

**OCCURRENCE, DIVERSITY, DISTRIBUTION AND  
MORPHOLOGY OF WILD MUSHROOMS COLLECTED  
FROM GAJNI FOREST OF BANGLADESH**

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**JUNE, 2018**

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**BY**

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**REGISTRATION NO. 12-05051**

A Thesis

Submitted to the Faculty of Agriculture  
Sher-e-Bangla Agricultural University, Dhaka-1207,  
in partial fulfillment of the requirements  
for the degree of

**MASTER OF SCIENCE (M.S.)**

**IN**

**PLANT PATHOLOGY**

**SEMESTER: JANUARY- JUNE, 2018**

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## *ACKNOWLEDGEMENTS*

*All admiration and praises are solely to “Almighty Allah” Whose mercy absolutely enabled the author to pursue the higher study in Agriculture discipline and complete M.S. Course and research work successfully for the degree of M.S. in Plant Pathology.*

*The author expresses her immense respect and deepest sense of gratitude and heartfelt thanks to her most reverend teacher and Supervisor, **Professor Dr. F. M. Aminuzzaman**, Department of Plant Pathology, Sher-e-Bangla Agricultural University, Dhaka for his untiring and efficient guidance, timely instruction, valuable advices and encouragement throughout the research work and completion of this thesis.*

*The author is grateful to her research Co-Supervisor, **Prof. Dr. Nazneen Sultana**, Department of Plant Pathology, Sher-e-Bangla Agricultural University, Dhaka for his guidance, keen interest, valuable advices and continuous encouragement regarding this research.*

*The author also wishes to pay her deep respect to **Prof. Khadija Akhter**, Chairman, Department of Plant Pathology, Sher-e-Bangla Agricultural University, Dhaka for her keen interest, continuous effort and valuable advices throughout the study period. The author also wishes to express her sincere gratitude to all other respected teachers of the Department of Plant Pathology, Sher-e-Bangla Agricultural University, Dhaka for their valuable teaching and helping during the study period.*

*Thanks are also extended to all the laboratory staffs, Department of Plant Pathology, Sher-e-Bangla Agricultural University, Dhaka, for their cordial help during the experimental work. Finally, the author expresses her deepest appreciation to her beloved parents and special thanks to **Tanjina Akter**, **Abdullah-al-Rafi**, **Rayhanul Islam** whose inspirations, sacrifices, moral support and continuous blessings opened the gate and paved the way to higher studies for the author.*

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## **CERTIFICATE**

*This is to certify the thesis entitled "OCCURRENCE, DIVERSITY, DISTRIBUTION AND MORPHOLOGY OF WILD MUSHROOMS COLLECTED FROM GAJINI FOREST OF BANGLADESH " submitted to the department of Plant Pathology, Faculty of Agriculture, Sher-e-Bangla Agricultural University, Sher-e-Bangla Nagar, Dhaka-1207, Bangladesh in partial fulfillment of the requirements for the degree of **MASTERS OF SCIENCE (MS) in PLANT PATHOLOGY**, embodies the result of a piece of bona fide research work carried out by Arifa Afrin Joty, Registration No. 12-05051 under my supervision and guidance. No part of the thesis has been submitted for any other degree or diploma.*

*I further certify that such help or source of information, as has been availed of during the course of this investigation have duly acknowledged by author.*

**June, 2018**  
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# OCCURRENCE, DIVERSITY, DISTRIBUTION AND MORPHOLOGY OF WILD MUSHROOMS COLLECTED FROM GAJNI FOREST OF BANGLADESH

## ABSTRACT

Gajni forest is located in north- east hilly area of Bangladesh under the Sherpur district which is adjacent with India, positioning at 25°16'N latitude and 90°08'E longitudes having a wide range of ecosystem. A survey was conducted from June to August of 2017 to 2018 to record the biodiversity, distribution and morphological characterization of wild mushrooms. In total of 32 mushroom samples were collected and identified to 29 species belongs to 11 genera, under 9 families. *Ganoderma* sp was found abundantly in the survey areas among the other collected species and it exhibited the maximum frequency of occurrence (75%), whereas the maximum density (20.50%) was recorded for *Agaricus bitorquis* and the dominant host was shal tree (*Shorea robusta*). The dominants genera were *Ganoderma*, *Agaricus*, *Trametes*, *Volvariella* and *Amanita*. The dominant family was Ganodermataceae followed by Polyporaceae, Agaricaceae, Amanitaceae, Rusullaceae and Pluteaceae. This is the report of wild mushrooms biodiversity and their distribution in the Gajni forest region of Bangladesh. The specimens were deposited to the Sher-e-Bangla Agricultural University Herbarium of Macro Fungi (SHMF).

# CHAPTER I

## INTRODUCTION

Fungi are considered the largest biotic community after insects (Steyart *et al.*, 1980). Yet only a small fraction of total fungal wealth has been subjected to scientific scrutiny. Out of 1.5 million fungi around the globe, only 50% are characterized until now and one third of total fungal diversity of the globe exists in India (Butler and Bisby 1960; Bilgrami *et al.*, 1991; Manoharachary *et al.*, 2005). Mushrooms are the heterotrophic organisms and quite specific in their nutritional and ecological requirements. It belongs to Ascomycota and Basidiomycota. The structure we recognize as a mushroom is in reality just a highly organized system of hyphae, specialized for reproduction, that develops from the otherwise vegetative mycelium inhabiting soil, leaf litter, or decaying wood. After a period of growth and under favorable conditions of temperature and moisture, the mycelium gives rise to one or more fruiting bodies, or mushrooms. Most of the fleshy and gilled macro fungi were prevalent in the rainy times of the year as this time is favourable for their moisture, warmth, relative humidity, and sunshine, which furthermore aids the macro fungi in the decomposition of dead organic tissue.

The use of wild mushrooms for food in all probability began with the prehistoric man. Wild edible mushrooms have been collected and consumed by people since thousands of years. Archaeological evidences reveal edible species associated with people living 13000 years ago in Chile (Rojas and Mansur, 1995). But in China where the eating of wild fungi was first reliably noted several hundred years before birth of the Christ (FAO, 2004). Globally, there are 2327 recorded useful species; 2166 are edible of which 1069 species are used as food, with at least other 100 known food species lacking published evidence (Boa, 2004). According to

Mizuno (1993), Wasser (1995) and Ferreira *et al.* (2010), approximately 700 species of *Basidiomycetes* have been found to possess significant pharmacological activities. Wild edible mushrooms are collected, consumed and sold in over 80 countries worldwide with a minimum value of US \$ 2.0 billion (Boa, 2004).

Recently, there have been increasing interests in mushrooms utilization worldwide. Mushrooms are promising resources of physiologically functional food because of their special biochemical compositions with significant contents of antioxidant compounds proteins, carbohydrates, lipids, enzymes, minerals, vitamins, water as materials for the development of harmless medicines, pharmaceuticals products, dietary supplements and healthy beverages etc. (Mizuno, 1993; Hobbs, 1995; Lorenzen & Anke, 1998). Mushrooms are extensive gene pool sources for biotechnology. Therefore it is necessary to preserve different species and strains in culture collections. Wild edible fungi are an important source of income for communities and national economies and are especially valuable to rural people in the developing countries (Boa, 2004). The global food and nutritional security of growing population is a great challenge, which looks for new crop as source of food and nutrition. In this context, mushrooms find a favour which can be grown even by landless people, that too on waste material and could be a source for proteinaceous food. There is a huge scope in our country to introduce mushroom as the income source to the people. Most of the people live in rural areas with their economic activities based on subsistence agriculture, which depends heavily on one crop mostly on rice. The changing climate has led to excessive drought which threatens the traditional crops. In order to promote rural development, there is a need to diversify rural income sources and increase job opportunities. Even it is possible to earn foreign currency by exporting mushroom.

Investigations on the taxonomy and diversity of macro fungi are gaining importance as wild mushrooms have deep biological and economical impact.

Mushrooms are seasonal fungi, which occupy diverse niches in nature in the forest ecosystem. Wild edible mushrooms are the special product of the forest. Mushroom species are the indicators of the forest life support system (Stamets, 2000). Many workers have been working on the wild mushrooms. Rashid *et al.* (2016) mentioned that mushroom diversity in Bangladesh is quite promising. Recently some study has done on the biodiversity of mushroom on some specific area. On the basis of the study we can say Bangladesh has a huge possibility to utilize the resources. Gajni forest under the Sherpur district is adjacent to India. It is very urgent to explore this area in different environmental condition to observe and study the biodiversity of mushrooms that prevail in this area. The knowledge of biodiversity at the community and species level is important for monitoring the effectiveness and effects of natural and artificial disturbances (Pakham, 2002). Data on their diversity in different vegetation types is important for planning and managing ecosystem biodiversity (Engola *et al.*, 2007). Information on mushroom diversity is important because of its major functions in natural and organised ecosystems as ectomycorrhizal fungi. The fungal group becomes a significant component for reforestation programs.

The purpose of the present survey was conducted to generate a database on morphology and ecology of wild mushrooms species of the Gajni forest region of Bangladesh with the following objectives:

- To collect different kind of wild mushrooms from Gajni forest area and identify the mushrooms up to genus and species level.
- To study diversity, distribution and morphological characters of those wild mushrooms.
- To determine the cultural characteristics of wild mushrooms collected from Gajni forest.

## CHAPTER II

### REVIEW OF LITERATURE

The survey was conducted at the Gajni forest that is the part of tropical moist deciduous forest region in Bangladesh which is also known as shal forest as the most dominated tree is shal tree (*Shorea robusta*). The main purpose of this chapter is to review the previous studies, which are related to the present study. Therefore, an attempt has been made here to compile the research work carried out on the related subject elsewhere.

Marjana *et al.* (2018) conducted a survey in Rangamati Hill Tracts forest of Bangladesh. A total of 66 samples of macrofungi were collected, recorded, photographed and preserved. Twenty species of macrofungi were identified under 17 genera and 15 families. The highest frequency of occurrence (44.44%) was recorded for *Xylaria polymorpha*. The highest density was found for *Xylaria polymorpha* also (55.56%) followed by *Coprinus disseminates* (52.78%), *Auricularia cornea* (38.89%), *Xylaria hypoxylon* (27.78%) and *Clavulina coralloides* (16.67%).

Das and Aminuzzaman (2017) first time investigated the largest tidal halophytic forest in the world which lies between the latitudes 21°30'N and 22°30'N and longitudes 89°00'E and 89°55'E. The predominant families were recorded- Polyporaceae, Ganodermataceae, Hymenochaetaceae, Fomitopsidaceae, Xylariaceae, Steccherinaceae and Gloeophyllaceae. The maximum frequency (75%) was recorded for *Daedaleopsis confragosa* and 50% for *Trametes elegans*, *Trametes conchifer*, *Polyporus sanguineus*, *Ganoderma curtisii* and *Irpex lacteus*. The maximum density was 31.82% for *Polyporus sanguineus* which was found on the Sundari (*Heritiera fomes*) tree.

Rubina *et al.* (2017) conducted a survey in National Botanical garden Dhaka located at 20°00'N (latitude), 90°00' (longitude) to document the morphology, diversity and distribution of macro fungi. A total of 23 macro fungi samples were collected and identified to 20 species under 10 genera and 10 families. The predominant genera were *Ganoderma* sp, *Lepiota* sp, *Daedaleopsis* sp, *Russula* sp, *Psathyrella* sp, *Lycoperdon* sp, *Crepidotus* sp. The survey revealed that five species are edible, six species have medicinal value, three species are inedible and three are unknown. The maximum density of occurrence was exhibited by *Psilocybe cubensis* (45%) followed by *Lepiota* sp (40%), *Ganoderma pfeifferi* (35%) and *Ganoderma lucidum* (25%).

A survey was conducted by Rashid *et al.* (2016) to study the biodiversity, habitat and morphology of mushroom grown in leaved, deciduous and mixed forest of Bangladesh. A total of 117 samples were collected from nine selected districts of Bangladesh viz., Barisal, Borguna, Patuakhali, Pirojpur, Jhalokathi, Bandorban, Dhaka, Gazipur and Tangail. About 12 different species were found under 10 families viz., Amanitaceae, Pyrenomataceae, Boletaceae, Agaricaceae, Tricholomataceae, Marasmiaceae, Cortinariaceae, Mycenaceae, Entolomataceae, Ganodermataceae. The predominant genera were *Amanita*, *Aleuria*, *Agaricus*, *Boletus*, *Mycena*, *Cortinarius*, *Nolanea* and *Ganoderma*.

Aminuzzaman and Das (2017) carried out an investigation in Bogra district under social forest region of Bangladesh. A total of 32 fungal samples were collected and identified to 16 species belong to two genera under 7 families. The dominant genera were *Ganoderma* sp (87.5%) and *Polyporus* sp (12.5%) of collected samples. The maximum frequency of occurrence (75%) was exhibited by *Ganoderma lucidum*, *Ganoderma multipileum*, *Ganoderma boninense*, *Ganoderma* sp and the maximum density was exhibited by *Ganoderma resinaceum* (66.67%).



Das *et al.* (2016) investigated the largest single block of tidal halophytic forest Mangrove (Sundarban) and collected 72 macro fungal samples identified to 21 genera and 32 species. The dominant species were *Agaricus campestris*, *Agaricus xanthodermus*, *Agaricus silvicola*, *Agaricus aungustus*, *Agaricus arvensis*, *Agaricus bitorquis*, *Coprinus silvaticus*, *Coprinus plicatilis*, *Marasmius* sp, *Marasmius siccus*, *Marasmius nigrodiscus*, *Marasmiellus albuscorticis*, *Volvariella hypopithys*, *Volvariella speciosa*, *Crepidotus alabamensis* and *Crepidotus applanatus*. The maximum frequency (75%) was recorded in *Agaricus silvicola*, *Lepiota* sp, *Marasmiellus albuscorticis* and *Volvariella speciosa*. The maximum density was 287.5% recorded for *Coprinus silvaticus*. The predominant families were Agaricaceae, Marasmiaceae, Pluteaceae, Crepidotaceae and Mycenaceae.

Beuy and Viroj (2016) stated that Linzhi (*Ganoderma lucidum*) is a well-known medicinal mushroom. The usefulness to kidney is mentioned in the literature. Linzhi (*Ganoderma lucidum*) is a well-known medicinal mushroom. This mushroom originated from China. The active ingredient in the mushroom is mentioned for anti-oxidative, glucose controlling and anti-cancerous proliferative activities. In nephrology, the advantage of Linzhi on kidney is also mentioned. However, the evidence in human beings is limited.

Rahaman *et al.* (2016) conducted a survey from June to October, 2014 in 5 districts namely Kushtia, Chuadanga, Jessore, Satkhira and Khulna. A total of 16 mushroom species belong to 10 genera under 8 families were recorded during the survey. *Lepiota cristata* was found abundantly in the survey areas among the other collected species and it exhibited the maximum frequency of occurrence (25%), whereas the maximum density (13.51%) was recorded for *Hypholoma fasciculeare* and *Coprinellus micaceus*, followed by *Lepiota cristata*, *Coprinus comatus* and *Mycena californiensis* (10.81%). Furthermore, the density of *Gymnopilus purpuratus*, *Coprinus sterquilinus*, *Marasmius oreades*, *Hypholoma capnoides* and *Coprinellus plagioporus* were recorded as 8.10%. Moreover, *Lepiota cristata* was

distributed in Daulatpur of Kushtia and Koira of Khulna districts in the south western region of Bangladesh.

Rumainul *et al.* (2015) reported that mushroom flora is an important component of the ecosystem and their biodiversity study has been largely neglected and not documented for the tropical moist deciduous regions of Bangladesh. They investigated macrofungi flora in seven different areas of tropical moist deciduous forest region of Bangladesh namely Dhaka, Gazipur, Bogra, Rajshahi, Pabna, Jaipurhat and Dinajpur. Mushroom flora associated with these forest regions were collected, photographed and preserved. The predominant genera were *Ganoderma* sp, *Lepiota* sp, *Marasmius* sp and *Collybia* sp.

Krishna *et al.* (2015) collected the fruiting bodies of macrofungi from some forests, fences, waste fields, timber depots of Telangana state during rainy season. This is an attempt to give a broad picture of diversity of macrofungi of Telangana region. There were 50 fruiting bodies were collected and cultured and among them only ten were identified based on their macroscopic features and molecular identification since they showed good lignolytic activity.

Kinge and Min (2015) studied the diversity and distribution of species of *Ganoderma* in south western Cameroon. Four species, *Ganoderma weberianum*, *Ganoderma cupreum*, *Ganoderma steyaertanum*, *Ganoderma zonatum* are new records for Cameroon. The remaining 11 species belong to *Ganoderma ryvardense*, *Ganoderma lobenense* and *Ganoderma* species 1-9 with different affinities might be new to science. Six plant species were identified as hosts to different species of *Ganoderma*. They are *Elaeis guineensis*, *Cassia* sp, *Acacia* sp, *Pinus sylvestris*, *Avocado* sp and unidentified hardwood, with *E guineensis* hosting the highest number of species.

Manna *et al.* (2014) reported that among 18 macrofungi species related to tribal use, the most usable species were *Astraeus hygrometricus*, *Amanita vaginata* var.

*alba*, *Amanita bannigiana*, *Russula nigricans*, *Termitomyces eurrhizus* and *Termitomyces microcarpus*. Monsoon and post monsoon periods which fall during the second half of August are found to be the optimum time for the production of 11 wild edible macrofungi. Out of the total calculated production, 47.2% of the same was noted during this time. These regions with tribal populations, especially the Santals in the forest fringes, have traditional knowledge related to macrofungi.

Vyas *et al.* (2014) conducted an experiment on Patharia forest which is mixed and dry deciduous type, dominated by *Acacia sp*, *Butea monosperma*, *Tectona grandis* and ground flora consisting of *Biophytum sensitivum*, *Cynodon dactylon*, *Lanata camara* etc. During the period of July 2011-July 2013, wild macrofungi were collected from Patharia forest and 18 mushroom species belonging to 12 families were identified viz., *Vascellum pretense*, *Lycoperdon pyriform*, *Coniphora puteana*, *Clitocybe geotrappa*, *Ganoderma tsugae*, *Microglossum virde*, *Panaeolus sphinctrimus*, *Pleurotus cornucopiae*, *Fomes fomentarius*, *Tyromyces lacteus*, *Lenzites betulina*, *Hypholoma elongatum*, *Pholita highlandensis*, *Serpula lacrymans*, *Tremella mesenterica*, *Lepisa nuda*, *Collybia butyracea* and *Omphalina ericetorum*.

Chelela *et al.* (2014) conducted a survey to assess mycological knowledge and socio-economic benefits along the wild edible macrofungi value chain among Benna ethnic groups in the southern highlands of Tanzania. From the survey, mushroom collection and selling was gender oriented dominated by women at 70 and 93.5%, respectively. Moreover, it was found that 30% of men were involved in collecting and only 6.5% in selling. About 45 species of wild edible macrofungi were collected mainly from *Lactarius*, *Rusula*, *Cantharellus* and *Amanita* species.

Andrew *et al.* (2013) reported the diversity and distribution of macrofungi in the Mount Cameroon Region. A total of 177 macrofungal species belonging to 83 genera and 38 families were recorded. Species richness was higher in the rainy

seasons (134 species) than in the early dry seasons (89 species) and tended to decrease with altitude, with 116 and 112 species for low and high altitudes, respectively. 88 species were recorded in the rainy seasons, 43 species in the early dry seasons only, and 46 species were common to both seasons. Sixty-five species were found only in the low altitude, 61 species only in the high altitude, and 51 species were common to both altitudes. *Auricularia auricular* was the most abundant species during the rainy seasons, while *Coltricia cinmamomea* was rare during the rainy seasons, and the most abundant during the dry seasons.

Pandey *et al.* (2013) conducted a study in Joypore Reserve Forest located in Assam, India to investigate the diversity of macro fungi associated with different tree species. Thirty macro fungal species representing 26 genera belonging to 17 families were collected from six different sites in the study area. The study revealed that maximum frequency of occurrence was exhibited by *Trametes versicolor* and *Schizophyllum commune* (83.33%), followed by *Microporus xanthopus*, *Pycnoporus sanguineus* (66.67%) and *Coprinus disseminates* (50%). The rest of the species exhibited the frequency distribution ranging between 16.67-33.33%. The maximum density was recorded for *Schizophyllum commune* (126.67%) followed by *Tametes versicolor* (120%) and *Xylaria polymorpha* (93.33%).

Farooq *et al.* (2013) performed an experient on Soon Valley Sakasur located in District Khushab of the province Punjab, Pakistan coordinates 72<sup>00</sup> E and 72<sup>030</sup> E longitudes 32<sup>025</sup> N and 32<sup>045</sup> N latitudes with diversified ecasystem. The ethno-mycological study of soon valley has been strongly neglected in the past. So, the survey was conducted during 2010-11 in four villages ie. Nowshedra, Sakhiabad and Knaty garden of the Soon Valley. A total of 25 mushroom species belonging to 9 families and 14 genera were identified from the study area. Among the collected mushroom species *Agaricus* was found as most dominant genus (36%) followed by *Innocybe* (12%).

Farid *et al.* (2013) collected forty four species of macrofungi belonging to 29 genera were collected from different localities in Erbil Governorate of Kurdistan region. The identified species were *Agaricus* sp, *Clitocybe* sp, *Collybia* sp, *Coprinus* sp, *Cortinarius* sp, *Craterellus* sp, *Crepidotus* sp, *Exidia* sp, *Fomes* sp, *Galerina* sp, *Hebeloma* sp, *Helvella* sp, *Auricularia auricular judae*, *Hygrocybe pratensis*, *Inocybe* sp, *Laciarius* sp, *Laccaria* sp, *Mycena* sp, *Peziza* sp, *Pluteus* sp, *Psathyrella* sp, *Panellus* sp, *Paxillus atrotomentosus*, *Russula fellea*, *Scutellinia scutellata*, *Trichloma* sp, *Tyromyces* sp, *Lepiota* sp and *Cystoderma* sp.

