagonium variegata*		Polyporaceae	Sivapuri	1680		Stump
23493	20.10.2003	*Hexagonium tenuis polytramma*		Polyporaceae	Sivapuri	1690		Stump
23494	20.10.2003	*Coprinus micaceus*		Coprinaceae	Sivapuri	1500		Soil
23495	20.10.2003	*Ganoderma tsugae*		Ganodermataceae	Sivapuri	2200		Stump (juniper)
23496	20.10.2003	*Scleroderma verrucosum*	Dalley, Aalu	Sclerodermataceae	Sivapuri	2200	Edible	Soil

23497	20.10.2003	*Auricularia polytricha*	Kaney	Auriculariaceae	Sivapuri	2000		Stump
23498	20.10.2003	*Stereum sp.*		Stereaceae	Sivapuri	1700		Stump
23499	20.10.2003	*Lentinus sp.*		Pleurotaceae	Sivapuri	1700		Stump
23500	21.10.2003	*Bisporella citrina*	Pahelo	Leotiaceae	Baneswore	1290		Stump
24501	19.05.2004	*Coprinus cinereus*		Coprinaceae	Baneswore	1290		Soil
24502	21.05.2004	*Lentinellus sp.*		Pleurotaceae	Kirtipur	1320	Edible	Stump
24503	22.05.2004	*Pleurotus sp.*	Kanney	Pleurotaceae	Baneswore	1290		Stump
24504	22.05.2004	*Auricularia mesentrica*	Thalthaley	Auriculariaceae	Baneswore	1290		Stump (Bamboo)
24505	22.05.2004	*Auricularia polytricha*	Kaney	Auriculariaceae	Baneswore	1290	Edible	Stump
24506	22.05.2004	*Auricularia auricula-judae*	Kaney	Auriculariaceae	Baneswore	1290		Stump
24507	22.05.2004	*Coprinus atramentarius*		Coprinaceae	Baneswore	1290	Edible	Stump
24508	24.05.2004	*Panellus sp.*		Pleurotaceae	Kirtipur	1320		Stump
24509	24.05.2004	*Bolbitus sp.*		Bolbitaceae	Kirtipur	1320		Stump
24510	24.05.2004	*Coprinus friesii*		Coprinaceae	Baneswore	1290		Stump
24511	25.05.2004	*Hypoxylon sp.*		Xylariaceae	Baneswore	1290		Stump
24512	29.05.2004	*Pholiota sp.*		Stropharaceae	Pulchowk	1250		Stump (Populos)
24513	10.06.2004	*Agaricus praeclaresquamosus*		Agaricaceae	Kirtipur	1320		Soil
24515	13.06.2004	*Armillaria mellea*	Pahelo	Tricholomataceae	Godavari	1450	Edible	Stump
24516	13.06.2004	*Pholiota sp.*		Stropharaceae	Godavari	1450		Soil
24517	13.06.2004	*Pholiota sp.*		Stropharaceae	Godavari	1450		Soil
24518	13.06.2004	*Chroogomphus sp.*		Gomphidiaceae	Godavari	1450		Soil
24519	13.06.2004	*Chroogomphus sp.*		Gomphidiaceae	Godavari	1450		Soil
24520	13.06.2004	*Stereum hirsutum*		Stereaceae	Godavari	1450		Stump
24521	13.06.2004	*Lycoperdon pyriforme*		Lycoperdaceae	Godavari	1460		Decayed wood
24522	13.06.2004	*Lycoperdon aerolatum*	Dalley	Lycoperdaceae	Godavari	1460		Soil
24524	13.06.2004	*Clitocybe sp.*		Tricholomataceae	Godavari	1450		Soil
24525	13.06.2004	*Gyroporus castaneus*		Boletaceae	Godavari	1450		Soil
24526	13.06.2004	*Laccaria laccata*	Budi, Jhari	Tricholomataceae	Godavari	1460	Edible	Soil
24527	13.06.2004	*Xylaria sp.*		Xylariaceae	Godavari	1450		Stump
24528	13.06.2004	*Pleurotus sp.*	Kanney	Pleurotaceae	Godavari	1450	Edible	Stump
24529	13.06.2004	*Leucoprinus fragilissimus*		Agaricaceae	Godavari	1460		Soil
24530	13.06.2004	*Ramaria botrytis*	Kauli	Ramariaceae	Godavari	1460	Edible	Soil
24531	13.06.2004	*Russula sp.*		Rusullaceae	Godavari	1450		Soil
24533	15.06.2004	*Tricholopsis sp.*		Tricholomataceae	Baneswore	1290		Soil

24534	17.06.2004	*Marasmius purproteus*		Marasmiaceae	Kirtipur	1320		Soil
24535	20.06.2004	*Hygrocybe conica*		Hygrophoraceae	Kirtipur	1320		Soil
24536	21.06.2004	*Agaricus campestris*	Gobrey	Agaricaceae	Kirtipur	1310	Edible	Soil
24538	22.06.2004	*Trichaptum abietinum*		Polyporaceae	Baneswore	1290		Stump
24539	25.06.2004	*Gymnosporangium clavariae - forme*		Clavariaceae	Langtang	3880		Soil
24540	25.06.2004	*Cup fungi*		Ascomycotina	Langtang	3880		Branch (Juniper)
24541	25.06.2004	*Laetiporous sulphurues*	Phenji thenga	Polyporaceae	Lantang (khaad khola)	3250	Edible	Stump
24542	25.06.2004	*Scleroderma sp.*		Sclerodermataceae	Langtang	2200		Soil
24543	25.06.2004	*Pycnoporus cinnabarinus*	Sindurey	Polyporaceae	Langtang	3250	Medicinal	
24544	25.06.2005	*Schizophyllum commune*	Mizu	Schizophyllaceae	Langtang	2200	religious	
24545	28.06.2004	*Tylopilus fumosipes*		Boletaceae	Sundarijal	1550		Soil
24546	28.06.2004	*Boletellus emodensis*		Boletaceae	Sundarijal	1575		Soil
24548	28.06.2004	*Russula aurora*	Raktey	Rusullaceae	Sundarijal	1550	Edible	Soil
24549	28.06.2004	*Boletus sp.*		Boletaceae	Sundarijal	1450		Soil
24550	28.06.2004	*Gyrodon lividus*		Gyrodontaceae	Sundarijal	1450		Soil
24551	28.06.2004	*Lepiota sp.*		Agaricaceae	Sundarijal	1450		Soil
24552	28.06.2004	*Boletus sp.*		Boletaceae	Sundarijal	1550		Soil
24553	28.06.2004	*Russula sp.*		Rusullaceae	Sundarijal	1550		Soil
24555	28.06.2004	*Russula sp.*		Rusullaceae	Sundarijal	1550		Soil
24556	28.06.2004	*Boletus sp.*		Boletaceae	Sundarijal	1550		Soil
24557	28.06.2004	*Xerocomus sp.*		Boletaceae	Sundarijal	1550		Soil
24558	28.06.2004	*Boletus sp.*		Boletaceae	Sundarijal	1550		Soil
24560	28.06.2004	*Mycena sp.*		Marasmiaceae	Sundarijal	1550		Soil
24561	28.06.2004	*Russula sp.*		Rusullaceae	Sundarijal	1550		Soil
24562	28.06.2004	*Boletus sp.*		Boletaceae	Sundarijal	1550		Soil
24563	28.06.2004	*Boletus sp.*		Boletaceae	Sundarijal	1550		Soil
24565	04.07.2004	*Lepiota acutesquamosa*		Agaricaceae	Baneswore	1290		Soil
24568	17.07.2004	*Russula sanguinea*	Raktey	Rusullaceae	Tistung Palung	1820	Edible	Soil
24569	17.07.2004	*Pleurotus rnucopiae.*	Kanney	Pleurotaceae	Tistung Palung	1820	Edible	Soil
24570	17.07.2004	*Lactarius volemus*	Dudhey	Rusullaceae	Tistung Palung	1820	Edible	Soil
24571	17.07.2004	*Lactarius Sp.*	Huduley dangey	Rusullaceae	Tistung Palung	1820	Edible	Soil
24572	17.07.2004	*Marasmius maximum*	Budi	Marasmiaceae	Tistung Palung	1820	Edible	Soil
24573	17.07.2004	*Lactarius sp.*	Pahelo	Rusullaceae	Tistung Palung	1820	Edible	Soil

