1. INTRODUCTION

1.1 General Background

The galaxy of fungi and their importance occupy prime place in the biological world and Nepal has been a cradle for such fungi due to its broad phytogeographical variation. The organisms commonly known as fungi are a tremendously diverse group ranging from microscopic forms to easily seen macro form. They are found virtually in all habitats and are commonly referred to as macrofungi, mushrooms, morels, truffles, molds, mildews, yeasts, earthstars, stinkhorns, rusts, smut and bracket or shelf-fungi etc. Fungi are a major component of biodiversity, essential for the survival of other organisms and are crucial in global ecological processes (Hawksworth, 1991). Contributing to the nutrient cycle and maintenance of ecosystem, fungi play an important role in soil formation, fertility, structure and improvement (Hao-quin *et al;* 2008).

According to the size fungi have been categorized into macro and micro fungi. Macro fungi have a visible structure to the unaided eye and produce spores (Boa, 2004). Two main groups which contain macro fungi are the Ascomycotina and Basidiomycotina.

Mushrooms are the fruiting bodies of macro fungi which include both edible and poisonous species. However 'Mushroom' is used for the edible members of the macro-fungi and 'Toadstool' for the poisonous ones. In a broad sense 'Mushroom is a macro fungus with a distinctive fruiting body, which can either be epigeous or hypogeous and large enough to be seen with naked eye' (Chang & Miles, 1992).

The structure that we call a mushroom in reality is only the fruiting body of the fungus. Surveys of this fruiting body does not adequately reflect the below ground Ectomycorhizal fungal diversity because some species lack carpophores or have a sporulating strategy that is disproportional to their underground abundance (Grades & Bruns 1996, Horton & Bruns, 2001). Despite this limitation, fruiting body surveys are considered the primary basis for documenting fungal diversity in a stand (Smith *et al.* 2002) since they can be easily identified at the species level (Richard *et al;* 2004).

(Dickinson & Lucas, 1979) and (Philips, 1981) agreed that the 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. The general form of an agaric fruiting body is umbrella shaped with a central stip, supporting a cap or pilus 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 of agarics as the gilled mushrooms. Similarly, (Purukayastha & 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. (Pacioni, 1985) made a clear distinction between "Mushrooms" considering only the edible species and "Toadstools" as inedible or poisonous species.

The 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), " 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 there is a general structure used in the language to distinguish the mushrooms in Nepal. In practical in 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 (Adhikari, 1979, 2000).

1.2 Historical Background

The collection and systematic study of macro fungi including mushrooms in Nepal have been started since the contribution of Llyod, 1808. Then the investigation, exploration and collection of macro fungi continued since the period of J.D. hooker 1854. His specimens were studied by M.J. Berkely, 1854 reported 44 Nepalese

species from those collections in “Indian Fungi”. Some others investigations of macro fungi are as follows.

Bhatt (1966) enumerated 118 species of fungi from different parts of Nepal among them 27 species were Ascomycotina and 33 Basidiomycotina.

Imazeki *et al.* (1966) reported 3 genera and 3 species (1 Ascomycotina & 2 Basidiomycotina).

Pegler (1977) reported two species of *Pleurotus* from Chakure lekh.

Waraith & Thind (1977) reported 29 genera and 37 species of Ascomycotina from central Nepal.

Bhandary (1980) collected 13 species of macrofungi related to seven different families, among them eight species were new to Nepal.

Adhikari (1988) reported the checklist of *Polipores* (Wood rotting fungi) of Nepal.

Adhikari (1988) reported ten species of the genus *Russula* from Kathmandu valley.

Adhikari (1991) collected 14 species of macrofungi from Manichaur to Gosinkunda, Central Nepal.

Adhikari & Manandhar (2004) recorded four species of wood rotting macrofungi.

Pandey (1976) published a list of 314 specimens of Basidiomycotina collected from central and eastern of Nepal.

Pandey (2008) investigated wild macrofungi in Central Nepal in context of ethnomycological approach.

Aryal (2009) collect some Nepalese beliefs during his research period on wild mushrooms.

New description after 2000 has increased the total number of macrofungi to 814 species Adhikari (2009), Aryal & Budhathoki (2013ab). Among them 228 species are edible (Christensen *et al.* 2008), 75 species are medicinal and 66 species poisonous Pandey (2008) and Adhikari (2009).

1.3 Diversity of Macro Fungi

There is a difficult task for defining the population of fungi globally to mycologist all over the world (Wood, 1992). The number of fungal species has been estimated up to 13.5 million (Adl, 2003 & Kirk *et al.* 2008), however the currently accepted working figure is 1.5 million species (Hawksworth, 2001). The total number of mushrooms forming species have been estimated in between 53,000 and 110,000 which suggest that only 18% to 38% of the total mushrooms have been documented (Mueller, 2007).

In Nepal, the complex phytogeographic factors have played an important role in growth distribution and diversity of fungi. All these conditions in turn have made the country a natural house for mycodiversity (Adhikari, 2000).

Adhikari 2000, 2007, 2009; Adhikari & Devkota2007; Manandhar & Adhikari 2009 are the major litratures concerned with the mycoflora which gives the detailed reference on the fungi from Nepal. The book 'Mushroom of Nepal' (Adhikari, 2000) includes all the macro fungi found from tropical to alpine regions of Nepal; a total of 776 species belonging to 213 genera and 77 families have been described.

2. Imporatance of Macrofungi

2.1 Medicinal value of Macro Fungi

Macro fungus are famous as the best nutraceuticals, excellent health food enriched by good quality protein and a multitude of beneficial vitamins and minerals. Many of them the poisonous and edible mushrooms are known for their antibiotic and anti–cancerous properties (Anonymous, 2000). *Amanita muscaria* highly poisonous mushroom, being effectively used in China to cure neural disorders and epilepsy (Bal Krishnan&Nair, 1994). Medicine from *Coriolus versicolar* is a top selling anti–cancer drug in Japan (Pai *et al;* 1990). It is now common to find medicinal preparations from mushrooms in various forms in the world market. For instance, 'Agarus' is an effective drug used in homeopathy for treating ailments of heart, epilepsy, mental disorders, etc. The total worth of the pharmaceutical and nutraceutical products derived from mushrooms is estimated to be more than $ 1.2 billion (Rai *et al;* 1997). Pharmaceuticals with $ 700 million are produced annually

in Japan from the species of *Lentinus, Coriolus Schizophyllum* and *Ganoderma.*The medicinal mushrooms that are dominant in the market are, however hardly a dozen produced exclusively by China and Japan (Chang&Buswell, 1996).

In Nepal, 19 species of wild mushrooms have been utilized by the rural people. These species still await for their chemical estimation and pharmaceuticals investigation. *Ganoderma lucidum, Coriolus hirsutus*, and *Pycnoporus cinnabarinus* are generally utilized to heal cuts and wounds (Adhkari, 1988; Bhandary, 1991). *Daldinia concentric* is used to treat burns (Bhandary, 1991). *Cordyceps sinensis* is powedered and combined with the rhizome of *Orchids latifolia* and consumed mixed with the powedered of the rice in the boiled milk. This fungus serves as special tonic and used as aphrodisiac (Adhikari, 2000).

The predominant mushrooms showing promise for their antiviral activities are *polypores* so called woody conks, thought to be the ancestors of most, if not all, gilled mushrooms. A number of unique antiviral compounds (lentinan from *Lentinus edodes*, ganoderic acid, lucidumol from *Ganoderma lucidum)* from mushrooms have sown efficacy in inhabiting the replication of the human immunodeficiency virus Suzuki, 1989); Nanba 1992; Kim *et al;* 1994; Collins 1997; Ghoneum 1998; Hattori, 1997.

During the past 100 years, human progress has created an environment in which our immune systems are well catered to. Today we live in artificial environments where air is filtered and the food is processed. We frequently subject ourselves to antibiotics and a variety of interventions to improve our well–being. A slow immune response will not be able to cope with an onslaught of pathogens. Mushrooms provide a regular challenge to the immune system in a non–hostile manner (www.mushrooms.com). Just like medicines, if mushrooms are also taken every day, we can fight against diseases like Scarvi, wound from burns.

In ‘Ayurveda’, the bool concerning human health science in Hindu philosophy also has been found to mention about the mushrooms. The ideas given in it about the nature of investigations were not postulated in the chemical formula but rather narrated in sacred hymns. ‘Madanpal Nighantu’ states to have sedative properties and effective to cough, vayu and pitta in the human body (Adhikari,1995) & 2004).

2.2 Nutritional value of Macro Fungi

The wild edible mushrooms serve as important natural seasonal crop which play an important role in the development of economic condition of the rural people.

Some wild edible species are tasty and delicious. The mushrooms are cooked with onions, garlic, aromatic herbs, tomatoes, green peppers and assorted species. The wild mushrooms contain different kinds of important chemical compounds such as protein, vitamins, minerals, organic acids and salts. Moreover, the proteins found in mushrooms are composed of all nine essential amino acid. Besides these, other basic components such as fat (low amount), phosphorus, iron, thiamin and riboflavin are also found in them. They also contain a high proportion of water (nearly about 90 – 95%) when fresh. On a dry weight basis mushrooms are richer in protein compared with fruit or other vegetables (Adhikari1999, Adhikari *et al;* 1996).