Hosen *et al.* (2013) described a new monotypic genus in the boletaceae, *Borofutus*, typified by *B. dhakamus*, using morphological and molecular evidence. This is a putatively ectomycorrhizal fungus associated with *Shorea reobusta*. *Borofutus* is sister to *Spongi* forma in molecular phylogenetic analysis using DNA nucleotide sequences of single or multiple loci. They presented a description, line drawings, phylogenetic placement and comparison with allied taxa of macrofungi.

Kumar *et al.* (2013) reported that, the macrofungal diversity and nutrient content of some edible macrofungi of Nagaland, India. They collected young and matured carpophores of 15 wild edible mushroom species from 12 locations in different districts of Nagaland. Out of the four species belongs to family Agaricaceae, two belongs to Tricholomataceae and rest belongs to Boletaceae, Cantherallaceae, Russulaceae, Sarcoscyphaceae, Auriculariaceae, Polyporaceae, Schizophyllaceae, Pleurotaceae and Lyophyllaceae during the survey.

Pitheki and Pukaute (2012) conducted survey on the diversity of macrofungi in dry dipterocarp forest Phuphan National Park to study the variety of macrofungi grown in the Dry Dipterocarp forest during the year 2008 - 2009 by releve method and to study the relationship between *Shorea merrillii* Miq. and ectomycorrhizal of the Amanitaceae and the Boletaceae families, the findings of

the study revealed the presence of a total 34 types of macrofungi in Dry Dipterocarp forest at the Phuphan where there were 26 types found in both years.

Dwivedi *et al.* (2012) studied on the taxonomy and diversity of macro fungi in semi evergreen and moist deciduous forest of Amarkantak where more than 50 samples were collected which is situated in Madhya Pradesh in India. Extensive surveys were conducted from July 2010 to September 2010 where collection, characterization, preservation and photo of macro fungal carried the genera like is *Agaricus*, *Amanita*, *Nyctalis*, *Russula*, *Boletus Macrolapiota*, *Ganoderma* and *Termitoyees*. Out of 50 samples only 16 samples were identified up to species level. This preliminary study shows that the forest is very rich in diversity of macrofungi.

Bankole and Adekunle (2012) conducted an experiment on biodiversity of macrofungi in Lagos State, Nigeria as they collected in Lagos State for 12 months. The predominant macrofungi collected included *Agaricus campestris*, *Coprinus comatus*, *Datdunia concentrica*, *Ganoderma adspersum*, *Ganoderma applanatum*, *Ganoderma lucidum*, *Mycena haematopus*, *Mycena sp*, *Pleurotus ostreatus*, *Pleurotus tuber regium*, *Polyporus sp*, *Polyporus squamosus*, *Polyporus sulphwens*, *Trametes versicolor*, *Xylaria polymorpha* and *Xylaria sp*, during investigation.

Karwa and Rai (2010) reported on the tapping into the edible fungi biodiversity of Melghat forest in Central India for occurrence of wild edible fungi and their prevalent favorable ecological factors in consecutive years in the months of June to February (2006-2008). A total of 153 species of macrofungi were recorded, collected, photographed and preserved. Enormous biomass in the forest favors variety of edible and medicinal macrofungi. Dominating species belong to genera *Agaricus*, *Pleurotus*, *Termitomyces*, *Cantharellus*, *Ganoderma*, *Auricularia*, *Schizophyllum*, *Morchella*, etc in Melghat forest in Central India.

Dreistadt *et al.* (2004) reported a species of fungus that digests moist wood and causing it to rot. Some species of wood-decay fungi attack dead wood causes brown rot like *Armillaria* (honey fungus), *Ganoderma applanatum* (artist's conk), *Ganoderma lucidum* (varnish fungus rot), *Laetiporus sulphureus* (sulfur fungus), *Pleurotus ostreatus* (oyster mushroom), *Schizophyllum commune* (common split gill), *Stereum* sp (parchment fungus), *Trametes versicolor* (turkey tail).

Gilbertson (1980) studied that Brown rot fungi are involved in the biodegradation of wood with a preference for conifers (softwood) although there have also been some reports of these organisms degrading hardwood.

Nilsson and Presson (1978) found that color, shape and size of the fruiting body of fleshy fungi can vary tremendously and to avoid a poisonous species it is most important to properly identify the mushrooms. They reported mushroom species as the indicators of the forest life system. Data of different vegetation types is important for planning to determine biodiversity and habitat at the community and species level they reported. Their habitat and climate are major factors that indicate their biodiversity.

## **CHAPTER III**

### **MATERIALS AND METHODS**

#### **3.1. Survey Area**

The area of Gajni in Sherpur district was selected for conducting survey. Gajni forest is located in north- east hilly area of Bangladesh under the Sherpur districts which is adjacent with India. Jhinaigati forest area locally called Gajni forest that is covered near about 9660 acres of land of Bangladesh. The collection sites were natural forests area.

#### **3.2. Experimental Site**

The experiments were conducted in the Laboratory under Department of Plant Pathology, Sher-e-Bangla Agricultural University (SAU), Dhaka, Bangladesh.

#### **3.3. Period of sample collection**

Several surveys were made to the selected area for collection of wild mushrooms during rainy season from June to August in 2017 to 2018.

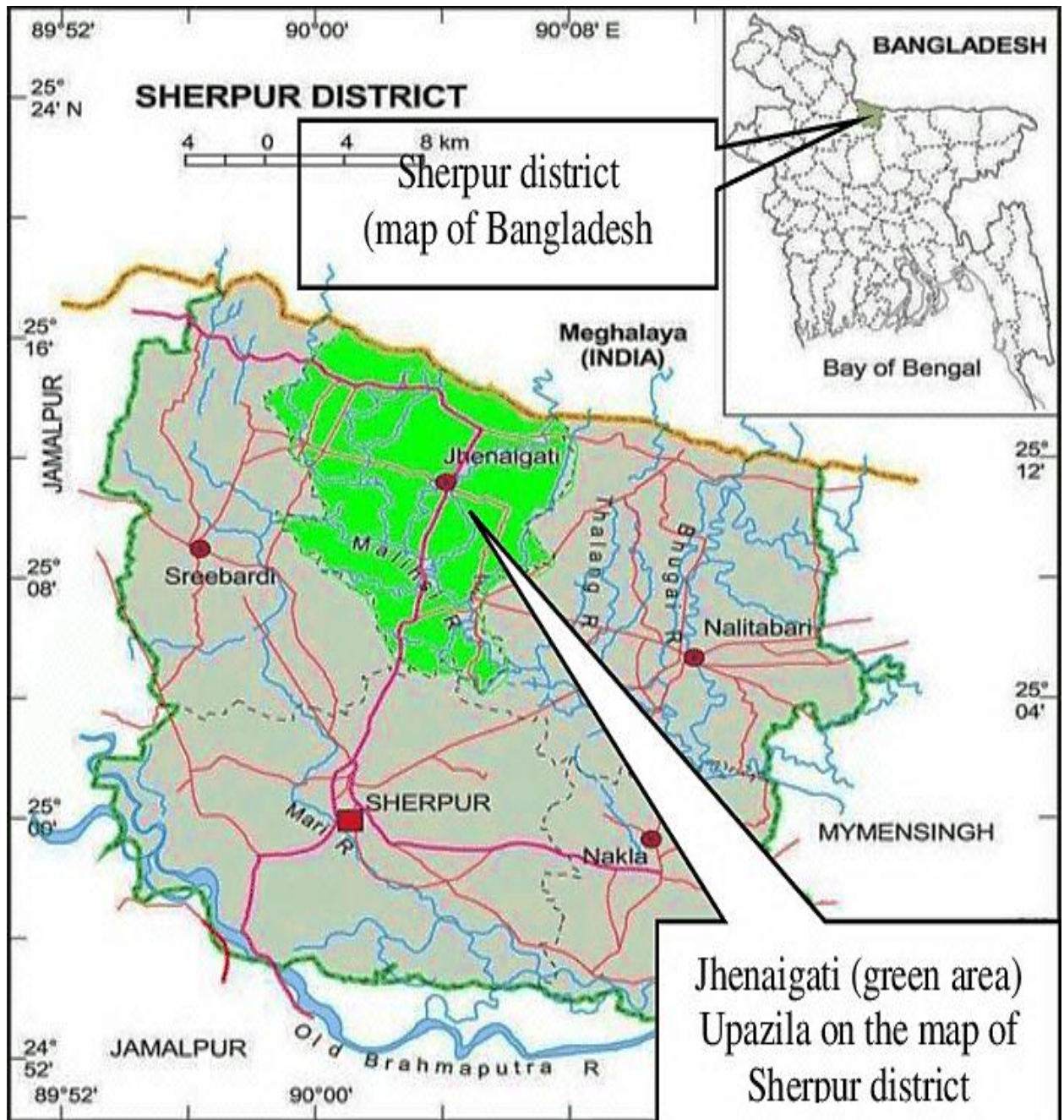
#### **3.4. Collection of wild mushrooms**

For determination of the morphological variability of wild mushroom's population in the selected area the spotted and fleshy mushrooms were minutely inspected, collected and brought to the laboratory for detailed inspection.

#### **3.5. Photography**

The photographs were taken during collection after drying. Each sample was wrapped with necessary information tagging *viz.* date of collection, sample number, location name and host name.





**Figure 1: Survey area of wild mushrooms at Gajni forest in Sherpur district of Bangladesh. source: (WWW.ResearchGate.com)**

### **3.6. Processing of collected mushrooms**

Mushrooms were dried and processed following the establish method (Kim, 2004).

#### **3.6.1. Drying**

Collected samples were cleaned and sun dried for 3-4 days. Collected samples were also dried by using electrical air flow drier at the 1000 VA., which can easily remove the moisture content from the collected mushrooms within 3-7 hours.

#### **3.6.2. Storage**

Dried mushrooms were stored into a zip lock type polybag for further studies. Silica gels were used at the rate of 10% of dry basis during the storage period.

### **3.7. Morphological characterization**

Morphological characters were recorded for identification of macrofungi specimens such as locality, habitat, type of soil, size of the fruiting body, scale, the gills color, gills edges, stipes, length, width, shape, type of veil, volva, (Srivastava and Bano, 2010). Final identification and classification were done by comparing recorded characteristics of mushrooms with the color dictionary of mushroom (Dickinson and Lucus, 1982), the mushroom guide followed by the reference of Jorden (2004) and Pegler and Spooner (1997).

### **3.8. Microscopic characterization**

Semi permanent glass slides were made from rehydrated basidiocarps with the aid of a sharp surgical blade for the microscopic characterization. Basidiocarps were immersed in cotton blue stain and glycerin and placed on glass slides and covered with cover slips. Furthermore, the spore was observed using light microscope with the magnification of  $\times 100$  and  $\times 400$  (Svrcek, 2000).

### **3.9. Mushroom cultures**

For investigation of the growth rate of collected macro fungi on artificial media, potato dextrose agar (PDA, pH 5.8) media were used, in which contained 20 g dextrose, 20 g agar powder, 200 g infused potato extracts in 1000 ml water. The media was sterilized at 121°C under 15 PSI for 15 min. After that the media was poured on petri plate and fragments of fruting body from lower part were placed on plate. Inoculated culture plates were incubated at 25°C for the growth of mycelium. After 5 to 7 days, photographs of mycelial growth on culture were taken and the plates were preserved in cool place for study on different parameter such as colour of mycelia and growth pattern.

### **3.10. Habitat, distribution and diversity analysis**

The mushrooms were found in an association with various substrata. The surrounding environment, temperature, soil pH, moisture condition and vegetation were recorded for the study of biodiversity of wild mushroom. The air temperature was measured by thermometer during the collection. Collected samples were wrapped with zip locked polybag with tag such as sample number, date of collection, host and brought into the laboratory for further study.

The distribution of mushrooms in the locality was also recorded. The frequency and density of different species has been determined by using the following formulas (Zoberi, 1973):

$$\text{Frequency of fungal sp (\%)} = \frac{\text{Number of site in which the species is present}}{\text{Total number of sites}} \times 100$$

$$\text{Density of fungal sp (\%)} = \frac{\text{Total no.of individual of a particular species}}{\text{Total number of species}} \times 100$$

## CHAPTER IV

### RESULTS AND DISCUSSION

Modern research on mushroom is increasing day by day due to their beneficial properties as well as the economic importance. Mushrooms are also an important component of forest ecosystem. Usually in the rainy season (July to October), mushrooms are found. Some are also found in the summer as well as in the winter season and it basically grown in everywhere, where they get adequate moisture or their favorable environment. They actually emerge from substrates such as peat, soil, humus, dung, sawdust, charcoal heaps etc. as described by Lakkhanpal (2005). From various studies that were conducted in Bangladesh it was found that our forest, both the natural and social are the source of various types of wild mushrooms.

The Survey was conducted to collect, preserve and identify mushrooms from the Gajni forest that is the part of tropical moist deciduous forest region in Bangladesh. It is also known as shal forest as the most dominated tree is shal tree. In total of 32 mushroom samples were collected among them 30 samples were identified to 28 species which belong to 9 families including 15 species of Ganodermataceae, 3 species of Polyporaceae, 2 species of Agaricaceae, 2 species of Amanitaceae, 2 species of Russulaceae, 2 species of Pluteaceae and 1 species each of the family Marasmiaceae, Tuberaceae and Strophariaceae (Table 1). Among all the species, the highest frequency was 75% recorded for *Volveriella gloiocephala*, *Ganoderma applanatum* and the highest density (20.25%) was found for *Agaricus bitorquis* (Table 3). The evenness and species richness was found in Ganodermataceae family. The second dominated species was found under Polyporaceae family. The morphology of basidiocarp and basidiospore are presented in figure 1- 30 and in table 2.

**Table 1. Systematic classification of collected wild mushroom fungi from phylum to species**

<b>Phyllum</b>	<b>Class</b>	<b>Order</b>	<b>Family</b>	<b>Genus</b>	<b>Species name</b>
Basidiomycota	Agaricomycetes	Polyporales	Ganodermataceae	<i>Ganoderma</i>	<i>Ganoderma applanatum</i>
Basidiomycota	Agaricomycetes	Polyporales	Ganodermataceae	<i>Ganoderma</i>	<i>Ganoderma lobatum</i>
Basidiomycota	Agaricomycetes	Polyporales	Ganodermataceae	<i>Ganoderma</i>	<i>Ganoderma lucidum</i>
Basidiomycota	Agaricomycetes	Polyporales	Ganodermataceae	<i>Ganoderma</i>	<i>Ganoderma boninense</i>
Basidiomycota	Agaricomycetes	Polyporales	Ganodermataceae	<i>Ganoderma</i>	<i>Ganoderma tsugae</i>
Basidiomycota	Agaricomycetes	Polyporales	Ganodermataceae	<i>Ganoderma</i>	<i>Ganoderma fornicatum</i>
Basidiomycota	Agaricomycetes	Polyporales	Ganodermataceae	<i>Ganoderma</i>	<i>Ganoderma sinense</i>
Basidiomycota	Agaricomycetes	Polyporales	Ganodermataceae	<i>Ganoderma</i>	<i>Ganoderma tropicum</i>
Basidiomycota	Agaricomycetes	Polyporales	Ganodermataceae	<i>Ganoderma</i>	<i>Ganoderma lipsiense</i>
Basidiomycota	Agaricomycetes	Polyporales	Ganodermataceae	<i>Ganoderma</i>	<i>Ganoderma</i> sp
Basidiomycota	Agaricomycetes	Polyporales	Ganodermataceae	<i>Ganoderma</i>	<i>Ganoderma calidophilum</i>
Basidiomycota	Agaricomycetes	Polyporales	Ganodermataceae	<i>Ganoderma</i>	<i>Ganoderma japonicum</i>
Basidiomycota	Agaricomycetes	Polyporales	Ganodermataceae	<i>Ganoderma</i>	<i>Ganoderma annulare</i>
Basidiomycota	Agaricomycetes	Polyporales	Ganodermataceae	<i>Ganoderma</i>	<i>Ganoderma pfeifferi</i>
Basidiomycota	Agaricomycetes	Polyporales	Ganodermataceae	<i>Ganoderma</i>	<i>Ganoderma</i> sp
Basidiomycota	Agaricomycetes	Polyporales	Ganodermataceae	<i>Ganoderma</i>	<i>Ganoderma orbiforme</i>
Basidiomycota	Agaricomycetes	Polyporales	Polyporaceae	<i>Trametes</i>	<i>Trametes elegans</i>
Basidiomycota	Agaricomycetes	Polyporales	Polyporaceae	<i>Trametes</i>	<i>Trametes versicolor</i>

Basidiomycota	Agaricomycetes	Polyporales	Polyporaceae	<i>Polyporus</i>	<i>Polyporus</i> sp
Basidiomycota	Agaricomycetes	Agaricales	Agaricaceae	<i>Agaricus</i>	<i>Agaricus</i> <i>bitorquis</i>
Basidiomycota	Agaricomycetes	Agaricales	Agaricaceae	<i>Agaricus</i>	<i>Agaricus</i> <i>arvensis</i>
Basidiomycota	Agaricomycetes	Agaricales	Amanitaceae	<i>Amanita</i>	<i>Amanita</i> <i>muscaria</i>
Basidiomycota	Agaricomycetes	Agaricales	Amanitaceae	<i>Amanita</i>	<i>Amanita</i> <i>excels</i>
Basidiomycota	Agaricomycetes	Russulales	Russulaceae	<i>Russula</i>	<i>Russula</i> <i>nobilis</i>
Basidiomycota	Agaricomycetes	Russulales	Russulaceae	<i>Lactariou</i>	<i>Lactariou</i> <i>deliciosus</i>
Basidiomycota	Agaricomycetes	Agaricales	Pluteaceae	<i>Volvariella</i>	<i>Volvariella</i> <i>goloicephla</i>
Basidiomycota	Agaricomycetes	Agaricales	Pluteaceae	<i>Volvariella</i>	<i>Volvariella</i> <i>speciose</i>
Basidiomycota	Agaricomycetes	Agaricales	Marasmiaceae	<i>Gymnopus</i>	<i>Gymnopus</i> <i>iocephalus</i>
Ascomycota	Pezizomycetes	Pezizales	Tuberaceae	<i>Tuber</i>	<i>Tuber</i> <i>aestivum</i>
Basidiomycota	Agaricomycetes	Agaricales	Strophariaceae	<i>Gymnopilus</i>	<i>Gymnopilus</i> <i>purpuratous</i>

## **1. Scientific Name: *Agaricus bitorquis***

Family: Agaricaceae

**Morphology:** Size of fruting body was 3.1×4.5 cm. The color of pileus (cap) was white. The shape of cap was ovate and edge was round but slightly wavy (Figure 1). Beneath the cap hymenophores were absent. White color gills (lamellae) were present underside of the cap. Ring was absent on the stipe and volva was absent on the lower part of the stipe.

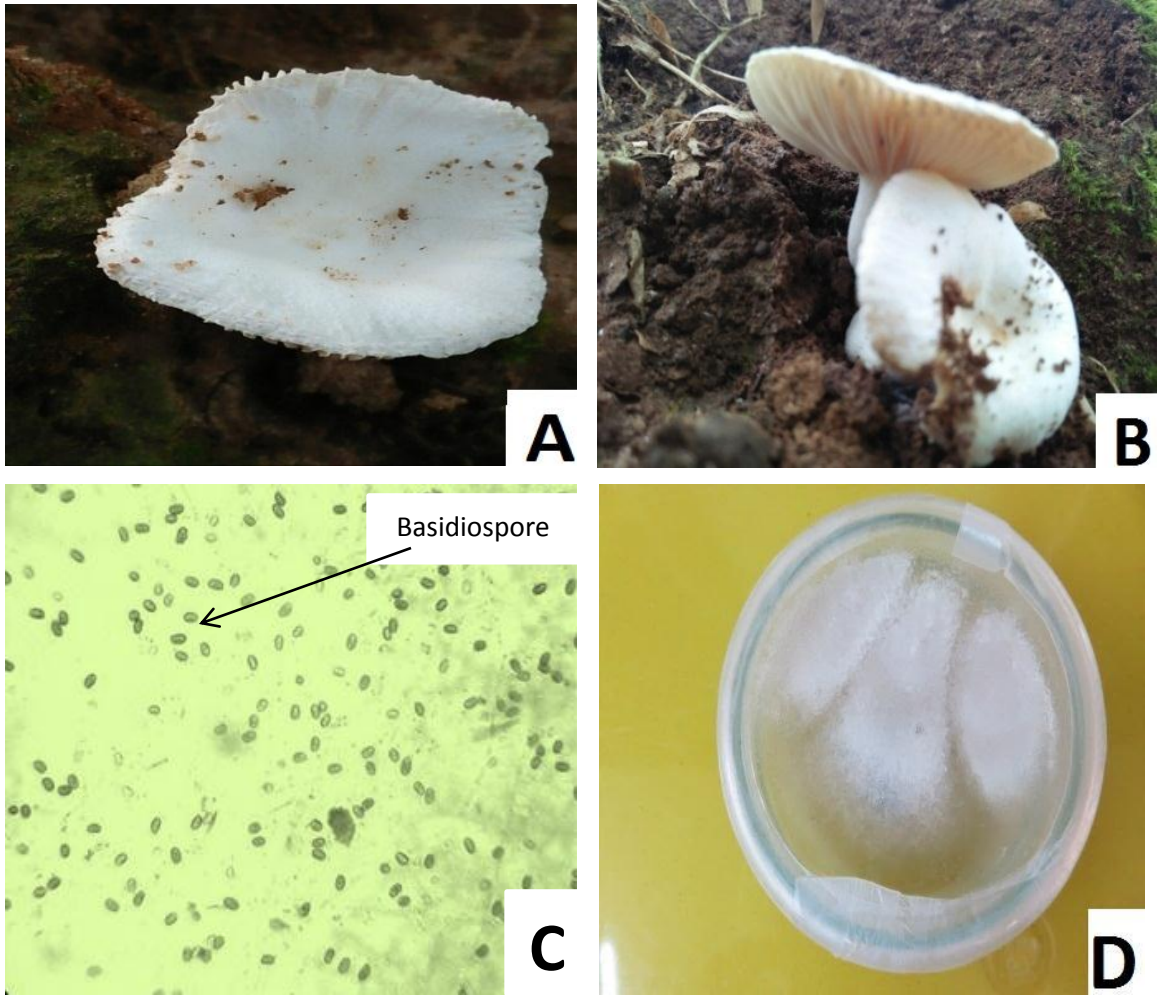
**Spore morphology:** Spore colour was brown. Spores were thin walled, round shaped, scattered.

