Biological Forum — An International Journal, **4**(1): 27-34(2012)

ISSN No. (Print) : 0975-1130
ISSN No. (Online) : 2249-3239

Diversity of Macrofungi in Shivapuri National Park of Kathmandu Valley, Nepal

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(Received 5 April, 2012, Accepted 20 April 2012)

ABSTRACT : Shivapuri Nagarjun National Park is the one of important park in Nepal. It is located in the country's mid-hills on the Northern fringe of the Kathmandu Valley. The annual precipitation of about 1,400 mm falls mostly from May to September. Temperatures vary from 2-17°C during the winter season, rising 19-30°C during the summer season. The macrofungal diversity is very rich due to litter decomposition. During present study a survey was made along the road side of the national park up to the height of 1800m. in order to collect variety of macrofungi were called habit, habitat, substrate and ethnobotanical information. The species were deposited in Museum, Department of Botany and identified through morphological and microscopic examination of pileus and stipes, colour of pileus, gills and stipes, cap profiles, stem profiles, spore structure. Out of 50 macrofungal species collected, 22 species were identified. The species were *Abortiporus biennis, Agaricus haemorrhoidarius, Amanita smithiana, Amanita phalloides, Amanita vaginata, Bovista pila, Boletus chrysentern, Calocybe chrysenteron, Cantharellus cibarius, Chrysomphalina chrysophylla, Coltricia cinnamonea, Lepiota ochraceofulva, Macrolepiota rhacodes, Omphalotus oleariusus, Rhizopogon luteolus, Russula delica, Russula emetic, Rusula fragilis, Russula sororia, Stereum hirsutum, Thelophora fuscella, Xerocomus badius.*

Keywords : Macrofungi, diversity, poisonous, medicinal.

INTRODUCTION

Shivapuri Nagarjun National Park is the ninth national park in Nepal and was established in 2002. It is located in the country's mid–hills on the northern fringe of the Kathmandu Valley and named after Shivapuri Peak of 2,732m. altitude. It covers an area of 159 km^2 in the districts of Kathmandu, Nuwakot and Sindhupalchowk, adjoining 23 Village Development Committees. The area has always been an important water catchment area, supplying the Kathmandu Valley daily with several hundred thousands cubic liter of water. In 1976, the area was established as a protected watershed and wildlife reserve. In 2002, it was gazetted as Shivapuri National Park, initially covering 144 km^2, and extended by the Nagarjun Forest Reserve in early 2009 to its present size. The park is located in a transition zone between subtropical and temperate climate. The annual precipitation of about 1,400 mm falls mostly from May to September, with 80% during monsoon. Temperatures vary from 2–17°C during the winter season, rising to 19–30°C during the summer season (Bhuju, *et al*., 2007).

There are numerous fungi that produce fleshy fruiting bodies known as mushroom belonging to group Basidiomycetes and Ascomycetes. Macrofungi are defined as fungi that form macroscopic fruiting bodies, which can be either epigeous or hypogenous and large enough to be seen with naked eye and to be picked by hand. The most common type of macrofungi is umbrella shaped while other species are in the form of gilled fungi, jelly fungi, coral fungi, stinkhorns, barket fungi, puffballs and bird nest fungi pliable cups, round like golf balls. Besides, they are in the shape of small clubs, coral and human ear like. Macrofungi may be edible, inedible, medicinal and poisonous also. Many kinds of macrofungi are not edible, but also possess tonic and medicinal qualities (Chang and Miles, 2004). Macrofungi are heterotrophic, saprophytes and utilize lignocellulosic wastes. The organic materials from which macrofungi derive their nutrition are referred to as substrates. They appear in all season, chiefly during rainy weather, wherever organic matter or decomposition products are available. Macrofungi are not only beautiful but play a significant role in daily life of human beings besides their utilization in industry, agriculture, medicine (Molina *et al*.,1993) and as biofertilizers and many other ways (Hunt,1999; Gates ,2005).

Berkeley (1854) described 44 species of higher fungi from Nepal. Adhikari (2000) reported nine genera of Ascomycotina and twenty–eight genera of Basidiomycotina from Maipokhari, East Nepal. Further, Adhikari (2001) reported 11 wild mushroom species from Kathmandu valley. Adhikari and Adhikari (2003) collected 12 species of fleshy fungi from the vicinity of Duradanda, Lamjung. Adhikari (2004) studied the mushroom poisoning and its state in Nepal. He found the annual casualty rate was between 15 and 30 people in the urban areas.The major report of Christensen *et al*. (2007) is available which recorded 228 species of wild macrfungi from Nepal. Therefore, present study is undertaken to collect the detailed information of macrofungi of Shivapuri area up to the height of 1800m.