The nutritive value of mushroom is not only specific but may in fact be strain specific. Certain mushroom can contribute to the protein content in a diet; others may be of value only for their flavor (Singer & Hairs, 1987).

2.3 Ecological Importance of Macro Fungi

Macro fungi play a principle role in recycling nutrients and influence plant community composition through symbiotic relationship (Dighton, 2003). There have been a few studies on community ecology (Packham *et.al;* 2002) and relationship of macro fungi with environmental variables (Zamora & Cecilia,1995). They are the vital contributors of terrestrial ecosystems because of their involvement in nutrient cycling (Jorden,1985; Lodge,1992) and are the principal decomposers of dead organic matter, such as dead wood and litter (Harmon *et al;* 1986). Most of the tree species depend on mycorrhizal symbiosis with fungal species (Smith & Read, 1997). Macro fungi have been shown to have a significant ecological function in the establishment and dynamic succession of plant communities, nutrient cycling and the protection of forest ecosystems, and are likely to be crucial to sustainable development, ecological construction and stability (Schmit, 2005; Dighton *et al;*

2005; Lee *et al;* 2009). Parasitic, Saprophytic and Mycorrhizal fungi are high value forest resources (Wang & Hall, 2004).

3. Ethnomycology

Ethnomycology is the study of the historical uses and sociological impact of fungus and can be considered a subfield of ethnobotany or ethnobiology(Rutajt, 2006). Ethnomycology is a multidisciplinary field of research involving many aspects of mycology (collecting, describing, taxonomy), anthropology and sociology (inquiries) and linguistics (languages and vernacular names). In many African countries mycologists have collaborated with local people in order to record, study, understand and disperse indigenous mycological knowledge. Mushrooms have been used as medicinal materials for 100's of years. Mushrooms have recently been getting attention as an anticancer agent. The origin of efficiency of these medicinal mushrooms, however, has not been identified (Daba, 2007).

Nepal possesses diverse phytogeographical zones related to altitude and other factors. Thus the vegetation varies greatly from east to west and from north to south. These varied elements have enriched Nepal with economically important mycoflora (Adhikari, 2005).

Makrahar V. D. C. is one of the most important V. D. C. of Rupandehi District as it hosts the homeland for different traditional peoples as Tharu and Magar. By this study the overall status of mushroom of the study area is evaluated and the different aspect related with the myths of mushroom as given points:

- Different species of mushrooms are grown in one season of a year.
- Toxicity of mushroom depends upon the internal condition of human body, same species will be poisonous for some and these may be non-poisonous for other people.
- The mushrooms which are grown in fast decaying plant wood (Bamboo) or latex producing plant wood (*Ficus* spp.) or bitterbark and leaves having tree (Nim) are poisonous. The mushrooms which are found in hard and slow decaying plant wood (*Shorea robusta* and *Dalbergia sissoo*) are edible.

- The children of Makrahar V.D.C. are eaten edible mushrooms with the suggestion of their parents.
- The mushrooms which produce irritation during touching or keeping on tongue are poisonous.
- The effect of poisonous mushroom will be more in those persons who drink alcohol.
- According to local people, the mushroom species without annulus will be poisonous.
- The mushrooms species having annulus near by the cap are poisonous but the mushroom having annulus far from the stipe may be edible.
- The mushroom species which are edible during rainy season, will be non-edible (may be poisonous) after rainy season.

Some Nepalese Beliefs and Myths about wild mushrooms as given points: (Aryal, 2009)

- Poisonous mushrooms discolor silver coins during cooking; edible mushrooms do not.
- Poisonous mushroom will change an onion from its usual color when cooked with it.
- Mushrooms eaten by cats, dogs, and monkeys are always safe.
- Mushrooms eaten by snails or insects are considered safe.
- Poisonous mushrooms will lose their poison when cooked with some vinegar.
- Mushrooms lose their poison when cooked with timur (*Zanthoxylum alatum).*
- Mushrooms having a fruity smell are safe to eat.
- Mushrooms with bitter, acrid, or pungent taste are poisonous.
- Smooth-capped mushrooms are edible.
- Mushrooms with a rough warty cap or rough texture are poisonous.
- Violet and dark-red-colored mushrooms are poisonous.
- Soil-inhabiting mushrooms are poisonous.
- Mushrooms growing on live trees or dead logs are edible.
- Mushrooms growing on decaying straw or manure are poisonous.
- The developmental stage of a mushroom also determines the toxicity.
- Mushrooms that produce latex upon being injured are poisonous.

- Mushrooms whose fruiting body changes color (bruises) after touch are poisonous.
- An edible mushroom can become poisonous through some strange influence exercised by snakes or amphibians.
- The first picked mushroom should be offered to God so that subsequent mushrooms will be safe.
- Mushrooms growing in a cluster or group are edible, but those growing alone are not.

These beliefs were collected from many different wild mushroom collectors and from different parts of the country. Some interesting thoughts regarding mushroom poisoning have also been collected during the training conducted in various parts of Nepal to strengthen economic status of poor Nepalese farmers. Many know these methods cannot absolutely be counted on to determine the poisonous from the edible, but to some these beliefs are still widely regarded as accurate.

The population of Nepal, one of the Himalayan countries, embraces 36 kinds with diverse traditional cultures. Nepal is said to be a garden composed of four diverse castes (Brahmin, Kshetriya, Vaisya and Sudra), which are based entirely on a religious point of view (Adhikari, 2000). Recent studies show that these four castes are composed of 65 ethnic groups. The relationship of ethnic groups with mushrooms is based on one hand on the castes that are aware of the religious sacredness of the Hinduism and on the other hand on traditional knowledge. The origin and distribution of some ethnic castes are found to localize in particular zone or area. The ethnic groups are the traditional collectors. Their knowledge on mushrooms and fungi are quite different. 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).

4. Justification

Nepal has expressed its commitment to develop a national strategy for conservation and sustainable use of biological resources (Dobremez, 1971). Very few study related to Nepalese mycoflora in comparison with higher plants are found (Adhkari, 2000). Nepal is considered the homeland of mushroom floral diversity. Rupandehi

district is a fertile land for exploration of diversity of wild mushrooms (Aryal & Budhathoki, 2013). Therefore the present study will be helpful to add knowledge about diversity of mushroom and ethnomycoligical concept. Among the mushrooms, *Rusulla* spp., *Scleroderma* spp. and *Pleurotu*s spp. are well known for their food value from long time. But local people of Makrahar VDC, there should be necessary to inform about poisonous and non poisonous mushrooms by concerned authorities.

5. Hypothesis

- Most of the species of Macro fungi are widely used by ethnic community of Macrahar V. D. C. as a source of food.

6. Objectives

- To document the macro fungi present in Sukhaura Hariyali Community forest of Makrahar V. D.C.
- To explore the traditional knowledge of ethnic community about Macro fungi

2. STUDY AREA

The study area lies in the sacred birth place of Lord Buddha, Makrahar V.D.C., Lumbini zone, Southern belt of west Nepal. Makrahar V.D.C lies 16 km north east from district hq. , Bhairahawa. It encompasses 27^0 34' 36.08" N to 27^0 39' 36.32"N latitude and 83^0 30'00" E to 83^0 33' 14.13" E longitude. The altitude of study area is 190m from the sea level. The area occupies 189 ha land between 160 and 195 msl altitude. The average annual rainfall is 1391mm. The climate is tropical with heavy monsoon rainfall. The maximum temperature recorded in the month of May is 39.6^0c.and minimum in January 10.4^0 c.

Phytogeographically, the area lies typically in tropical riverine belt composed of the natural degraded plants of *Shorea robusta* and *Dalbergia sissoo*. These phytodiversity and ecological conditions of this study area provide a good homeland for the growth of macro fungi. The northern belt of this area has loamy sand, while the southern belt consists of sandy loam to loamy soil. This is the virgin area for study and investigation of mushroom.

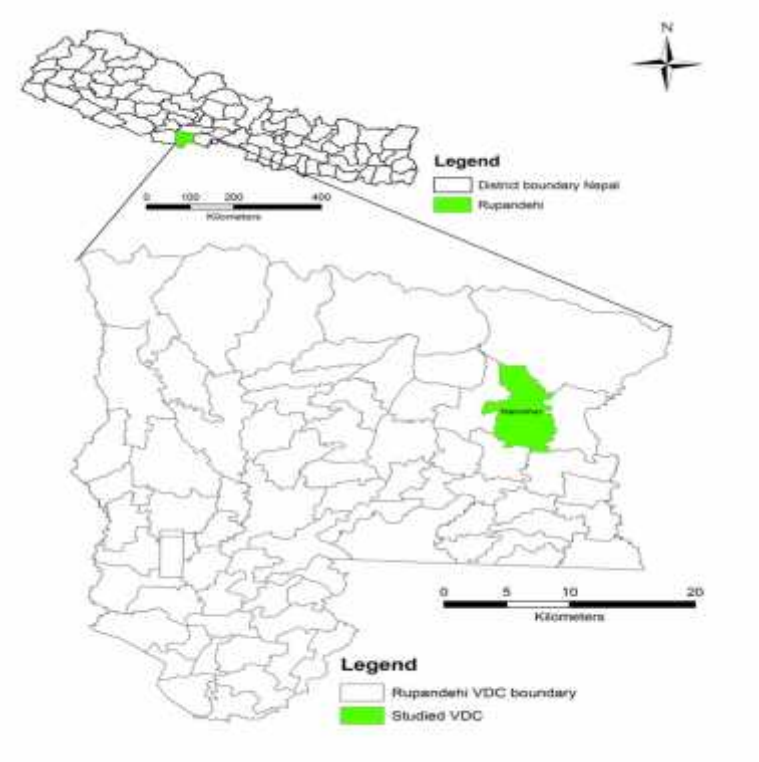


Figure I: Location map of study area, showing position of Rupandehi district in Nepal, VDC in district.