24574	20.07.2004	*Agaricus sp.*		Agaricaceae	Kirtipur	1310		Soil
24575	09.07.2004	*Polyporus gramocephalus*		Polyporaceae	Baneswore	1290		Bamboo log
24576	09.07.2004	*Omphalotos olearius*		Paxillaceae	Baneswore	1290		Bamboo log
24577	12.07.2004	*Xerocomus sp.*		Boletaceae	Kirtipur	1310		Soil
24578	10.08.2004	*Pleurotus sp.*	Kanney	Pleurotaceae	Baneswore	1290		Stump
24579	10.08.2004	*Coriolus hirsutus*		Coriolaceae	Baneswore	1290	Medicinal	Dead stump
24580	10.08.2004	*Coprinus dissemanatus*	Masiney	Coprinaceae	Baneswore	1290		Stump
24582	15.08.2004	*Clavaria fusiformis*		Clavariaceae	Matatirtha	1450		Soil
24583	15.08.2004	*Clavaria vermicularis*		Clavariaceae	Matatirtha	1450		Soil
24584	15.08.2004	*Clavaria rosea*		Clavariaceae	Matatirtha	1450		Soil
24585	15.08.2004	*Boletus sp.*		Boletaceae	Matatirtha	1450		Soil
24586	15.08.2004	*Gyropus sp*		Boletaceae	Matatirtha	1450		Soil
24587	15.08.2004	*Boletus sp.*		Boletaceae	Matatirtha	1450		Soil
24588	15.08.2004	*Tylopilus nigerrimus*		Boletaceae	Matatirtha	1460		Soil
24589	15.08.2004	*Russula sp.*		Rusullaceae	Matatirtha	1460		Soil
24590	15.08.2004	*Agaricus placomyces*		Agaricaceae	Matatirtha	1400	Inedible	Soil
24591	15.08.2004	*Stereum hirsutum*		Stereaceae	Matatirtha	1475		Tree trunk
24592	15.08.2004	*Boletus sp.*		Boletaceae	Matatirtha	1475		Soil
24593	15.08.2004	*Lactarius lignyotis*	Dudhey	Rusullaceae	Matatirtha	1475		Soil
24594	15.08.2004	*Hygrophorus coccinepora*		Tricholomataceae	Matatirtha	1470		Soil
24595	15.08.2004	*Russula aurora*	Raktey	Rusullaceae	Matatirtha	1470	Edible	Soil
24596	15.08.2004	*Astroboletus*		Boletaceae	Matatirtha	1460		Soil
24598	15.08.2004	*Laccaria laccata*	Budi, Jhari	Tricholomataceae	Matatirtha	1460	Edible	Soil
24599	15.08.2004	*Amanita sp.*		Amanitaceae	Matatirtha	1425		Soil
24600	15.08.2004	*Russula sp.*		Rusullaceae	Matatirtha	1425		Soil
24601	15.08.2004	*Russula aurora*	Raktey	Rusullaceae	Matatirtha	1425		Soil
24602	15.08.2004	*Strobilomyces mirandus*		strobilomycetaceae	Matatirtha	1425		Soil
24603	15.08.2004	*Russula delica var. dobremezii*	Chaatey	Rusullaceae	Matatirtha	1425		Soil
24604	15.08.2004	*Russula sp.*		Rusullaceae	Matatirtha	1425		Soil
24605	15.08.2004	*Russula cyanoxantha*	Bhatmaas	Rusullaceae	Matatirtha	1430		Soil
24606	15.08.2004	*Cantharellus subcibarius*	Pahelo, Soli	Cantharellaceae	Matatirtha	1430	Edible	Soil
24607	15.08.2004	*Kobasya nipponica*		Protophallaceae	Matatirtha	1430		Soil
24609	15.08.2004	*Amanita vaginata*		Amanitaceae	Matatirtha	1425	Edible	Soil
24611	15.08.2004	*Coltricia perennis*		Hymenochaetaceae	Matatirtha	1425		Soil

24612	15.08.2004	*Lycoperdon sp.*		Lycoperdaceae	Matatirtha	1425		Soil
24613	11.09.2004	*Amanita sp.*		Amanitaceae	Suryabinayak	1400		Soil
24614	11.09.2004	*Mycena sp.*		Marasmiaceae	Suryabinayak	1400		Soil
24615	11.09.2004	*Russula frailis*		Rusullaceae	Suryabinayak	1400	Poisonous	Soil
24616	11.09.2004	*Russula emetica*		Rusullaceae	Suryabinayak	1400	Poisonous	Soil
24617	11.09.2004	*Oudimansiella radicata*		Dermolomataceae	Suryabinayak	1425	Edible	Soil
24618	11.09.2004	*Laccaria Proxima*	Budi, Jhari	Tricholomataceae	Suryabinayak	1425	Edible	Soil
24619	11.09.2004	*Laccaria amethystina*	Budi, Jhari	Tricholomataceae	Suryabinayak	1425	Edible	Soil
24620	11.09.2004	*Laccaria laccata*	Budi, Jhari	Tricholomataceae	Suryabinayak	1440	Edible	Soil
24621	11.09.2004	*Boletus radicans*		Boletaceae	Suryabinayak	1440		Soil
24622	11.09.2004	*Hydnellum concrescens*		Hydnaceae	Suryabinayak	1450		Soil
24625	11.09.2004	*Entoloma hirsitipes*		Cortinariaceae	Suryabinayak	1450		Soil
24626	11.09.2004	*Amanita vaginata*		Amanitaceae	Suryabinayak	1450	Edible	Soil
24627	11.09.2004	*Gyroporus atroviolaceus*		Boletaceae	Suryabinayak	1450		Soil
24628	11.09.2004	*Russula aurora*		Rusullaceae	Suryabinayak	1450		Soil
24629	11.09.2004	*Volvariella pusilla*		Pluteaceae	Suryabinayak	1450		Soil
24630	11.09.2004	*Cantharellus subcibarius*	Pahelo, Soli	Cantharellaceae	Suryabinayak	1675	Edible	Soil
24631	11.09.2004	*Scleroderma verrucosum*	Dalley	Sclerodermataceae	Suryabinayak	1675	Edible	Soil
24632	11.09.2004	*Boletus sp.*		Boletaceae	Suryabinayak	1675		Soil
24633	11.09.2004	*Boletus sp.*		Boletaceae	Suryabinayak	1675		Soil
24634	11.09.2004	*Marasmius sp.*		Marasmiaceae	Suryabinayak	1650		Soil
24635	11.09.2004	*Amanita echinocephala*		Amanitaceae	Suryabinayak	1650		Soil
24636	11.09.2004	*Auricularia polytricha*	Kaney	Auriculariaceae	Suryabinayak	1650		Stump (Alnus)
24637	15.09.2004	*Volvariella bombycina*	Chaate	pluteaceae	Kirtipur	1320	Edible	Stump
24638	15.09.2004	*Lentinus sp.*		Pleurotaceae	Kirtipur	1320		Stump
24639	15.09.2004	*Coprinus dissemanatus*	Masiney	Coprinaceae	Baneswore	1290		Stump
24640	15.09.2004	*Guepenia spathularia*		Tremellaceae	Kirtipur	1320		Stump
25641	05.03.2005	*Schizophyllum commune*	Pankey	Schizophyllaceae	Nagarkot	1800	Medicinal	Stump
25642	30.04.2005	*Lycoperdon sp.*		Lycoperdaceae	Baneswore	1290		Soil
25643	30.04.2005	*Vasculum prantae*		Lycoperdaceae	Baneswore	1290		Soil
25644	01.06.2005	*Ganoderma applantum*		Ganodermataceae	Kirtipur	1320	Medicinal	Stump
25645	04.06.2005	*Coriolus hirsutus*	Rekhi	Polyporaceae	Langtang,Thulo barku	2030	Edible	Decayed log

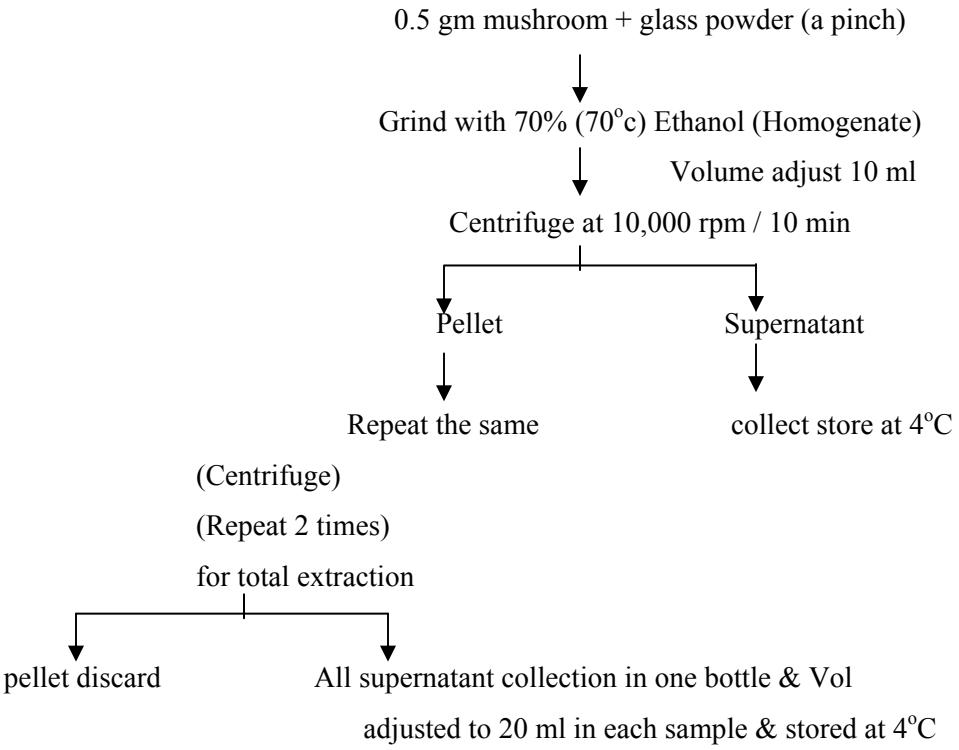
25646	04.06.2005	*Polyporus Xerantinus*		Polyporaceae	Langtang,Thulo barku	2220		Stump
25647	04.06.2005	*Trametes versicolar*	Rekhi	Polyporaceae	Langtang, Barbal	2280	Medicinal	Stump
25648	04.06.2005	*Phellinus sp.*		Phellinaceae	Langtang, Barbal	2280		Decayed log
25649	04.06.2005	*Stereum sp.*		Stereaceae	Langtang, Barbal	2300		Decayed log
25650	05.06.2005	*Ganoderma applantum*	Kathey	Ganodermataceae	Langtang, Lama hotel	2500	Medicinal	Stump
25651	05.06.2005	*Mycena sp.*		Marasmiaceae	Langtang, Lama hotel	2550	Edible	Decayed log
25652	06.06.2005	*Lycoperdon mammeneforme*		Lycoperdaceae	Langtang, Gumna chowk	2850	Poisonous	Soil
25653	07.06.2005	*Hypholoma copsonoides*	Siltu shyamo	Stropharaceae	Langtang, Gumna chowk	2835	Edible	Stump
25654	07.06.2005	*Marasmius sp.*	Karpu shyamu	Marasmiaceae	Langtang, Gumna chowk	2800	Edible	Decayed wood
25655	07.06.2005	*Coltricia cinnamomea*		Hymenochaetaceae	Langtang, Gumna chowk	2770	Edible	Soil
25656	07.06.2005	*Coriolus hirsutus*		Polyporaceae	Langtang, Ghoda tabela	3000	Edible	Decayed log
25657	07.06.2005	*Innonotus sp.*		Polyporaceae	Langtang, Ghoda tabela	3000		Decayed log
25658	07.06.2005	*Russula sp.*		Rusullaceae	Langtang, Ghoda tabela	2800		Soil
25659	07.06.2005	*Coriolus sp.*	Teku shyamo	Polyporaceae	Langtang, Ghoda tabela	2800	Edible	Stump (Acer)
25660	07.06.2005	*Lenzites betulinus*		Polyporaceae	Langtang, Ghoda tabela	3000		Decayed wood
25661	08.06.2005	*Argaricus augustus*	Chhatey	Agaricaceae	Langtang, Ghoda tabela	2940	Edible	Soil
25663	08.06.2005	*Ganoderma sp.*	Kathey	Ganodermataceae	Langtang, Ghoda tabela	2870		stump
25664	08.06.2005	*Coprinus sp.*		Coprinaceae	Langtang, Ghoda tabela	2800		Soil
25665	09.06.2005	*Trametes versicolar*		Polyporaceae	Langtang,Rimche	2400		Stump
25666	09.06.2005	*Cordyceps sinensis*	Yarsa gumba	Clavicipataceae	Langtang, Kyangin	4300	Medicinal	insect body
25668	05.07.2005	*Coprinus sp.*		Coprinaceae	Kritipur	1320		Soil
25669	05.07.2006	*Russula sp.*		Rusullaceae	Kirtipur	1320		
25670	05.07.2005	*Lactarius volemus*	Dudhey	Rusullaceae	Kritipur	1320		Soil
25671	18.07.2005	*Clitocybe Olearia*		Tricholomataceae	Kritipur	1320		Soil
25672	15.07.2005	*Coprinus sp.*		Coprinaceae	Kalanki	1350	Edible	Makai Bari
25673	18.07.2005	*Amanita vaginata*		Amanitaceae	Kritipur	1320		Soil
25674	21.07.2005	*Amanita virosa*		Amanitaceae	Kritipur	1320		Soil
25675	23.08.2005	*Lactarius detrimus*	Dudhey	Rusullaceae	Dakchinkali	1400	Inedible	Soil