MATERIALS AND METHODS

The specimens were collected from July, 2010–October, 2011 using methods of (Kumar *et al*., 1990; Atri *et al*., 2003). During collecting the mushrooms various equipments such as hunting knife, digging tools, scissors and wax paper pockets for wrapping the collected mushrooms were used. Morphological details such as shape, size, color of the fresh specimens were recorded before preservation. Collected specimens were then preserved in a liquid preservative (25 : 5 : 70 ml Rectified alcohol + formalin + distilled water, Hawksworth *et al*., 1995). Crystals of 1–4, dichlorobenzene were used to protect dried specimen from insect infection. Photographs of fresh specimens were taken in the field with digital camera (Panasonic DMC–F2). Microscopic characterization was carried out with cotton blue lactophenol (1g/100ml lactophenol). Identification of various macrofugal genera was made using publication of Adhikari (2000a), Arora (1996) and Singer (1996). Information related to species of various macrofungal genera was also taken from Hawkshworth *et al*. (1995) and Kirk *et al*. (2008). Identification was made on the basis of critical observations of the specimens and Mycokey (http:/www.mycokey.com). All the identified and un–identified specimens were diposite to herbarium, Bacteriology and Natural Pesticide Laboratory, Department of Botany, DDU Gorakhpur University, Gorakhpur U.P. India.

RESULTS AND DISCUSSION

During the survey 50 species of macrofungi were collected 22 species were identified belonging to 14 families. These are individually described. The present description agrees with the description given by Jordan (1995).

1. *Abortiporus biennis* (Bulliard: Fries) Singer (Family–polyporaceae) (Fig. 1.)

Specimen No. DDUNPL–097

Diagnostic characters: Fruiting body annual, fan–shaped to infundibuliform, pilei 6–12 cm broad, often clustered; margin level to uplifted, wavy; upper surface tomentose, white, pinkish, reddish–brown, tan to ochre–brown, "aberrant fruitings" also produced, consisting of cauliflower–like layered masses, the entire surface poroid; context up to 1.0 cm thick, two–layered, upper layer soft–textured, lower layer leathery, stipe if present, poorly developed, spores ellipsoid to ovoid, smooth, hyaline, non–amyloid.

Habitat: In small groups in soil or grass near wood stumps *Place of collection*: Panimuhan, *Altitude:* 1280m, *Date of collection*: June 17, 2011. *Edibility*–Inedible.

2. *Agaricus haemorrhoidarius* Kchb. & Schulz. (Family–Agaricaceae) (Fig. 2A, 2B)

Specimen No. DDUNPL–098

Diagnostic characters: Medium–sized agaric with brown scaly cap, chocolate or black gills, stem with ring and bulbous base, flesh reddening where damaged; in trooping groups on soil with broad–leaf trees. Cap 6.0–9.0cm dia; stem 6.0–10cm tall × 1.0 –2.0cm dia. Cap dull umber–brown, breaking up into addressed scales against a slightly more pallid background; at first sub–spherical, becoming convex and expanded. Gills blackish, free, crowded spores chocolate –brown, smooth. Stem white, then tinged brown more or less equal but with broad bulbous base. Ring white, single, pendulous, superior.

Habitat: On soil, *Place of collection*: Mudkhu, *Altitude*: 1280m. *Date of collection:* July 13, 2011. *Edibility*: Edible

3. *Amanita smithiana* Bas (Family–Amanitace) (Fig. 3).

Specimen No DDUNPL–099

Diagnostic characters: Medium to large, the spiny warts which clothes the fruiting body, cap whitish, stem white, gills white, free, on soil, solitary, poorly scattered. Cap 5.0–11.0cm dia; stem 6.0–18.0cm tall × 1.5–2.5cm. Cap white with spiny warts, convex, gills white, free, spore hyaline, smooth, ellipsoid. Stem white covered with spiny warts, basal bulb. Ring absent.

Habitat: On soil, *Place of collection:* Shivapuri, *Altitude*: 2250m, *Date of collection:* Augest 2, 2010.

Edibility: Deadly poisonous (Symptoms include nausea and vomiting beginning 2–12 hours after ingestion and progresses to kidney failure in 2–6 days).