3. MATERIALS AND METHODS

The collected specimens were illustrated based on the field study of fresh specimens and standard methods were followed for collection, preservation, morphological, and microscopic studies (Atri, 2003).

3.1 Materials and Equipments

Following materials and equipments are necessary for the collection of mushrooms (Adhikari, 1991; Brundrett, *et al;*1996)

Equipments:

- Digital camera
- Collecting bags
- Compass, GPS
- Knife
- Storage containers

3.2 Stationeries

- Brush for cleaning specimens
- Envelops for storing dried specimens
- Maps, pens/pencils
- Reference books (field-guide type)
- Ruler for measuring mushrooms
- Small and large paper bags to keep collections from the same collection.
- Small notebook for recording data
- Wax paper roles, bags
- White/black paper for spore prints

3.3 Others

- First aids

3.4 Chemicals

- Formalin solution

The data about distribution of macro fungi and their uses by local people was collected by primary and secondary methods.

3.5 Site Selection

Makrahar V.D.C. of Rupandehi was selected as research site because it has dense community forest. Different ethnic peoples having low economic status, are living this area and it is near the east-west highway.

3.6 Secondary data collection:

The information about study area, forest, population etc. of this V.D.C. was obtained by V.D.C. office, articles of others researchers and magazines.

3.7 Primary data collection:

The field work was conducted two times (August-2012 and June-2013) in Makrahar V.D.C. While conducting field trips in Makrahar, I was accompanied by a professional mushrooms hunter and other friends. Moving in a dense forest in rainy season with the risk of wild animals was a challenging task. Different mushrooms grown in forest of Makrahar V.D.C. were collected.

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 idea of all morphological characters. Keeping in mind ‘ Few good specimens are better than several ones’ (Adhikari,1991), to many specimens were not collected in the same day rather the collections were usually made till 3-4 o’clock and rest of the time was utilized in processing of collected specimens. The collected specimens were cleaned with the help of brush and placed in separate wax paper bags to prevent mixture of spores. Paper bags were used for the collection of specimens in the field.

3.8 Spore Print

For taking spore prints, stipe of the fruit body was cut and the cap was set on a piece of half white and half black paper (attached half white and half black paper) turning the gills downwards. A drop of water was mounted on the cap in order to minimize drying out of tissues. The materials were then placed on a container and incubated for some time (2-4 hours). Finally, cap was removed carefully and the characteristics of the spore prints were noted.

3.9 Preservation of Mushrooms

The specimens were preserved in dry condition and in liquid.

3.9.1 Dry Preservation

The specimens gathered were dried immediately in order to prevent from rotting. Sun drying was suitable for drying mushrooms. However, due to poor weather conditions and collections were made in rainy season, all the specimens could not be dried only in sunlight. After drying properly, the specimens were packed in paper bags.

3.9.2 Liquid Preservation

The fleshy specimens were preserved in a mixture of distilled water and formalin.

3.10 Mushroom Identification

The local name of mushrooms was identified by local people of study sites and that was converted in to scientific name by concerning the literature (Viz. Bakshi, 1971; Mckenenny, (1971); Svreck, (1975); Kibby, (1971); Singer, (1986); Imazeki, (1988); Adhikari, (2000); Pandey, (2008); Aryal & Budhathoki, (2012 a,b; 2013 a,b,c,d); Aryal *et.al;* (2012) and concerning the expert from Central Department of Botany, Kathmandu, Nepal.

3.11 Interview with Local Peoples

Tharu and Magar ethnic groups were gathered in two groups separately. Information about methods of mushroom identification, their uses and other cultural and sociological values was obtained by asking Magar and Tharu of Makrahar V.D.C. by

open questionnaires. Local names were converted in to scientific names with the help of books and identification keys.

4. RESULT

Diverse mushroom species were collected on which 23 were identified with 9 families and 15 genera belong to Basidiomycotina. Most species were poisonous (11) following food mushroom (8) and medicinal mushrooms (4) respectively.

Enumeration of Species:

***Agaricus arvensis* Schaeff.**

Basidiocarp: Large, white mushroom, flattened, fibrous cap with ring on stalk, spicy odor. **Pilus:** 7.5-15cm wide; convex to flat; smooth or with small, flattened fibers; dry, shiny, white. Flesh thick. **Gills:** free, crowded, narrow; white, becoming pink, then brown. **Stalk:** 7.5-15cm long, 1-1.5cm thick, tapering down to small, abrupt bulb; smooth, white. **Spores:** 6-8x4-5microns; elliptical, smooth, purple-brown. Spore print purple-brown. **Uses:** Choice, with caution. **Habitat:** On the ground, in decidiuous and mixed woods.

Distribution: Throughout America and Nepal.

***Amanita fulva*: (Schaeff. : Fr.) Fr.**

Basidiocarp: Universal veil membranous and firm, lacking inflated cells that darken with age; fleshy volval sac, loosely curving, filamentous, undifferentiated hyphae, basidia arising from partially inflated or uninflated hyphal segments. **Pileus:** orange to brown, paler towards the margin and darker in the centre, up to 10 cm diameter, smooth, slightly sticky and slippery. **Gills:** Free, close and broad. **Stipe:** white, smooth, powdery with very fine hairs. slender, ring less, hollow and quite fragile, tapering, up to 15cm tall and 1-1.5cm thickness with white and sac-like vulvae. **Flesh:** White to cream. **Spores:** white, 8-10µm, round, smooth. **Spore print:** White. **Habitat:** Growing on soil, in the most shady places with deciduous trees. **Uses:** Poisonous.

Distribution: North America, Europe, Japan and Nepal.

***Amanita cokeri* Gill. & Kuin.**

Basidiocarp: Large, white mushroom with pyramidal patches on cap, and rooting stalk with ring and scales towards base. **Pilus:** 7.5-15cm wide; rounded, convex to flat, shiny when dry; with large, high, pyramidal, wartlike patches, cottony towards margin. **Gills:** free or somewhat attached, broad, white to yellowish. **Stalk:** 12.5-20cm long, 1.5-2cm thick, with large, spindle shaped, white. **Spores:** 11-13.5x7-9 micrometer, elliptical, smooth, colorless. **Spore print:** white. **Habitat:** On the ground. **Uses:** Poisonous.

Distribution: North America, Europe, Japan and Nepal.

***Boletus subtomentosus* Fr.**

Boletaceae, Agaricales.

Basidiocarp: Dry, velvety, cracked, brownish pilus, showing yellowish between cracks, yellowish **Pileus:** 5-20cm wide, convex, dry, brownish- yellow. **Stipe:** Yellow, 4-10cm long, 1-3cm thick. **Spore:** 10-15x3.5-5µm, smooth, elliptical.**Spore print:** Olive-brown. **Habitat:** on the ground in mixed woods. **Uses:** edible.

Distribution: Eurasia, North America, Australia and Nepal.

***Claveria vermicularis* Fr.**

Basidiocarp: Fructification up to 5 cm. tall, solitary, scattered, erect. Slender, small sized, radial, trunk present, simple, clavate, fleshy, brittle, smooth, glabrous. **Pilus:** 0.4- 0.7cm. long and 0.7-1mm wide, white, elongated, cylindrical, usually slightly broader at the pilus, apex acute in young fruit bodies, becoming obtuse or blunt in mature ones; **Stipe:** 1-2.8cm. long and o.4- 1mm.wide, distinctly demarcated, white, narrow, smooth but with very fine narrow hyphae, numerous rhizomorphic mycelia threads given out from the base of the fructifications; **Flesh:** white; smell and taste inparticular.Basidia 37-44.5x5-7µm hyaline, clavate with along tapered base, provided with a wide loop-like clamp at the base.Basidiospores 8-10x2-5µm, hyaline, oval, papilate, smooth,filled withdense granular contents. **Uses:** unknown.

Distribution: Europe and Nepal.

