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NEW REPORTED SPECIES OF MACRO FUNGI FROM PAKISTAN

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ABSTRACT

During the years 2012- 2013, a general survey of macro fungi was conducted in Rahimabad, district Gilgit. It has been observed that the study area have high diversity of macro fungi. In the present study, 19 species of Basidiomycetes and Ascomycetes, of the family Agaricaceae (2 genera with 3 species, Boletaceae (1 genus with 2 species) , Tricolomataceae (3 genera with 3 species) , Coprinaceae (1 genus with 1 sp.) , Helvellaceae (1 genus with 2spp.) Cortinariaceae (1genus1sp.) , Sclerodermataceae (1 genus with 1 sp.) , Lycoperdaceae (1 genus with 1sp.) , Polyporaceae (2 genera 2spp.) , Psathyrellaceae (2 genera 2spp.) and Russulaceae (1 genus 1sp.) were identified. There were 6 species are edible, while the remaining species are non edible. During the survey it was observed that the *Boletus separans* have extremely valuable for human being. The aim of this research work is to explore and to identify the species of Macro fungi from concern area. It is also noted that the local inhabitants have lack of knowledge about the importance of macro fungi diversity.

Keywords: *Edible, macro fungi, species*.

INTRODUCTION

The macro fungi are differentiated by containing spore bearing structures that are seen by naked eye, it consist of mushrooms, puffballs, bracket fungi, false-truffles, and cup fungi are common examples of macro fungi. The members of Ascomycetes and Basidiomycetes are very common. Usually the plant pathogens and saprophytic fungi are fruiting on woody substrata. Although through definition, Macro fungi are easily observable to bare eye. They intermingle and participate or compete with other microorganisms behavior and predators. They produce a lot of pharmaceutically vigorous chemicals like hormones, pheromones, toxins, carcinogenic enzymes, antibiotics, anticarcinogens and pigment genetically (Redhead, 1997). Macro fungi comprises different groups of taxa which perform significant function in cycling of nutrients and uptake of nutrients, these nutrients are very important for tree health by balancing the pH from noxious natural resources and nutritious them by mycorrhizal relationship (Gates, 2011) fungi form a main portion of worldwide biodiversity. The total number of fungal species are worldwide expected to be between 750.000 and 1.500.000 of which only about 100. 000 presently are recognized and described (Hawksworth 2001; Schmitand & Mueller, 2007). The two major groups which include macro fungi are *Ascomycota* and *Basidiomycota*. While most of the *Ascomycota* are microscopic species, these are also contains some "larger fungi" cup-fungi, morels and truffles. The *Basidiomycota*, which is a larger group, mostly comprise of macro fungi, including mushrooms, toadstools, bracket fungi, polyporus and puffballs, although about 30% of its species are microscopic. A large number of macro fungi are decomposers, about one tenth species form mycorrhiza and only few species are parasitic in nature.

The macro fungi have macroscopic and microscopic characters. Mostly are composed of microscopic, elongated chains of cells called hyphae forming a cobwebby structure called mycelium, which grows in soil, wood or other substrata. From this mycelium, they make macroscopic sporocarp. In some species sporocarp is short-lived; in others they are persistent and may

be perennial. Fruiting body of this group is extremely dependent on weather conditions and abundance of sporocarp may therefore vary by several orders of magnitude between the years. Furthermore, fruiting and production of spores are important for the long term survival of fungal species. Fungi is one of the most rich and diverse groups of organisms on Earth. They comprise a significant part of terrestrial ecosystems, forming a large share of the species richness and key-players for ecosystem processes. Fungi were long considered a strange group of organisms, poorly understood and difficult to study due to their mainly hidden nature and commonly sporadic and short-lived spore carps. Hence fungi have mainly been ignored and unnoticed in national and international nature conservation actions. However, through the research of professional mycologists and field observers over the last few decades our knowledge of fungi was significantly increased. It is thus now largely feasible to evaluate the present rank and future for fungal species and how human activities, such as land management procedures, will affect fungal diversity.