**Habitat:** The mushroom species was found on soil surface in Gajni forest that is the part of tropical deciduous forest is association with shal (*Shorea robusta*). The occurrence of species was abundant. Type of soil was clay and acidic. The moist weather of forest is affecting their distribution. During the collection the average relative humidity was 90% and temperature was 33°C.

**Biodiversity:** *Agaricus bitorquis* was found in Gajni forest under sherpur district. Abundants number of mushroom of *Agaricus bitorquis* were found during collection. The frequency of its presence was 70% and the density was 20.25%.

**Cultural character:** The culture of *Agaricus bitorquis* was grown in PDA. The growth pattern of mycelia was flapy and irregular round. Mycelial colour was whitish.

**Edibility:** The mushroom is reported as edible and delicious.



**Figure 1.** *Agaricus bitorquis*; A. Fruiting Body, B. Gill, C. Spore ( $\times 100$ ), D. Culture growth in PDA media.



## **2. Scientific Name: *Agaricus arvensis***

Family: Agaricaceae

**Morphology:** Size of fruting body was 1.5×2.1 cm. The color of pileus (cap) was white. The shape of cap was round smooth (Figure 2). Beneath the cap hymenophores were absent. White color gills (lamellae) were present underside of the cap. Ring or anal was absent on the stipe and volva was absent on the lower part of the stipe.

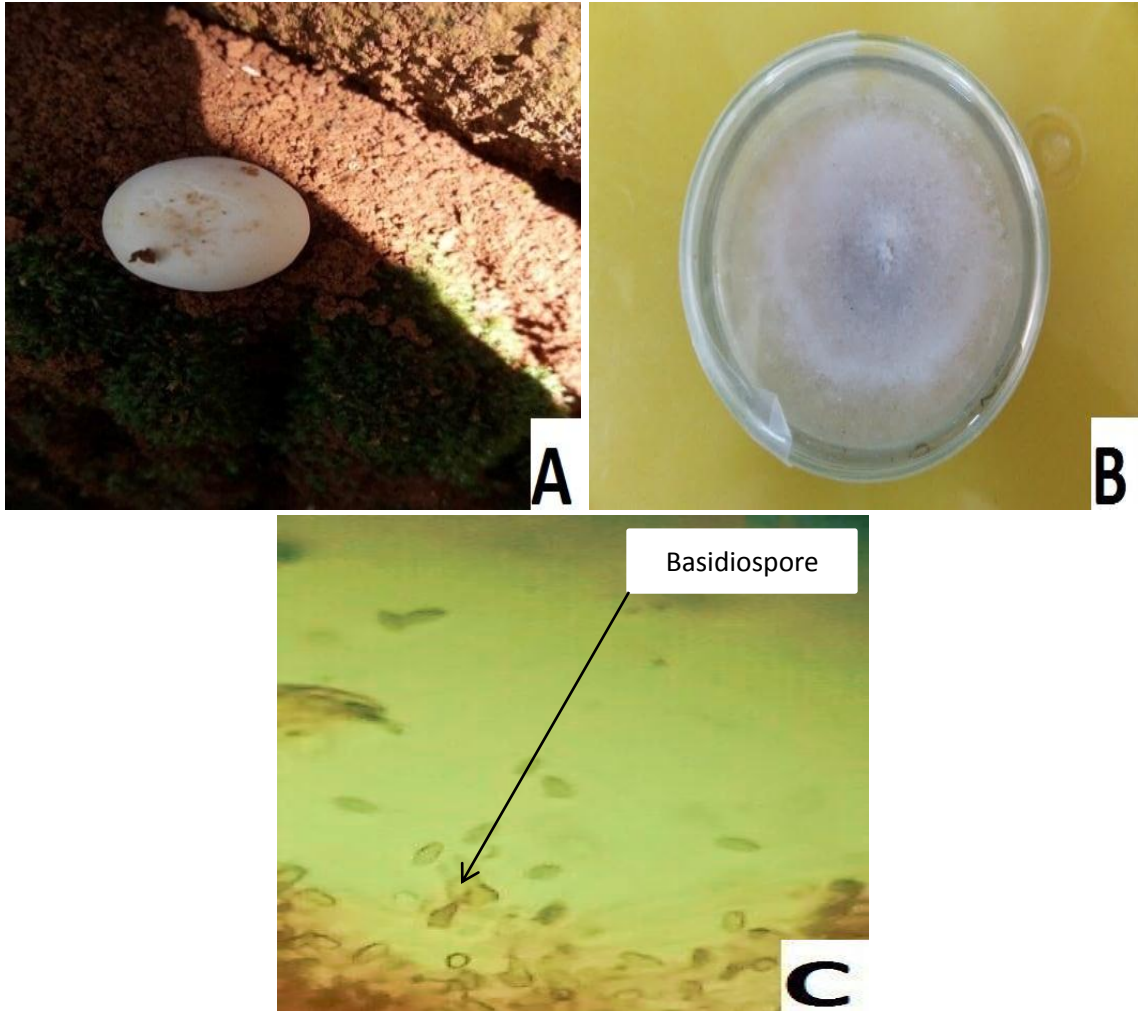
**Spore morphology:** Spore colour was brown. Spore was thick walled, conicle shaped, scattered.

**Habitat:** The mushroom species was found on soil surface in Gajni forest that is the part of tropical deciduous forest is association with shal (*Shorea robusta*). The occurrence of species was unabundant. Type of soil was clay and acidic. The moist weather of forest is affecting their distribution. During the collection the average relative humidity was 90% and temperature was 33°C.

**Biodiversity:** *Agaricus arvensis* was found in Gajni forest under sherpur district. In total 3 number of mushrooms of *Agaricus arvensis* were found during collection. The frequency of its presence was 70% and the density was 18.60%.

**Cultural character:** The culture of *Agaricus arvensis* was grown in PDA. The growth pattern of mycelia was flapy and round. Mycelial colour was whitish.

**Edibility:** The mushroom is reported as edible and popular.



**Figure 2.** *Agaricus arvensis*; A. Fruiting Body, B. Culture growth in PDA media, C. Spore ( $\times 100$ ).

### **3. Scientific Name: *Amanita muscaria***

Family: Amanitaceae

**Morphology:** Size of fruting body was 4.5×3.5 cm. The color of pileus (cap) was blackish to white (Young and mature). The shape of cap was round, smooth and Ellipsoid (Figure 3). Spore bearing surface under cap was gills. Beneath the cap hymenophores were absent. Regular white color gills (lamellae) were present underside of the cap. Ring or anal was absent on the stipe and volva was absent on the lower part of the stipe.

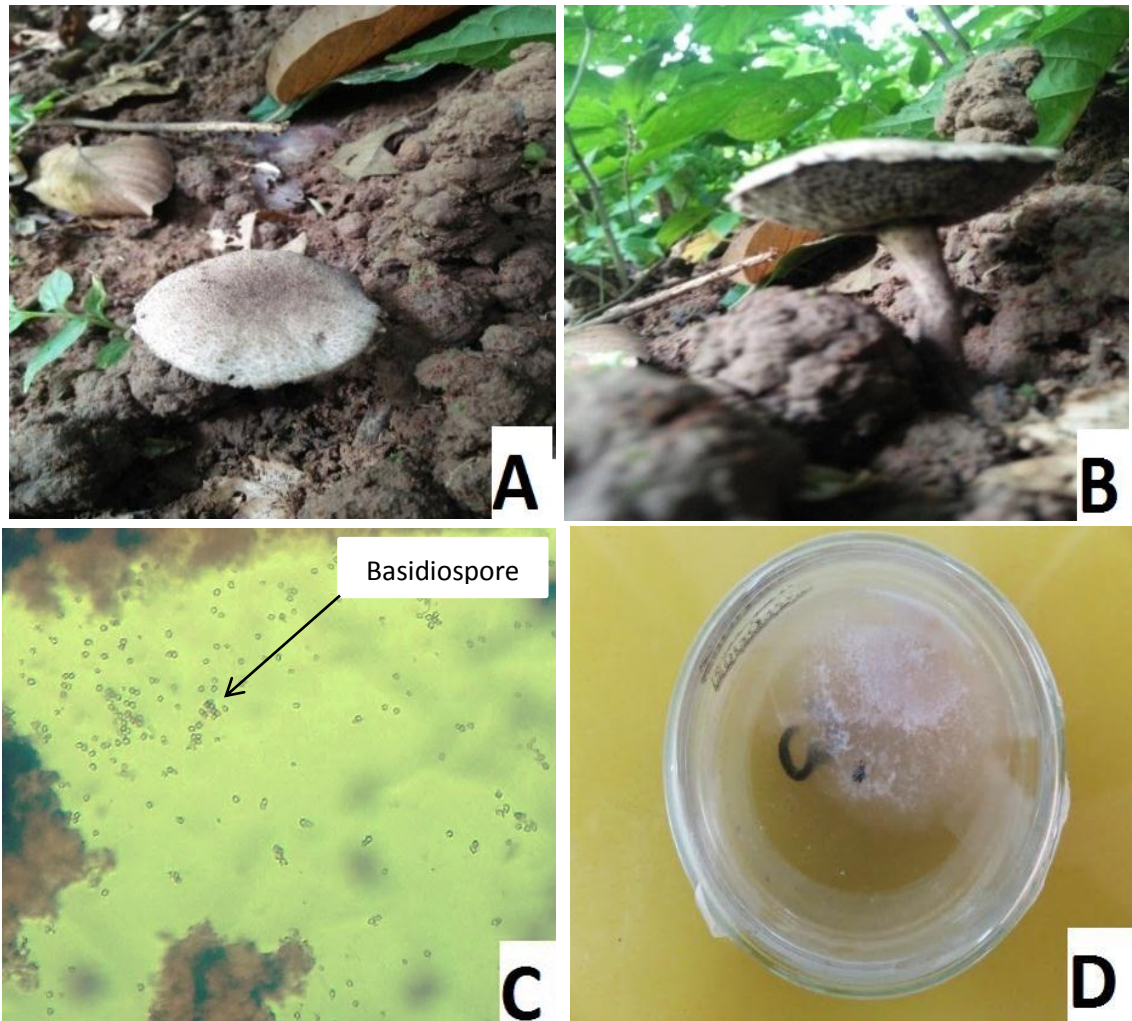
**Spore morphology:** Spore colour was light brown. Spore was thin walled, round shaped.

**Habitat:** The mushroom species was found on soil surface in Gajni forest that is the part of tropical deciduous forest is association with shal (*Shorea robusta*). The occurrence of species was abundant. Type of soil was clay and acidic. The moist weather of forest is affecting their distribution. During the collection the average relative humidity was 90% and temperature was 33°C.

**Biodiversity:** *Amanita muscaria* was found in Gajni forest under serpur district. Only 4 number of mushrooms of *Amanita muscaria* was found during collection. The frequency of its presence was 25 % and the density was 7.45%.

**Cultural character:** The culture of *Amanita arvensis* was grown on PDA. The growth pattern of mycelia was flapy and round and colour was whitish.

**Edibility:** This is reported as inedible and poisonous.



**Figure 3. *Amanita muscari*; A. Fruiting Body, B. Gill, C. Spore ( $\times 100$ ), D. Culture growth in PDA media.**

#### **4. Scientific Name: *Amanita excels***

Family: Amanitaceae

**Morphology:** Size of fruting body was 4.5×3.5 cm. The color of pileus (cap) was blackish. The shape of cap was corcky and ellipsoid. Spore bearing surface under cap was gills (Figure 4). Beneth the cap hymenophores were absent. Regular blackish color gills (lamellae) were present underside of the cap. Ring or anal was absent on the stipe and volva was absent on the lower part of the stipe.

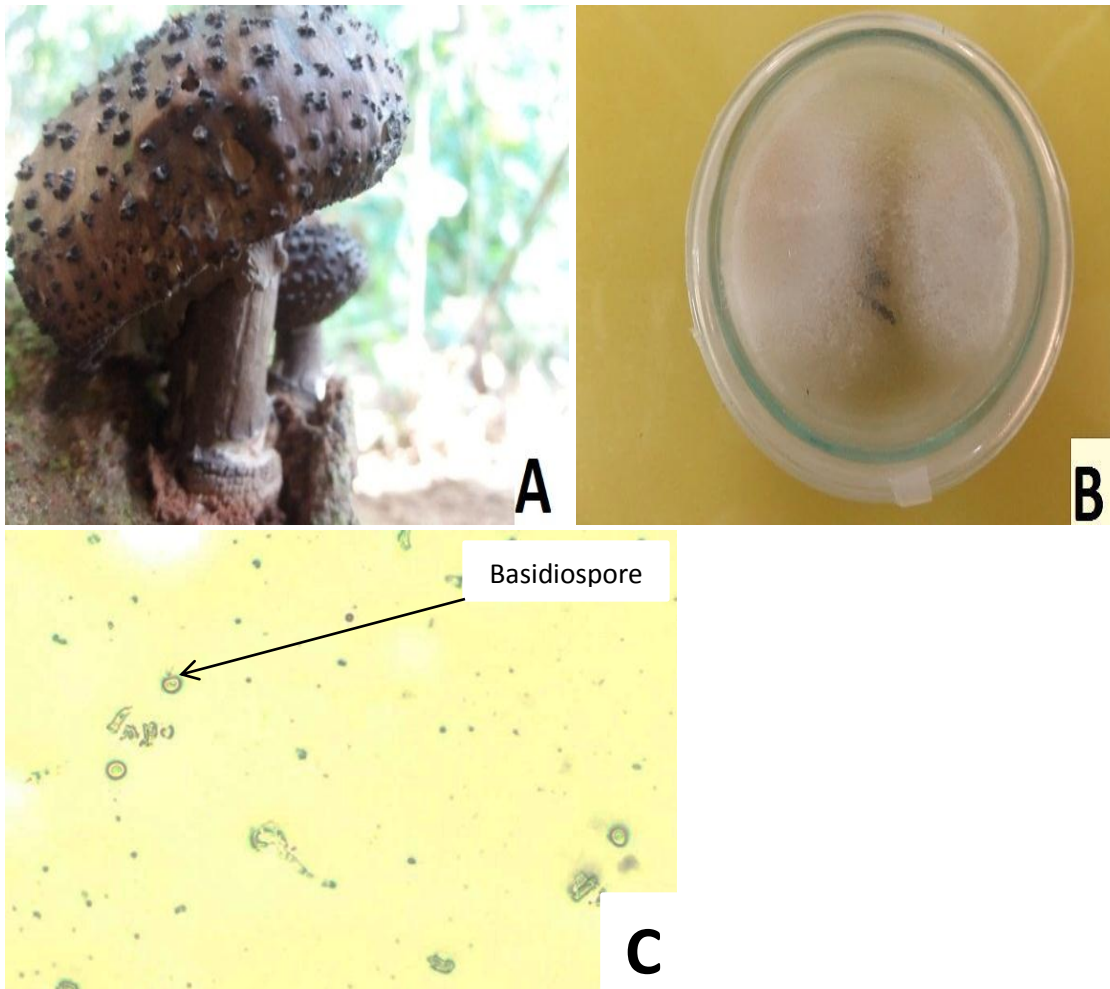
**Spore morphology:** Spore colour was slightly brown. Spore was thick walled, irregular shaped.

**Habitat:** The mushroom species was found on soil surface in Gajni forest that is the part of tropical deciduous forest is association with shal (*Shorea robusta*). The occurrence of a particular mushroom in specific habitat was unabundant. Type of soil was clay and acidic. The moist weather of forest is affecting their distribution. During the collection the average relative humidity was 90% and temperature was 33°C.

**Biodiversity:** *Amanita excels* was found in Gajni forest under Serpur district. Only 2 numbers of mushrooms of *Amanita excels* were found during collection. The frequency of its presence was 25% and the density was 2.25 %.

**Cultural character:** The culture of *Amanita excels* was grown in PDA media. The growth pattern of mycelia was flapy and round. Mycelial colour was whitish.

**Edibility:** This is reported as inedible and poisonous.



**Figure 4.** *Amanita excels*; A. Fruiting Body, B. Culture growth in PDA media, C. Spore ( $\times 100$ ).

## 5. Scientific Name: *Lactarius deliciosus*

Family: Russulaceae

**Morphology:** Size of fruting body was 3×3.5cm. The color of pileus (cap) was pinkish. The shape of cap was ovate and edge was round but slightly wavy (Figure 5). Beneath the cap hymenophores were absent. Regular pinkish color gills (lamellae) were present underside of the cap. Ring or anal was absent on the stipe and volva was absent on the lower part of the stipe.

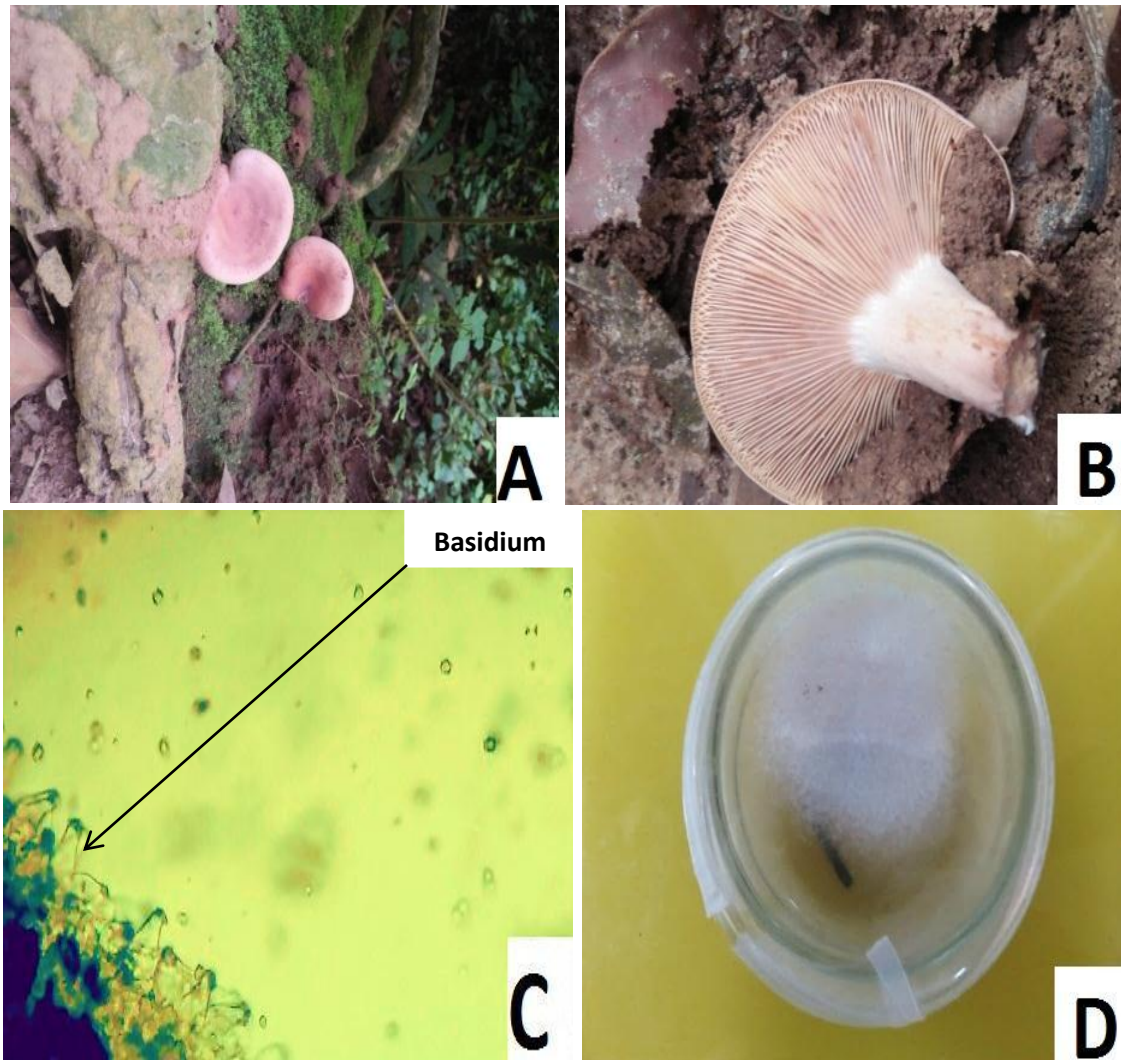
**Spore morphology:** Spore colour was light brown. Spore was thin walled, round shaped, scattered.

**Habitat:** The mushroom species was found on soil surface in Gajni forest that is the part of tropical deciduous forest is association with shal (*Shorea robusta*). The occurrence of a particular mushroom in specific habitat was abundant. Type of soil was clay and acidic. The moist weather of forest is affecting their distribution. During the collection the average relative humidity was 90% and temperature was 33°C.

**Biodiversity:** *Lactarius deliciosus* was found in Gajni forest under sherpur district. Total 4 numbers of mushrooms of *Lactarius deliciosus* were found during collection. The frequency was 50 % and the density 10.75%.