***Coprinus plicatilis* (W. Curtis ex Fr.) Fr.**

Basidiocarp: Grayish-brown, grooved pilus with smooth, circular, sunken center, blakish gills and fragile, white stalk. **Pileus:** 1-2.5cm wide, conical, becoming flat to somewhat upturned; radially grooved with brown, disk-shaped, sunken center; gray to gray-brown toward margin.**Gills:** Free and attached to collar about stalk, distant, narrow; grayish. **Stipe:** 5-7.5cm long,1-3mm thick, sometimes with basal bulb; dry, fragile; white; hollow. **Spores:** 10-13x6.5-10µm; broadly oval, smooth. **Spore Print:** Black .**Uses:** Edible. **Habitat :**Single to numerous, in grass.

Distribution: Widely distributed in North America and Nepal.

***Fomes fomentarius* (L. Fr.) Fr.**

Basidiocarp: Steam decay plant pathogen, woody, dark grayish-brown, generally crusted, hoof-shaped, stalkless cap with brown pores. **Pilus:** 5-20cm wide; hoof-shaped; gray to gray brown or gray-black, with dark brown-black zones; dry, velvety to smooth, with hard, horny, thick crust. fruit body 5-45cm across, 3-25cm wide, 2-25cm thick, attach to the tree, shaped like horse' hoof, bracket, umbonate, broad, concentric rings, rounded margin .**Flesh:** 0.3-3cm thick, hard, fibrous, varying colour like silvery- white, grayish and nearly black. **Spores:** lemon- yellow, 15-20x 5-7µm, cylindrical, smooth, colorless, fruity smell; spore print white. **Habitat:** On dead deciduous trees or wounds in living trees, including maple, birch, beech, and cherry. **Uses:** Medicinal.

Distribution: Throughout North America, Nepal.

***Macrolepiota rhacodes:* (Vittad.) sing.**

Basidiocarp: white to cream, brown, grey to beige.**Pileus:** distinctly scaly, 7.5-20cm, globose then convex to flat, cuticle brownish, smooth.**Gills:** whitish. **Stipe:** 10-20x1.5-2.5cm, club- shaped, white. **Spores:** 8-15x6-8µm., white, elliptical, smooth, dextrinoid. **Flesh:** discolours. **Habitat:** grows on ground. **Uses:** Edible.

Distribution: Widely distributed throughout North America

***Marasmius orades* (Bolt. ex Fr.) Fr.**

Fairy Ring Mushroom

Pilus: 1-4cm wide; bell-shaped with inrolled margin, becoming convex to broadly knobbed; margin upturned with age; dry, smooth, feltlike; pale yellowish-brown, fading to buff-white, sometimes grayish to raddish-brown in part or overall. **Gills:** attached or free, close to almost distant, broad; yellowish-white. **Stalk:** 1-7.5cm long, 1.5-5mm thick; straight, dry rubbery, smooth or with long, twisted ribs, minutely hairy or felted; white to pale or orange-yellow, yellow or light reddish-brown; solid to stuffed. **Spores:** 7-10x 4-6µm; elliptical, smooth, colorless. Spore print white to buff. **Uses:** Poisonous. **Habitat:** In grassy areas.

Distribution: Widely distributed in North America and Nepal.

***Pleurotus ostreatus* (Fr.) Sing.**

Basidiocarp: White, cottony-scaly cap with inrolled margin, white gills, solid stalk. **Pilus:** 5-12.5cm wide; broadly convex; margin inrolled at first, with fragments of veil persisting; dry, cottony-hairy, then somewhat scaly; whitish. Odor aromatic to pungent. **Gills:** descending stalk, almost distant to close, narrow to broad; often with crossveins on stalk; white, discoloring. **Stalk:** 5-10cm long, 1-3cm thick; stout, usually short, solid; whitish. **Spores:** 9-12x3.5µm; elliptical, smooth, colorless. Spore print white. **Uses:** Edible. **Habitat:** single to several, on ground and deciduous trees.

Distribution: North America and Nepal.

***Pycnoporus cinnabarinius* Jaca:(Fr.) Karst.**

Basidiocarp: 3-6cm or more, bracked- shaped, sessile, deep orange-red, tending to darken, at first slightly pubescent then glabrous, fairly rugose, with faint zonation toward margin. **Stipe:** 1-3mm long, blood-red, pores small, round, pubscent, vermillion. **Flesh:** red, leathery, first spongy then suberose. **Odor and flavor:** negligible. **Spores:** white cylindrical, smooth, 5-6x 2-2.5µm. **Habitat:** found on dead broadleaf branches and trunks. **Uses:** Medicinal.

Distribution: Worldwide**.**

***Ramaria botrytis* Fr.**

Basidiocarp: Carpophore 4-5cm high, yellow, spherical. **Stipe:** short, hairy, yellowish rootlike filaments, pointed, branches, thin, unequal, straight, cylindrical, smooth, with tipped apex. **Flesh:** white **Spores:** 7-9x4microns. **Uses:** edible **Habitat:** On the ground in *Shorea robusta* forest.

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

***Russula variata* (Fr.) Fr.**

Basidiocarp: This taxon is characterized by a fleshy and brittle basidiocarp with convex pileus which later becomes expanded and depressed in the center. The stout stipe lacks annulus and volva. The fruit body fails to produce latex from its body. The trama is composed of sphaerocysts or round cells. The lamellae are mostly adnate (not always) to the stipe. The name *Russula* refers to russulus, rubescens and red forms. **Pileus:** It is commonly assumed that small or minute fruit bodies are primitive and that the large and massive, as they employ the environments more fully, are the products of the upward evolution of the minute and tree trunk without such limitations. **Colour:** The colour of basidiocarps play significant role in the nomenclature of the taxon. A wide range of variation, specialization or combinations can be observed. The variations or combinations of different shades of colours can create confusion in the taxonomic determination of species despite of their specific characters. Some colour can be washed by rain and change on drying. **Stipe:** One of the main taxonomic feature in *Russula* species is the colour (white, creamy, yellow, rosy, violet etc.) and nature (hollow, stuffed, solid) of stipe. **Taste and smell:** Each species has its own characteristics taste and smell. In this taxon the taste varies from mild, mild to acrid, slightly acrid, and acrid. Likewise the smell also varies from none to strong. It can be faint and not distinct, faint and pleasant, strong, pleasant or unpleasant. The pleasant smells are generally fruity like those of apricot, and other fruits or radish. The unpleasant smells are similar to that of rotten fish.

Distribution: Worldwide

***Russula emetica* (Schaeff. : Fr.) Pers.**

Basidiocarp: Slimy-tacky, raddish pilus with off-white gills and stalk; acrid taste. **Pilus:** 2.5-7.5cm wide; cushion shaped, becoming convex, flat with sunken center or vase-shaped; margin incurved, fragile, becoming rough-lined; sticky, smooth, sometimes minutely cracked; red to reddish-orange or deep pink. **Flesh:** white, brittle **Taste:** Strongly acrid. **Gills:** attached, close, moderately broad; yellowish-white. **Stalk:** 5-10cm long, 0.5-2.5cm thick, enlarging toward base ; dry, dull, longitudinally wrinkled; white to yellow-white; stuffed becoming partly hollow. **Spores:** 8-11.3x6.7-9 µm; elliptical to oval. **Spore print**: white. **Uses:** Poisonous. **Habitat:** Singly or in groups, usually in sphagnum moss, rarely on very rotten wood, in boggy areas in coniferous or mixed woods.

Distribution: North America, Europe and Nepal

***Russula lacatea:* (Schw.) Fr.**

Basidiocarp: Large, dry, white, short stalk. **Pilus:** White, 10-20cm wide, convex, dry. **Gills:** Attached or somewhat descending stalk, white. **Stalk:** 2.5-7.5cm long, 2.5-4cm thick; dry, smooth. **Spores:** 8-11x6.5-10 microns; elliptical. **Spore print:** White. **Uses:** Poisonous. **Habitat:** On the ground in mixed wood.

Distribution: North America, Japan, India and Nepal.

.***Russula nigricans*: (Bull.) Fr.**

Basidiocarp: convex at first but soon becomes depressed in the center, through it retains its inrolled margins for a long times, dirty white and turns to black, 5-20cm in diameter. **Gills:** thick and widely spaced, fragile. **Stipe:** short and thick, flesh gray to black, fruity smell. Spore 7-8x6-7µm. **Spore print**: white, oval. **Uses:** Edible. **Habitat:** On the ground.

Distribution: Europe, Japan, North America and Nepal.

***Russula rosea* (Pers. Ex Secr.) Fr.**

Basidiocarp: Red cap with yellowish-white gills and red stalk. **Pilus:** 2.5-10cm wide; convex to flat, sticky when wet, smooth; dark red to bright. **Gills:** attached or slightly descending stalk, close, narrow to broad; white to pale yellow. **Stalk:** 5-10cm long, 1-1.5cm thick, smooth, dry; white. **Spores:** 7-9x6-8microns; round to oval. **Spore print:** pale yellow. **Uses:** poisonous.

Habitat: on the ground.

Distribution: Europe, Japan North America and Nepal.