25676	23.08.2005	*Helvella atra*		Pezizaceae	Dakchinkali	1400		Soil
25677	23.08.2005	*Fomes sp.*		Fomitopsidaceae	Dakchinkali	1400		Stump
25678	23.08.2005	*Ganoderma sp.*		Ganodermataceae	Dakchinkali	1400		Stump
25679	23.08.2005	*Hexagonium sp.*		Polyporaceae	Dakchinkali	1400		Stump
25680	23.08.2005	*Cantharellus lateritius*	Besarey	Cantharellaceae	Dakchinkali	1425	edible	Soil
25681	23.08.2005	*Russula virescens*	Dhidey	Rusullaceae	Dakchinkali	1440	Edible	Soil
25682	23.08.2005	*Lactarius volemus*	Dudhey	Rusullaceae	Dakchinkali	1450	Edible	Soil
25683	23.08.2005	*Laccaria laccata*	Budi, Jhari	tricholomataceae	Dakchinkali	1450	Edible	Soil
25684	25.08.2005	*Leucoprinas brinbaumii*		Agaricaceae	Baneshore	1290		Stump base (Juniper)

Appendix-XIV

Flow sheets for Chemical Analysis

Flow sheet for the determination of free amino acids



Quantitation by Colorimetric method

Control (blank) - 0.5 ml 70% Ethanol + 0.5 ml dH_2O + 2ml Ninhydrin

Standard - 1 ml Glycine + 2 ml Ninhydrin

Test Sample - 0.5 ml Extract + 0.5 ml dH_2O+ 2 ml Ninhydrin

In all cases, Vol. 3 ml incubate 10 min in 90°c water bath or incubate for 10 min for color development and read the optical density against blank at 560 nm.

Flow sheet for the Micro Kjeldahl Method

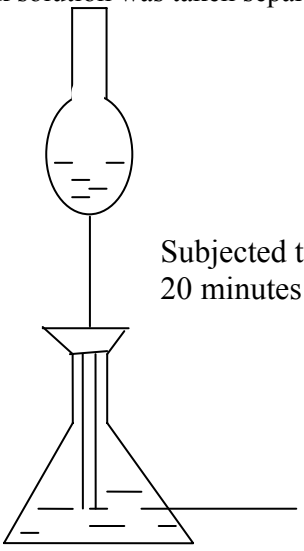
0.5gm sample +0.2 gm $CuSO_4 5H_2O$ + 0.1gm K_2SO_4 +10ml conc H_2SO_4
(Volumetric flask)

↓ Digestion -3 to 4 hr until clear supernatant seen.

After digestion, vol. was made 50ml by adding d.H_2O
This is the stock solution.

↓

10 ml of each stock solution was taken separately in different flask and added 16 ml of 40% NaOH



Subjected to distillate 10-20 minutes

In distillate flask already added 10 ml of 2% Boric acid.

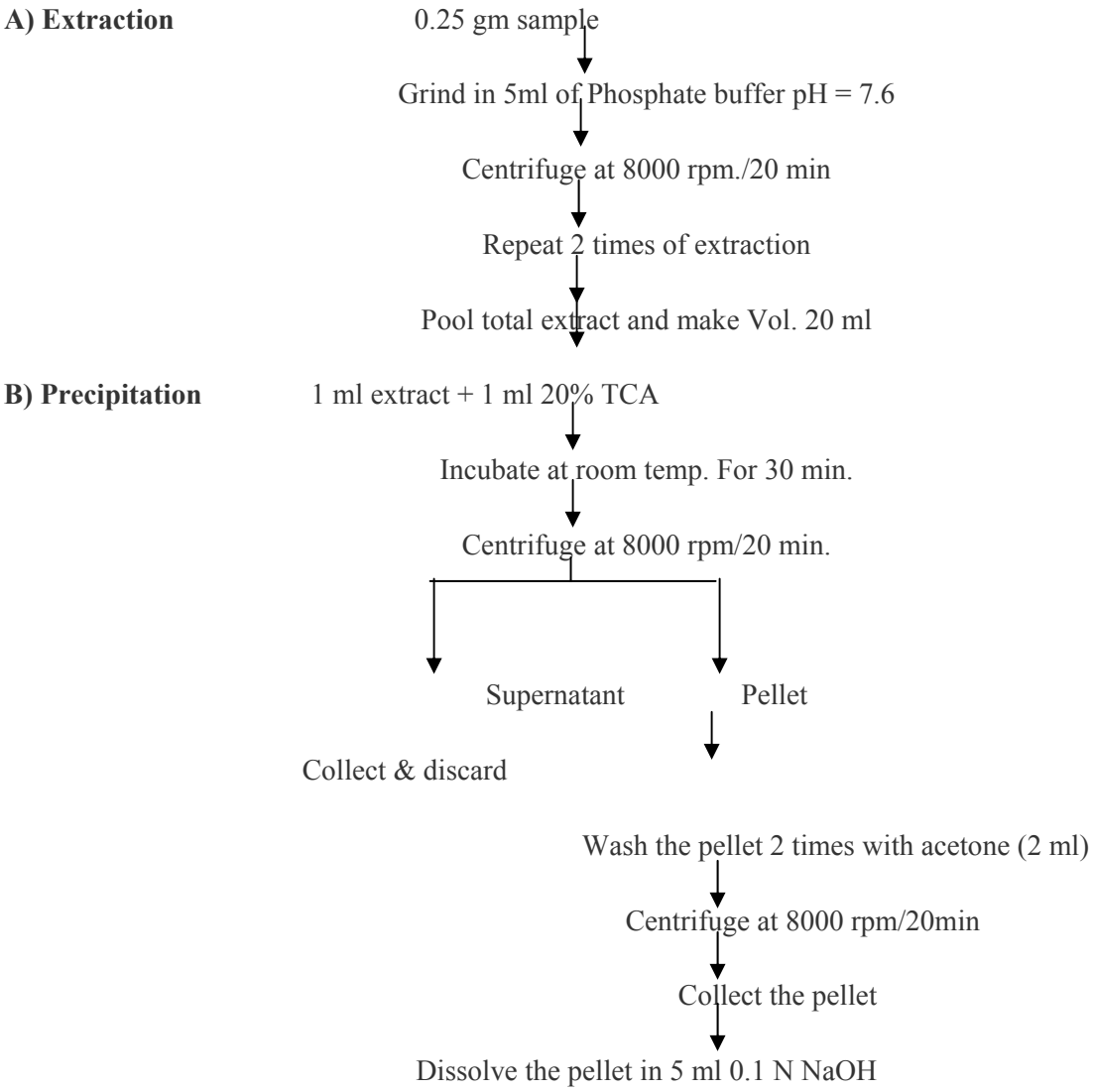
During distillation, NH_3 evolved & reacts & PH change & color change from reddish to greenish.

After distillation, volume increased & color change from reddish to greenish.

The flask is taken out & subjected to titrate.

After titration by measuring the vol of 0.01 Hcl consumed , we can calculate the % of protein presence in the sample.

Flow sheet for the determination of soluble protein by Lowry method



C) Quantitation through Colorimetric method

Control – 1 ml distilled water + 5ml alkaline copper sulphate

Standard- 1ml BSA + 5 ml alkaline copper sulphate

Test sample: 1ml of sample + 5 ml alkaline copper sulphate

Appendix XV

List of Edible Mushroom from Nepal.