4. *Amanita phalloides* (vaill.:Fr.) Link (Family– Amanitaceae) (Fig.4)

Specimen No. DDUNPL–0100

Diagnostic characters: Medium to large fleshy agaric with greenish–olive cap, whitish stem, no patches but distinctive volval sheath: solitary or scattered on soil, favouring mixed light broad–leaf woods, usually with oak. Cap 5.0–10cm dia; stem 6.0–11cm tall × 0.8–1.5cm dia. Cap greenish, with yellow or olivaceous tinges, convex, becoming expanded or flattened. Gills white, free, crowded, spores hyaline, smooth, sub–spherical or broadly ellipsoid, amyloid. Stem white or tinged cap colour, tapering upwards, basal bulb sheathed by large, loose, ragged, white volval sac. Ring white.

Habitat: On soil, *Place of collection*: Shivapuri, *Altitude*: 1850m. *Date of collection*: July 08, 2011.

Edibility: Deadly poisonous. It contains both phallotoxins and amanitins. All human organs are effected, but damage to the liver is primarily responsible for the death of *A. phalloides* victims. Symptoms usually appear 8–12 hours after ingestion. Death occurs in 5–7 days in 10–20 % of patients.

5. ***Amanita vaginata*** (Bull.:Fr.) Vitt. (Family – Amanitaceae) (Fig. 5)

Specimen No. DDUNPL–0101

Diagnostic characters: Medium –size, greyish, fleshy agaric with volval bag but no ring or cap patches, solitary or scattered on soil. Cap 4.0–7.5cm dia. stem 10 – 18cm tall × 1.0–2.0cm dia. Cap greyish brown, expended to almost flat with a slight umbo and with sulcate margin. Gills white with tinged cap color, stem tapering upwards, arising from large volval bag, Ring absent.

Habitat: On soil, *Place of collection:* Mudkhu

Altitude: 1500m, *Date of collection*: July 24, 2010.

Edibility: Medicinal.

6. *Bovista pila Berk.* and Curt. (Family – Lycoperdaceae) (Fig. 6a, 6b).

Specimen No. DDUNPL–0102

Diagnostic characters: Large, white or grey, solitary, scattered, to gregarious along trails, grassy areas, or in sandy soils under tree fruiting throughout the rainy season or starting of the winter season. Fruiting body 7.0–11.0cm broad, globose to slightly compressed, lacking a sterile base, attached to the substrate via a white mycelial cord, peridium thin, thick; exoperidium white, glabrous to matted–tomentose, becoming dingy–tan, endoperidum metallic–grey, gleba white, turning olivaceous, then dark–brown to slightly purplish at maturity, texture firm; spores released via apical cracks and tears; sterile base and subgleba absent; odor and taste mild. Spores–Spores 3.5–4.5 µm, globose, thick–walled, smooth to roughened, often with a central oil droplet, some with a clear, short pedicel, usually <1.0 µm, rarely up to 3.0µ spores dark–brown; capillitium bovistioid, composed of individual filaments, branching more or less dichotomously from a trunk–like base; pits absent.

Habitat: Under the tree *Place of collection*: Mudkhu,

Altitude: 1400m. *Date of collection*: October 24, 2010.

Edibility: Inedible.

7. *Boletus chrysentern* Bll. (Family–Boletaceae) (Fig. 7)

Synonym: Xerocomus chrysenteron (Bull.) Quélet

Specimen No.DDUNPL–0103

Diagnostic characters: Medium–sized, Pileus–dark brown to olive brown, soon areolate, the exposed context pallid at the disc, pinkish near the margin; flesh white, thick, Solitary or in small groups in hardwood, Hymenophore–Pores relatively large 1–2 mm, yellow, Stipe–thick, dry, smooth to longitudinally ridged, yellowish, with reddish tints usually predominating at the base. Cap 5.0–9.5cm dia. Stem 5.0–11cm tall × 1.0–1.5 cm dia. Spores–Spores 11.5–14.0 × 4–6 µm, smooth, elliptical to fusiform; spore print olive–brown.

Habitat: Under the tree, *Place of collection:* Panimuhan,

Altitude: 1400m. *Date of collection*: September 24, 2010.

Edibility: Edible (But not popular).