***Russula virescens:* Beard & Burl.**

Basidiocarp: Gray or bluish green, entirely whitish, convex and open, slightly depressed at center, dry. **Pilus:** white, 5-12cm wide, curved and margin thin. **Gills:** Creamy white, reddish brown markings, unequal. **Stipe:** 3-9x1.5-4cm wide, whitish, narrowing at base. **Flesh:** whitish thick and soft. **Spores:** 6-8.5x5-6.5 microns, elliptical, with distant warts. **Uses:** edible. **Habitat:** In grass on *Shorea robusta* forest.

Distribution: Europe, Japan India and Nepal.

Scleroderma bovista Berk.

Basidiocarp: Round, becoming detached and rolling about; with white outer skin smooth. 3-9cm wide; attached to ground. **Spore mass:** white. **Spores:** 3.5-4.3 micrometer, round, smooth, colorless stalk; **Uses:** edible. **Habitat:** single to many in ground.

Distribution: Widely distributed in North America and Nepal.

***Scleroderma cepa* Pers. : Pers.**

Basidiocarp: Fruit body 1-2cm. Exoperidium yellowish grey, globose to semiglobose, smooth to slightly scaly. **Spores:** 6.25-10 micrometer. **Uses:** edible. **Habitat:** Growing on soil in *Shorea robusta* forest.

Distribution: Australia, South-east Asia, China, Europe, India, Japan, North America and Nepal.

***Scleroderma citrinum* Pers.**

Pilus 2.5-10cm wide, 2-4cm high; roundish to somewhat flattened; covered with rough warts, white ball, opening by pore at top. **Spore mass:** whitish. **Spores:** 8-12µm. **Uses:** Poisonous. **Habitat:** Single to many, on the ground and on wood debris.

Distribution: Widely distributed in North America and Nepal.

***Sprassis crispa* Wulf. Fr.**

Eastern Cauliflower Mushroom

Basidiocarp: Large, stalk less, rounded mushroom with finely wavy, white to pale yellowish, flat-edged, leaf like branches. Fruit body 15-30cm wide, 15-25cm high; large, somewhat rounded, rosette like, composed of variously curled, folded, lobed, and flattened branches, usually wavy; white to creamy yellow, cordlike root as base. **Flesh:** White, fleshy. **Spores:** 4-7x 3-4 µm; oval, smooth. Spore print white. **Uses:** Poisonous. **Habitat:** On the wood.

Distribution: worldwide.

***Xylaria hypoxylon* (L.) Grev.**

Basidiocarp: Flask fungi, thin, club – shaped structure, often forked at the tip, erect, tough, 4-7 cm tall, 0.3–0.5cm in diameter, white near the tip but black below, the lower portion somewhat hairy; decomposer of wood. **Stipe:** cylindrical to flattened, black, the upper part white, powederd because of the asexual conidiospores, or enlarged and unbranched as a tapering, pointed cylinder. **Spores:** black in mass, bean shaped, smooth, 11-14x 5-6 µm. **Habitat:** on dead wood in broad leaf forests, typically occurring in clusters. **Uses:** Poisonous.

Distribution: Widely distributed throughout North America, Nepal.

The interpretation of traditional knowledge's regarding mushrooms from the perspectives of Tharu and Magar ethnic cast of Makrahar V.D.C. as follows:

According to of Chetnarayan Darlami and his neighbours, while eating same mushrooms, some people can be sick whereas some cannot. Simply, this happens on the basis of body structure of an individual.

Chetnarayan Darlami quotes that the statements of Dil Bahadur Gurung and says that before three years in Jestha, while eating white mushroom and some red types of mushroom found in the root of Bhogate made him intoxicated, red marks and sore were seen in the body. Likewise, he felt pukish, sleepy and fell down because of giddiness. Furthermore, according to him, nobody has come to ask about mushroom in detailed like until today.

After bringing mushrooms, while cooking with siltimur, timur and ash, all the germs are killed and all the poison contained in it is removed.

He has the habit of eating Gobre chyau found in dung field of corn if it is white and round in shape.

He also further says that the neat and clean mushrooms found in jungle causes swelling in tongue and irritation in tongue. From these symptoms, it is understood that this sort of mushroom is poisonous.

According to Chetnarayan Darlami, the available soil is of various sorts: the acidic, loamy, salty etc. Though the shapes of mushrooms look similar, the structure of soil may have poisonous and effect in mushroom. Many people cannot identify the edible mushroom from non-edible ones. According to some experienced people, some less poisonous mushroom can be eaten after being washed mixed with ash, *Zaxthoxylem*, *Zaxthoxylem oxyphyllum* etc.The *Russula spp.* look white and this quality attracts people to eat this kind of mushrooms which are burnt and eaten on the spot where the mushrooms are found. Such mushrooms are said to be nutritious like fat of the meat. People say that such mushrooms are found on the ground in the month of Asoj when Soraha shradha is going on.

*Scleroderma spp.*are oval shaped like egg, grows in the different levels of soil having taste of meat and sold in Rs. 80 per Kilogram.The edible mushrooms from the month of Kartik should not be eaten because they turn poisonous. The mushrooms are washed, broken, cooked in salt and oil then eaten. The children of Tharu and Magar learnt to search mushroom from their elders and most of them said that they search *Scleroderma spp*.

In accordance with attitudes of Muktinarayan Chaudhary, the chaudharies of Makrahar V.D.C. are aware of about the habit of eating mushroom. There are no cases of sickness or death after eating mushroom in this V.D.C.'s Tharu. With the objective of keeping this condition sustain, the elders of Tharu community impart the knowledge to their children and make sure they know which mushrooms are edible and which are non-edible.

Proverb like "if the Brahmines have eaten the mushrooms, they could have known the actual taste of mushrooms" also prevails in Makrahar V.D.C., different types of belief was found in Makrahar V.D.C. about this proverb. Many years ago, in month of Ashad, farmers were busy planting rice in the fields. There was a sick old person lying in the bed of their home. The old man died but the farmers wrapped the dead body by mat and went to their field to plant rice. Because they thought that planting rice was more important than cremating the dead body. After completing their farming, they gathered to cremate him. At that time they found that the mushrooms were growing on the dead body. After that event, Brahmins had discarded mushroom as food. But nowadays Brahmins have also started to eat mushrooms due to their taste and knowledge about it.

The present survey also proved that the Tharus are the traditional mycophagus in the society of Makrahar V.D.C. and followed by Magar. According to them mushrooms are considered as vegetables. They are mild in taste and contain fat and protein. Those species which grow on straw are agreeable in taste. The mushrooms growing on sugar cane are bitter in taste and have sedative properties. The mushrooms cause cough, gastric trouble, arthritis, liver trouble, enhance urinary excretion, act as purgative and favour the multiplication of parasites in the body. The species growing on bamboos cause stomach disorder. The species growing on dung are bitter. They are responsible for causing sweating and arthritis. It is advised that mushrooms are

not to be eaten with milk. The sporocarps of *Pycnoporus cinnabarinus* are cut and rubbed against mortar with drops of water. The paste obtained from it is applied against the otitismedia.

Four species of wild mushrooms with their medicinal value have been collected from Makrahar V.D.C. and they were:

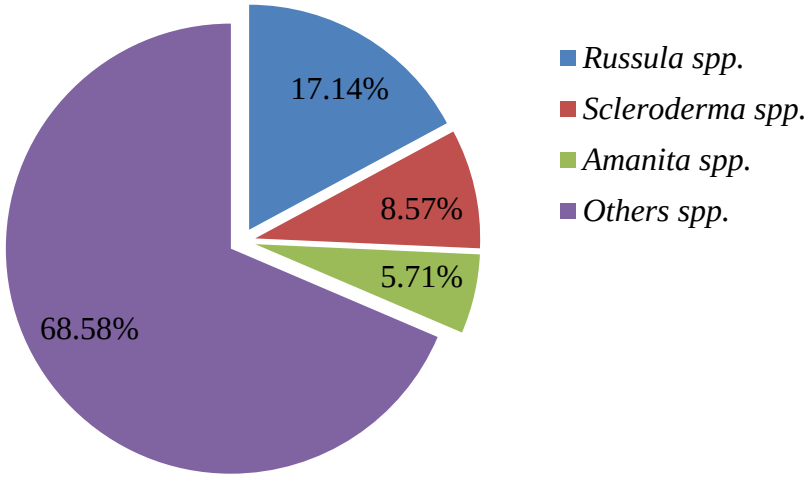
- *Agaricus* species used as cooling, tonic, indigestible, vomiting, dysentery, fever.
- *Boletus* species is used in inhibition of tumor.
- *Fomes fomentarius* used in tumor inhibition.
- *Pycnioporus cinnabarinius* used to heal wounds and ear diseases.