MATERIALS AND METHODS

The samples of macro fungi were collected from different areas of District Gilgit. These fungi were photographed in their natural habitat. The samples were brought to Department of Biological Sciences, Karakoram International University, Gilgit and identified up to species level after reference to Ahmed, (1997), Demoulin & Mirriott (1981), Surcek (1988), Buczacki (1989), Leelavathy & Ganesh (2000), Swann & Taylor (1993), Shibata (1992), Murakami (1993), and Sultana, (2011). The specimens were dried at room temperature to make a herbarium for future reference. An Olympus B x51 microscope equipped with bright field and camera Olympus DP 12 was used to examine and photographs the different parts of macro fungi.

RESULTS AND DISCUSSION

Hawksworth (2001) pointed out that the tremendous discrepancy between the numbers of known versus estimated species of fungi could be attributed to the woefully inadequate sampling of fungi in many parts of the world most notably from tropical and subtropical regions. It therefore appears important to explore the previously unexplored parts of the world in order to increase information about the distribution of fungi. It would also help in discovering the previously undescribed fungi. The conducted survey area has highly diversity for macro fungi. In the present study 19 species of Basidiomycotina and Ascomycotina are identified, each of the family Agaricaceae (2 genera with 3 species , Boletaceae (1 genera with 2 species), Tricolomataceae (3 genera with 3 species) , Coprinaceae (1 genus with 1 species) , Helvellaceae (1 genus with 2spp.) Cortinariaceae (1genus 1sp.) , Sclerodermataceae (1 genus with 1 sp.) , Lycoperdaceae (1 genus with 1sp.) , Polyporaceae (2 genera 2spp.) , Psathyrellaceae (2 genera 2spp.) and Russulaceae (1 genus 1sp.), (Table 1). There were 6 species are edible, while the remaining species are poisonous. During the survey it was observed that the species of genus Boletus have extremely valuable for the inhabitants of study area. In this research 10 species of macro fungi have been recorded for the first time from Pakistan. All these species have been reported for the first time from Gilgit valley (Mirza & Qureshi, 1978; Ahmed, 1997). During the present studies 6 edible Basidiomycetous fungi were collected, among these 4 species are non edible. During the present work, 10 species (Fig.1.A-T) viz., Agaricus dulcidolus , Lactarius glaucescens, Boletus separans, Trichomoloma ustale, Polyporus umbelatus, Lepista inversa, Cortinaria acetosus, Helvella monachella, Helvella leucopus and Coprinopsis cinerea, were recorded. These species have been recorded for the first time from Gilgit-Baltistan and all these species are appeared to be new records from Pakistan.

Agaricus dulcidolus Schulzer (1874)
Synonymy: Agaricus purpurellus (F. H. Moller) F. H. Moller, Agaricus rubelloides Bon
Distinguish characters: Capsule is 3-5cm wide .the shape of cap is slightly convex initially and become Plan at maturity with plano or some time it have slightly undulating margins. The surface of cap is smooth and also it is fleshy the color of cap is off-white-light brown. Gills are regular and attached with stipe. Stipe is 2-6cm tall, smooth, cylindrical and off –white in color. Its smell is un pleasant. The microscopic examination shows that the spores are ovate and brown in color.
Growing season: September
Occurrence: Collected from Rahimabad District Gilgit.
Ethnic uses /importance: Edible
Habit/Habitat: Found solitary in moist areas.
Previous report from Pakistan: Not reported
Lactarius glaucescens (Crossl.)
Synonymy: Lactarius piperatus (Fr.)

Distinguish characters: Capsule is 3-10 cm wide, becoming flate, broadly convex, scaly, undulating and enrolled margins and off-white in color. Gills are regular initially and become crisped at maturity and pale cream in color and attached with

stipe. Stipe is short 2-6cm long 2-3 cm thick, solid, stratified, fleshy, tapering to base, off-white in color, have mycelia pad. The microscopic examination shows that it has broadly ellipsoid and colorless spores .It has unpleasant smell.
Growing season: September-October
Occurrence: Collected from Rahimabad District Gilgit.
Habit/Habitat: It is found individually in dry places mostly found as embedded in soil.
Ethnic uses /importance: Edible
Previous report from Pakistan: Not reported