8. *Calocybe chrysenteron* (Bull.: Fr.) (Family–Tricholomataceae) (Fig. 8)

Specimen No. DDUNPL–0104

Diagnostic characters: Small to medium–sized fleshy agaric, reddish–orange cap with yellow margin, yellowish gills, in trooping groups on stumps and dead wood of broad–leaf trees. Cap 3.5–6.0cm dia; stem 3.0–5.0cm tall × 0.4–0.5cm dia. Spores hyaline, smooth, sub–spherical, non–amyloid, droplets. Cystidia and ring absent.

Habitat: On dead wood, *Place of collection*: Mudkhu, *Altitude*: 1350m. *Date of collection*: October 24, 2011.

Edibility: Edible (Confusion must be avoid with poisonous species).

9. *Cantharellus cibarius* L.*:* Fries. (Family – Cantharellaceae) (Fig. 9)

Specimen No. DDUNPL–0105

Diagnostic characters: Egg–yellow, funnel–shaped fruiting body with gills, on soil in trooping groups on twigs, leaves and other litter of broad–leaf trees. Cap 2·0–7·0cm dia; stem 2·0–6·0cm tall × 0·3–0·9cm dia. Cap egg–yellow with in curved margin and wavy, smooth and more or less shiny. Gills absent–lower surface yellow bearing vein–like ridges, irregularly froked, decurrent. Stem yellow slightly tapering downwards. Flesh yellowish, fading and firm.

Habitat: on soil in trooping groups on twigs, leaves and other litter, *Place of collection*: Shivapuri, *Altitude*: 1600m. *Date of collection:* July 30, 2011. *Edibility*: edible.

10. *Chrysomphalina chrysophylla* (Fries) Clémençon (Family–Tricholomataceae) (Fig. 10).

Synonyms: *Omphalina chrysophylla* (Fries) Murrill; Gerronema chrysophyllum (Fries) Singer.

Specimen No.DDUNPL–0106

Diagnostic characters: Small to medium orange agaric with funnel–shaped cap and broad decurrent gills, in troops on soil.Cap 1.5–5.0cm dia. Stem 1.5–4.0cm tall × 0.1–0.3cm dia. convex, broadly so in age, often with a depressed disc; margin incurved at first, becoming decurved, light–brown to apricot–brown over a dull yellowish ground color, palest at the margin, fading overall in age; flesh thin, pale yellow–orange, unchanging. Gills subdecurrent to decurrent, not forked, moderately broad, thin, at first pale–yellow, becoming yellowish–buff. Stipe–stuffed to hollow, more or less, equal, round, somewhat brittle; surface glabrous, dull orange–brown lighter at the apex; partial veil absent. Spores–Spores 9–14 × 4.5–6 µm, elliptical, smooth, nonamyloid; spore print not seen. Ring absent.