Tabulated Form of Collected Species:

Scientific Name	Local name	Family	Use
Agaricus arvensis.	Chhate chyau	Agaricaceae	Medicinal
Amanita fulva	Tahar chyau	Amaniataceae	Poisonous
Amanita cokeri	Katle chyau/ Bhoot chyau	Amanitaceae	Edible
Boletus subtomentosus	Martep chyau	Bolataceae	Medicinal
Clavaria vermicularis	Keshari chyau	Clavariaceae	Poisonous
Coprinus plicatilies			Poisonous
Fomes fomentarius		Poliporaceae	Medicinal
Macrolepiot rhacades		Macrlepioteaceae	Poisonous
Marasmius oreade		Tricholomataceae	Poisonous
Pleurotus ostreatus		Pleurotaceae	Edible
Pycnioporus cinnabaranus	Rato chyau/ Sindhre chyau	Polyporaceae	Medicinal
Ramaria botrytis	Keshari chyau	Ramariaceae	Edible
Russula variata		Russulaceae	Poisonous
Russula lacatea		Russulaceae	Poisonous
Russula viresces		Russulaceae	Poisonous
Russula rosacea		Russulaceae	Poisonous
Russula emitica		Russulaceae	Edible
Russula nigricans		Russulaceae	Edible
Scleroderma bovista	Aunde chyau	Sclerodermaceae	Edible
Scleroderma cepa		Sclerodermaceae	Edible
Scleroderma citrinum	Phusphuse chyau/ Dalle chyau/Alu chyau	Sclerodermaceae	Edible
Sprassis crispia		Clavariaceae	Poisonous
Xylaria hypoxylon		Xylariaceae	Poisonous

Graphical Representation:

Figure No. 2: Graphical Representation of Total Species Found on Study Area



5. DISCUSSION

The present work has attempted to study two perspectives of wild mushroom. First major objective was to collect, identify and enumerate the mushrooms of Makrahar VDC; second objective was ethno mycological study of few species.

Among the collected species, 23 were identified with 9 families and 15 genera belong to Basidiomycotina.Genus *Russula* has 6 species, *Scleroderma* has 3 species, *Amanita* has 2 species and other genera were present single species of each.

The study area was visited two times in the rainy season. The field visit was accompanied with the local professional collectors. Although, the results of this study cannot predict the total no. of mushrooms species in Makrahar V.D.C., it will help in visualization of the distribution pattern of the wild mycoflora.

Some edible, medicinal and poisonous mushrooms were found in study area. The genus *Russula* has both edible as well as non edible species were found. Ethnomycological informations were obtained from direct interviews and discussion with local people. Direct observations were made on the way where different varieties of mushrooms were collected and gained ethnic concept through open questionnaires. The actual taste of wild edible mushrooms was most palatable and nutrients than cultivated species. Edible mushrooms contain high level of dietary fibers, substantial amount of protein, vitamin and mineral, but are low in fat and sugar. They also have various health benefits such as anti-oxidative, anti- tumor and hypocholestrolic effect. During rainy season, mushrooms grow abundantly in this study area.

Some of the species were previously reported from different study area in the context of Nepal such as the *Amanita fulva*, *Boletus* spp., *Macrolepiota rhacodes* and *Russula spp.* are growing on soil, in the shady places, in the pine forests, Godavari (1515m); Brajayogini (1600m); Gokarna, Kakani (18oom); Nagarkot (1700m) (Adhikari, 1996); Matatirtha (1650m); Lele (1500m); Tokha (1670m) (Adhikari *et a.,* 1996) and Kathmandu valley (Bhandary, 1992). Recently gathered (1998) from Daman. In Nepal the mycophagous ethnic casts collect this mushroom mostly from temperate and subtropical forests for their food.

Similarly, the *Fomes fomentarious*, *Pleurotus* sp., *Coprinus* sp., *Claveria* sp., *Marasmius* sp. *Picnoporus cinnabarinus, Ramaria* sp., *Scleroderma* spp., and *Xylaria* spp. have previous study in Khare and Kuldi (Hjort. & Ryv., 1984); on trunk of *Quercus* sp., Manuchur (Kutung Sang); on dead stump, Namrung(Gorkha Dist.) (2400m) (Adhikari, 1998) and on decayed log, Nay Oder (Dhulia, Bashing Dist.) (2900m) (Adhikari, 1988a). In tropical to temperate belts (Adhikari, 1996a). *Russula nigricans* growing on moist shady place , Suryavinayak (1540m) (Singh & Nisha, 1976; Singh & Upadhyaya, 1979); in *Quercus* forest, Jiri (2300m), (Adhikari, 1990); Manichur (2150m) (Adhikari,1991) and Nagarkot (1670m).

The different ethnic group (Tharu and Magar) collect and consume wild edible mushrooms. Till now no data is recorded to illustrate the amount of collection and consumption of this study area. Present survey is mainly based on the information gathered through interviews of mushrooms collectors in the forest. The field surveys provided the information on the status and frequency of fungi growing in the forest. It was found that the initial collectors of wild edible mushrooms were mainly herds, wood cutters, the collectors of fodders and semi decayed leaf litters.

Based on the interviews at sites it was very difficult to analyze how much amount or number of species one can collect in a day on alternate days and month and how much species one can pack. According to local collectors, the wild edible mushrooms can be collected in large quantities (ranging between 1-10 kg in a day) from the forest during 'in season' especially in full moon and new moon days. Sometimes they cannot get anything. There is no previous data to illustrate the biomass of mushrooms production in these forests. Nobody could say exactly how much they could pick and pack. The frequency of species was found to vary depending on the species.

The fungi survive in nature to adverse condition, by their mycelium, spores, sclerotia and draught resisting structures. Nowadays due to several factors (change in habitat and climate, urbanization, landslides, grazing, cutting down of forest or trees, slash, burn and untimely or unscientific harvesting etc.) the fungi are disappearing from their natural habitat.

The conservation of fungi requires the protection of their environment and ecological habitat by maintaining the natural biodiversity. The conservation of nature and its prevailing surrounding or ecological habitat also helps to control the biological diversity naturally. So to conserve the fungi in nature it is suggested that the surrounding natural habitat, soil structure and texture, debris, the forest and the ecological habitat should not be disturbed. During collection or harvest of fungi leave some well developed ascocarp or basidiocarp in its natural habitat for spore dispersal. Conserve and monitor the host and pest of fungi do not burn the natural environment.

Generally, the fungi are perishable or rotting item. So it is advisable to harvest the useful mushrooms in their season of appearance. People should be encouraged to collect the mushrooms scientifically from the natural resources for their proper utilization. The regular scientific collection will certainly provide service or job opportunities, enhance the income and raise the revenue of the country. The revenue of the each species per kilogram should be based on the cost involved during collection of the species concerned. Domestication of the edible, medicinal and other species must be strictly regulated to control the collection, make sustainable availability and use of the species to raise local funds. The user groups or community forest groups should be trained and strengthened to manage and harvest the mushrooms in a sustainable way.

No simple test can determine whether a mushroom is edible or poisonous. The only way to be certain is to know exactly what species have been found. Only experience can teach to recognize characteristics that differentiate edible from poisonous species.

There are some rules of thumb that can be helpful: 1. Do not eat any *Amanita* species and be especially careful in identifying *Amanita* look-alikes or any other white mushrooms; 2. Avoid little brown mushrooms and large brownish mushrooms, especially those with pinkish, brownish, purple-brown, or blackish gills; 3. Avoid false species of mushrooms. Only a few mushrooms cause life-threatening illness. Many others cause mild to severe poisoning. Some mushrooms toxins affect the central nervous system and others the peripheral nervous system. Some people react adversely to species that are harmless for most and some react adversely to species they have eaten before without ill effects. Typical symptoms include diarrhea and

vomiting. Before any person eat any wild mushroom, be sure to read the appendix on cooking and eating wild fungi.

Before eating any wild mushroom, be absolutely sure about identification and that the mushroom is safely edible. The first time any person eats any species, take only a small portion and do not drink any liquor. If the person experiences no side effects, try a slightly larger portion the next time. Don't eat a large quantity, no matter how often mushrooms, in general, are indigestible.

Unless otherwise advised, cook all wild mushrooms. Some people may experience upset after eating even cooked fungi. Others inexplicably develop a reaction to a species they have eaten for years. Some people are allergic to even the common cultivated mushroom. Don't serve wild mushrooms to children, the elderly, or the sick; these individuals are most susceptible to poisoning. And don't force anyone who is unwilling to share about enthusiasm for wild foods. Be sure to read the appendix on mushroom poisoning and learn to recognize its symptoms.

Almost all mushrooms are best in butter or oil. Most require seasoning with salt and pepper, or with onions, garlic, shallots or scallions. Lemon juice heightens the taste of many mushroom dishes. Mushrooms can be preserved in a number of ways. Most dry well and can be stored for quite a long time. Most mushrooms can be frozen for later use. Clean, then blanch the mushrooms, then plunge them in ice water, drain and pack in freezer-safe containers.

6. CONCLUSION

It is noted that very few species of macro fungi were reported from Sukhaura Hariyali Comminity Forest of Makrahar V.D.C., Rupandehi, Western Tarai. The investigation was concentrated to macrofungi and ethnomycological study in Tharu and Magar ethnic groups of Makrahar V.D.C. Diverse mushroom species were collected on which 23 were identified with 9 families and 15 genera belong to Basidiomycotina. Most species were poisonous (11) following food mushroom (8) and medicinal mushroom (4) respectively. Genus *Russula* has maximum number of species among collected species.

REFERENCES

Adhikari, M.K. 1976. Chyau: ek charcha. *Gorkhapatra* (Kath) **76:** 6. (in Nepali) (2033.8.10).