S.N.	Scientific Name
	Agaricus bisporus (Lange) Imbach.
1	*A. bitorquis* (Quel.) Sacc.
2	• *A. campestris* L. : Fr.
3	*A. silvicola* (Vitt.) Peck.
4	*A. subrufescens* (Peck.) Hobson & Stuntz
5	*Aleuria aurantia* (Fr.) Fuck.
6	•*Amanita caesarea* (Scop. : Fr.) Pers.
7	•*A. hemibapha* (Berk. & Br.) Sacc.
8	*A. rubescens* (Pers. :) S. F. Gray
9	•*Armillaria mellea* (Vahl. : Fr.) Kummer.
10	*A. tabescens* (Scop. : Fr.) Em.
11	*Astraeus hygrometricus* (Pers. : Pers.) Morgan
12	•*Auricularia auricula-judae* (Bull. : Fr.) Wettst
13	•*A. delicata* (Fr.) Henn. Apud Bres.
14	•*A. mesenterica* (Dicks. : Fr.) Pers.
15	•*A. polytricha* (Mont.) Sacc.
16	•*Boletus edulis* Bull. : Fr.
17	*Bondarzewia berkeleyi* (Fr.) Bond & Singh.
18	*B. montana* (Quel.) Singer
19	*Bovista plumbea* Pers.
20	• *Bjerkandera adusta* (Fr.) Karst.
21	*Calvatia gigantea* (Batsh. Ex Pers.) Lloyd
22	•*Cantharellus cibarius* (Fr. : Fr.) Fr.
23	*C. leucocomus* Bigelow
24	*C. odoratus* (Scw. : Fr.) Fr.
25	*C. subalbidus* Smith & Morse
26	•*C. subcibarius* Corner
27	•*C. tubiformis* Fr.
28	*Clitocybe diatreta* (Fr. : Fr.) Kummer
29	*C. gibba* (Pers. : Fr.) Kummer
30	•*Cordyceps sinensis* (Berk.) Sacc.
31	*Craterellus cornucopioides* (L. : Fr.) Pers.
32	*C. cornucopioides* var. *Mediosporus*
33	•*Clavaria acuta* Sch. :Fr.
34	•*C. vermicularis* Swartz : Fr.
35	*Clavulinopsis fusiformis* (Sow. : Fr.) Corner
36	*Clavulina cinerea* (Bull. :Fr.) Schroet.
37	*C. cristata* (Fr.) Schroet.
38	*Collybia butyracea* (Bull. : Fr.) Kummer
39	*Conocybe lactea* (Lange) Metrod
40	*C. tenera* (Schaeff. Ex Fr.) Fayod
41	•*Coprinus comatus* (Mull. : Fr.) Pers.
42	*Craterellus cornucopioides* (L. : Fr.) Pers
43	*Dacrymyces palmatus* (Schw.) Burt.
44	*Entoloma subcostatus* Atkinson
45	*Exobasidium butleri* P. & H. Sydow
46	*Favolus canadensis* Klotzsch.
47	•*Fistulina hepatica* (Schaeff.) Fr.
48	*Flammulina velutipes* (Curt. : Fr.) Karst.
49	*Gomphus clavatus* (Pers. : Fr.) S. F. Gray
50	*G. floccosus* (Schw.) Singer
51	•*Grifola frondosa* (Dick. & Fr.) S. F. Gray
52	•*Helvella crispa* (Scop. : Fr.) Fr.

53 •*H. elastica* Bull. : Fr.

54 *Hericium clathroides* (Pall. : Fr.) Pers.

55 •*H. erinaceus* (Bull. : Fr.) Pers.

56 *H. flagellum* (Scop) Pers.

57 *Hydnellum concresecns* (Pers.) Banker

58 *H. velutinum* (Bohm. : Fr.) Karst.

59 *Hydnum imbricatus* L. : Fr.

60 •*H. repandum* L. : Fr.

61 *Hygrocybe conica* (Scop. : Fr.) Kummer

62 *H. nigrescens* (Quel.) Kuhn.

63 *H. miniata* (Fr. : Fr.) Kummer

64 *Hygrophorus eburneus* (Bull. : Fr.) Fr.

65 •*Laccaria amethystina* (Huds.) Cooke

66 •*L. laccata* (Scop. : Fr.) Cooke

67 *Lactarius controversus* (Pers. : Fr.) Fr.

68 •*L. deliciosus* (L. : Fr.) S. F. Gray

69 *L. deceptivus* P.K.

70 *L. indigo* (Schew.) Fr.

71 •*L. lignyotus* Fr.

72 •*L. piperatus* (Fr.) S. F. Gray

73 *L. subdulcis* (Fr.) S.F. Gray

74 •*L. subpiperatus* Hongo

75 •*L. volemus* (Fr.) Fr.

76 *L. thakalorum* Bills & Cotter

77 *Laetiporus sulphureus* (Fr.) Murr.

78 *Lentaria macrospora* Corner

79 •*Lentinellus ursinus* (Fr.) Kuhner

80 *Lentinus badius* (Berk.) Ber.

81 *L. conchatus* (Bull. : Fr.) Schr.

82 *L. polychrous* Lev.

83 *L. sajor-caju* (Rumph. : Fr.) Fr.

84 *L. strigosus* (Schw.) Fr.

85 *L. tigrinus* (Bull. : Fr.) Fr.

86 *L. tuber-regium* (Fr. : Fr.) Fr.

87 *L. velutinus* Fr.

88 *Lentinula edodes* (Berk.) Pegler

89 •*Lycoperdon perlatum* Pers. : Pers.

90 •*L. pyriforme* Schaeff. Ex Pers.

91 *Macrolepiota procera* (Scop. : Fr.) Singer

92 •*Marasmius oreades* (Bolt. : Fr.) Fr.

93 *Meripilus giganteus* (Fr.) Karst.

94 *Microporus affinis* (Blume & Nees)Kuntze

95 *M. xathopus* (Fr.) Kuntze

96 *M. venicipes* (Berk.) Kunt.

97 *Morchella angusticeps* Peck.

98 •*M. conica* Pers.

99 *M. deliciosa* Fr.

100 *M. elata* Fr.

101 •*M. esculenta* L. : Fr.

102 *M. smithiana* Cooke

103 *M. vulgaris* (Pers.) Boud.

104 •*Oudimansiella radicata* (Rehl. : Fr.) Singer

105 *Omphalina* sp.

106 *Peziza repanda* Pers.

107 *P. vesiculosa* Bull.

108 *Pholiota aurivella* (Batsch. : Fr.) Kummer

109 *P. gummosa* (Lasch. : Fr.) Singer

110 *P. nameko* (Ito) Ito & Imai

111 *P. squarrosa* (Mull. : Fr.) Kummer

112 *Phyllopporus rhodoxanthus* (Schw.) Bres.

113 *Pleurotus circinatus* Fr.

114 •*P. cornucopiae* (Paul.) Rolland

115 *P. dryinus* (Pers. : Fr.) Kummer

116 *P. nepalensis* Corner

117 *P. ostreatus* (Jacq. : Fr.) Kummer

118 •*P. ostreatus* var. *magnificus* Peck.
119 *Pluteus cervinus* (Sch. : Fr.) Kummer
120 *Polyporellus brumalis* (Fr.) Karst.
121 •*Polyporus arcularius Fr.*
122 *P. arcularius* Fr. var. *arcularius* Pilat
123 *P. arcularius* Fr. var. *strigosus* Bourd. &Galz.
124 *P. badius* (S. F. Gray) Schw.
125 *P. durus* (Timm.) Kreisel
126 *P. nepalensis* Berk.
127 *P. squamosus* Michel. : Fr.
128 *P. varies* Fr.
129 *Psathyrella piluliformis* (Bull. : Fr.) Orton
130 *Ramaria aurea* (Sch.) Quel.
131 •*R. botrytis* (Pers. : Fr.) Ricken
132 *R. botrytoides* (Peck.) Corner
133 *R. flaccida* (Fr. : Fr.) Ricken
134 •*R. flava* (Sch. : Fr.) Quel.
135 •*R. formosa* (pers. : Fr.) Quel.
136 *Rhizopogon luteolus* Fr. & Nordholm
137 *R. roseolus* (Corda) Fr.
138 *Russula adusta* (Pers. : Fr.) Fr.
139 •*R. aurora* Krombh.
140 •*R. chloroides* (Krombh.) Bres.
141 *R. chloroides* (Krombh.) Bres. var.*godavariensis* Adhikari
142 *R. claroflava* Grove
143 *R. cyanoxantha* (Sch.) Fr.
144 •*R. delica* Fr.
145 *R. delica* Fr. var. *dobremezii* Adhikari
146 *R. densifolia* (Secr.) Gill.
147 *R. galochroa* (Fr.) Fr.
148 *R. heterophylla* (Fr. : Fr.) Fr.
149 *R. kathmanduensis* Adhikari
150 *R. lactea* (Pers. : Fr.) Fr.
151 •*R. nigricans* (Bull.) Fr.
152 *R. ochroleuca* (Hall.) Pers.
153 *R. puellaris* Fr.
154 •*R. sanguinaria* (Schum.) Rausch.
155 *R. undulata* Vel.
156 *R. velenovskyi* Melz. & Zvara
157 *R. vesca* Fr.
158 •*R. virescens* (Sch.) Fr.
159 *Sarcodon asparatus* (Berk.) Ito
160 *S. laevigatus* (Swartz) Karst.
161 •*Schizophyllum commun* Fr. : Fr.
162 •*Scleroderma cepa* Pers. : Pers.
163 •*S. citrinum* Pers. : Pers.
164 •*S. polyrhizum* J. F. Gmel. : Pers.
165 •*S. verrucosum* (Bull.) Pers.
166 •*Termitomyces eurhizus* (Berk.) Heim.
167 *Tremella mesenterica Retz. : Fr.*
168 *Tricholoma terreum* (Schaeff. : Fr.) Kummer
169 •*Vascellum pratense* (Pers. : Pers.) Kreisel
170 *Volvariella volvacea* (Bull. : Fr.) Singer

(Source: Bhandary, 1999; Adhikari, 2000, Devkota 2005)

• - *Mushrooms found in study areas*

Edible species added by Investigator.

1. *Agaricus augustus* Peck
2. *Cantharellus lateritius (*Berk.)
3. *Coprinus atramentarius*
4. *Coprinus micaceus* (Fr.) Fr.;
5. *Dictyophora duplicata* (Bosc) E. Fischer
6. *Gyroporus castaneus* (Fr.) Quel.,Ench,
7. *Hypholoma capnoides* (Fries) Kumm
8. *Laccaria proxima*(Boudier) Orton Singer
9. *Marasmius maximus* (Hongo)
10. *Volvariella bombycina* (Schaeff. Ex Fr.) Singer

Appendix XVI

List of Toxic mushroom from Nepal.