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2A


2B


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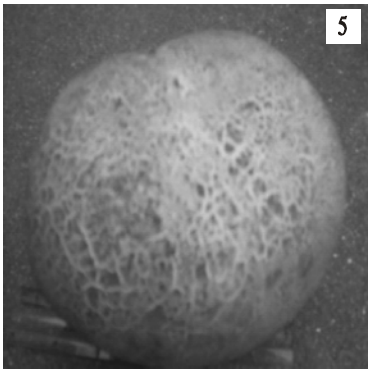
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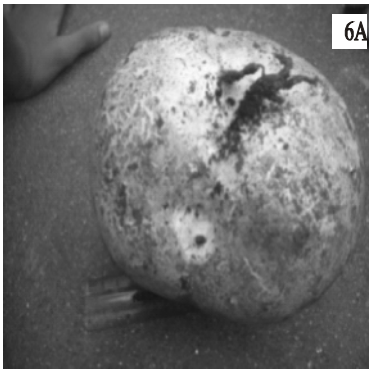
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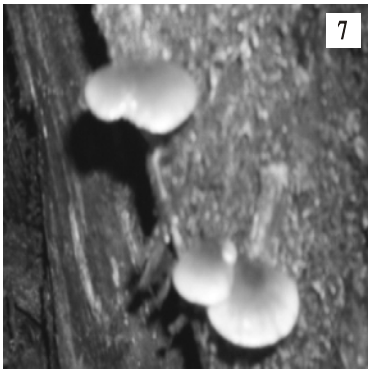
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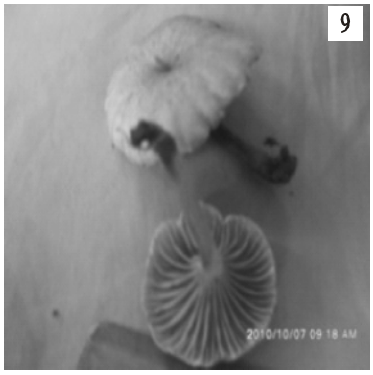
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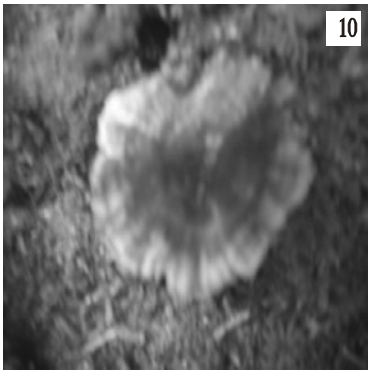
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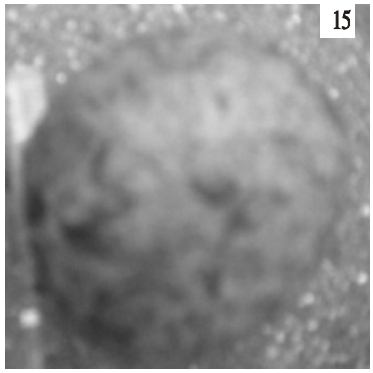
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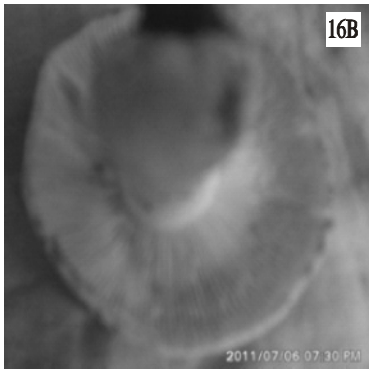
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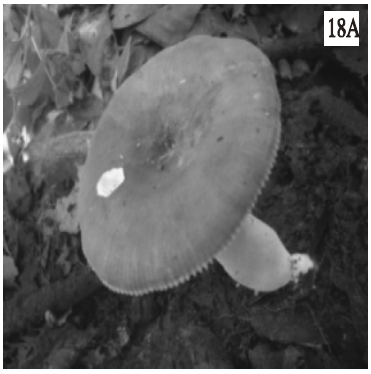
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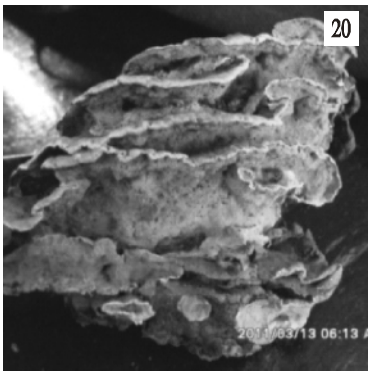
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Habitat: In troops on well decayed wood, *Place of collection*: Gumba, *Date of collection*: August 24, 2010 *Altitude:* 1270m.

Edibility: Inedible.

11. *Coltricia cinnamonea* (Persoon) Murrill (Family–Hymenochaetaceae) (Fig. 11)

Specimen No. DDUNPL–0107

Diagnostic characters: Faintly–zoned, reddish–brown fruiting body. Cap plano–depressed to funnel–form or umbilicate; margin straight to wavy, frequently deflexed at maturity; surface dull, matted–tomentose, sometimes faintly wrinkled, with usually well–defined bands of cinnamon–brown, beige, yellowish–brown and greyish–tan, the actively growing margin lighter; specimens in exposed locations greyish with age; medium–brown to rust–brown, Hymenophore–Pore layer subdecurrent to decurrent, buff–brown to pale cinnamon–brown, Stipe–long, thick, central, round to compressed, solid, equal except swollen at the base; surface tomentose to velutinate, dingy orange–brown, colored like the stipe surface. Solitary, gregarious, or clusters, usually associated with conifers, often growing in disturbed areas, e.g. roadsides, moss–banks etc., rarely on rotting wood. Cap1.0–7.0 cm dia. Stem 0.5–5.0 cm long× 3.0–7.0 mm thick, Spores 6.0–8.5 × 4.0–4.5 µm, elliptical to oblong–elliptical, smooth, thin–walled.

Habitat: On soil, usually associated with conifers, often growing along the roadside & moss–banks.

Place of collection: Shivapuri, *Altitude*: 1380m.

Date of collection: July 30, 2011.