Boletus separans (peck.) halling
Synonymy: Xanthoconium separans Bell
Distinguish characters: Cap is 3-7cm wide, hemispherical, soft, fleshy and rough surface due to small pits .stipe is 3-9cm tall and 2-6 cm thick. It is solido, cylindrical, thick; slightly tilt at the centre of the stipe. Stipe is reticulate, scratches are appeared at some points the stipe base is bulbous end with mycelia pads. The pores are very fine and rounded and white in color. it has pleasant smell.
Growing season: September
Occurrence: Collected from Rahimabad District Gilgit.
Ethnic uses /importance: Edible
Habit/Habitat: Usually found in small groups, shady and moist places among grasses.
P***revious report from Pakistan***: Not reported

Trichomoloma ustale (Fr.) P.Kumm. (1871)
Synonymy: Agaricus ustalis Fr. (1818)
Distinguish characters: Capsule is 2-4cm wide initially the cap is broad convex and have incise and undulating margins at its maturity .the cap colour is redish brown and dark brown stains are some time appears on cap the cap is fleshy and soft the surface is smooth, white regular gills are present attached with annular ring of the stipe at the apex of the stipe. Stipe is 2-4 cm tall, cylindrical, smooth and orange- brown in color .The stipe base has mycelial pads. It has unpleasant smell. The microscopic examination shows that it has roughly spherical to ellipsoid spores.
Growing season: October-November
Occurrence: It was collected from Rahimabad District Gilgit.
Ethnic uses /importance: Non edible
Habit/Habitat: Found usually in small groups and grows in margins of the streams among the grasses.
Previous report from Pakistan: Not reported

Polyporus umbelatus (Pers.) Fr polyporaceae polyporales
Synonymy: Boletus ramosissimus Scop
Distinguish characters: The individual capsule is 2-4 cm wide, over all it is usually about up to 40-50cm wide but only 1mm thick. Caps are whitish to pale brown it have very tough or woody fruiting bodies often plate like and depressed at its center. It is velvety and smooth in young and tough with the age. The underside off-white and consist of fine decurruent pores and becoming pale at maturity. It have basal stock 2-7cm tall the thick basal stock produce many branches and produce many caps and each cap have centrally stalked. The fruiting bodies and it have wood like smell.
Growing season: October
Occurrence: It was collected from Rahimabad District Gilgit.
Ethnic Uses /Importance: Edible
Habit/Habitat: Mostly grows on roots of hardwood, underground woods and also grows on the ground. Appear in cluster form.
Previous report from Pakistan: Not reported

Lepista inversa (Scop. Fr.) Pat., 1887
Synonymy: Agaricus inversus Scop.
Distinguish characters:Capsule is up to 5cm wide.the surface is smooth,with inrolled margins and shape is plano and yellowish brown in color. the gill are regular,crispedo ,brown and attched with stipe.the stipe is is 2-5cm tall and 2-4cm thick.the stipe is solid,fibrillos,drandular in fresh . stipe base have rhizoids with bulbous end.the cap is fleshy at young. it produce spores in the form of fine brown powder from the gills at maturity. The microscopic examination shows that it has oval brown spors .it have unpleasnt smell.
Growing season: september-october
Occurrence: It was collected from Rahimabad District Gilgit.

Ethnic uses /importance: Edible
Habit/Habitat: Usually found in colonies form, in dry places under the wild bushes.
Previous report from Pakistan: Not reported

Cortinaria acetosus (velen.)melot1987
Synonymy: Hydrocybe acetosa velen 1921

Distinguish characters: The capsule is 4-8cm wide, reddish brown .there is slightly depressed at the center of cap and have slightly undulating margins at initially and deeply undulating margins at maturity. The gills are light brown in color, regular and free. The stipe is 4-6cm tall cm, fibrillose elongated, solid and tilts at upper end of stipe and stipe base have myoebal pad. The microscopic examination shows that it has colorless round spores.
Growing season: March
Occurrence: It was collected from Rahimabad District Gilgit.
Ethnic uses /importance: Non edible
Habit/Habitat: Mostly found in groups, and grows in moist areas under the trees among grasses.
Previous report from Pakistan: Not reported

Helvella monachella (Scop.) Fr.