**Cultural character:** The culture of *Lactarius deliciosus* was grown in PDA media. The growth pattern of mycelia was flat and round, white color.

**Edibility:** It is reported as inedible.



**Figure 5.** *Lactarius deliciosus*; A. Fruiting Body, B. Gill, C. Spore ( $\times 400$ ), D. Culture growth in PDA media.



## **6. Scientific Name: *Russula nobilis***

Family: Russulaceae

**Morphology:** Size of fruting body was 2.5×1.5 cm. Pileus shape was funnel shape. Color was pink to red. Texture of the fruting body was soft and spongy (Figure 6). Spore bearing surface under cap was gills. Stipe was present. Ring or anal was absent on the stipe and volva was absent on the lower part of the stipe.

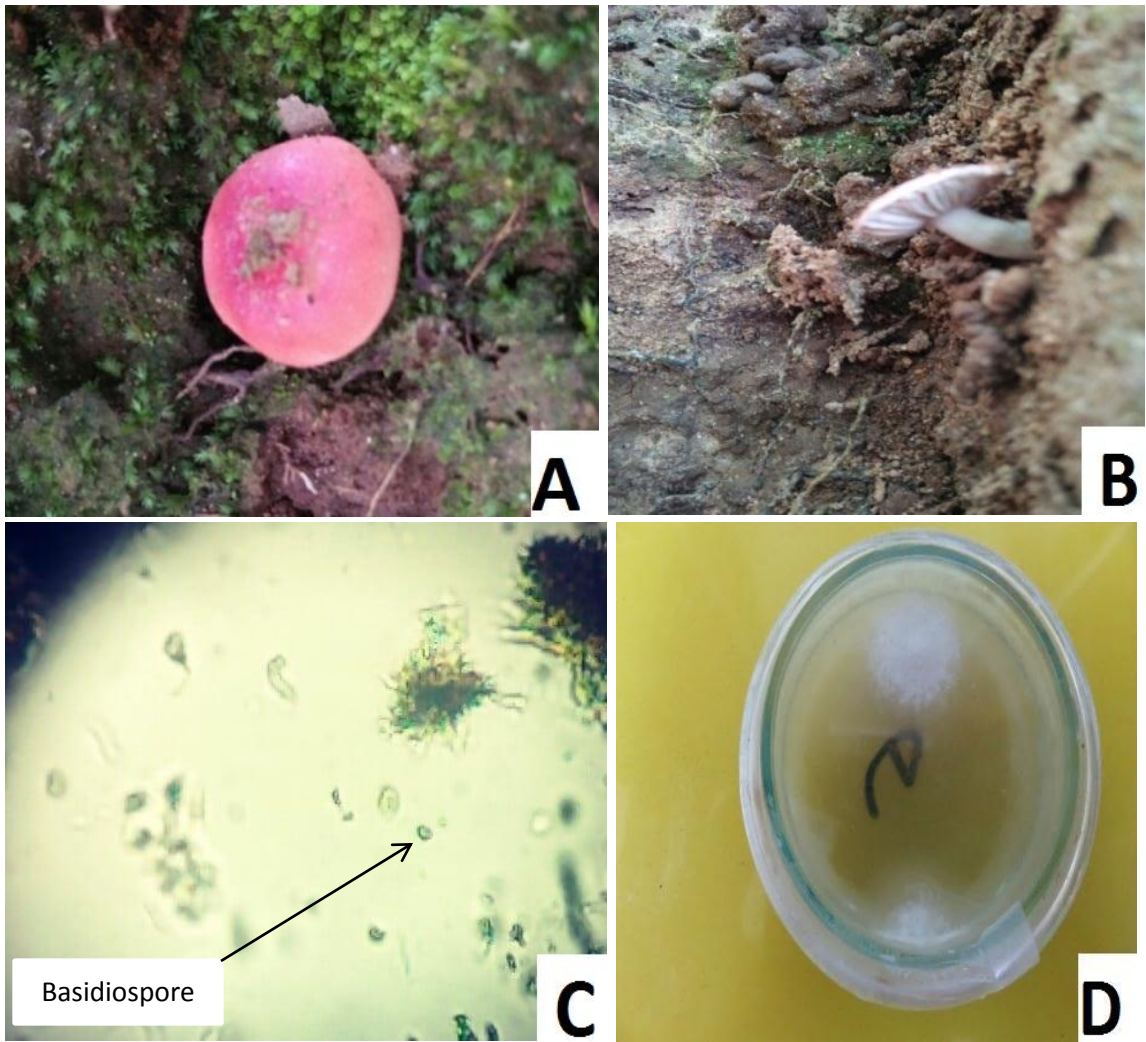
**Spore morphology:** Spore colour was blackish. Spore was thick walled, irregular round shaped, clustered.

**Habitat:** The mushroom species was found on soil surface in Gajni forest that is the part of tropical deciduous forest is association with shal (*Shorea robusta*). The occurrence of a particular mushroom in specific habitat was unabundant. Type of soil was clay and acidic. The moist weather of forest is affecting their distribution. During the collection the average relative humidity was 90% and temperature was 33°C.

**Biodiversity:** *Russula nobilis* was found in Gajni forest under sherpur district. Only 2 numbers of mushrooms of *Russula nobilis* were found during collection. The frequency of its presence was 10% and the density was 3.25%.

**Cultural character:** The culture of *Russula nobilis* was grown in PDA media. The growth pattern of mycelia was flat and irregular round. Mycelial growth rate was poor and whitish color.

**Edibility:** It is reported as inedible.



**Figure 6.** *Russula nobillis*; A. Fruiting Body, B. Gill, C. Spore ( $\times 100$ ), D. Culture growth in PDA media.

## **7. Scientific Name: *Polyporus* sp**

Family: Polyporaceae

**Morphology:** Size of fruting body was  $4.5 \times 2.8$  cm. Color was yellow, soft and fleshy. Pileus was cup shaped (Figure 7). Spore bearing surface under cap was gills. Gill attachment was Free. Volva was not present on the lower part of the stipe.

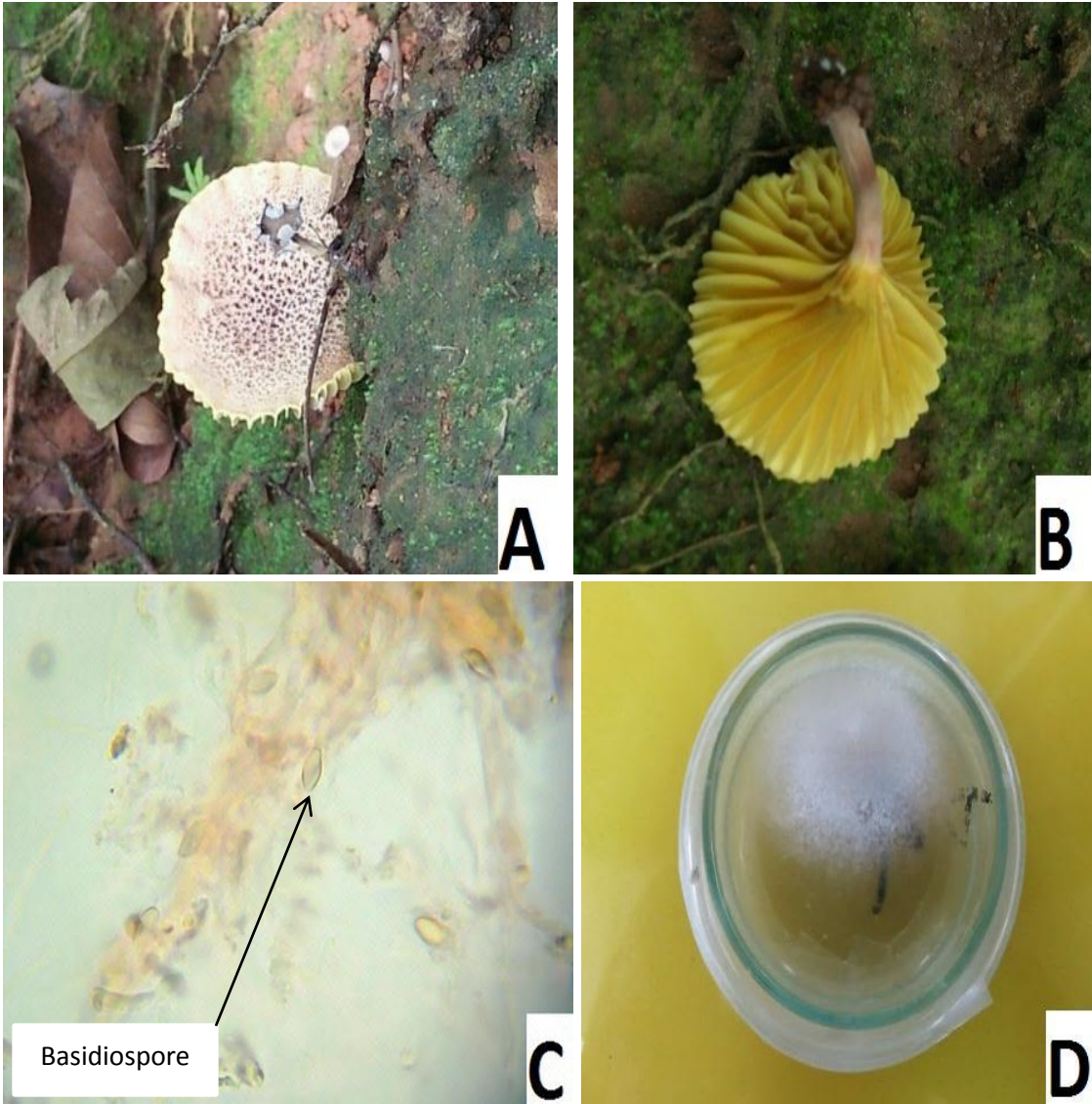
**Spore morphology:** Spore colour was slightly brown. Spore was thin walled, round shaped, scattered.

**Habitat:** The mushroom species was found on soil surface in Gajni forest that is the part of tropical deciduous forest in association with shal (*Shorea robusta*). The occurrence of a particular mushroom in specific habitat was un-abundant. Type of soil was clay and acidic. The moist weather of forest is affecting their distribution. During the collection the average relative humidity was 90% and temperature was 33°C.

**Biodiversity:** *Polyporus* sp was found in Gajni forest under sherpur district. Only 2 numbers of mushrooms of *Polyporus* sp were found during collection. The frequency of its presence was 10% and the density was 2.25%.

**Cultural character:** The culture of *Polyporus* sp was grown in PDA media. The growth pattern of mycelia was flat and irregular round. Mycelial colour was grayish white.

**Edibility:** It is reported as inedible.



**Figure 7. *Polyporus* sp; A. Fruiting Body, B. Gill, C. Spore ( $\times 100$ ), D. Culture growth in PDA media.**

## **8. Scientific Name: *Volvariella gloiocephala***

Family: Pluteaceae

**Morphology:** Size of fruting body was  $10.5 \times 6.8$  cm. Color was white (Young and mature), soft and fleshy (Figure 8). Spore bearing surface under cap was gills. Gill attachment was Free. Shape was ovate or flat. Pileus color was creamy, brownish. Volva was present on the lower part of the stipe.

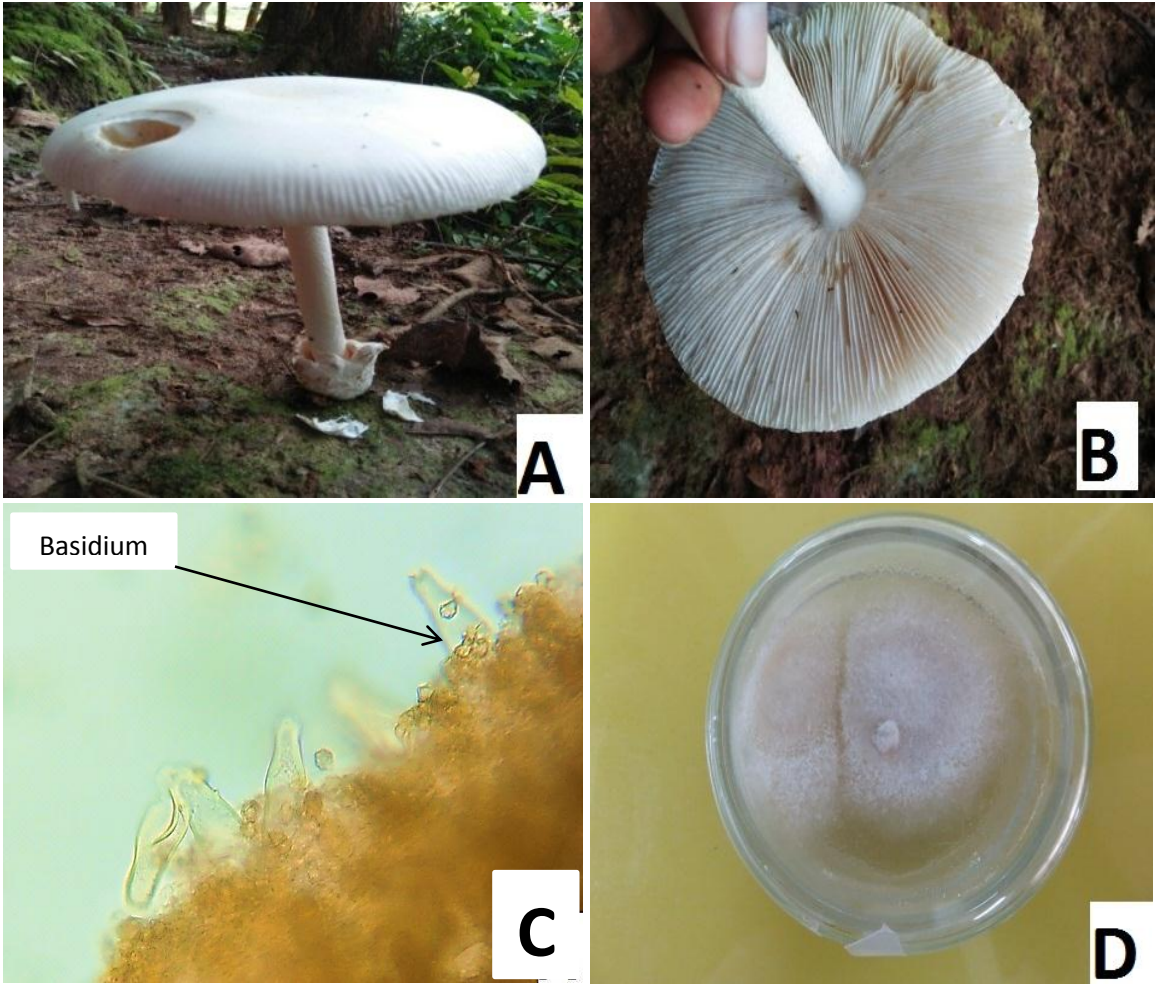
**Spore morphology:** Spore colour was light brown. Spore was thin walled, elliptical shaped, scattered.

**Habitat:** The mushroom species was found on soil surface in Gajni forest that is the part of tropical deciduous forest is association with shal (*Shorea robusta*). The occurrence of a particular mushroom in specific habitat was unabundant. Type of soil was clay and acidic. The moist weather of forest is affecting their distribution. During the collection the average relative humidity was 90% and temperature was 33°C.

**Biodiversity:** *Volvariella gloiocephala* was found in Gajni forest under sherpur district. Only 2 numbers of mushrooms of *Volvariella gloiocephala* were found during collection. The frequency of its presence was 75% and the density was 8.25%.

**Cultural character:** The culture of *Volvariella gloiocephala* was grown in PDA media. The growth pattern of mycelia was flat and irregular round. Mycelial colour was whitish.

**Edibility:** The mushroom is also known to be edible.



**Figure 8. *Volvariella gloiocephala*; A. Fruiting Body, B. Gill, C. Spore ( $\times 100$ ), D. Culture growth in PDA media.**

**9. Scientific Name:** *Volvariella speciosa*

Family: Pluteaceae

**Morphology:** Size of fructification was  $4.2 \times 2.4$  cm. The color of pileus (cap) was brown and creamy. The shape of cap was flat and edge was smooth and striate (Figure 9). Cream color scale was found on the cap. Beneath the cap hymenophores were present. Regular shaped light brown gills (lamellae) were present underside of the cap. Ring or anal was absent on the stipe and volva was absent on the lower part of the stipe.

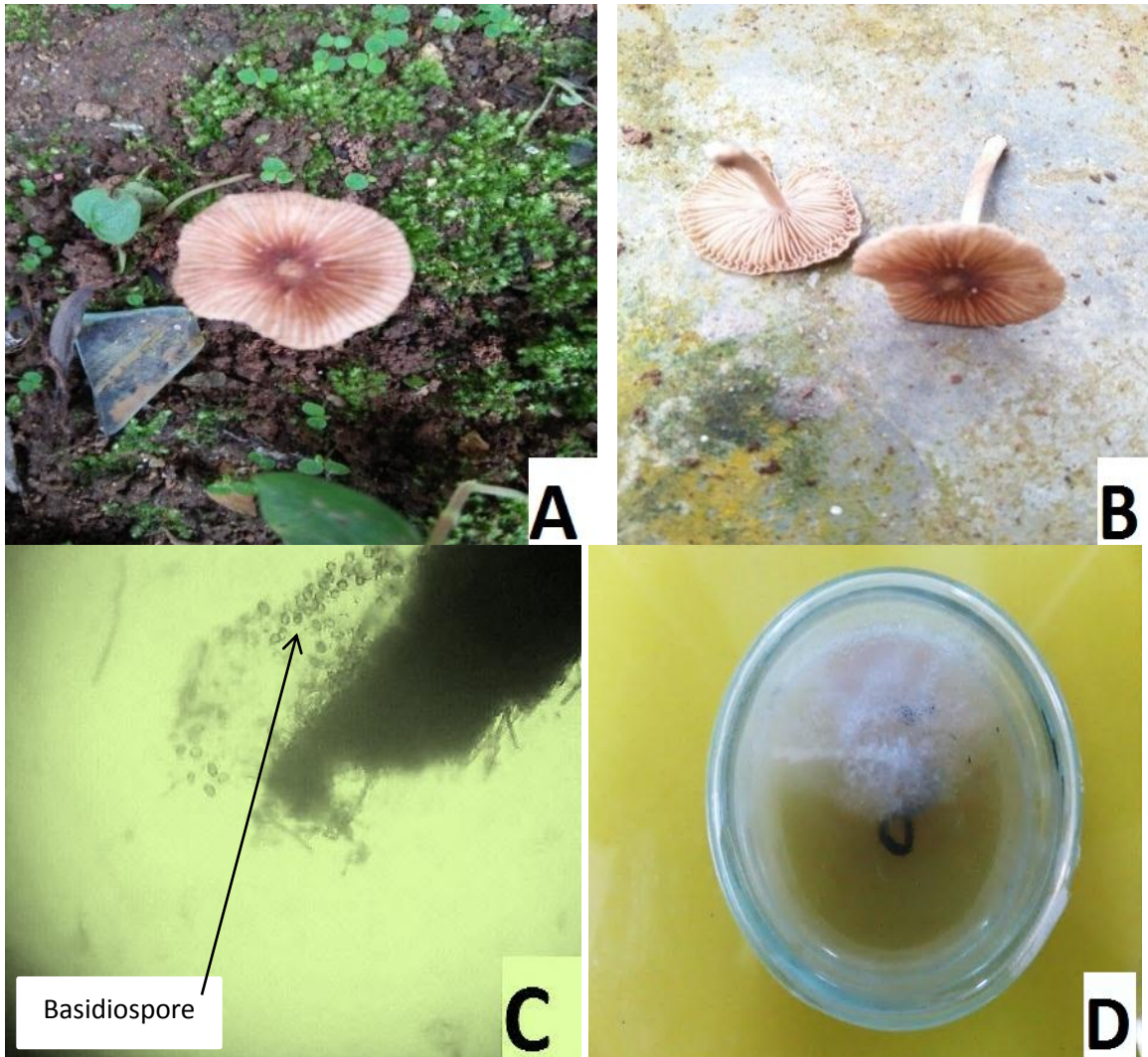
**Spore morphology:** Spore colour was blackish. Spore was thin walled, round shaped, clustered.

**Habitat:** The mushroom species was found on soil surface in Gajni forest that is the part of tropical deciduous forest is association with shal (*Shorea robusta*). The occurrence of a particular mushroom in specific habitat was abundant. Type of soil was clay and acidic. The moist weather of forest is affecting their distribution. During the collection the average relative humidity was 90% and temperature was 33°C.

**Biodiversity:** *Volvariella speciosa* was found in Gajni forest under sherpur district. In total 5 numbers of mushrooms of *Volvariella speciosa* were found during collection. The frequency of its presence was 60% and the density was 15.75%.

**Cultural character:** The culture of *Volvariella speciosa* was grown in PDA media. The growth pattern of mycelia was flapy and round. Mycelial colour was whitish.

**Edibility:** The mushroom is also known to be edible.



**Figure 9.** *Volvariella speciosa*; A. Fruiting Body, B. Gill, C. Spore ( $\times 100$ ), D. Culture growth in PDA media.



## **10. Scientific Name: *Gymnopus iocephalus***

Family: Marasmiaceae

**Morphology:** Size of fruting body was 4.1×2.5 cm. Pileus shape was funnel shape. Color was violet with white strip. Texture of the fruting body was soft and spongy (Figure 10). Spore bearing surface under cap was gills. Stipe was present. Ring was absent on the stipe and volva was absent on the lower part of the stipe.