Edibility: Inedible, leathery.

12. *Lepiota ochraceofulva* P Orton (Family–Agaricaceae) (Fig. 12)

Specimen No. DDUNPL–0108

Diagnostic characters: Smallish agaric with creamy–brown scaly cap, white gills and stoutish stem with ring and slightly swellen base; clustered on soil. Cap 3.0–6.5 cm dia; stem 4.0–10 cm tall × 0.4–1.0 cm dia. Cap brown or rust, breaking up into scales revealing cream flesh beneath; at first sub–spherical, becoming expanded–convex with slight umbo. Gill white, free, crowded. Spores hyaline, smooth, ellipsoid. Stem ochraceous–brown, smooth ,more or less equal, base slightly swollen. Ring membranous, zone–like,superior.

Habitat: On soil, *Place of collection:* Gumba, Altitude: 1270m.

Date of collection: July 24, 2010. *Edibility*: Inedible.

13. *Macrolepiota rhacodes* (vitt.) Sing. (Family–Agaricaceae) (Fig. 13)

Specimen No. DDUNPL–0109

Diagnostic characters: Large agaric with pale greay–brown cap and white stem with ring and bulbous base, scattered on soil. Cap 4.0–12cm dia. Stem 7.0–14cm tall × 1.0–1.6cm dia. Cap grey–brown, decorated with darkish brown,broad, slightly reflexed, fibrous shaggy scales; at first bun–shaped, become flattened. Gills white, free. Spores hyaline, smooth, ellipsoid. Basidia 4–spored. Cystidia not distinctive. Stem white, tapering slightly upwards. Ring concolorous with stem.

Habitat: On soil under broad–leaftrees, *Place of collection*: Gumba, *Altitude*: 1300m. *Date of collection:* July 3, 2011. *Edibility*: Inedible.

14. *Omphalotus olearius* (DC.: Fr.) Sing (Family–Paxillaceae) (Fig. 14)

Specimen No. DDUNPL–0110

Diagnostic characters: Large orange–yellow, agaric with funnel–shaped cap, tufted on root and at the base of the trunks of trees. Cap 6.5–13cm dia. Stem 4.0–16cm tall × 1.5–3.0cm dia. Cap intense orange–yellow, smooth, more or less incurved at margin. Gills deeper orange, decurrent, crowded. Spores hyaline, smooth, sub–spherical, non–amylod, 4–7× 3–6µm. Stem concolorous with cap, tapering downwards, smooth, typically curved. Ring absent.

Habitat: On stumps, *Altitude*: 1650m, *Date of collection*: September 02, 2011. *Place of collection:* Shivapuri.

Edibility: Inedible.

15. *Rhizopogon luteolus Fr.* (Family – Rhizopogonaceae) (Fig. 15)

Specimen No. DDUNPL–0111

Diagnostic characters: Small brown tuberous fruiting body, in clusters, half portion in side soil, 3.0–6.0cm dia. Fruiting body sub–spherical, peridium ochraceous, thick, tough, cracking. Gleba at first pallid, becoming olivaceous when mature.

Habitat: In sandy soil, *Altitude*: 1550m.

Date of collection: July 25, 2011. *Place of collection*: Shivapuri, *Edibility*: Medicinal.

16. *Russula delica* Fr. (Family – Russulaceae) (Fig.16a,16b)

Specimen No. DDUNPL–0112

Diagnostic characters: Medium sized, agaric with whitish cap, whitish gills and white stem, Solitary or in scattered groups on soil.Cap 6.0–12.0 cm dia, stem 3.0–5.0cm tall × 2.0–3.5 cm dia. Cap whitish, convex, gills slightly decurrent. Stem more or less equal, smooth. Ring absent.

Habitat: On soil under broad leaf, *Place of collection*: Gumba, *Altitude*: 1700m. *Date of collection:* July 13, 2010. *Edibility*: Inedible.

17. *Russula emetica* (Schaeff.Fr) S.F Gray (Family – Russulaceae) (Fig. 17)

Specimen No. DDUNPL–0113

Medium or large agric with red, creamy white gills and white stem, solitary or inscattered groups on soil. Cap 4.0–9.0cm dia, stem 3.0–10.0cm tall × 1.0cm–2.0cm dia. Cap cherry–red in colour, convex. Gills whitish, more or less free. Stem more or less equal slightly clavate at base, curve. Ring absent.