Distinguish characters: A thick flap of tissue which has chocolate brown at outer side and light brown at inner side form cup like structures at upper side and at the lateral side of stipe. This is 4-9cm wide. The stipe is 3-4 cm, smooth, hollow, and off-white in colour. The stipe base is bulbous .through the microscopic examination the spores are double layered, semi ellipsoid and colorless .the smell is pleasant.
Growing season: March
Occurrence: Collected from Rahimabad District Gilgit.
Ethnic uses /importance: Edible
Habit/Habitat: Found solitary or in small groups, mostly grows along the edges of the streams and moist places.
Previous report from Pakistan: Not reported

Helvella leucopus Fr.

Distinguish characters: Capsule is 8-20cm wide .thick flap form many enfolding irregularly form the flower like arrangement at some point it looked like a human ear. Color of this flap is chocolate brown from one side and off-white at other end .the flap margins are undulating. The stipe is 3-5cm tall, thick, smooth, offwhite and bulbous base. By the microscopic examination the spores are double layer, semi ellipsoid and colorless. it has pleasant smell.
Growing season: March-April
Occurrence: Collected from Rahimabad District Gilgit.
Ethnic uses /importance: Non edible
Habit/Habitat: Solitary, grows in moist areas along the edges of the streams, in fields and shady areas.
Previous report from Pakistan: Not reported.

Coprinopsis cinerea (Schaeff.) Redhead, Vilgalys & Moncalvo (2001)
Synonymy: Agaricus cinereus Schaeff. (1774)
Distinguish characters: Capsule is 2-8cm,pinkish white ,shape is parabolic in young, hemispherical at maturity with lisp margins ,deep cracks are appeared at maturity .the cap margins are become agrietado at maturity. The off-white stipe 5-15cm, cylindrical, fibrillose and wet in fresh condition. The gills are chocolate brown in color, regular, free and release chocolate brown sticky secretion when touch by fingers. Stipe base is revestido. It has unpleasant smell (pungent). Through the microscopic examination the spores are brown, ellipsoid and smooth.
Growing season: March
Occurance: Collected from Rahimabad District Gilgit.
Ethnic uses /importance: Edible
Habit/Habitat: Found in the form of the colonies, in fields, attached with the tree trunks, semi dry places and among the grasses.
Previous report from Pakistan: Not reported

Table 1. List of identified species with their proper classification

S. No.	Spp. Name	Genus name	Family	Order
1	Agaricus dulcidulus	Agaricus	Agaricaceae	Agaricales
2	Agaricus compestris	Agaricus	Agaricaceae	Agaricales
3	Boletus edulis	Boletus	Boletaceae	Boletales
4	Boletus separans	Boletus	Boletaceae	Boletales
5	Scleroderma citrinum	Scleroderma	Sclerodermataceae	Boletales
6	Calvitia gigantia	Calvitia	Lycoperdaceae	Agaricales
7	Lacctarius glaucescens	Lacctarius	Russulaceae	Russulales
8	Tricoloma ustale	Tricoloma	Tricolomataceae	Agaricales
9	Trametus versicolor	Trametus	Polyporaceae	polyporales
10	Polyporus umbelatus	Polyporus	Polyporaceae	polyporales
11	Lipista inversa	Lipista	Tricolomataceae	Agaricales
12	Psathyrella candolleana	Psathyrella	Psathyrellaceae	Agaricales
13	Cortinaria acetosus	Cortinaria	Cortinariaceae	Agaricales
14	Morchella conica	Morchella	Morchellaceae	pezizales
15	Morchella esculanta	Morchella	Morchellaceae	pezizales
16	Phaeolepiota aurea	Phaeolepiota	Agaricaceae	Agaricales
17	Helvella monachella	Helvella	Helvellaceae	Pezizales
18	Helvella leocopus	Helvella	Helvellaceae	Pezizales
19	Mycena pura	Mycena	Tricholomataceae	Agaricales
20	Coprinus disseminates	Coprinus	Coprinaceae	Agaricales
21	Coprinopsis cinerea	Coprinopsis	Psathyrellaceae	Agaricales

Figure 1. Agaricus dulcidolus (A-B), Lactarius glaucescens (C-D), Boletus separans (E-F) Trichomoloma ustale (G-H), Polyporus umbelatus(I), Lepista inversa (J-K), Cortinaria acetosus (L-M), Helvella monachella (N-O), Helvella leucopus (P-Q), Coprinopsis cinerea fruiting body (R-T)

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