Adhikari, M.K. 1988a. Polypores (wood rotting fungi) of Nepal. *Banko Janakari.* **2 (1)**: 9-20.

Adhikari, M.K.1988b. The genus *Russula* from the Kathmandu valley. *Ibid.* Pp. 141-146.

Adhikari, M.K. 1990. History of mycological explorations in Nepal. *Cryptog. Mycol.***11** (2): 111-128.

Adhikari, M.K. 1991a. *Hunting wild mushrooms in Nepal.* Presented at the training on the study, collection and preservatio0n on Natural History of Nepal. Organized by Natural History Musseum, Goethe Institute and King Mahendra Trust for Nature Conservation. Pp. 12.

Adhikari, M. K. 1991b. Notes on some higher fungi from Nepal. *Jour. Nat. Hist. Mus.* **12 (1-4):** 9-18.

Adhikari, M.K. 2000. *Mushroom of Nepal.* Edited by G.Durrieu, P. U. printers, Kathmandu, Nepal. Pp.236.

Adhikari, M.K. 2007. Mushroom diversity in Nepal: *Glimpse in Mycological and Mushroom Production in Nepal.* Organized by Mycological and Phytopathological Society of Nepal, 18th June 2007. Pp.20-36

Adhkari, M.K. 2009. *Researches on Nepalese mycoflora (Revised account on the history of mycological exploration.* Alka Basti Marga, Kathmandu Nepal. Pp.90.

Adhikari, M. K. and V. Manandhar, 2004. Populus trees and their diseases in Nepal. In: *Plant Resources Bulletein* No. 25, Department of Plant Resources Kathmandu, Nepal.

Adhikari, M.K., S. Devkota and R. D. Tiwari. 2005. Ethnomycological knowledge on uses of Wild Mushroom in Western and Central Nepal. *Our Nature:* 3 **(1)**:13 -19.

Adl, S. 2003. *The Ecology of Soil Decomposition.* CABI, Wallingford.

Annonymous, 2000. Mushrooms may stop Cancer cells multiplying. *THE HINDU,* India's National Newspaper. Sep. 28,2000.

Aryal, TR. 2009. Mushroom Poisoning Problem in Nepal and Its Mitigation. *Fungi* **2**: 1 Pp 44-46.

Aryal *et.al;* 2012. Mycodiversity in Peepal danda community forest, wetern Tarai Region of Nepal, 2012. Bull Dept PL. Res. 34: 13-17, Kathmandu Nepal.

Aryal HP. & U. Budhthoki, 2012a. Macro fungi of Karhiya community forest, western Tarai, Nepal. 2012. Nep. Bio. Soc. **2:** 93-97. Biratnagar, Nepal.

Aryal H.P. & U. Budhathoki, 2012b. Survey on Mycodiversity in Namuna community forest, Rupandehi District Nepal: An Ethnomycological approach, In: Proceedings of seminar on Modern trends in science & technology. Dec. 28-29. Biratnagar, Nepal. Organied by RECOST, NPS & NBS. 51-61Pp.

Aryal, H.P. & U. Budhathoki, 2013a. *Buchwaldobolems lignicola* (Basidiomycetes) an Inedible Wild Mushroom New to Nepal. *Our Nature,* 11**(1):** 31-35.

Aryal, H.P. & U. Budhathoki, 2013b. The Genus *Amanita* (Pers.) In Lumbini Zone Nepal. Scientific World, 11**(1):** 113-120.

Aryal & U. Budhathoki, 2013c. Mycodiversity of Sankarnagar community forest, Rupandehi District. *Nep. Jour. Sc. Tech.* 2013, 14 **(1):**

Aryal, H.P. & U. Budhathoki, 2013d. Ethnomycological studies on some macro-fungi in Rupandehi District, Nepal. *Banko Janakari,* 2013. 23 **(1):** 51-56.

Aryal, H.P. & U. Budhathoki, 2014. Some wild mushroom of Rupandehi District, west Nepal. BIBECHANA. *A Multidisiplinary Journal of science, technology and mathematics.* ISSN 2091-0762.10 (2014) 34-43: BMHSS. P.34.

Atri, N.S. and H. Kaur. 2003. Wild mushrooms collection and identification. *Mushroom Res.* **14:** 56-59.

Bakshi, B. K. 1971. Indian Polyporaceae. *Indian Council of Agriculture Resources,* New Delhi, India.

Balkrishna, B. & Nair, M.C. 1994. Medicinal mushrooms. In Nair, M.C., Gokulapalan. C., and Luludas-Eds: *Advance In Mushroom Biotechology.* Scintific publishers, Jodhpu, India.

Balfour-Browne, F. L. 1955 Some Himalayan fungi. *Bull. Brit. Mus. (Nat. Hist.) Ser. Bot.* **1:** 189-218.

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. Natural History.*3: 375- 401.

Berkeley, M.J. 1854. Decades of fungi, XLI-XLII. Indian fungi. *Hooker's Jour. Bot.* Kew. Gard. Misc. jour. **6** : 129-143.

Bhandary, H.R. 1980. Notes on some macrofungi of Nepal. *Jour. Nat. Hist. Mus.* **4:** 23-32.

Bhatt, D.D. & JD. Manandhar,1971. Two species of *Saprolagnia* ***[S.*** *terrestris* Cook. & *S. ferox* (Curt.) Turd.**]**from Kathmandu. *Ibid.* **4:** 55-60.

Bhatt, D. D. 1966. Preliminary list of plant diseases recorded in Kathmandu valley. *J. Nat. His. Mus.,* **2:** 13-20.

Boa, E. 2004. *Wild Edible Fungi: A Global Overview of Their Use and Importance to people.* Non-wood forest products series no.17. Food and Agriculture Organization of the United Nations, Rome.

Brundertt, M., Bougher, N. Dell; B. Grover; & N. Malajczuk, 1996. Working with mycorrhizas in forestry and agriculture. ACIAR. *Monograph.* 32. Pp.374.

Chang, S.T., & P.G., Miles, 1992. Mushroom biology – A new discipline. *Mycologist,* **6:** 64-65.

Christesen, M., Devkota, S. and Bhattarai, S. 2008. Use of wild edible mushrooms in 2205-2221

Collins, R.A. 1997. "Polysaccharopeptide from *Coriolus versicolor* has potential for use against human immunodeficiency virus type 1 infection. *Life Sciences* **60 (25):** PL 383-7.

Daba, A.S. 2007.Mushroom growing program in Egypt. *Mycoafrica. Vol 2(1): 1 – 11.*

Dickinson,C. and J. Lucas. 1979. *Encyclopedia of Mushrooms.* Orchid Publication, London.

Dobremez, J.F. 1971. *Carte Ecologique du Nepal,* Annapurna / Dhaulagiri. Doc. Carte Veg. Alpes, IX.

Dighton J. 2003. *Fungi in ecosystem processes.* Marcel Dekker, New York.

Dighton, J.F. White, & P. Oudemans, 2005. *The fungal community: its organization and role in the ecosystem.* CRC, Boca Ratan, FL.

Dix , NJ. & J. Webster, 1995. *Fungal ecology.* Chapman and Hall, London.

Ghoneum, M. 1998. "Anti-HIV activity in vitro of MGN-3, an activated arabinoxylane from rice bran. *Biochemical and Biophysical Research Communications.* 243: 25-29.

Grades,M; and T.D., Bruns, 1996. ITS-RFLP matching for identification of fungi. In: Clapp, E.J. (Ed.). *Methods in Molecular Biology* 50: 177-186.

Hao-qin Pan, Jin-feng Yu, Yue-ming Wu, Tian-yu Zhang and Hong-feng Wang. 2008. Diversity analysis of soil dematiaceous hypomycetes from the Yellow River source area. *Journal of Zhejiang University Science 6: 64-69.*

Harmon, M.E., JF. Franklin & F.J. Swanson, [and others]. 1986. Ecology of coarse woody debris in temperate ecosystems. *Advanced Ecological Research 15: 133-320.*

Hattori, M. 1997. **"**Inhabitory effects of components from *Ganoderma lucidum* on the growth of human immunodeficiency virus (HIV) and the Protease Activity" In: *Proceeding of the 1st International Symposium on Ganoderma lucidum* in Japan. Nov. 17-18th , Tokyo.Pp. 128-135.

Hawksworth 1991. The fungal dimension of biodiversity: magnitude, significance and *conservation. Mycological Reasearch* 95:641-655.

Hooker, J.D. 1954. *Himalayan Journals* 1-2. J. Murray. London.

Horton, T.R. & T.D. Bruns, 2001. The molecular revolution in ectomycorrihizalecology: Peeking into the black- box. *Molecular Ecology* 10: 1855-1871.

Imazeki, R; Y. Kobayashi; and K. Aoshima, 1966. Fungi. *The flora of eastern Himalaya.* Ed. H. Hara. University of Tokyo, Japan. Pp. 611-626.

Jordan, C.F. 1985. *Nutrient cycling in tropical forest ecosystems.* Wiley, Chichester, West Sissex.

Kibby G. 1979. Mushrooms and Toadstools. Oxford University Press, London.