Habitat: On soil, *Altitude*: 1650m, *Date of collection*: July 13, 2011. *Place of collection*– Shivapuri, *Edibility*: Medicinal.

18. *Rusula fragilis* (Pers: Fr.) Fr. (Family–Russulaceae) (Fig. 18a,18b)

Specimen No. DDUNPL–0114

Diagnostic characters: Small to medium–sized agaric with purplish cap, white gills and white stem, solitary or in scattered groups on soil. Cap 3.0–6.0cm dia. stem 2.0–7.0cm tall × 0.5–1.3cm dia. Cap purple or reddish–purple with olivaceous tinges at centre; at first convex, later flattend or slightly depressed, striate at margin on age, cuticle peeling ½ or ¾ to centre. Cystidia cylindrical. Gills white, adnexed, slightly crenulated edges, spore hyaline, sub–spherical, Stem white, more or less equal, clavate. Ring absent.

Habitat: On soil under broad leaf trees. *Place of collection:* Gumba, *Altitude*: 1420m. *Date of collection*: September 11, 2010. *Edibility*: Indible.

19. *Russula sororia* (Fr.) Romell (Family–Russulaceae) (Fig. 19)

Specimen No. DDUNPL–0115

Diagnostic characters: Medium–sized agaric with brown cap and whitish gills and stem, in scattered groups on soil. Cap 3.5–5.0cm dia. Stem 4.0–6.0cm tall × 1.0–1.5cm dia. Cap sometimes with grayish tinge, at first covex,later flattened and slightly depressed. Gills white, adnexed. Spores hyaline,sub–spherical 6–8 × 4–7µm. Cystidia cylindrical, stem more or less equal. Ring absent

Habitat: On soil under broad leaf trees. *Place of collection*–Panimuhan, *Altitude*: 1450m. *Date of collection*: August 26, 2010. *Edibility*: Edible.

20. *Stereum hirsutum* (Bull.) Quel (Family–Stereaceae) (Fig. 20)

Specimen No. DDUNPL–0116

Diagnostic characters: Growing in tiers on dead branches. Cap 3.0–7.0cm in dia., bracket like with the broad basal attachment region spreading over the substrate. Upper surface yellowish orange with conspicuous concentric zoning and a thin wavy margin. Spore deposit white.

Habitat: On dead wood, *Place of collection:* Shivapuri *Altitude*: 1300m. *Date of collection:* July 23, 2011. *Edibility*: Inedible.

21. *Thelophora fuscella* (Family – Thelephoraceae) (Fig. 21)

Specimen No. DDUNPL–0117

Diagnostic characters: Pluropodial palmaely divided from a common trunk. In clusters amongst leaf liter and other debris in broad–leaf. Fruit bodies 6.0–15.0cm high, stipe 0.5–4.0cm × 2.0–5.0mm consisting a compact dark core, 0.8–1.2mm thick and a loose tomentous layer, 0.5–3.0mm thick, branches flattened, broad 10.0mm or narrow 2.0–5.0 mm thick and loose tomentous layer 0.5–3.0mm thick; branches, flattened, broad 10.0mm or narrow becoming speculate or digitate, acute or obtuse, often fimbriate, the upper side more or less strigose or appressedly spiculose fibrillose pale dirty,grey to pale yellow.

Habitat: On leaf litter, *Altitude*: 1500m. *Place of collection:* Shivapuri, *Date of collection*: July 13, 2011. *Edibility*: Inedible.

22. *Xerocomus badius* (Fr.) Gilb (Family–Xerocomaceae) (Fig. 22A, 22B)

Specimen No. DDUNPL–0118

Diagnostic characters: Medium or large bolete with date brown cap, greenish–yellow pores and red–streaked stem, solitary, on soil under broad–leaf trees. Cap 5.0–10cm dia. Stem 3.5–11cm tall × 1.0–4.0cm dia. Spores olivaceous–brown, smooth, thick–walled, sub–fusiform, without droplets.

Cystidia fusiform. Ring absent.

Habitat: On soil under broad–leaf trees, *Altitude*: 1500m.

Place of collection: Phulbari, *Date of collection*: July 13, 2011. *Edibility*: Edible.

CONCLUSION

During survey, 50 macrofungal species were collected, 22 species were identified belonging to 14 families. The diversity of climatic condition prevalent in Nepal made the region a natural habitat of large number of macrofungal species. These macrofungal species play an important key role in sustenance of tribal, aborigines and other inhabitants living in vicinity of tropic and temperate forests, harboring these macrofungal resources. They use them in various ways for edible as well as curing several diseases and ailments. Macrofungi can be used as an aid in solving the problems of global importance including protein shortage, resource recovery and environmental management.