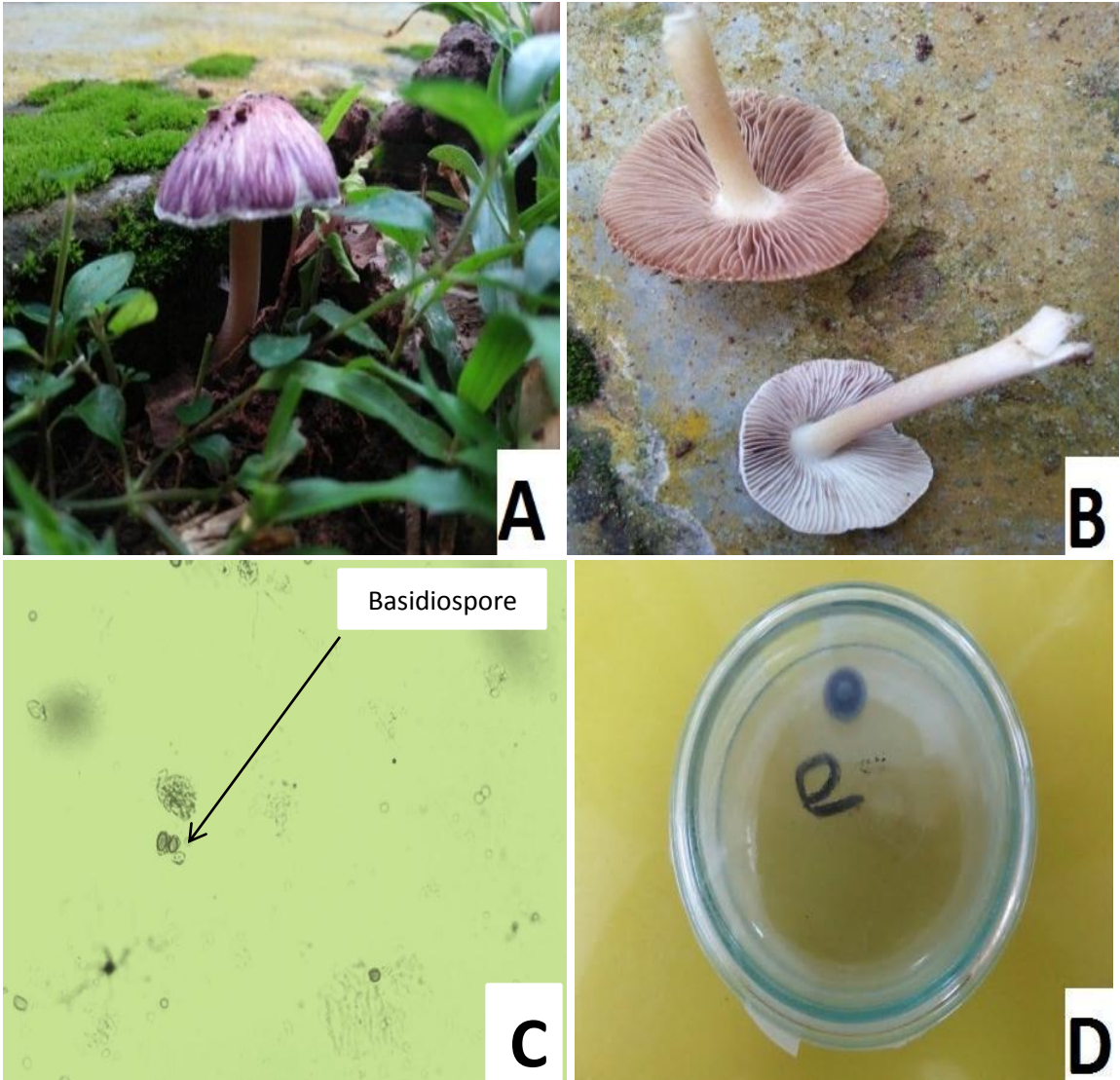
**Spore morphology:** Spore colour was brown. Spore was thick walled, irregular round shaped, clustered.

**Habitat:** The mushroom species was found on soil surface in Gajni forest that is the part of tropical deciduous forest is association with shal (*Shorea robusta*). The occurrence of a particular mushroom in specific habitat was abundant. Type of soil was clay and acidic. The moist weather of forest is affecting their distribution. During the collection the average relative humidity was 90% and temperature was 33°C.

**Biodiversity:** *Gymnopus iocephalus* was found in Gajni forest under shepur district. 4 numbers of mushrooms of *Gymnopus iocephalus* were found during collection. The frequency of its presence was 70% and the density was 15.25%.

**Cultural character:** The culture of *Gymnopus iocephalus* was grown in PDA media. The growth pattern of mycelia was flat and irregular. Growth rate was very poor. Mycelial colour was blackish.

**Edibility:** This is reported as inedible and poisonous.



**Figure 10.** *Gymnopus iocephalus*; A. Fruiting Body, B. Gill, C. Spore ( $\times 100$ ), D. Culture growth in PDA media.

## 11. Scientific Name: *Trametes elegans*

Family: Polyporaceae

**Morphology:** Size of basidiocarp was  $2.3 \times 3.7$  cm. The color of pileus (cap) was brown and creamy. Shape of cap was flat and cap edge was undulating. Light yellow color scale was present on the cap (Figure 11). The white and brown color macro pores were present under the cap. The surface character was dry in nature. The texture of the fruiting body was hard, brittle and woody.

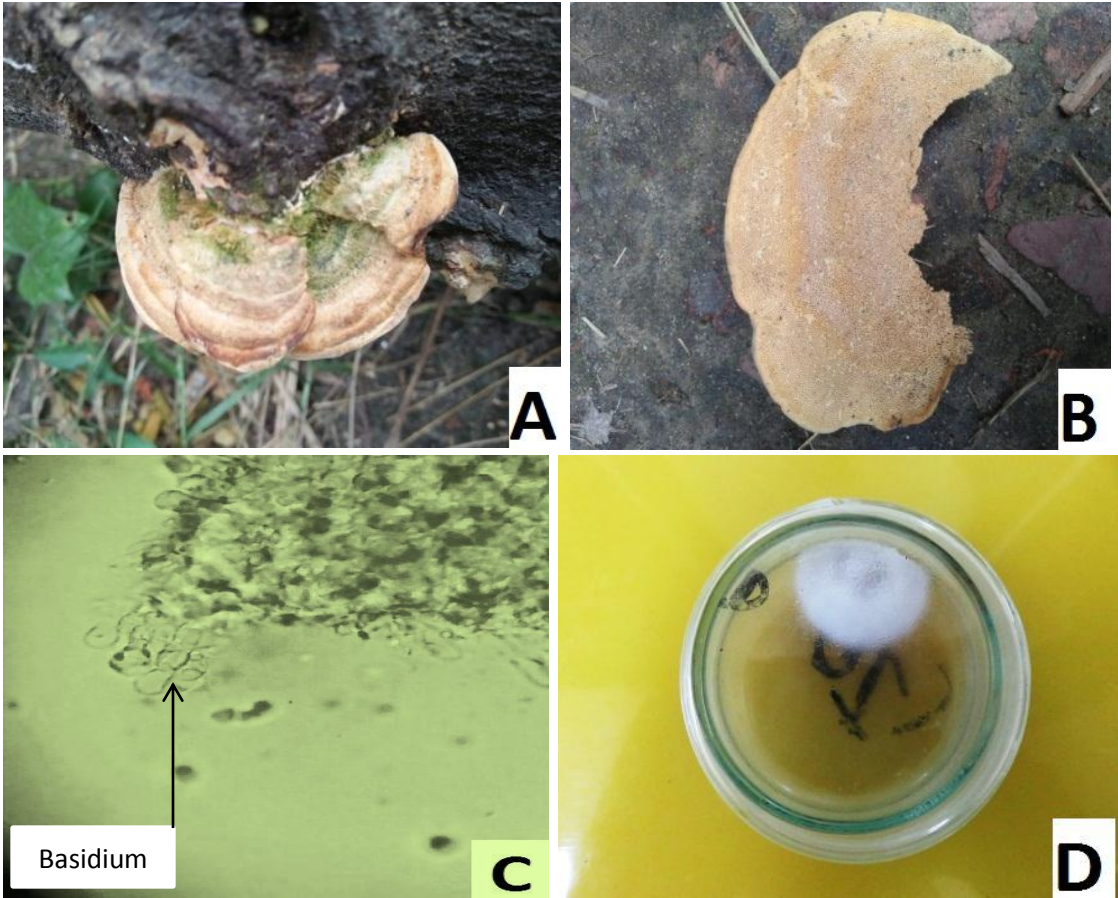
**Spore morphology:** Spore colour was light brown. Spore was thick walled, irregular round shaped.

**Habitat:** The mushroom species was found on soil surface in Gajni forest that is the part of tropical deciduous forest in association with shegun tree (*Tectona grandis*). The occurrence of a particular mushroom in specific habitat was abundant. Type of soil was clay and acidic. The moist weather of forest is affecting their distribution. During the collection the average relative humidity was 90% and temperature was 33°C.

**Biodiversity:** *Trametes elegans* was found in Gajni forest under sheerpur district. Abundant numbers of mushroom of *Trametes elegans* were found during collection. The frequency of its presence was 55% and the density was 5.25%.

**Cultural character:** The culture of *Trametes elegans* was grown in PDA media. The growth pattern of mycelia was flappy and round. Mycelial colour was whitish.

**Edibility:** It is reported as inedible.



**Figure 11.** *Trametes elegans*; A. Fruiting Body, B. Gill, C. Spore ( $\times 100$ ), D. Culture growth in PDA media.

## **12. Scientific Name: *Trametes versicolor***

Family: Polyporaceae

**Morphology:** Size of pileus was 4×3.5 cm. Pileus shape was convex. Color was brown to white coloured. Surface character was dry in nature. Margin was incurved in shape. Margin was thick, cream colour. Texture of the fruiting body was corky and tough (Figure12). Spore bearing surface under cap was pores on hymenium. Pores color was milky. Pore spacing was crowded.

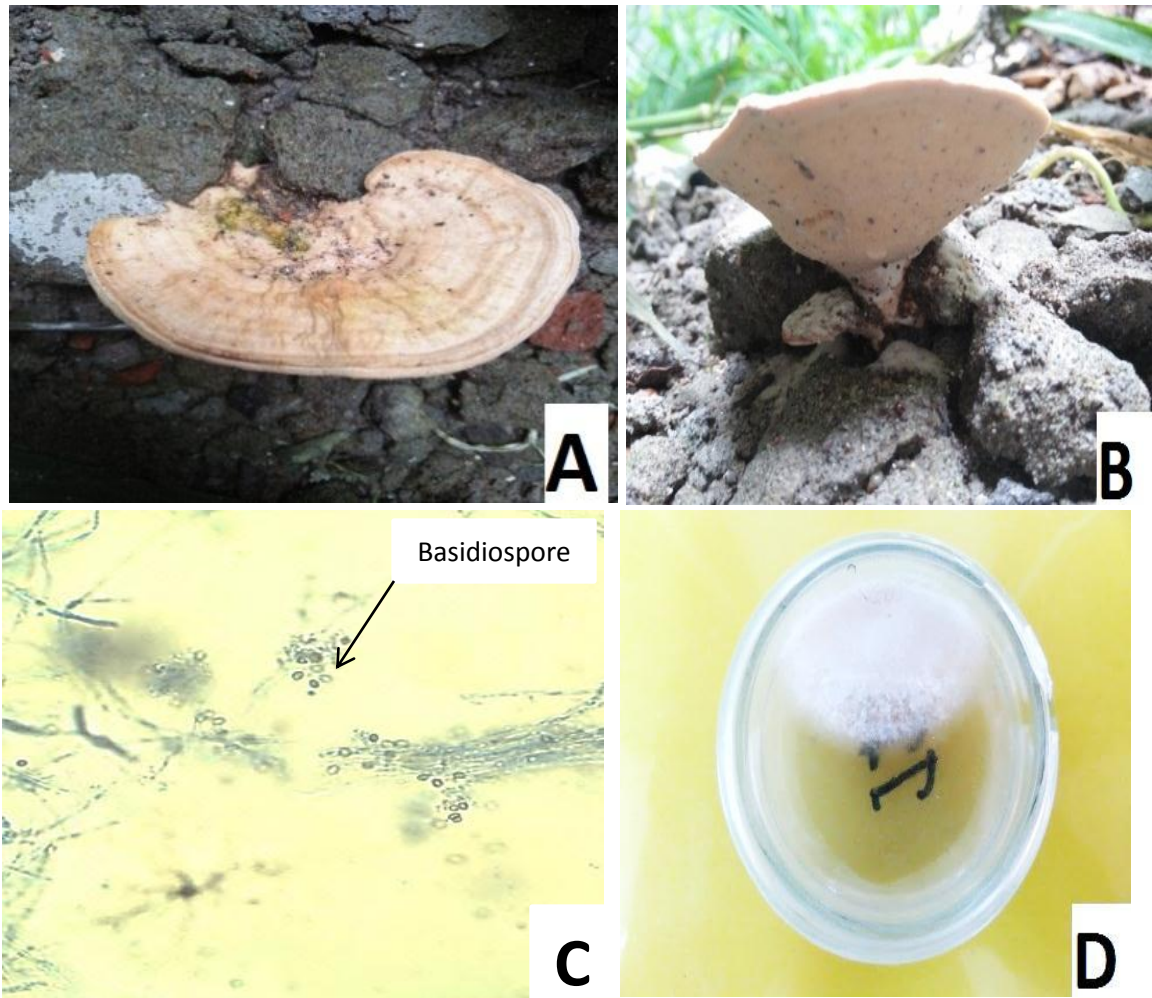
**Spore morphology:** Spore colour was blackish. Spore was thick walled, elongated shape.

**Habitat:** The mushroom species was found on soil surface in Gajni forest that is the part of tropical deciduous forest is association with shegun tree (*Tectona grandis*). The occurrence of a particular mushroom in specific habitat was unabundant. Type of soil was clay and acidic. The moist weather of forest is affecting their distribution. During the sample collection the average relative humidity was 90% and temperature was 33°C.

**Biodiversity:** *Trametes versicolor* was found in Gajni forest under sherpur district. 1 number of mushrooms of *Trametes versicolor* was found during collection. The frequency of its presence was 10% and the density was 2.25%.

**Cultural character:** The culture of *Trametes versicolor* was grown in PDA media. The growth pattern of mycelia was flapy and round. Mycelial colour was grayish white.

**Edibility:** It is reported as inedible.



**Figure 12. *Trametes versicolor*; A. Fruiting Body, B. Gill, C. Spore ( $\times 100$ ), D. Culture growth in PDA media.**

### **13. Scientific Name: *Ganoderma tropicum***

Family: Ganodermataceae

**Morphology:** Size of pileus  $7.5 \times 6.5$  cm. Pileus shape flat. Color was dark red with white border. Surface character and zonation was brittle, rugose, reddish brown and dry in nature (Figure 13). Margin was incurved in shape, thick and coffee color. Texture of the fruiting body is corky to woody. Pores were on hymenium.

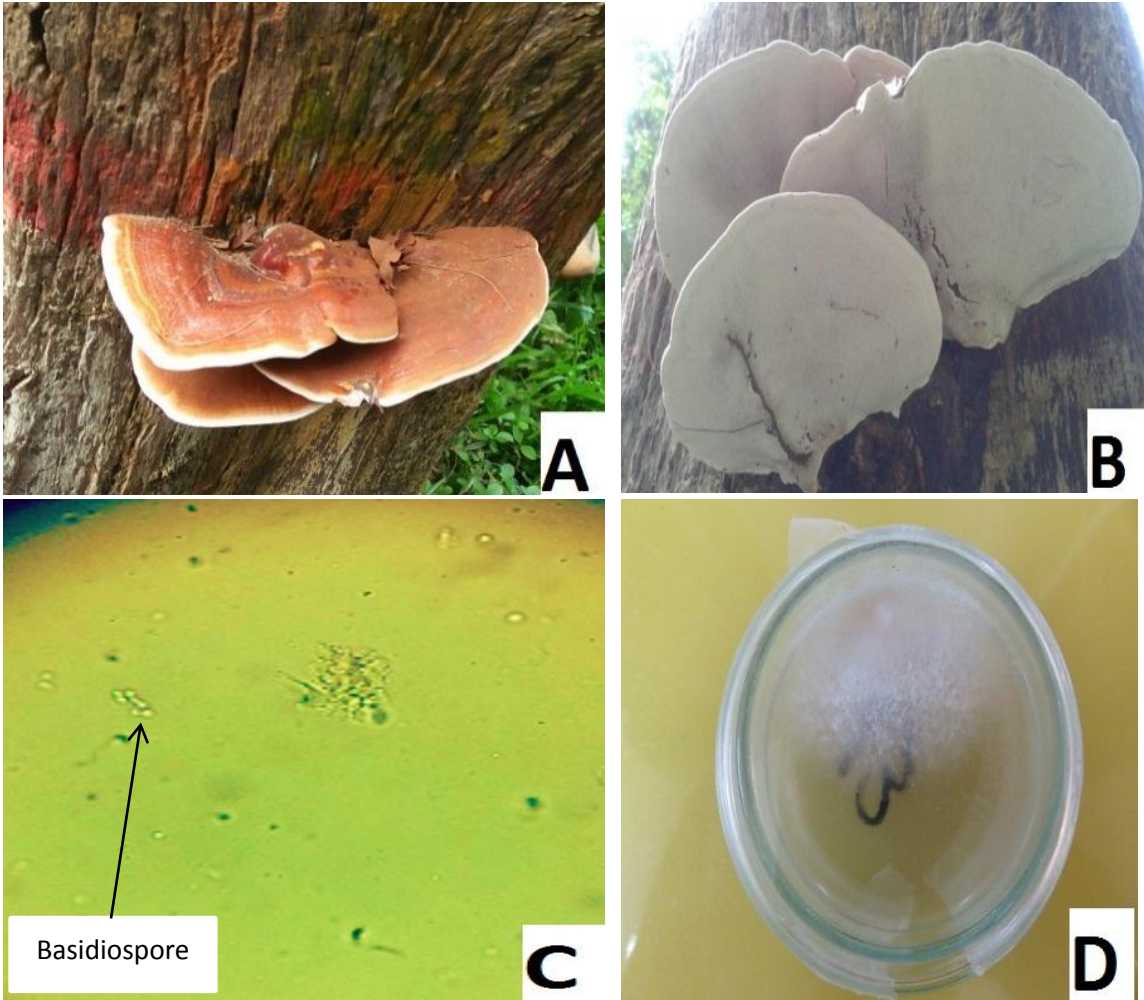
**Spore morphology:** Spore colour was brown. Spore was thick walled, round shaped.

**Habitat:** The mushroom species was found on soil surface in Gajni forest that is the part of tropical deciduous forest is association with shegun tree (*Tectona grandis*). The occurrence of a particular mushroom in specific habitat was abundant. Type of soil was clay and acidic. The moist weather of forest is affecting their distribution. During the sample collection the average relative humidity was 90% and temperature was 33°C.

**Biodiversity:** *Ganoderma tropicum* was found in Gajni forest under shepur district. Abundant numbers of mushrooms of *Ganoderma tropicum* were found during collection. The frequency of its presence was 50% and the density was 8.50%.

**Cultural character:** The culture of *Ganoderma tropicum* was grown in PDA media. The growth pattern of mycelia was flat and irregular round. Mycelial colour was whitish.

**Edibility:** It is reported as inedible but has medicinal values.



**Figure 13.** *Ganoderma tropicum*; A. Fruiting Body, B. Gill, C. Spore ( $\times 100$ ), D. Culture growth in PDA media.



#### **14. Scientific Name: *Ganoderma applanatum***

Family: Ganodermataceae

**Morphology:** Size of pileus was 12.5 × 9.8 cm. Pileus shape was convex. Color was cocoa to brownish. Surface character and zonation was dry in nature, surface become dull when coated by deposit spores. Margin was incurved in shape. Texture of the fruiting body was corky (Figure 14). Pores were on hymenium.

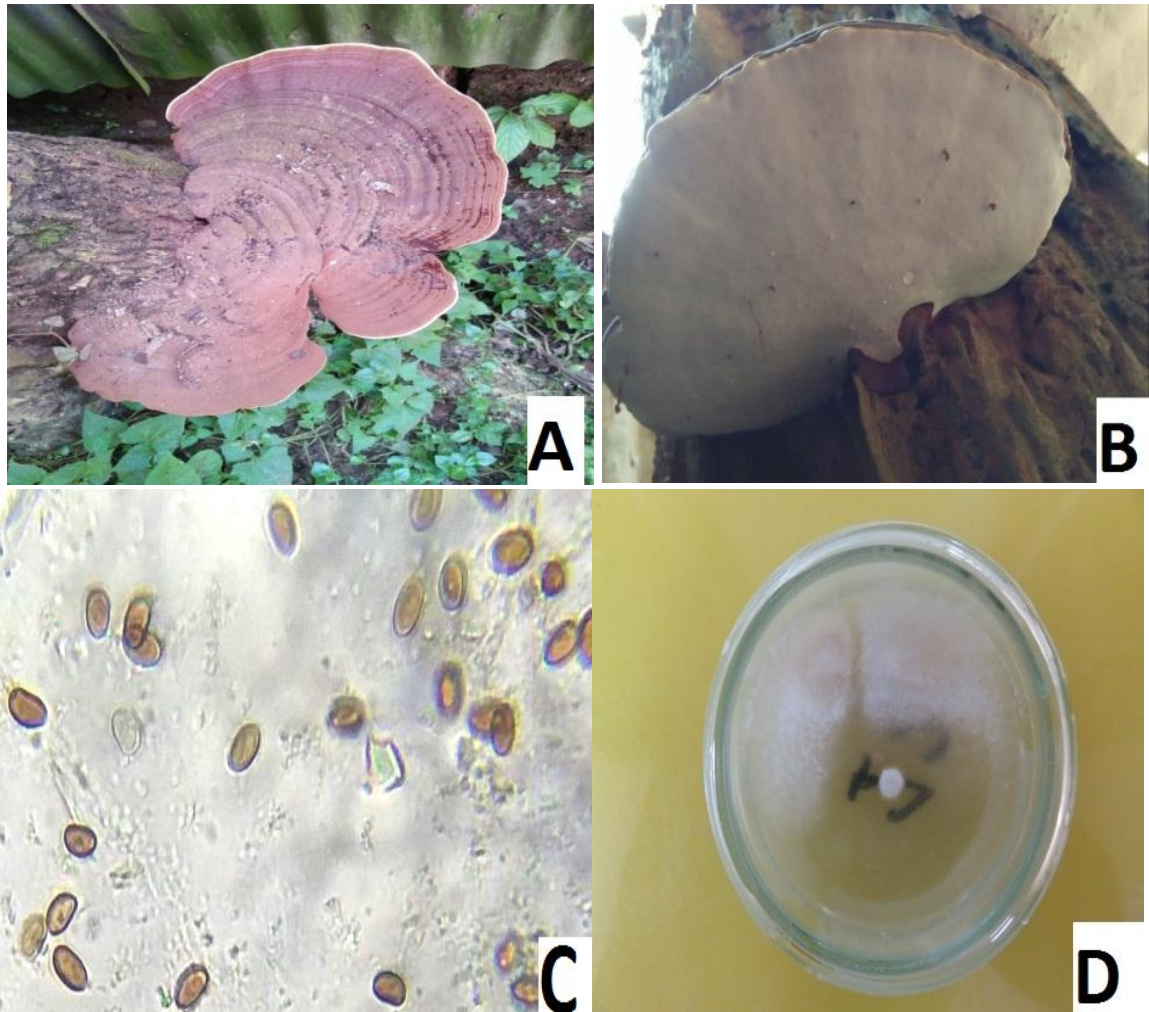
**Spore morphology:** Spore colour was brown. Spore was thick walled, oblong shaped, smooth.