Khadka, B.B;and S.M. Shah,1967. preliminary list of plant diseases recorded in Nepal. *Nep. Jour. Agri.* **2 :** 47-76.

Kim, B.K., H.W.Kim; & E.C. Choi, 1994. "Anti-HIV effects of *Ganoderma lucidum"* In: Ganoderma: Systematics, Phytopathology and Pharmacology: *Proceedings of Contributed Symposium 59 A, B. 5th International Mycological Congress.* Vancouver, Canada.

Kirk, P.M & P.F. Cannon; D.W. Minter and J.A.Stalpers,2008. *Ainsworth & Bisby's Disctionary of the Fungi.* 10th edn. CAB International, Wallingford, UK.

Lama, T.K. 1976 Some parasitic fungi from Pokhara (W. Nepal). *Jour. Sc.* **6:** 49-52.

Lama, T.K. 1977 Some parasitic fungi from Pokhara. *Jour. Nat. Hist. Mus.* **1:** 63-66.

Lee, S.S. Y.S. Chang, & M.N.R. Noraswati 2009. Utilization of macrofungi by some indigenous communities for food and medicine in Peninsular Malaysia. *Forest Ecology and Management* 257:2062-2065.

Llyod, C.G. 1808 *Mycological notes.* Mycology Cincinnts, olio: Library & Misum 1898-1925.Pp.1-75.

Lodge, D.J. 1992. *Nutrient cycling by fungi in wet tropical rainforest. In: Whalley AJS (ed) Aspects of tropical mycology.* Cambridge University, University of Liverpool.

Manandhar, V.K. & M.K. Adhikari, 2009. The family Sclerodormaceae: ectomycorhizal fungi from Nepal. *Bull.of Dep.of pl. res.*31: 29 – 34.

Mckenenny, M. 1971. The savory wild mushroom. University of Washington Press, USA.

Miller, O.K. 1984. *Mushroom of North America.* E. P. Duttom Publishing Company Inc. New York.

Mueller, G.M. J.P. Schmitt, Leacock, PR. Buyck, B. Cifuentes, J. Desjardin, DE. Halling, R.E. HIjorstam, K. Iturriaga, T. Larsson, K-H. Lodge, DJ. May, TW. Minter, D. Rajchenberg, M. Redhead, SA. Ryvarden, L. Trappe, JM. Walting, R. WuQX. 2007. Global diversity and distribution of macrofungi. *Biodiversity and conservation.* 16:37-48.

Nanba, H. 1992. "Immunostimulat activity in-vivo and anti-HIV activity in-vitro of 3 branched glucans extracted from Maittake mushroom (*Grifola frondosa). Proceedings of the VIII International Conference on AIDS and the III STD World Congress.*

Otani, Y. 1982 Cup fungi collected in Nepal. 1. *Reports on the Cryptogamic study in Nepal.* Ed. Y. Otani, National Science Museum, Tokyo. 75-91

Pacioni, G.1985. *The Mcdonald's encyclopedia of mushrooms and toadstools.* Mcdonald & Co. Ltd., London.

Packham, J.M. May, T.W. Brown, M.J. Wardlaw, T.J. & Mills, K.A., 2002. Macrofungal diversity and community ecology in mature and regrowth wet eucalpt forest in Tasmania: A multivariate study. *Australian Ecology* 27: 149-161.

Pai, S.H. S.C. Jong, & D.W.Low,1990. Uses of Mushroom. *Bio-industry,* Vol, V.

Pandey, B.D. 1976 Survey, collection, preservation and identification of the mushrooms in Nepal. *Nep. Jour. Agri.* **6 – 11 :** 115-129.

Pegler, D. N. 1977. *Pleurotus* (Agaricales) in India, Nepal and Pakistan. *Kew Bull.* **31 (3):** 501-510.

Philips, R. 1981. *Mushrooms and other fungi of Great Britain and Europe.* Pan Book Ltd. London.

Purukayastha, R. P. and A. Chandra,1985. *Manual of Indian Mushrooms.* Jagendra Book Agency, New Delhi, India.

Rai, S.D, B.L. Dhar, & Verma. 1997. Advances of Mushroom Biology and Production. In: *Proceedings of National Conference on Mushrooms.* NCMRT. Solan.

Ramsbottom, J. 1954. *Mushrooms & toadstools.* Collins 14 ST Jame's Place London.

Richard, F. Moreau, P. Selosse, MA. and Grades, M. 2004. Diversity and fruiting patterns of ectomycorrhizal and saprophytic fungi in an old-growth Mediterranean forest dominated by *Quercus ilex L. Canadian Journal of Botany* 82:1711-1729.

Rinaldi, A. & V. Tyandalo, 1972. *The Complete Book of Mushrooms.* Crescent Book, New York.

Rutajit, A. 2006. *Astrotheology & Shamanism: Unveiling the Law of Duality in Christianity and Other Religions.* The Book Tree. P. 216.

Schmit, J.P. 2005. Species richness of tropical wood-inhabiting macrofungi provides support for speciesenergy theory. *Mycologia* 97:751-761.

Singh, S.C. 1966 Mushrooms. Deorali. **4:** 15-31.

Singh, S. C. & Nisha 1973 Notes on some Cercospore of Nepal. *1. Jour. Sc.***5 :** 22-24 .

Singh, S.C. & Nisha 1976 Myxomycetes of Nepal. *Jour. Sc.* **6 :** 73-83.

Singh, S.C. & B.N. Upadhyaya, 1979. Notes on some fungi to Nepal. *Ibid.* **2:** 51-53.

Singer, R. 1986. The Agaricales in Modern Taxonomy. 4th edition Bishen Singh and mahendra Pal Singh, Dehradun, India.

Singer, R. & Hairs 1987. *The Agaricales in Modern Taxonomy.* Koeltz Sc. Germany.

Smith, S.E; & D.J. Read, 1997. *Mycorrhizal Symbiosis.* second ed. Academic Press, London.

Suzuki, H., A. Okubo, S. Yamazaki; K. Suzuki; H. Mitsuya; and S.Toda; 1989. "Ihibition of the infectivity and cytopathic effect of human immunodeficiency virus by water soluble lignin extract of the culture medium of *Lentinus*

edodes mycelium (LEM)." *Biochemical and Biophysical Research communications.* Vol. 160, no.1.

Suman and Sharma, O. P. 1998. *Textbook of Fungi.* TataMcGraw Hill. New Delhi, India.

Svreck, M. 1975. A colour guide to familiar mushrooms. Octopus Book Company.

Swapna S, Syed Abrar; & M. Krishnappa, 2008. Diversity of macrofungi in semi-evergreen and moist deciduous forest of Shimoga district-Karnataka, India. *Journal of Mycology and Plant Pathology* 38:21-26.

Wang, Y. & R. Hall, 2004. Edible ectomycorrhizal mushrooms: challenges and achievements. *Canadian Journal of Botany* 82: 1063-1073.

Webster, J.1970. *Introduction to Fungi.* (2nd Ed.) Cambridge University Press, Cambridge.

Waratich, K. S. & K.S. Thind, 1977. Fungi of Nepal. *Jour nat. Hist. mus.* **1:** 21-34.

Wood, T. 1992. *Mycorrhizal fungi: Challenges for commercialization. In: handbook of Applied Mycology.* Fungal Biotechnology, Arora, D. K., R. P. Elander and K. G. Mukerji (Eds). Marcel Dekker, New York.

Zamora, C.M. & Cecilia; De. Nieto; Pascuala-Pola. 1995. Natural production of wild edible mushrooms in southwestern rural territory of Mexico City, Mexico. *Forest Ecology and Management 72: 13-20.*

ANNEX 1: FORMAT OF THE QUESTIONNAIRE

Date:

Name:

Address:

Age: **Sex:** **Caste:** **Occupation:**

1. Do you go daily/ occasionally for collection?
2. Which type of forest you prefer to go for collection?
3. Which season is favorable for collection?
4. Do you know some Tithis in which mushrooms are found enough?
5. What are the plant species and their condition on which mushrooms generally grow?
6. How do you collect mushrooms?
7. How do you store mushrooms?
8. How do you identify poisonous or edible mushrooms?
9. How can we minimize the poisonous nature of mushrooms so that the can be suitable to eat?
10. What are the best edible mushrooms and generally collected?
11. Do you know any mushrooms having religious/ medicinal values?
12. Do you know some more values?
13. Have you ever sold mushrooms?
14. Which species the buyer usually prefer?
15. Have you seen any type of mushrooms, which were existed in the past time but now are rare or extinct?
16. Have you marked any type of mushrooms eaten by animals like monkey or others?
17. Have you ever eaten poisonous mushrooms unknowingly? If yes, then what did you feel? After, how did you do at that time?
18. Do you face the problems during mushrooms collection?
19. Do you think that, the mushrooms diversity should be conserved?
20. It is saying that, “If the Brahmins have eaten the mushrooms, they could have known the actual taste of mushrooms.” What do think about this? In your opinion why this type of belief arose?
21. Lastly, do you know the local names of mushrooms in Makrahar V.D.C.?