ACKNOWLEDGEMENT

Authors are thankful to Head, Department of Botany, DDU Gorakhpur University, Gorakhpur and Prof. Kamal, for his valuable suggestions. One of the authors (S.K. Jha) thanks Tribhuvan University, Institute of Science & Technology for granting study leave.

REFERENCES

Adhikari, M.K. (2000a). Mushroom of Nepal, Edited by G. Durieu, P.U. Printers, Battisputali, Kathmandu, Nepal, 236 p.

Adhikari, M.K (2000b). A Preliminary study on the mycodiversity of Maipokhari, East Nepal. Bull. National Sceience Museum, Tokyo, Ser; B26; 67–74.

Adhikari, M.K. (2001). New record of fleshy fungi from Kathmandu valley, Nepal–4.Green world, **7:** 3–7.

Adhikari, S. and Adhikari, M.k. (2003).Some higher fungi from lamjung Nepal. *Botanica Orientalis*. **3:**133–134.

Adhikari, M.K. (2004). Mushroom poisoning and its state in Nepal. In: Plant Resources Bulletin No. 25, Department of Plant Resources Kathmandu, Nepal. pp.56–58.

Arora, D. (1996). Mushroom demystified: A comprehensive guide to the fleshy fungi. Barkely Ten speed press.

Atri, N.S. and Kaur, H. (2003). Wild Mushrooms– Collection and identification. *Mushroom Res.* **14:** 56–59.

Berkeley, M.J. and Decades (1854). XLII.M.J. Indian.Hooker's Jour. Bot. (Kew. Gard.Mic. Jour) **6:** 129–143.

Bhuju, U.R., Shakya, P.R., Basnet, T.B. and Shrestha, S. (2007). Download Nepal Biodiversity Resource Book. Protected Areas, Ramsar Sites, and World Heritage Sites. International Centre for Integrated Mountain Development, Ministry of Environment, Science and Technology, in cooperation with United Nations Environment Programme, Regional Office for Asia and the Pacific. Kathmandu, ISBN 978–92–9115–033–5

Chang, S.T. and Miles. P.G., (2004). Mushroom: cultivation, Nutritional value, Medicinal effect and environment impact. Second edition CRC Press 2–4.

Chistensen, M, Bhattri S, Devkota and Larsen H.O. (2007). Collection and use of wild edible fungi in Nepal.www.Nepjob/ index.php/ Bank o/article/View article/987–Cashed.

Gates, G.M., Ratkowsky, D.A., and Grove, S.J. (2005). A Comperisation of macrofungi in young silviculculture regeneration and mature forest at the warm Lter site in the southern forests of Tasmania Tasforests **16:** 127.

Hawksworth, D.L., Kirk, P.M., Sutton, B.C., and Pegler, D.N., (1995). Ainsworth and Bisby's Dictionary of the fungi. *Int. Myco. Inst. CAB International*, London 616p.

Hunt, G.A., (1999). Assessing Macrofungi of special cocern for conservation in forest ecosystems. In: *Proc Biology and management of species and habitats at risk*. **2:** 15–19

Jordan, M. (1995). The Encyclopedia of fungi of Britain and Europe (John Taylor Book Ventuse Ltd. Ed.) Devid and Charles, Brunel House, Newton Abbot, Devon.1–384p.

Kirk, P.M., Cannon, P.F., Minter, D.W., and Stalpers, J.A., (2008). Ainsworth and Bisby's Dictionary of the fungi (10th ed). CAB International walling ford, U.K.771p.

Kumar, A., Bhatt, R.P., and Lakhanpal, T.N. (1990). The Amanitaceae of India.Bishan Sing Mahendra Pal Singh, Dehradun, 1990;160p.

Molina, R, O'Dell T., Amaranthus, M., Castellano, and Russel, K. (1993). Biology, Ecology and Social aspects of Wild Edible Mushrooms in the forest of the Pacific Northwest: A Preface of Managing Commercial Harvest. U.S. Dept. of Agriculture Forest service, Pacific Northwest Research station, United States. 45pp.

Singer, R. (1996). The Agaricales in modern Txonomy. Bishan Singh Mahendrapal Singh, Dehradun (India).981p.