**Habitat:** The mushroom species was found on soil surface in Gajni forest that is the part of tropical deciduous forest is association with shal (*Shorea robusta*). The occurrence of a particular mushroom in specific habitat was abundant. Type of soil was clay and acidic. The moist weather of forest is affecting their distribution. During the sample collection the average relative humidity was 90% and temperature was 33°C.

**Biodiversity:** *Ganoderma applanatum* was found in Gajni forest under sherpur district. Abundant numbers of mushroom of *Ganoderma applanatum* were found during collection. The frequency of its presence was 75% and the density was 12.75%.

**Cultural character:** The culture of *Ganoderma applanatum* was grown in PDA media. The growth pattern of mycelia was flat and irregular. Mycelial colour was whitish.

**Edibility:** It is reported as inedible but has medicinal values.



**Figure 14.** *Ganoderma appalantum*; A. Fruiting Body, B. Gill, C. Spore ( $\times 400$ ), D. Culture growth in PDA media.

## **15. Scientific Name: *Ganoderma lobatum***

Family: Ganodermataceae

**Morphology:** Size of pileus 8.3 × 9.8 cm. Pileus shape was convex to irregular in shape. Pileus color was mature cocoa brown. Surface character and zonation was dry in nature laccate, highly sulcate, brown of chestnut. Margin was incurved in shape, hard, acute (Figure 15). Texture of the fruiting body was woody and corky. Spore bearing surface under cap. Pores were on hymenium.

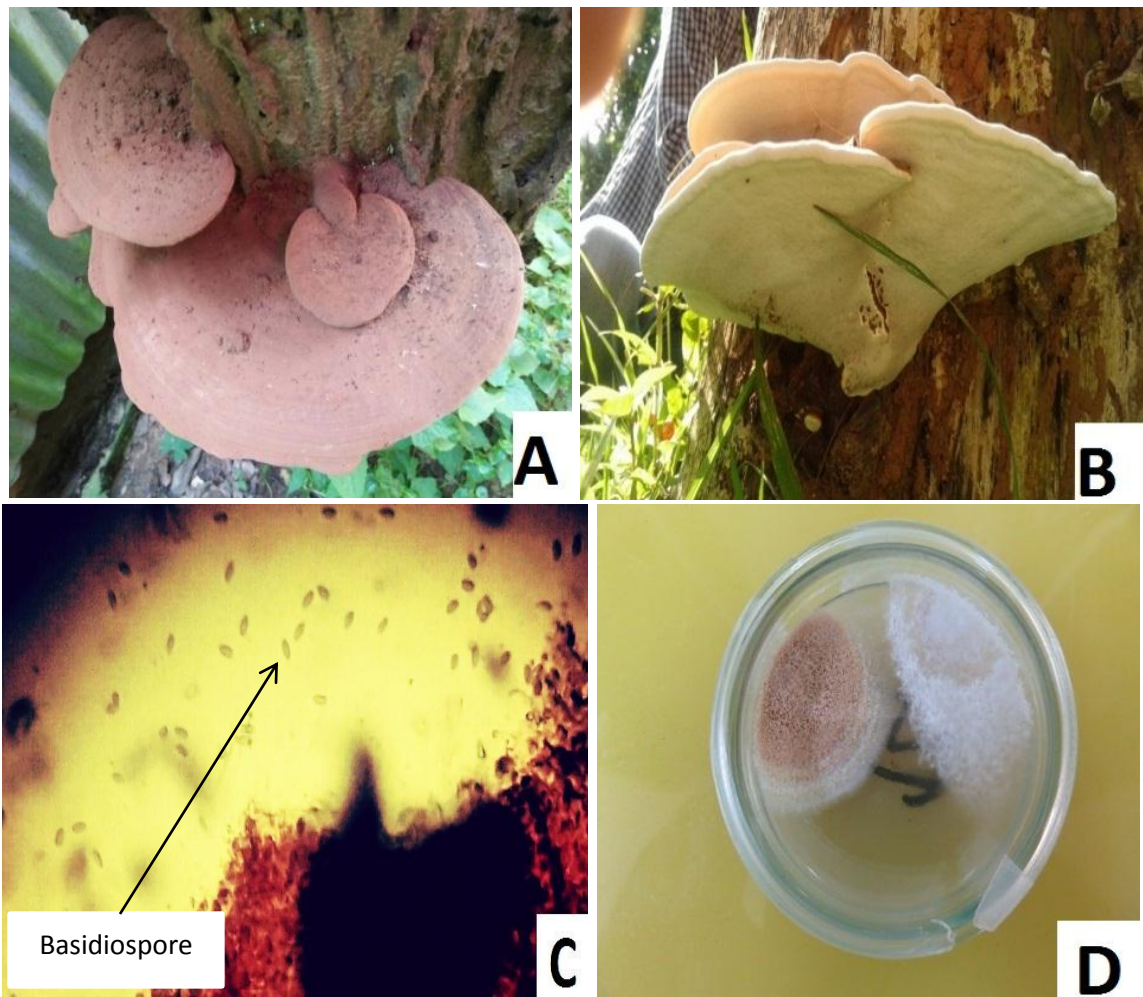
**Spore morphology:** Spore colour was brown. Spore was thick walled, ovate shaped, smooth.

**Habitat:** The mushroom species was found on soil surface in Gajni forest that is the part of tropical deciduous forest is association with shal (*Shorea robusta*). The occurrence of a particular mushroom in specific habitat was abundant. Type of soil was clay and acidic. The moist weather of forest is affecting their distribution. During the collection the average relative humidity was 90% and temperature was 33°C.

**Biodiversity:** *Ganoderma lobatum* was found in Gajni forest under sherpur district. Abundant number of mushroom of *Ganoderma lobatum* were found during collection. The frequency of its presence was 50% and the density was 10.75%.

**Cultural character:** The culture of *Ganoderma lobatum* was grown in PDA media. The growth pattern of mycelia was flat and irregular. Mycelial colour was whitish gray.

**Edibility:** It is reported as inedible but has medicinal values.



**Figure 15.** *Ganoderma lobetum*; A. Fruiting Body, B. Gill, C. Spore ( $\times 100$ ), D. Culture growth in PDA media.

**16. Scientific Name:** *Ganoderma orbiforme*

Family: Ganodermataceae

**Morphology:** Size of pileus 6.3 × 3.8 cm. Pileus shape was convex to irregular in shape. Pileus color was cocoa brown. Surface character and zonation was dry in nature (Figure16). Margin was incurved in shape, hard, acute. Texture of the fruiting body was woody and corky. Spore bearing surface under cap. Pores were on hymenium.

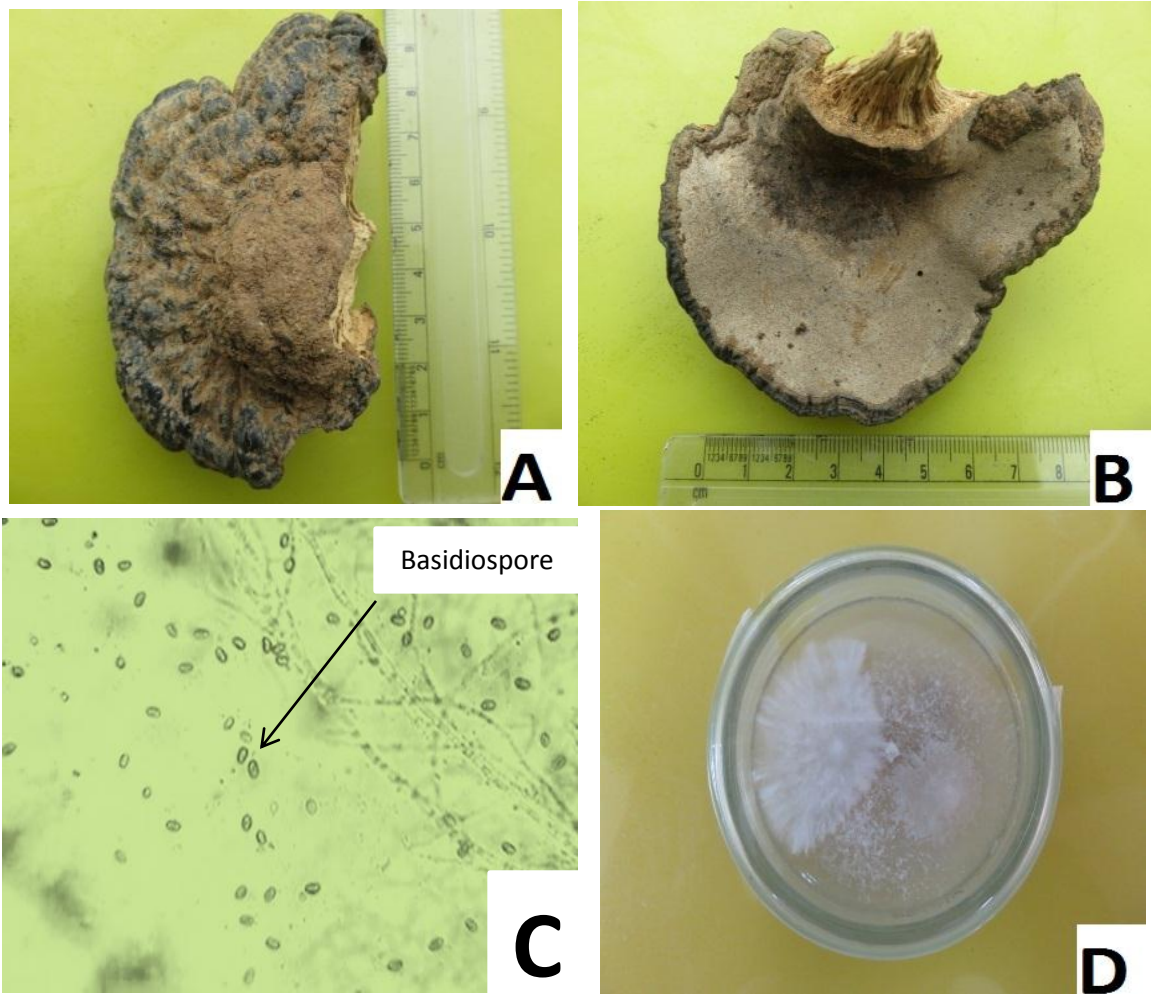
**Spore morphology:** Spore colour was blackish. Spore was thick walled, ovate shaped, smooth.

**Habitat:** The mushroom species was found on soil surface in Gajni forest that is the part of tropical deciduous forest is association with the tree sissoo (*Dalbergia sissoo*). The occurrence of a particular mushroom in specific habitat was abundant. Type of soil was clay and acidic. The moist weather of forest is affecting their distribution. During the collection the average relative humidity was 90% and temperature was 33°C.

**Biodiversity:** *Ganoderma orbiforme* was found in Gajni forest under sherpur district. Abundant number of mushroom of *Ganoderma orbiforme* were found during collection. The frequency of its presence was 50% and the density was 12.50%.

**Cultural character:** The culture of *Ganoderma orbiforme* was grown in PDA media. The growth pattern of mycelia was flapy and irregular round. Mycelial colour was whitish.

**Edibility:** It is reported as inedible but has medicinal values.



**Figure 16.** *Ganoderma orbiforme*; A. Fruiting Body, B. Gill, C. Spore ( $\times 100$ ), D. Culture growth in PDA media.

## **17. Scientific Name: *Ganoderma sinense***

Family: Ganodermataceae

**Morphology:** Size of pileus  $7.5 \times 6.5$  cm. Pileus shape was slightly wavy. Color was grissy red. Surface character and zonation was brittle, rugose, reddish brown and dry in nature (Figure 17). Margin was incurved in shape, thick and coffee color. Stipe was present. Texture of the fruiting body is corky to woody. Pores were on hymenium.

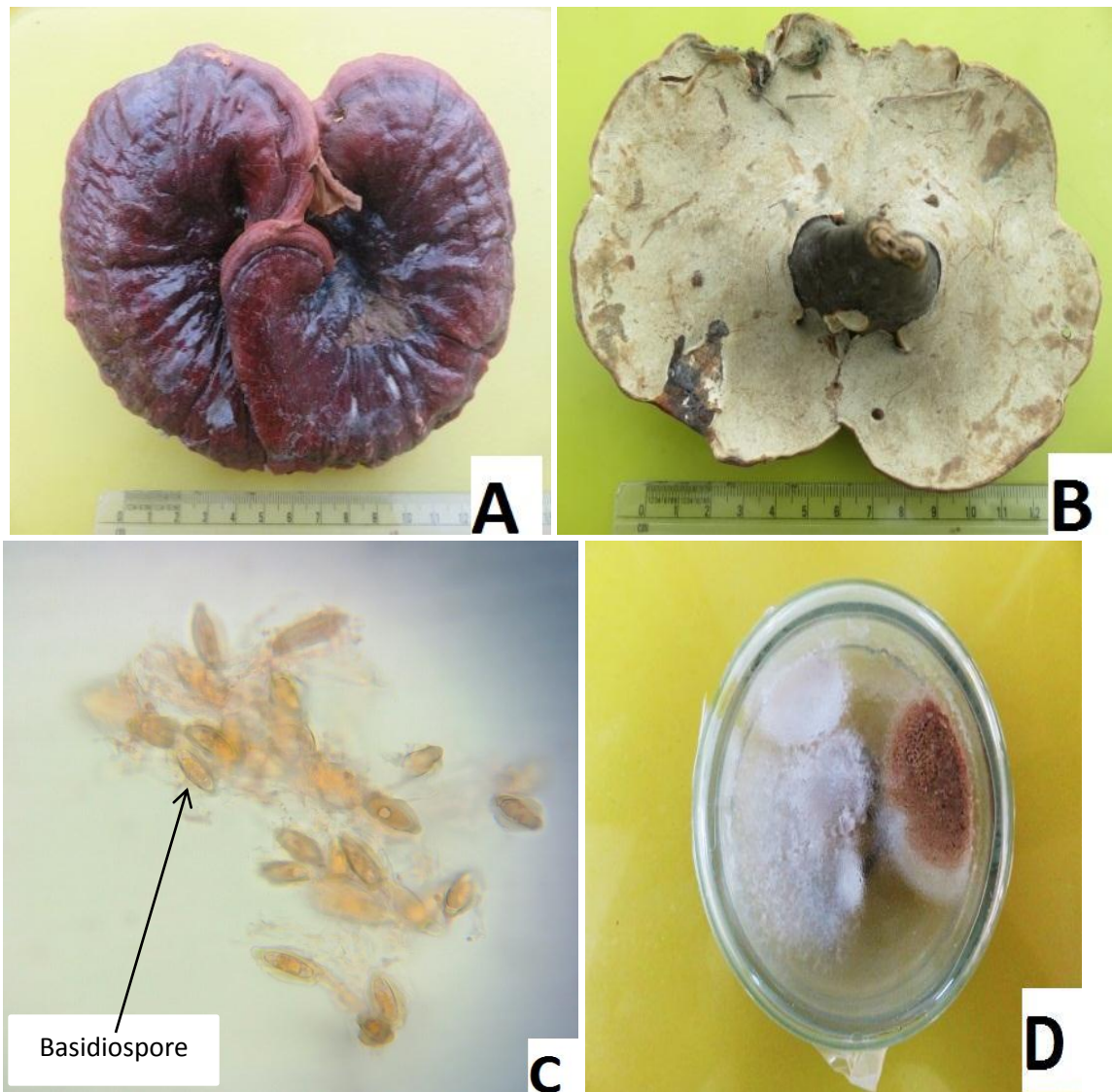
**Spore morphology:** Spore colour was brown. Spore was thick walled, oval shaped, clustered.

**Habitat:** The mushroom species was found on soil surface in Gajni forest that is the part of tropical deciduous forest is association with shal (*Shorea robusta*). The occurrence of a particular mushroom in specific habitat was abundant. Type of soil was clay and acidic. The moist weather of forest is affecting their distribution. During the collection the average relative humidity was 90% and temperature was 33°C.

**Biodiversity:** *Ganoderma sinense* was found in Gajni forest under sherpur district. Un-Abundant numberS of mushroom of *Ganoderma sinense* were found during collection. The frequency of its presence was 30% and the density was 5.25%.

**Cultural character:** The culture of *Ganoderma sinense* was grown in PDA media. The growth pattern of mycelia was flat and irregular round. Mycelial colour was browinsh.

**Edibility:** It is reported as inedible but has medicinal values.



**Figure 17. *Ganoderma sinense*; A. Fruiting Body, B. Gill, C. Spore ( $\times 400$ ), D. Culture growth in PDA media.**



## **18. Scientific Name: *Ganoderma fornicatum***

Family: Ganodermataceae

**Morphology:** Size of pileus  $6.5 \times 4.5$  cm. Pileus shape was slightly wavy and convex. Color was blackish brown. Surface character and zonation was brittle, brown and dry in nature (Figure 18). Margin was incurved in shape, thick and coffee color. Texture of the fruiting body is corky to woody. Pores were on hymenium.

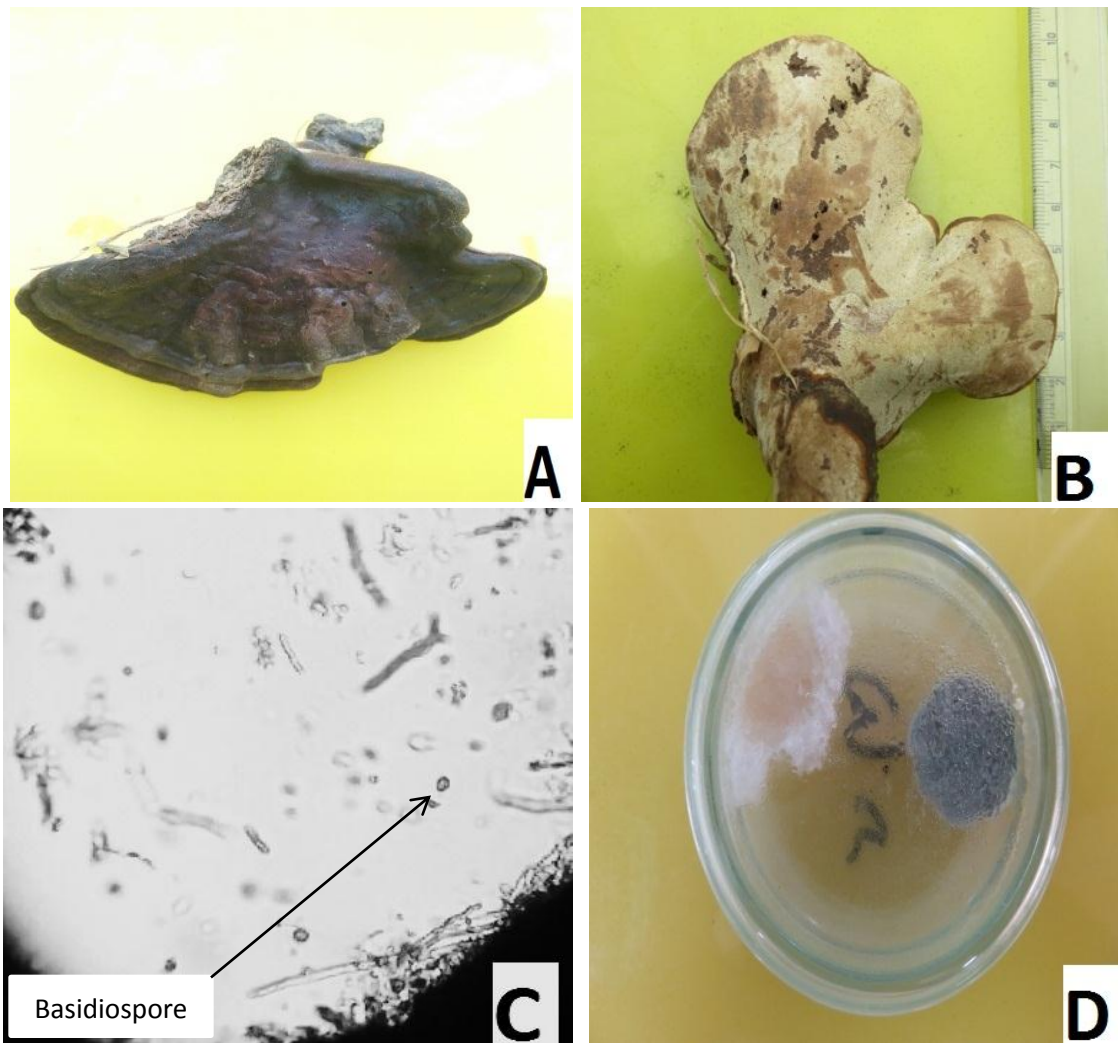
**Spore morphology:** Spore colour was blackish. Spore was thin walled, oblong shaped.