S.N.	Scientific Name
1	*Agaricus subrufescens* (Peck.) Hobson & Stuntz
2	*Amanita citrina* (Schaeff. : Fr.) S. F. Gray
3	*A. cokeri* (Gilb. & Kuhn.) Gilb. Ex Pilat
4	*A. muscaria* (L. : Fr.) Hook
5	*A. pantherina* (DC. : Fr.) Kromb.
6	•*A. phalloides* (Veill. : Fr.) Link.
7	*A. porphyria* (Alb. & Schw. : Fr.) Mlady
8	•*A. pseudoporphyria* Hongo
9	*A. rubrovolvata* Imai
10	*A. virosa* (Lam.) Bert.
11	*A. vittadinii* (Moretti) Vitt.
12	*Bolbitius* sp.
13	*B. vitellinus* (Pers. : Fr.) Fr.
14	*Boletus luridus* Schaeffer : Fr.
15	*Cavimalum indicum* Doi
16	*Conocybe brunneola* (Kuhn.) ex Kuhn. & Watl.
17	*Cortinarius callisteus* (Fr. : Fr.) Fr.
18	*Cortinarius* sp.
19	*Crepidotus mollis* (Fr.) Stoude
20	*Coprinus bulbillosus* Pat.
21	•*C. disseminatus* (Pers. : Fr.) Gray
22	*Clitocybe diatreta* (Fr. : Fr.) Kummer
23	*Gymnopilus spectabilis* (Fr. :Fr.) Smith
24	*Hebeloma* sp.
25	*Hygrocybe conica* (Scop. : Fr.) Kummer
26	•*H. miniata* (Fr. : Fr.)Kummer
27	*H. pseudoconica* Lange
28	*H. conia* (Scop. : Fr.) Kummer
29	*Hygrophorus camarophyllus* (Alb. & Schw. : Fr.)Fr.
30	*Hypholoma fasciculare* (Huds. : Fr.) Kummer
31	*H. udum* (Pers. : Fr.) Kuhn
32	*Inocybe rimosa* (Bull. : Fr.) Kummer
33	*Inocybe* sp.
34	*Lentinellus* sp.
35	•*Lepiota castanea* Quel
36	•*L. cristata* (Alb. & Schw.) Fr.
37	*L. erminea* (Fr. : Fr.) Gill.
38	*L. felina* (Pers. :Fr.) Karst.
39	*L. friesii* (Lasch.) Fr.
40	*Marasmius crinis-equi* Müll. Ex Kalch.
41	•*M. oreades* (Bolt. : Fr.) Fr.
42	*Mycena galericulata* (Scop. :Fr.) S.F. Gray
43	*Mycena* sp.
44	*Macrolepiota procera* (Scop. : Fr.) Singer
45	*Naematoloma* sp.
46	*Nyctalis agaricoides* (Fr. : Fr.) Bon
47	*N. parasitica* (Bull. : Fr.) Fr.
48	*Omphalina* sp.
49	*Panellus stypticus (Bull. : Fr.) Karsten*
50	*Panus* sp.
51	*Psathyrella lacrymabunda* (Bull. : Fr.) Moser
52	*P. piluliformis* (Bull. : Fr.) Orton
53	*Paneolus papilionaceus* (Bull. : Fr.) Quel.
54	*P. retrugis* (Fr.) Gillet
55	*P. rickenii* Hora
56	*Pholiota aurivella* (Batsch. : Fr.) Kummer
57	*P. gummosa* (Lasch. : Fr.) Singer
58	*Psilocybe coprophila* (Bull. : Fr.) Kummer
59	•*Ramaria flava* (Schaeff. : Fr.) Quel.
60	•*R. formosa* (Pers. : Fr.) Quel.
61	*Suillus bovinus* (Fr.) Kurtz.
62	•*S. granulatus* (L. : Fr.) Rous.
63	*S. placidus* (Bonord.) Singer
64	*S. sibiricus* (Singer) Singer
65	*Suillus* sp.
66	*S. viscidus* (L.) Rous

Sources: (Adhiikari, 2000)

•-*Mushrooms found in study areas*

Appendix XVII

List of Medicinal mushroom from Nepal.

S.N.	Scientific Name
1	•*Cordyceps sinensis* (Berk.) Sacc.
2	• *Coriolus hirsutus* (Fr.) Quel.
3	• *Daldinia concentrica* (Bull. : Fr.)
4	• *Fistulina hepatica* (Schaeff.) Fr.
5	*Fibuloporia vailantii* (Fr.) Bond & Singer
6	• *Ganoderma applanatum* (Pers.) Pat.
7	• *G. lucidum* (Fr.) Karst.
8	• *Grifola frondosa* (Dick. & Fr.) S. F. Gray
9	*Inonotus hispidus* (Fr.) Karst.
10	• *Laetiporus sulphureus* (Fr.) Murr
11	• *Lycoperdon perlatum* Pers. : Pers
12	• *Lycoperdon pyriforme* Schaeff. : Pers.
13	*Meripilus giganteus* (Fr.)Karst.
14	*Polyporellus brumalis* (Pers. : Fr.) Karst
15	*P. melanopus* (Schw. : Fr.) Fr.
16	• *Pycnoporus cinnabarinus* (Jacq. : Fr.)Karst.
17	*Scleroderma* species
18	• *Schizophyllum commune* Fr. : Fr.
19	• *Trametes versicolor* (L. Fr.) Llyod

Sources: (Adhiikari, 1988b, 1990a, 1991b, 1994, 1995a, 1996, 2000; Bhandary, 1991)

- *Mushrooms found in study areas*

Morchella species added by the researcher

Appendix XVIII

Identification Key for Field Mushroom

1. Fruiting body with stipe and cap with gills beneath

a) Spores white, cream or yellowish

1 a	lingnicolous (on wood)	2
b	terricolous (terrestrial)	12
2 a	with eccentric to lateral stipe or none	3
b	with central stipe	8
3 a	gill-edge entire	4
b	gill edge serrated or split lengthwise	6
4 a	cap fan-shaped, stipe short and thin, spores amlyoid	*Panellus*
b.	stipe large,often with several caps	5
5 a	brown, leathery, dry	*Panus*
b	gray, bluish, brown, whitish, fleshy	*pleurotus*
6 a	edge of gill split, cap grayish, tomentose (downy)	*Schizophyllum*
b	gills serrate	7
7 a	stipe eccentric, cap coarsely squamose, spores nonamyloid	*Lentinus*
b	gills stipe lateral to absent, cap smooth to hairy, spores amyloid	*Lentinellus*
8 a	not white	9
9 a	tufted, caps yellowish brown, with hairs, gills adnate to decurrent, with ring	*Armillariella*
b	tuffed, caps orange, without hairs, gills decurrent, without ring	Omphalotus
c	otherwise	10
10 a	gills notched	*Tricholomopsis*
b	otherwise	11
11 a	fruit-body small, stipe often horsehairlike, long, slender, cap convex	*Marasmius*
b	stipe thin, fragile, cap conical to bell-shaped	*Mycena*
12 a	gills adnate to decurrent	13
b	otherwise	17
13 a	flesh brittle	14
b	flesh of stipe fibrous	15
14 a	with latex (milk) `	*Lactarius*
b	without latex	*Russula*
15 a	gills crowded, thin-edged cap often funnel-shape	*Clitocybe*
b	otherwise	16

16 a	gills, distant, wedge shape, thin- edged, waxy	*Hygrophorus*
b	gills often distant, thick-edged, forked, or vein like	*Cantharellus*
17 a	with distant volva in young stage, often with ring, cap varied, gills typically free	*Amanita*
b	without volva, gills free or attached	18
18 a	with ring on stipe or veil remains	19
b	without remains of partial veil 24	
19 a	cap coarsely squamose, granular, dry	20
20 a	cap finely granular	21
b	cap coarsely squamose, fibrillose or smooth	22
21 a	fruit-bodies reddish or whitish, gills attached	*Cystoderma*
b	otherwise	*Lepiota*
22 a	gills free	*Lepiota*
b	gills attached	23
23 a	stipe with marginate bulb	*Cortinellus bulbiger*
b	stipe cylindrical, gills notched	*Tricholoma*
24 a	spores smooth nonamyloid	*Tricholoma*
b	otherwise	25
25 a	stipe thin and rubbery, often tufted, revives in water	*Marasmius*
b	stipe cartilaginous, non reviviscent, cap convex	*Collybia*
c	stipe fragile, hollow, non reviviscent, cap bell shape	*Mycena*

b) Spores pink to salmon-colored

1 a	stipe central to eccentric	2
2 a	with volva	*Volvariella*
b	without volva	3
3 a	gills free, typically on wood	*Pluteus*
b	gills attached, typically on ground	4
4 a	gills adnexed to notched	5
5 a	spores angular, pinkish salmon *Entoloma*	
b	spores smooth to minutely roughened, pinkish buff	*Clitocybe (Lepista)*

c) spores purplish brown or blackish

1 a	gills self-digesting, ie. Dissolving into a sort of ink	*Coprinus*
b	gills not self- digesting	2
2 a	gills decurrent, with glutinous vell	*Gomphidius*
b	otherwise	3
3 a	cap dry, gills free or attached	4
b	cap glutinous-viscid or tacky, gills attached	5
4 a	cap white or brown, sometimes coarsely squamose, with ring, gills free	*Agaricus*

b	with or without ring, tufted, thinner, gills attached	*Psathyrella*
5 a	often yellowish with cobweb like veil, typically tufted	*Naematoloma*
b	otherwise	7
6 a	ring or remains visible	*Stropharia*
b	without ring and / or bruising blue	*Psilocybes*

2. Fruiting body with stipe and cap with pores beneath

1 a	tubes detachable	2
	tubes not detachable	3
2 a	stipe central, typically terrestrial	*Boletus*
b	stipe lateral, liver-red on wood	*Fistulina*
3 a	on wood	4
b	terrestrial	*Polyporus*
4 a	stipe central	*Polyporus*
b	stipe lateral	5
5 a	surface crusty, shiny	*Ganoderma*
b	without crust, flesh brown	6
6 a	spores white	*Phaeolus*
b	spores yellowish	*Coltricia*