**Habitat:** The mushroom species was found on soil surface in Gajni forest that is the part of tropical deciduous forest is association with shal (*Shorea robusta*). The occurrence of a particular mushroom in specific habitat was abundant. Type of soil was clay and acidic. The moist weather of forest is affecting their distribution. During the collection the average relative humidity was 90% and temperature was 33°C.

**Biodiversity:** *Ganoderma fornicatum* was found in Gajni forest under sherpur district. Abundant number of mushroom of *Ganoderma fornicatum* were found during collection. The frequency of its presence was 50% and the density was 7.75%.

**Cultural character:** The culture of *Ganoderma fornicatum* was grown in PDA media. The growth pattern of mycelia was flat and irregular round. Mycelial colour was grayish.

**Edibility:** It is reported as inedible but has medicinal values.



**Figure 18.** *Ganoderma fornicatum*; A. Fruiting Body, B. Gill, C. Spore ( $\times 100$ ), D. Culture growth in PDA media.

**19. Scientific Name:** *Ganoderma lipsiense*

Family: Ganodermataceae

**Morphology:** Size of pileus was 6 × 4.5 cm. Pileus shape was convex. Color was dark brown to cocoa coloured. Surface character and zonation was dry in nature, slightly zonate, solitary, crust and rigid. Margin was incurved in shape. Margin was thick, coffee colour (Figure 19). Texture of the fruiting body was corky and tough. Spore bearing surface under cap. Pores were on hymenium.

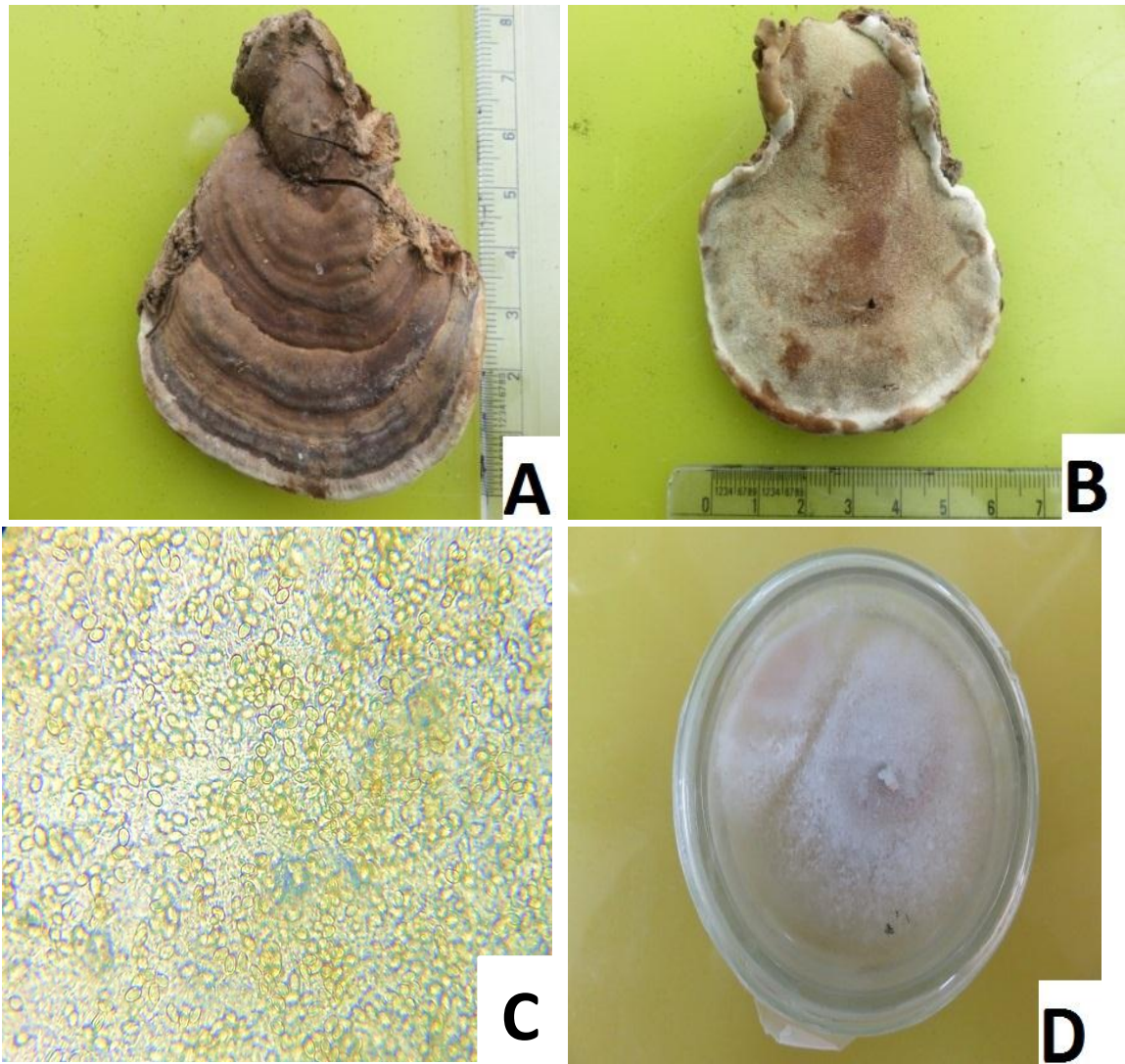
**Spore morphology:** Spore colour was light brown. Spore was thin walled, oblong shaped.

**Habitat:** The mushroom species was found on soil surface in Gajni forest that is the part of tropical deciduous forest is association with shal (*Shorea robusta*). The occurrence of a particular mushroom in specific habitat was abundant. Type of soil was clay and acidic. The moist weather of forest is affecting their distribution. During the collection the average relative humidity was 90% and temperature was 33°C.

**Biodiversity:** *Ganoderma lipsiense* was found in Gajni forest under sherpur district. In total 3 numbers of mushrooms of *Ganoderma lipsiense* were found during collection. The frequency of its presence was 50% and the density was 7.75%.

**Cultural character:** The culture of *Ganoderma lipsiense* was grown in PDA media. The growth pattern of mycelia was flat and irregular round. Mycelial colour was whitish.

**Edibility:** It is reported as inedible but has medicinal values.



**Figure 19.** *Ganoderma lipsiense*; A. Fruiting Body, B. Gill, C. Spore ( $\times 100$ ), D. Culture growth in PDA media.

**20. Scientific Name:** *Ganoderma tsugae*

Family: Ganodermataceae

**Morphology:** Size of pileus was 3.8 × 3.1 cm. Color was brick red with white cap. Pileus shape was conical. Surface character and zonation was dry in nature (Figure 20). Margin was irregular in shape. Texture of the fruiting body was brittle and woody. Spore bearing surface under cap. Pores were on hymenium.

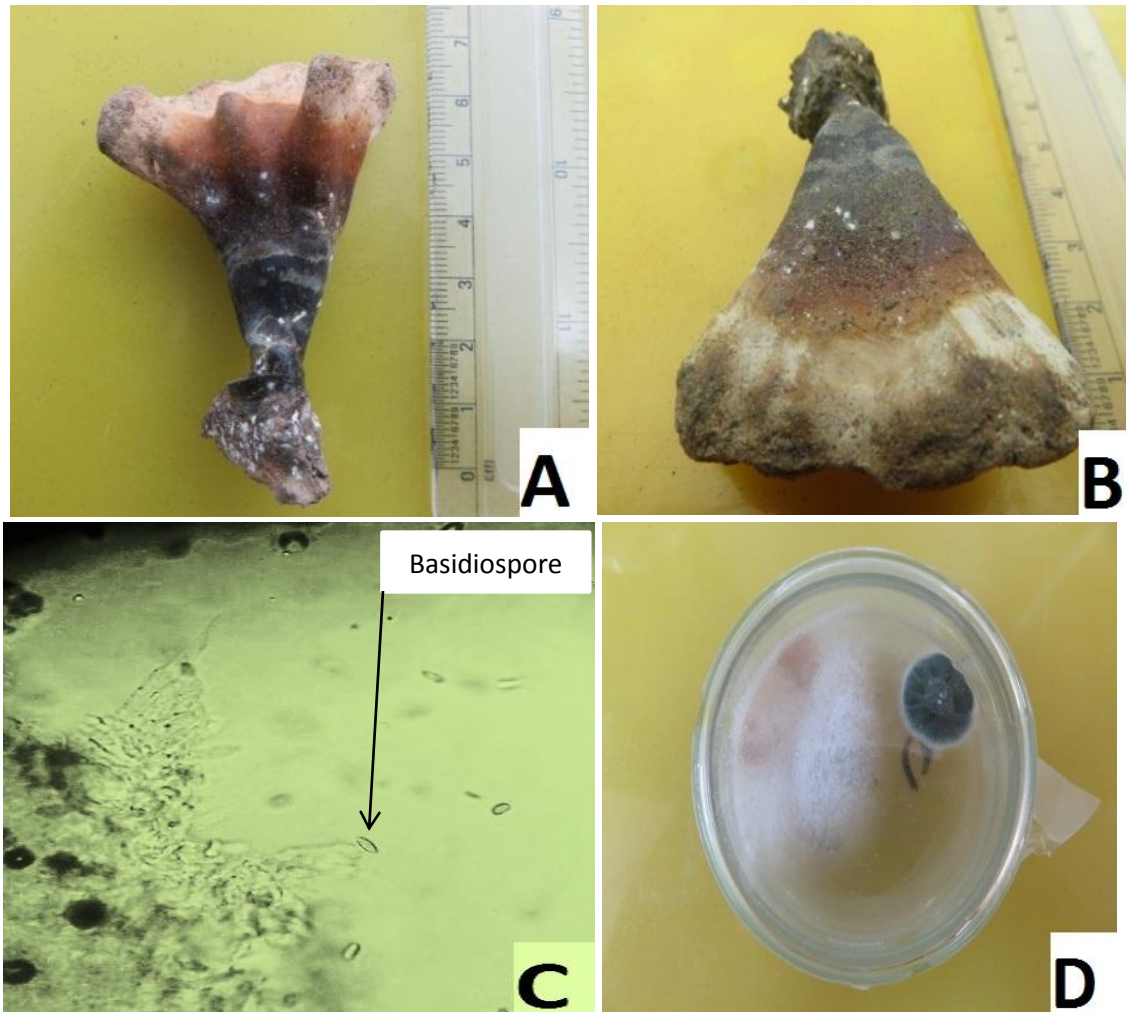
**Spore morphology:** Spore colour was brown. Spore was thin walled, ovate shaped, scattered.

**Habitat:** The mushroom species was found on soil surface in Gajni forest that is the part of tropical deciduous forest is association with shal (*Shorea robusta*). The occurrence of a particular mushroom in specific habitat was abundant. Type of soil was clay and acidic. The moist weather of forest is affecting their distribution. During the collection the average relative humidity was 90% and temperature was 33°C.

**Biodiversity:** *Ganoderma tsugae* was found in Gajni forest under sherpur district. Abundant numbers of mushroom of *Ganoderma tsugae* were found during collection. The frequency of its presence was 60% and the density was 10.20%.

**Cultural character:** The culture of *Ganoderma tsugae* was grown in PDA media. The growth pattern of mycelia was flat and irregular. Mycelial colour was whitish.

**Edibility:** It is reported as inedible but has medicinal values.



**Figure 20.** *Ganoderma tsugae*; A. Fruiting Body, B. Gill, C. Spore ( $\times 100$ ), D. Culture growth in PDA media.

**21. Scientific Name: *Ganoderma* sp**

Family: Ganodermataceae

**Morphology:** Size of pileus was 3.8 × 2.4 cm. Pileus shape was figure like. Color was upper portion cocoa and lower portion brick red. Surface character and zonation was dry in nature (Figure 21). Margin was incurved in shape. Spore bearing surface under cap. Pores were on hymenium.

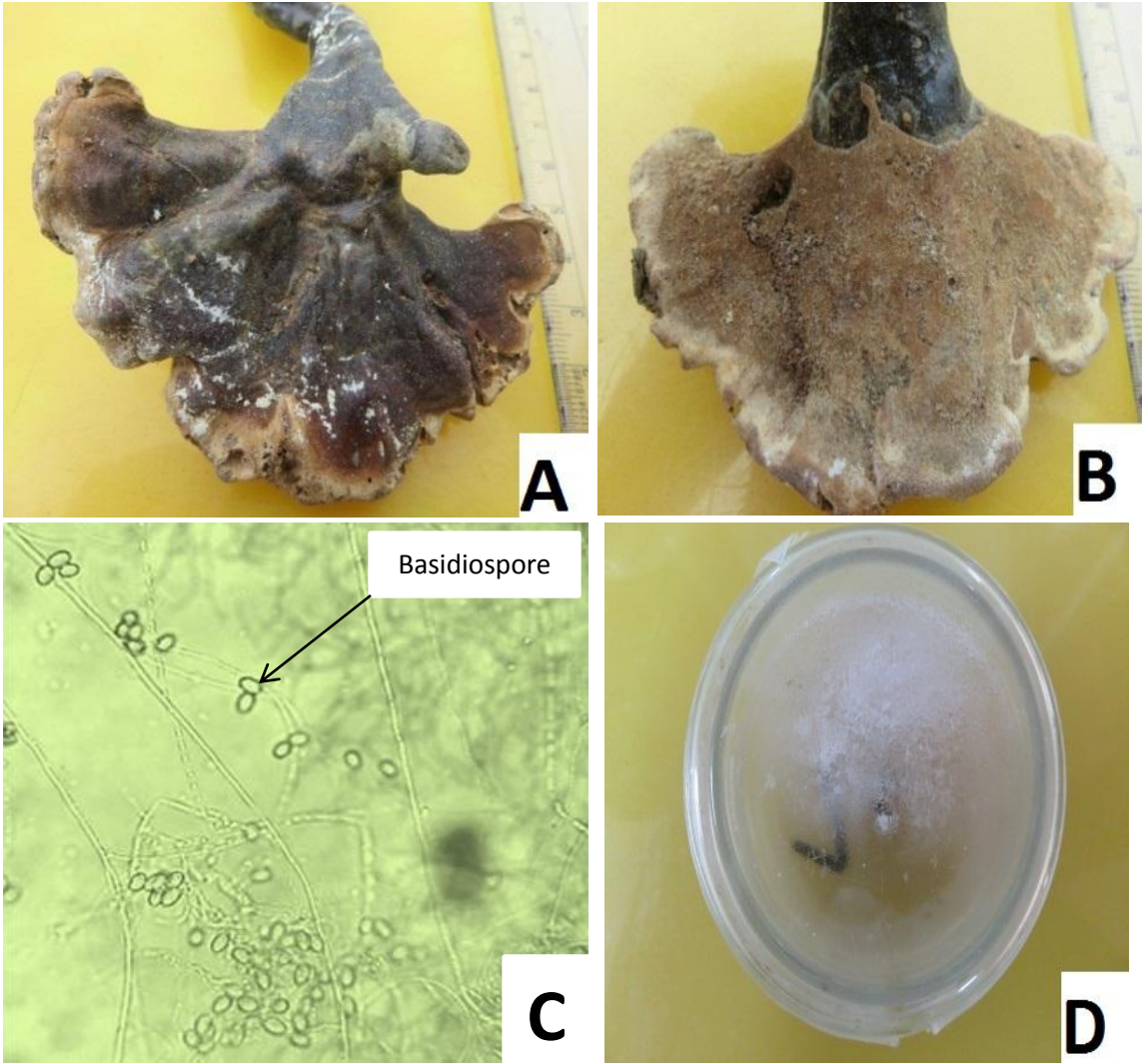
**Spore morphology:** Spore colour was blackish. Spore was thick walled, round shaped, scattered.

**Habitat:** The mushroom species was found on soil surface in Gajni forest that is the part of tropical deciduous forest is association with the tree sissoo (*Dalbergia sissoo*). The occurrence of a particular mushroom in specific habitat was abundant. Type of soil was clay and acidic. The moist weather of forest is affecting their distribution. During the collection the average relative humidity was 90% and temperature was 33°C.

**Biodiversity:** *Ganoderma* sp was found in Gajni forest under sherpur district. Abundant numbers of mushroom of *Ganoderma* sp were found during collection. The frequency of its presence was 50 % and the density was 12.5%.

**Cultural character:** The culture of was *Ganoderma* sp grown in PDA media. The growth pattern of mycelia was flat and irregular round. Mycelial colour was whitish.

**Edibility:** It is reported as inedible but has medicinal values.



**Figure 21.** *Ganoderma* sp; A. Fruiting Body, B. Gill, C. Spore ( $\times 100$ ), D. Culture growth in PDA media.



## **22. Scientific Name: *Ganoderma* sp**

Family: Ganodermataceae

**Morphology:** Size of pileus was 3.5 × 2.4 cm. Pileus shape was oval. Color was cocoa and blackish (Figure 22). Surface character and zonation was dry in nature. Spore bearing surface under cap. Pores were on hymenium.

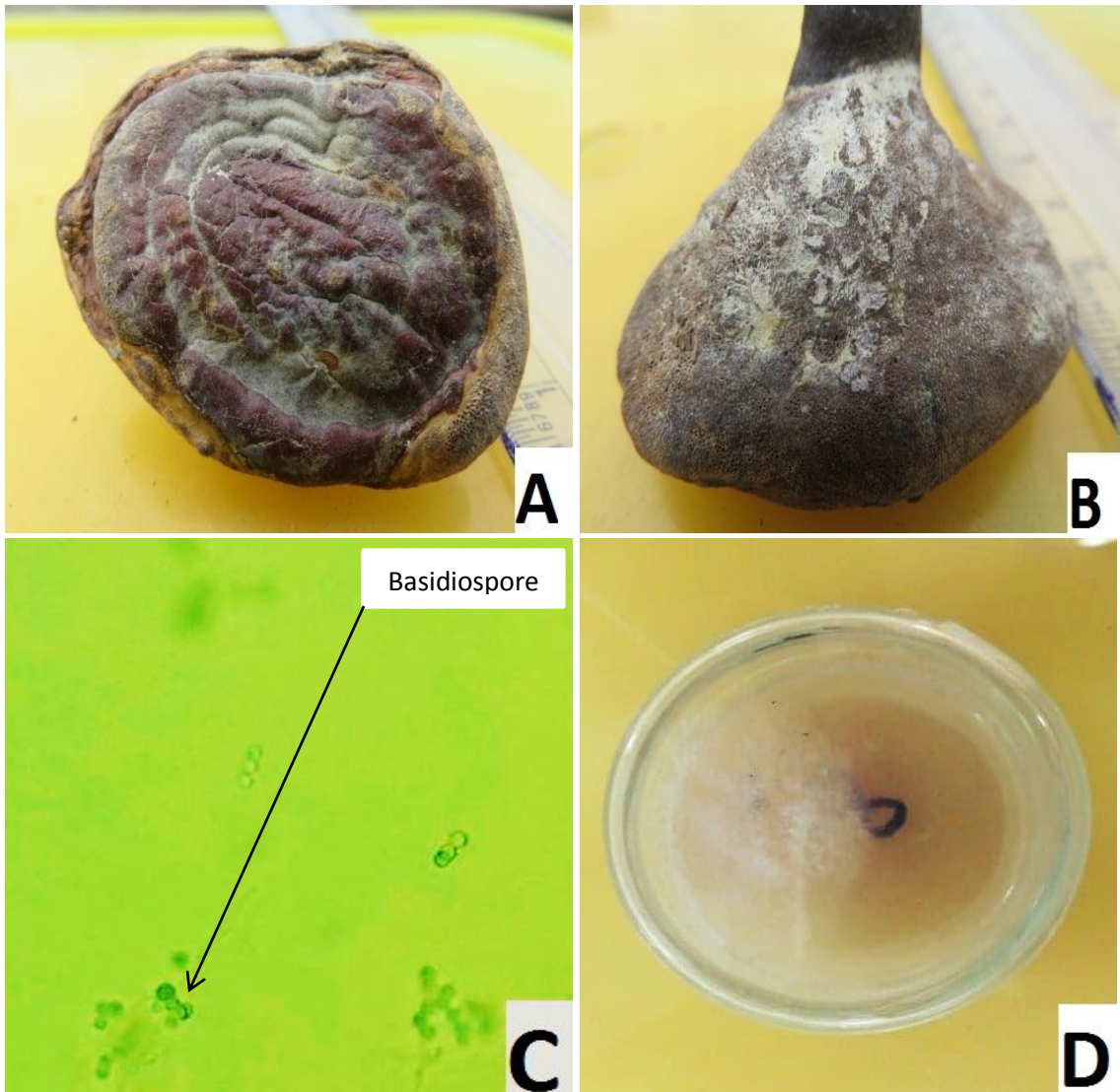
**Spore morphology:** Spore colour was blackish. Spore was thin walled, round shaped, scattered.

**Habitat:** The mushroom species was found on soil surface in Gajni forest that is the part of tropical deciduous forest is association with shal (*Shorea robusta*). The occurrence of a particular mushroom in specific habitat was unabundant. Type of soil was clay and acidic. The moist weather of forest is affecting their distribution. During the collection the average relative humidity was 90% and temperature was 33°C.