3. Fruiting body with stipe and cap with teeth beneath

1 a	stipe central	2
b	stipe lateral	3
2 a	consistency, fleshy tough or leather often bitter taste	*Hydnum, Hydnellum*
3 a	on pine cones, surface velvety	*Aurscalpium*
4 a	teeth erect and divergent all over surface, on wood	*Hericium*

4. Fruiting body with stipe and hood shaped cap

1 a	honey comb like cap	*Morchella*
	Otherwise	2
2 a	Cap smooth, saddle or cup shaped	*Helvella*
2 b	cap smooth, gelatineous with smooth base	*Leotia*

5. Fruiting body bracket shaped with pores, gills or teeth beneath or smooth, on wood

1.	a.	With gills	*Lenzites*
	b.	With teeth	2
	c.	With pores	3
2.	a..	With maze like hymenium	*Daedalea*
	b.	Otherwise	
3.	a.	Pores very large, hexagonal, surface crust like	*Hexagonia*
4.	a	Surface crust like, typically applanate, surface lacquered	*Ganoderma*
	b.	applanate to hoof shaped, flesh and pore whitish	*Fomitopsis*
	c.	hoof shaped, flesh and pore brownish	*Fomes*
	d.	hoof shaped, flesh and pores yellow brown to a orange brown	*Phellinus*
5	a	Small with slender stalk, yellowish spore	*Coltricia*

6. Fruiting body cup or saucer shaped

1.	a.	bright red, yellow, green or violet	2
2.	a.	terrestrial	4
	b.	on wood	3
3.	a.	yellow, smooth	*Bisporella*
4.	a.	reddish brown, flattered with rhizoids from lower surface	Rhizina

7. Fruiting body globose, pear or star-shaped,

1.	a	on earth or wood (epigeal)	2
	b	subterranean (Hypogeal)	3
2.	a	Gleba (spore mass) powdery at maturity	
	b.	Gleba not powdery	3
3.	a.	fruit body opens in form of a star, with globose center, with or without ostiole	*Geastrum*
	b	fruit body not opening star like	4
4	a	outer layer yellowish, thick, mature gleba blackish	*Scloroderma*
	b	external perdium with spines, sterile tissue at base	*Lycoperdon*
5	a	on wood, blackish, concentrically zoned internally	*Daldinia*

8. Fruiting body club shaped or branched(Bush like)

1 a	club shaped or slightly branched	2
b	plentifully branched	6
2 a	on wood	3
b	on other matter	4
3 a	black leathey	*Xylaria*
4 a	finely specked or with warts, on insects or hypogeal fungi	*Cordyceps*
b	terrestrial	5
5 a	yellow, smooth	*Spathularia*
b	yellow, yellowish, white	*Clavaria*
6 a	a dark brown, leathery with slightly flatterned ramification, terrestrial otherwise	*Thelepora*
7 a	on wood black leathery	*Xylaria*
	otherwise	8
8 a	markedly ramified, with flattened branches	9
b	markedly ramified with cylindrical branches	10
9 a	with porous hymenium	*Grifola*
10 a	thick branches	*Ramaria*

9. Fruiting body gelatinous, mainly on wood

1 a	with toothed hymenium and stipe	*Pseudohydrnum*
b	otherwise	2
2 a	brown yellow, circumvolute	3
3 a	yellow, on living juniper	*Gymnosporangium*
4 a	ear shaped, with violet brown hymenium	*Auricularia*

Key to genus and species

The species of marasmimus are small, often tuft, the entire fruiting body will revive and regain a fresh appearance when placed in water, spore print white, spores smooth, non amyloid, gills adanate or adnexed (notoched) …….…….*Marasmius*

Stalk glabrous often shiny blackish brown stiff, odor and taste mild……..*M. maximus*

Volvariaceae

They are salmon to pink spored gill fungi, they have free gills which are best seen in mature specimens.

Key to genera

Volva (cup) present at stalk base……..……*Volvariella*

Volva (cup) absent…….……..….*Pluteus*

Key to species

Cap dark brown to drab brown with vertical white stripes……..…….*Pluteus thomsonii*

Cap dingy yellowish, volva deep and dull white, growing on hard logs, sticks and stumps…….……..*V. bombycina*

Appendix XIX
Graphs for Mushrooms Chemical Analysis

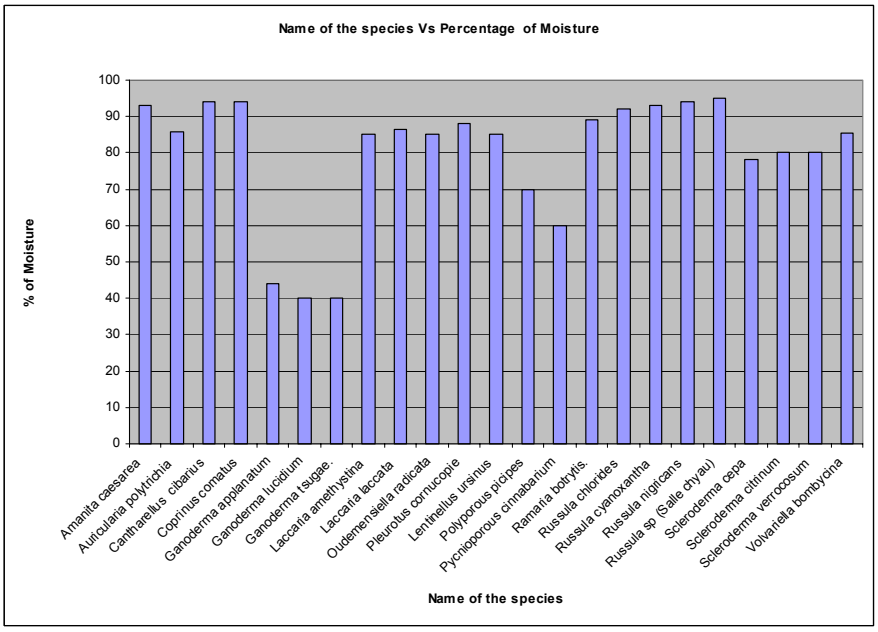


Figure XIX.1: Result of percentage of Moisture

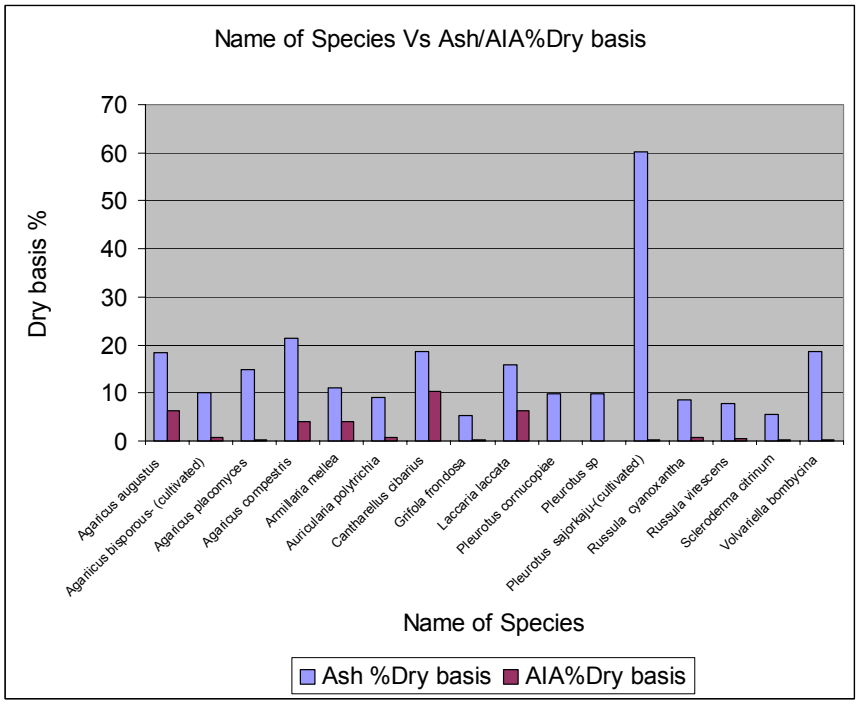


Figure XIX.2 Result of Ash and Acid in soluble ash.

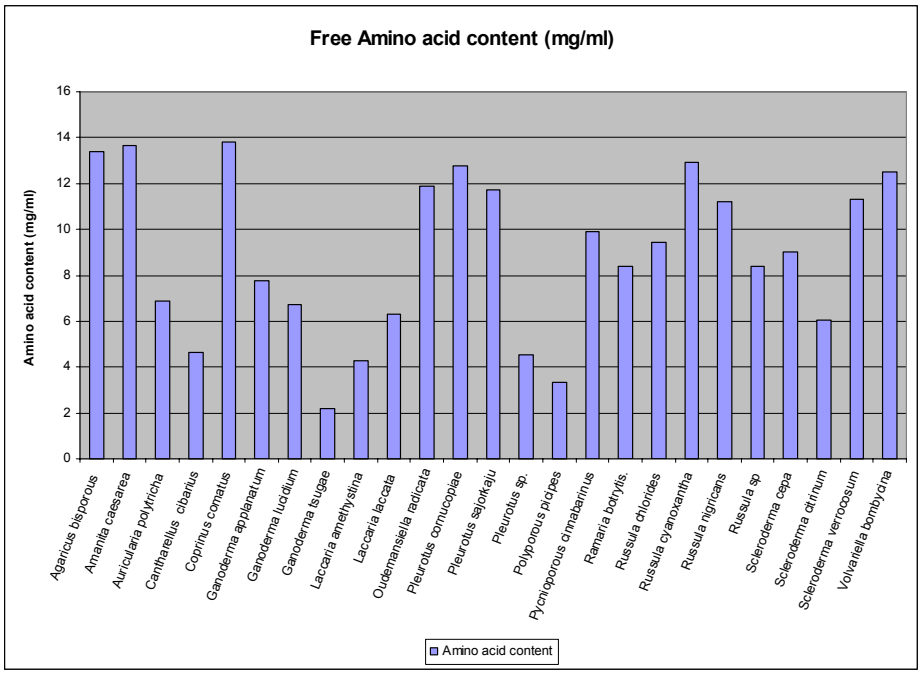


Figure XIX.4: Free amino acid content (mg/ml) of isolated mushroom sample observed through Colorimetric method

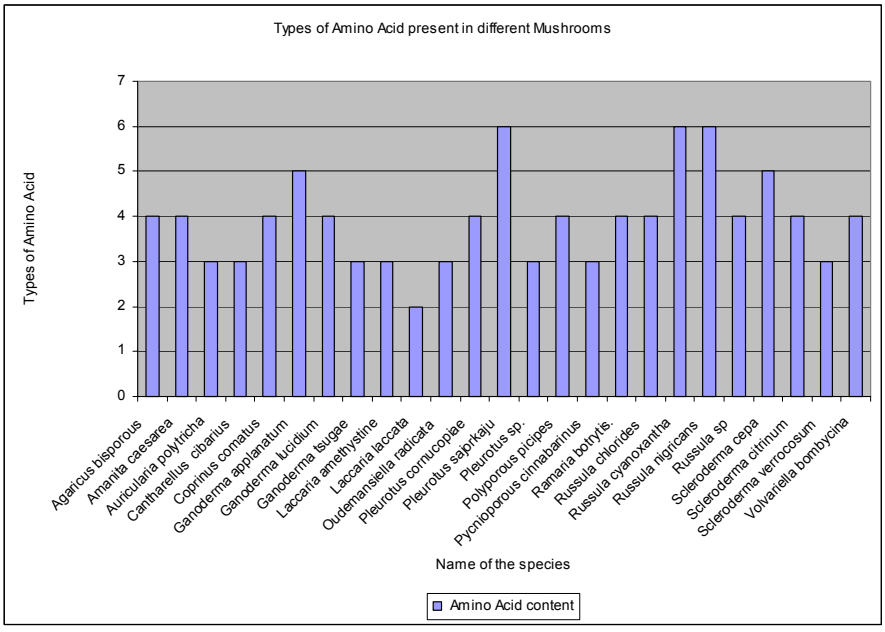
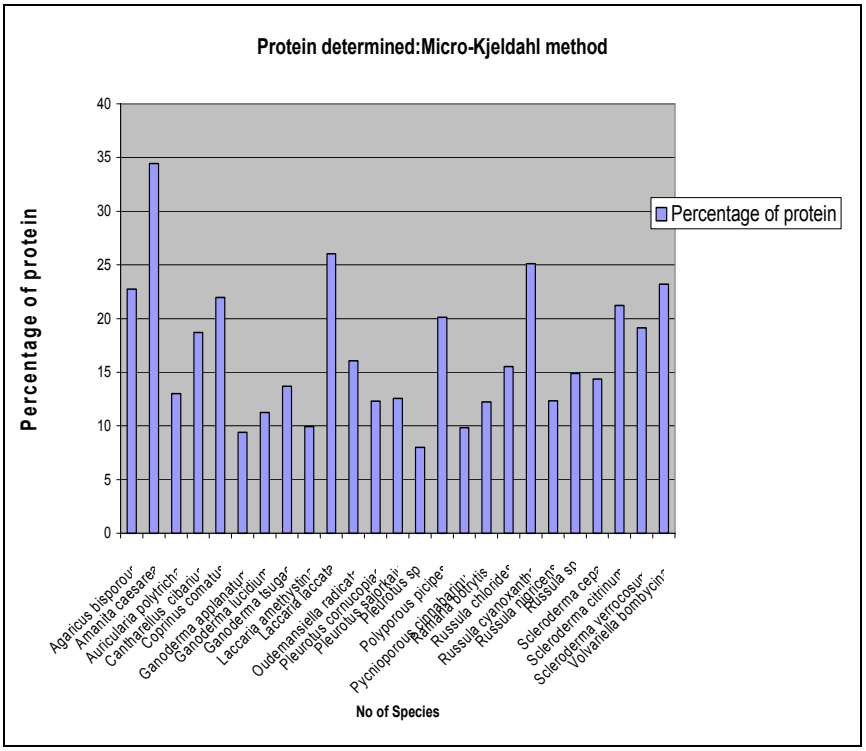


Figure XIX.5: Different types of amino acid obtain from the one dimensional paper chromatography.



Graph 5.6: Percentage of protein determined:Micro-Kjeldahl method.

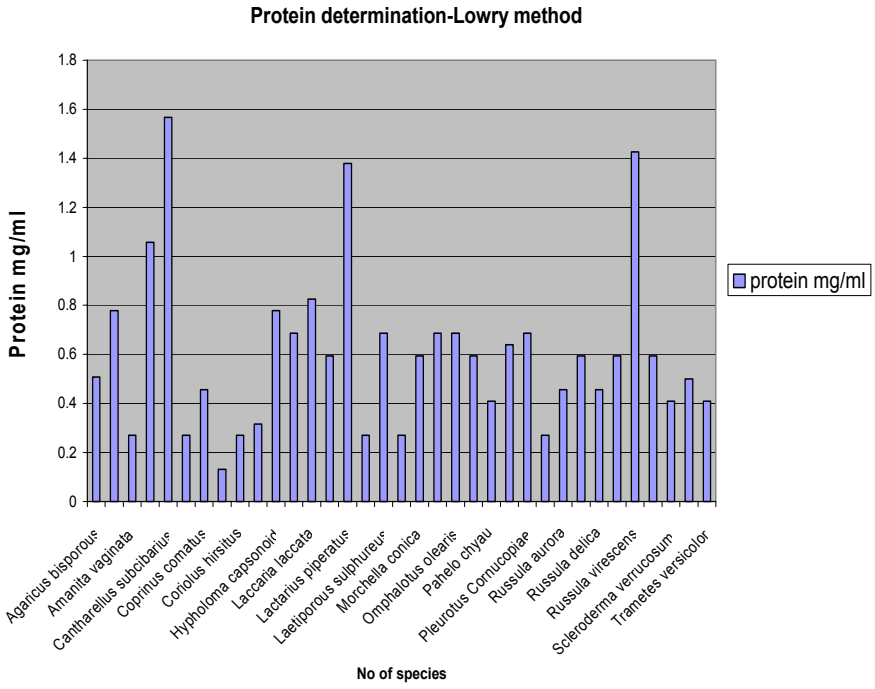
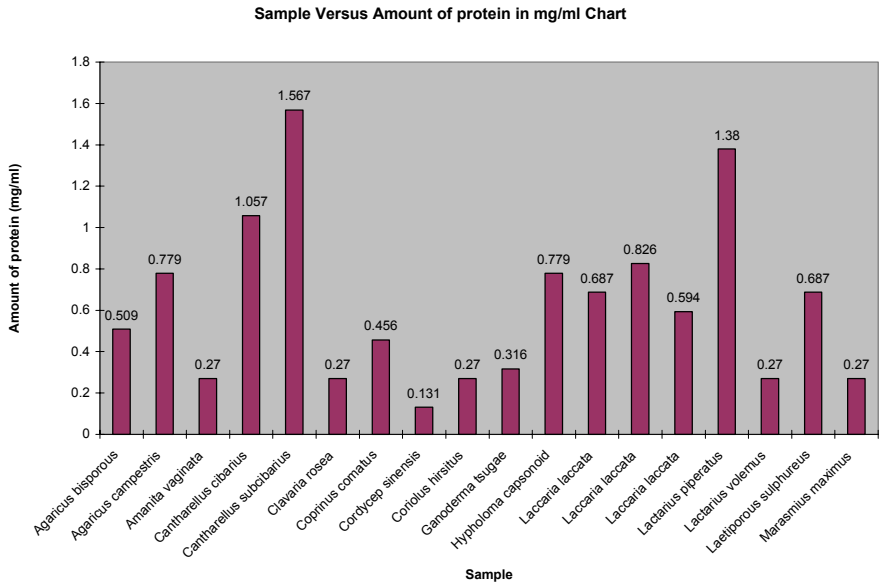
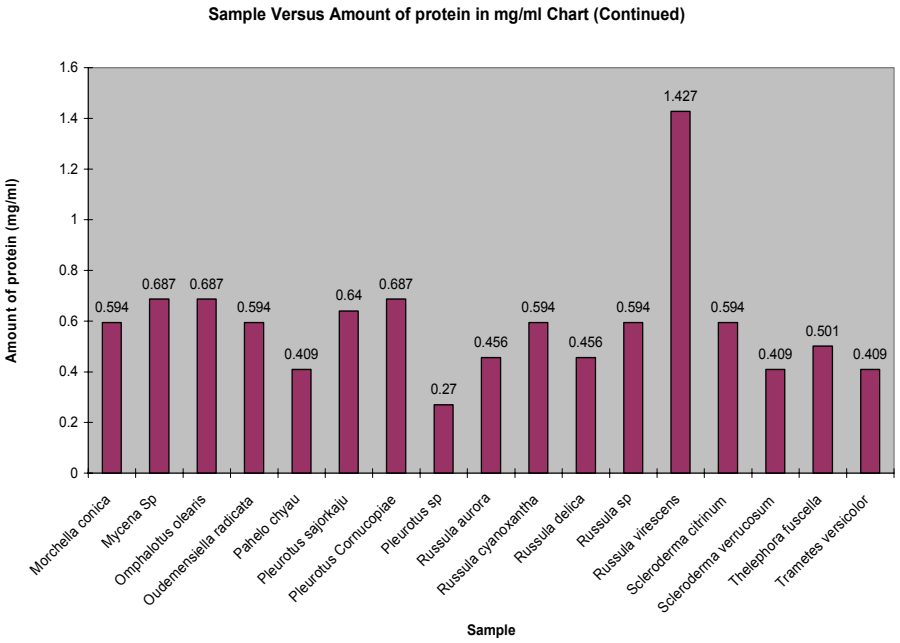


Figure XIX.7 : Calculation of protein concentration in each gram of mushroom sample



Graph 5.8 A Bradford's method result



Graph 5.8 B Bradford's method result

Appendix XX

Ethnicity / Ethnic Groups of Nepal

Ethnic groups /Caste in Nepal (% of Population)

Ethnic groups/Caste*	%	Ethnic groups/Caste*	%
Chhetri	15.8	Satar / Santhal	0.19
Brahmin (Hill)	12.74	Dhagar/ Jhagar	0.18
Magar	7.14	Bantar	0.16
Tharu	6.75	Barae	0.16
Tamang	5.64	Kahar	0.15
Newar	5.48	Gangai	0.14
Muslim	4.27	Lodha	0.11
Kami	3.94	Rajbhar	0.11
Yadav, Ahir	3.94	Thami	0.10
Rai	2.79	Dhimal	0.09
Gurung	2.39	Bhote	0.08
Damai/Dholi	1.72	Bing/ Binda	0.08
Limbu	1.58	Bhediyar/Gaderi	0.08
Thakuri	1.47	Nurang	0.08
Sarki	1.40	Yakkha	0.07
Teli	1.34	Darai	0.07
Chamar/Harijan	1.19	Tajpuriya	0.06
Koiri	1.11	Thakali	0.06
Kurmi	0.94	Chidimar	0.05
Sanyasi	0.88	Pahari	0.05
Dhanuk	0.83	Maali	0.05
Musahar	0.76	Bangali	0.04
Dusadh/Paswan/Pasi	0.70	Chhantel	0.04
Sherpa	0.68	Dom	0.04
Sonar	0.64	Kamar	0.04
Kanu	0.60	Bote	0.04
Brahmin (Terai)	0.59	Baramu /Brahmu	0.03
Baniya (Bania)	0.56	Gaine	0.03
Gharti /Bhujel	0.52	Jirel	0.02
Mallah	0.51	Aadibasi/ Janajati	0.02
Kalwar*	0.51	Dura	0.02
Kumal/Kumhar	0.44	Churaute	0.02
Hajaam/Thakur	0.43	Baadi	0.02
Kanu	0.42	Meche	0.02
Rajbansi	0.42	Lepcha	0.02
Sunuwar	0.42	Halkhor	0.02
Sudhi	0.40	Sikh/Punjabi	0.01
Lohar	0.36	Kisan	0.01
Tatma	0.34	Raji	0.01
Khatwe	0.33	Byangsi	0.01
Dhobi	0.32	Hayu	0.01
Majhi	0.32	Koche	0.01
Nuniya	0.29	Dhunia	0.01
Kumhar	0.24	Walung	0.01
Danuwar	0.23	Jaine	0.001
Chepang (Praja)	0.23	Munda	0.001
Haluwai	0.22	Raute	0.001
Rajput	0.21	Yehlmo	0.001
Kayastha	0.20	Kuswadiya/Patharkot	0.001
Badhae (Baadi?)	0.20	Kusunda	0.001
Marwadi	0.19	Dalit	0.76
		Unidentified Ethnic groups	1.02

Source: Central Bureau of Statistics, HMG, Kathmandu (2001).

Appendix XXI

Native languages / Mother languages

Native languages (Mother Tongue) in Nepal			
Languages	**%**	**Languages**	**%**
Nepali	48.98	Dura	0.02
Maithili	12.40	Meche	0.01
Bhojpuri	7.59	Pahari	0.01
Tharu	5.90	Lepcha/Lapche	0.01
Tamang	5.22	Bote	0.01
Newari/Nepal Bhasa	3.66	Bahing	0.01
Magar	3.41	Koi/Koyu	0.01
Awadhi	2.48	Raji	0.01
Bantawa	1.64	Hayu	0.01
Gurung	1.50	Byangshi	0.01
Limbu	1.48	Yamphu/Yamphe	0.01
Bajjika	1.05	Ghale	0.01
Urdu	0.77	Khadiya	0.01
Rajbansi	0.58	Chhiling	0.01
Sherpa	0.58	Lohorung	0.01
Hindi	0.47	Punjabi	0.01
Chamling	0.20	Chinese	0.001
Santhali	0.18	English	0.001
Chepang	0.16	Mewahang	0.001
Danuwar	0.14	Sanskrit	0.001
Dhangar/Jhangar	0.13	Kaike	0.001
Sunuwar	0.12	Raute	0.001
Bangala	0.10	Kisan	0.001
Marwadi	0.10	Churauti	0.001
Majhi	0.10	Baram/Maramu	0.001
Thami	0.08	Tilung	0.001
Kulung	0.08	Jerung/Jero	0.001
Dhimal	0.08	Dungmali	0.001
Angika	0.07	Oriya	0.001
Yakkha	0.06	Lingkhim	0.001
Thulung	0.06	Kusunda	0.001
Sangpang	0.05	Sindhi	0.001
Bhujel/Khawas	0.05	Munda	0.001
Darai	0.05	Hariyanwi	0.001
Khaling	0.04	Magahi	0.001
Kumal	0.03	Sam	0.001
Thakali	0.03	Kurmali	0.001
Chhantyal	0.03	Kagate	0.001
Sanketik/Symbolic	0.03	Dzonkha	0.001
Tibetan	0.02	Kuki	0.001
Dumi	0.02	Chhintang	0.001
Jirel	0.02	Mizo	0.001
Wambule/Umbule	0.02	Nagamise	0.001
Puma	0.02	Lhomi	0.001
Yholmo	0.02	Assamise	0.001
Nachhiring	0.02	Sadhani	0.001
Unidentified languages			0.75

Appendix XXII

Total Mushroom Species Recorded In Nepal

Taxa	Family		Genus		Species	
ASCOMYCOTINA		18		49		106
BASIDIOMYCOTINA						
Transitional group		1		4		11
Phragmo & Homobasidiomycetes						
Auriculariales	1		1		6	
Dacromycetales	1		3		5	
Tremellales	1		3		5	
Corticales	4		14		18	
Thelophorales	2		2		8	
Hymenochaetales	2		6		39	
Ganodermatales	1		2		7	
Polyporales	8		41		112	
Cantharellales	2	48	3	142	14	572
Clavariales	3		7		39	
Hericiales	3		3		9	
Tricholomatales	5		20		59	
Agaricales	2		7		37	
Pluteales	1		2		8	
Entolomatales	1		1		2	
Cortinariales	4		14		35	
Boletales	4		10		22	
Amanitales	1		1		31	
Russulales	2		2		116	
Gasteromycetes						
Sclerodermatales	2		2		12	
90 Lycoperdales	2		8		57	
Tulostomatales	2		2		5	
Hymenogastrales	1	10	1	18	4	87
Nidulariales	1		3		6	
Phalales	2		2		3	
Grand Total		77		213		776

Source: Adhikari, 2000

Appendix XXIV

List of Published Paper Based on Present Study

Pandey, N & Budathoki, U**.** 2002, Mushrooms in Relation to Different Ethnic groups of Kathmandu Valley and its adjoining Area*, Journal of Basic and Applied Mycology* **1(2):** 191-193

Pandey, N. and Budhathoki, U. 2003a. New record of fleshy fungi from Kathmandu Valley. *Botanica Orientalis* **3**: 111.

Pandey, N. and Budathoki, U. 2003b, Edible Wild Mushrooms as a source of income, Proceedings of International Conference on Women, Science & Technology for Poverty Alleviation. 68-70.

Pandey,N. 2004. Chemical analysis of mushrooms of Kathmandu valley. A report submitted to University Grants Commission (UGC), Kathmandu. pp. 59.

Pandey , N. 2006, Preliminery Study on the Mushroom's Diversity of Langtang National Park-Submitted to Department of National Park and Wildlife Conservation

Pandey, N and Budhathoki, U 2006a Mushrooms in the Langtang Area, Gosainthan, a sacred wetland in Nepal, Wetland studies series No.3 pp. 62.

Pandey, N and Budhathoki, U 2006b *Profiling of Major Proteins in Wild Nepalese Mushrooms by SDS Page*. Plant Archives 6 No.2 pp. 465-469.

Pandey, N. Adhikari M.K and Budhathoki U.2006 The New Record of Fleshy Fungi from Kathmandu valley proceeding of Fourth National Conference on Science & Technology. **1:** 429.

Pandey N, Devkota,S., Christensen, M. and Budhathoki, U. 2006, Use of Wild Mushrooms Among the Tamangs of Nepal, *Nepal Journal of Science and Technology* 7 pp. 97-104.

Pandey N. and Budhathoki U. 2007a. Status of Ethnomycology in Nepal. Mycological Research and Mushroom Production in Nepal, published by The Mycological and Phytopathological Society, Nepal (MAPSON) 53-60.

Pandey, N**.** and Budhathoki U. 2007b Protein determination through Bradford's method of Nepalese mushroom *Journal Scinetific World* **5 (5)** 85-88.

Pandey, N**.** and Budhathoki U. 2007c. Ethnomycology of Chepang Community in Chitwan. *Nepal Journal of Science and technology*. **8**: 75-79

Pandey, N**.** and Budhathoki U. 2007d. Three New records of Aquarics from Kathmandu Valley, Nepal. *Journal of Basic and Applied Mycology*. **6(I& II):** 5-7

Pandey, N**.** and Budhathoki U. 2007e. Four New records of Aquarics from Kathmandu Valley, Nepal. *Journal of Basic and Applied Mycology*. **6(I& II):** 8-10

Pandey, N**.** and Budhathoki U. 2007f. Three New records of Aquarics from Kathmandu Valley, Nepal. *Journal of Basic and Applied Mycology*. **6(I& II):** 110-113

नीना पाण्डे 2066/04/11 "जंगली च्याउ" छोटो जानकारी Nepal women Environment Education & Health Association (NWEEHA)

Paper on Pipe line

Paney. N., and U. Budhathoki " Preliminary study on mushrooms of Sundarijal, Kathmandu, Nepal." Paper submitted to publish in fourth coming Journal of IOST.