**Biodiversity:** *Ganoderma* sp was found in Gajni forest under sherpur district. Only one number of mushrooms of *Ganoderma* sp was found during collection. The frequency of its presence was 20% and the density was 3.25%.

**Cultural character:** The culture of *Ganoderma* sp was grown in PDA media. The growth pattern of mycelia was flat and irregular. Mycelial colour was whitish.

**Edibility:** It is reported as inedible but has medicinal values.



**Figure 22.** *Ganoderma* sp; A. Fruiting Body, B. Gill, C. Spore ( $\times 100$ ), D. Culture growth in PDA media.

### **23. Scientific Name: *Ganoderma boninense***

Family: Ganodermataceae

**Morphology:** Size of pileus was 4.1 × 2.9 cm. Pileus shape was concave. Color was White color, cap. Surface character and zonation was dry in nature. Margin was incurved in shape (Figure 23). Texture of the fruiting body was brittle and woody. Spore bearing surface under cap. Pores were on hymenium.

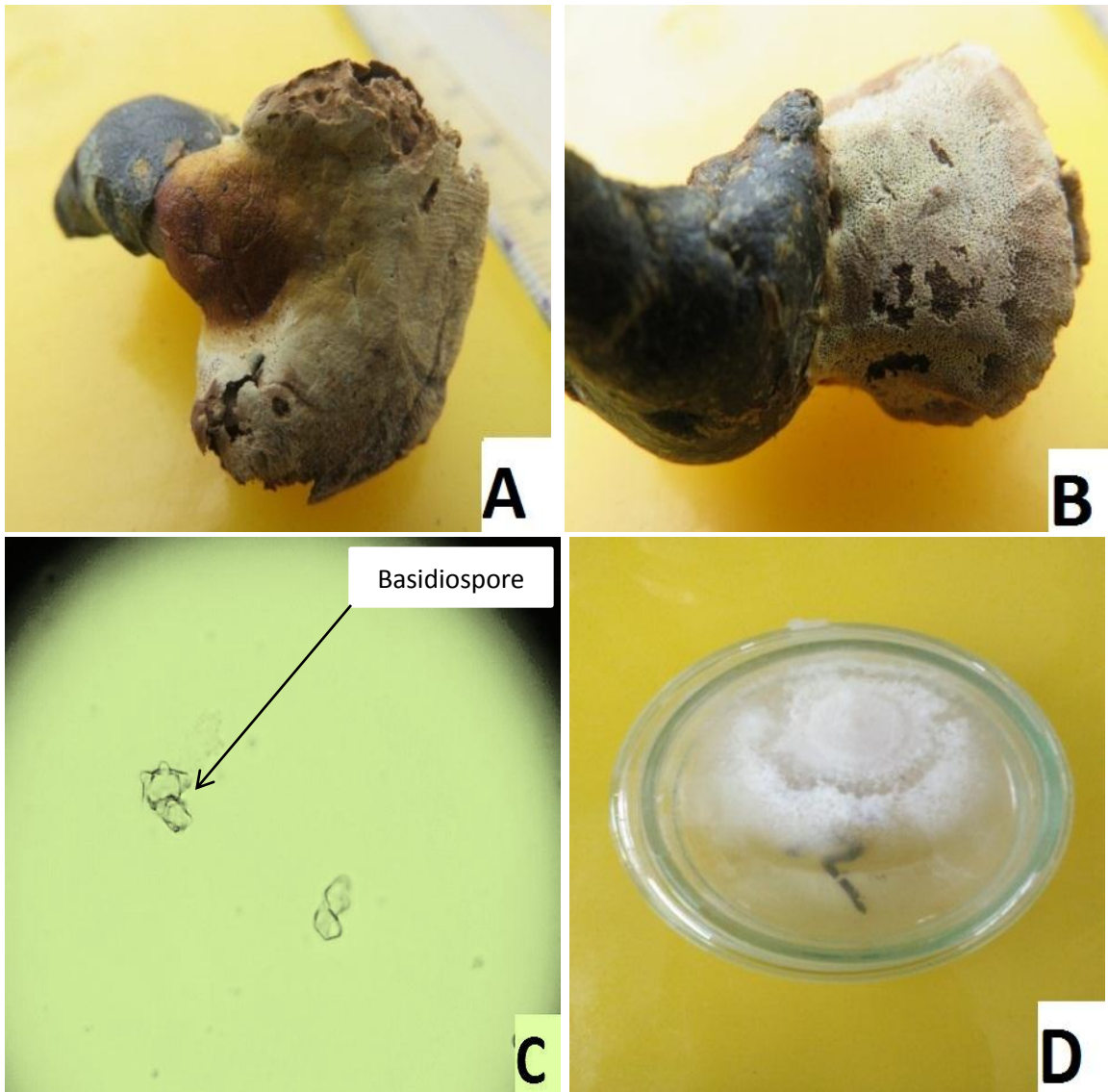
**Spore morphology:** Spore colour was light brown. Spore was thin walled, round shaped, clustered.

**Habitat:** The mushroom species was found on soil surface in Gajni forest that is the part of tropical deciduous forest is association with shal (*Shorea robusta*). The occurrence of a particular mushroom in specific habitat was abundant. Type of soil was clay and acidic. The moist weather of forest is affecting their distribution. During the collection the average relative humidity was 90% and temperature was 33°C.

**Biodiversity:** *Ganoderma boninense* was found in Gajni forest under sherpur district. Abundant numbers of mushroom of *Ganoderma boninense* were found during collection. The frequency of its presence was 50% and the density was 6.5%.

**Cultural character:** The culture of *Ganoderma boninense* was grown in PDA media. The growth pattern of mycelia was flat and irregular. Mycelial colour was whitish.

**Edibility:** It is reported as inedible but has medicinal values.



**Figure 23.** *Ganoderma boninense*; A. Fruiting Body, B. Gill, C. Spores ( $\times 100$ ), D. Culture growth in PDA media.

## **24. Scientific Name: *Ganoderma lucidum***

Family: Ganodermataceae

**Morphology:** Size of pileus was  $7.1 \times 6.9$  cm. Pileus shape was concave. Color was black with white stripe. Surface character and zonation was dry in nature. Margin was incurved in shape (Figure 24). Texture of the fruiting body was brittle and woody. Spore bearing surface under cap. Pores were on hymenium.

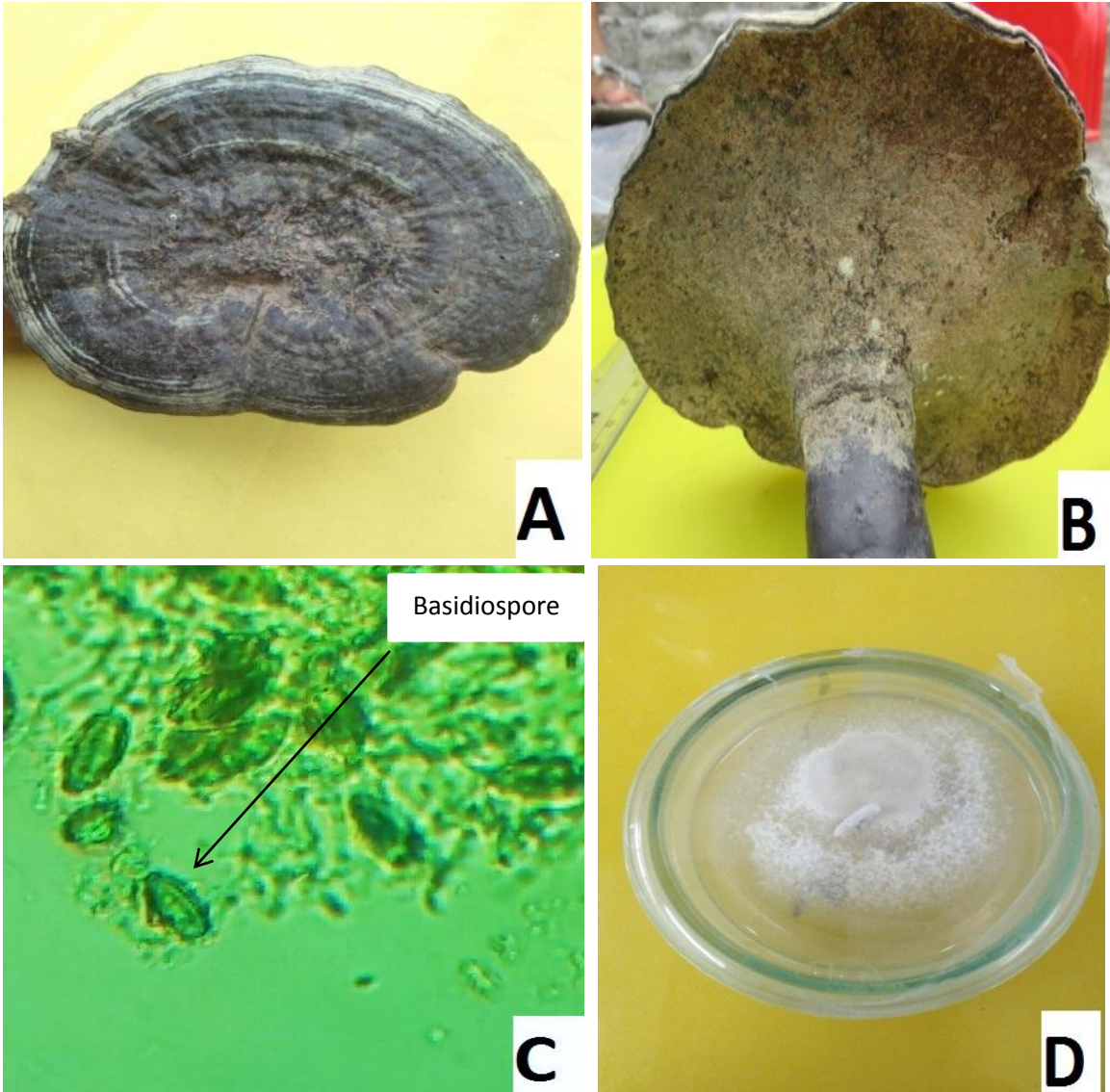
**Spore morphology:** Spore colour was brown. Spore was thick walled, oval shaped, scattered.

**Habitat:** The mushroom species was found on soil surface in Gajni forest that is the part of tropical deciduous forest is association with shal (*Shorea robusta*). The occurrence of a particular mushroom in specific habitat was unabundant. Type of soil was clay and acidic. The moist weather of forest is affecting their distribution. During the collection the average Relative Humidity was 90% and temperature was 33°C.

**Biodiversity:** *Ganoderma lucidum* was found in Gajni forest under sherpur district. Only 2 numbers of mushrooms of *Ganoderma lucidum* were found during collection. The frequency of its presence was 25% and the density was 5.25%.

**Cultural character:** The culture of *Ganoderma lucidum* was grown in PDA media. The growth pattern of mycelia was flat and irregular round. Mycelial colour was grayish white.

**Edibility:** It is reported as edible and also has medicinal values.



**Figure 24.** *Ganoderma lucidum*; A. Fruiting Body, B. Gill, C. Spore ( $\times 400$ ), D. Culture growth in PDA media.

## **25. Scientific Name: *Ganoderma calidophilum***

Family: Ganodermataceae

**Morphology:** Size of pileus was  $7.1 \times 6.9$  cm. Pileus shape was concave. Color was red. Surface character and zonation was dry in nature. Margin was incurved in shape (Figure25). Texture of the fruiting body was brittle and woody. Spore bearing surface under cap. Pores were on hymenium.

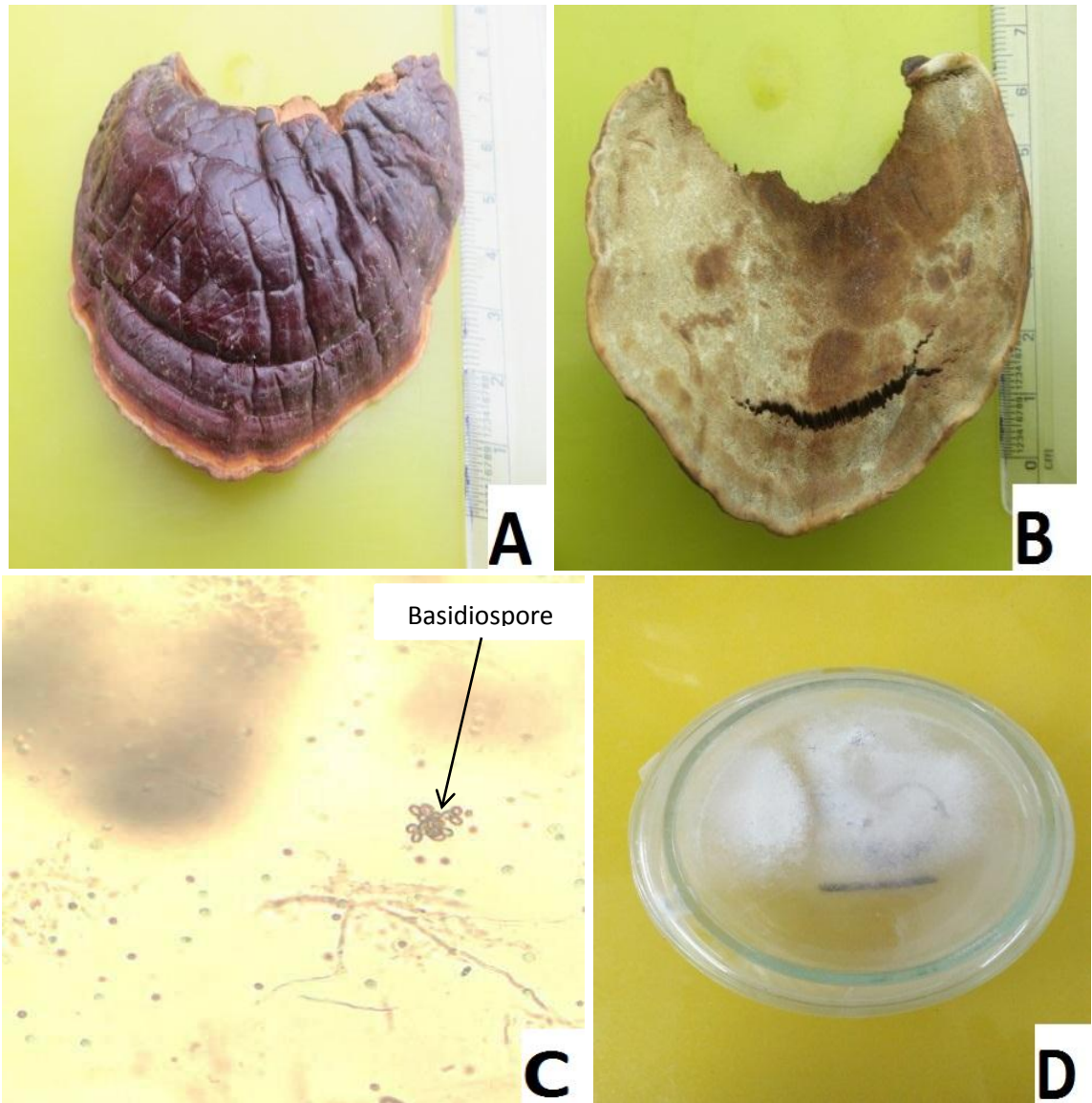
**Spore morphology:** Spore colour was brown. Spore was thick walled, oblong shaped, scattered.

**Habitat:** The mushroom species was found on soil surface in Gajni forest that is the part of tropical deciduous forest is association with shal (*Shorea robusta*). The occurrence of a particular mushroom in specific habitat was abundant. Type of soil was clay and acidic. The moist weather of forest is affecting their distribution. During the collection the average relative humidity was 90% and temperature was 33°C.

**Biodiversity:** *Ganoderma calidophilum* was found in Gajni forest under sherpur district. In total 3 numbers of mushrooms of *Ganoderma calidophilum* were found during collection. The frequency of its presence was 60% and the density was 10.5%.

**Cultural character:** The culture of *Ganoderma calidophilum* was grown in PDA media. The growth pattern of mycelia was flat and irregular. Mycelial colour was whitish.

**Edibility:** It is reported as inedible but has medicinal values.



**Figure 25.** *Ganoderma calidophilum*; A. Fruiting Body, B. Gill, C. Spore ( $\times 400$ ), D. Culture growth in PDA media.



## **26. Scientific Name: *Tuber aestivum***

Family: Tuberaceae

**Morphology:** Size of pileus was  $8.1 \times 7.5$  cm. Pileus shape was concave. Color was cocoa. Surface character and zonation was dry in nature. Margin was incurved in shape (Figure 26). Texture of the fruiting body was brittle and woody. Spore bearing surface under cap. Pores were on hymenium.

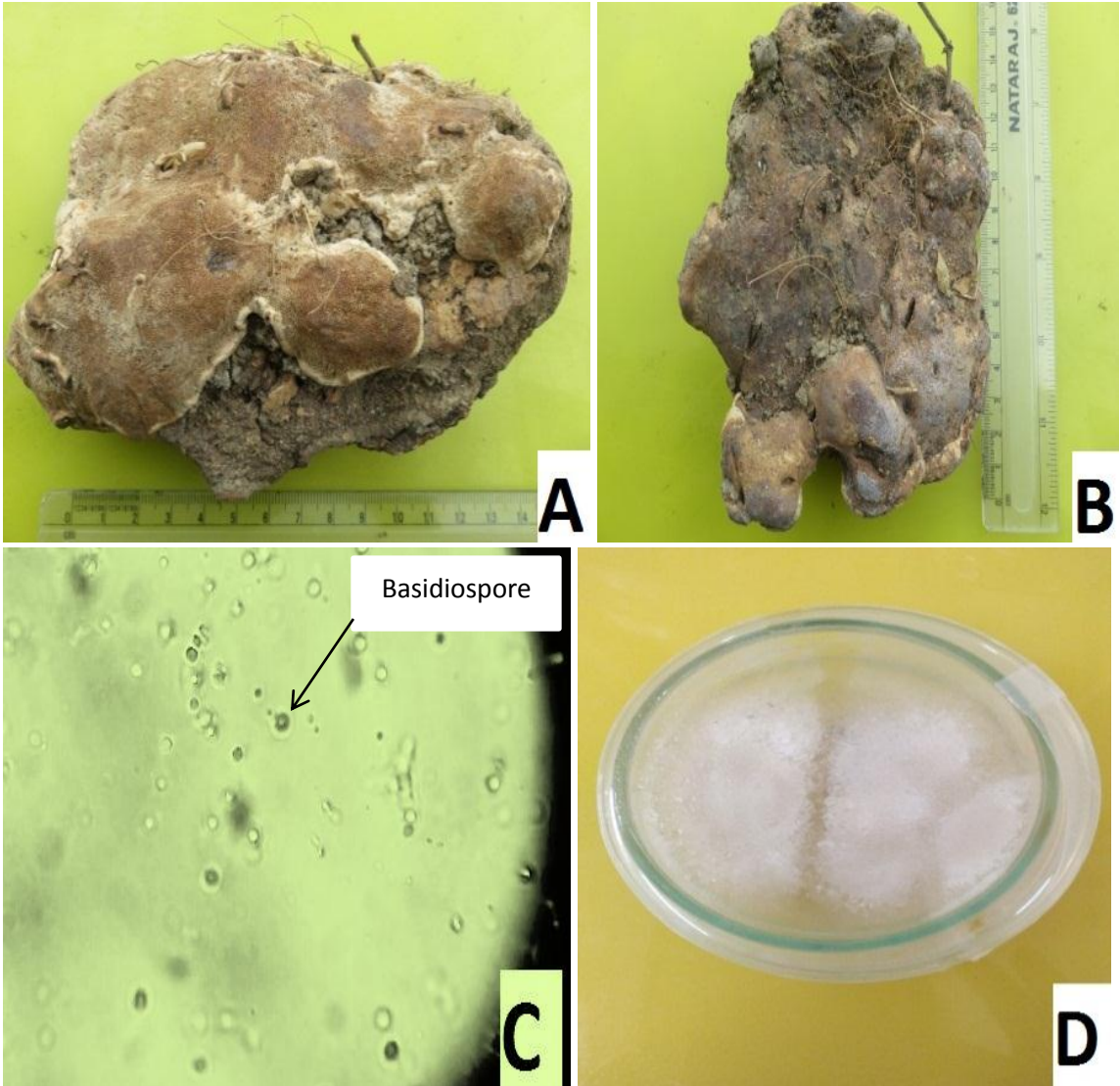
**Spore morphology:** Spore colour was blackish. Spore was thin walled, oval shaped, clustered.

**Habitat:** The mushroom species was found on soil surface in Gajni forest that is the part of tropical deciduous forest in association with the tree sissoo (*Dalbergia sissoo*). The occurrence of a particular mushroom in specific habitat was abundant. Type of soil was clay and acidic. The moist weather of forest is affecting their distribution. During the collection the average Relative Humidity was 90% and temperature was 33°C.

**Biodiversity:** *Tuber aestivum* was found in Gajni forest under sherpur district. Only 1 number of mushrooms of *Tuber aestivum* was found during collection. The frequency of its presence was 20% and the density was 2.25 %.

**Cultural character:** The culture of *Tuber aestivum* was grown in PDA media. The growth pattern of mycelia was flat and irregular. Mycelial colour was whitish.

**Edibility:** Its edibility is not well known.



**Figure 26. *Tuber aestivum*; A. Fruiting Body, B. Gill, C. Spore (×100), D. Culture growth in PDA media.**

## **27. Scientific Name: *Ganoderma japonicum***

Family: Ganodermataceae

**Morphology:** Size of pileus was 3.1 × 2.5 cm. Pileus shape was concave. Color was cocoa. Surface character and zonation was dry in nature. Margin was incurved in shape (Figure 27). Texture of the fruiting body was brittle. Spore bearing surface was pores on hymenium.

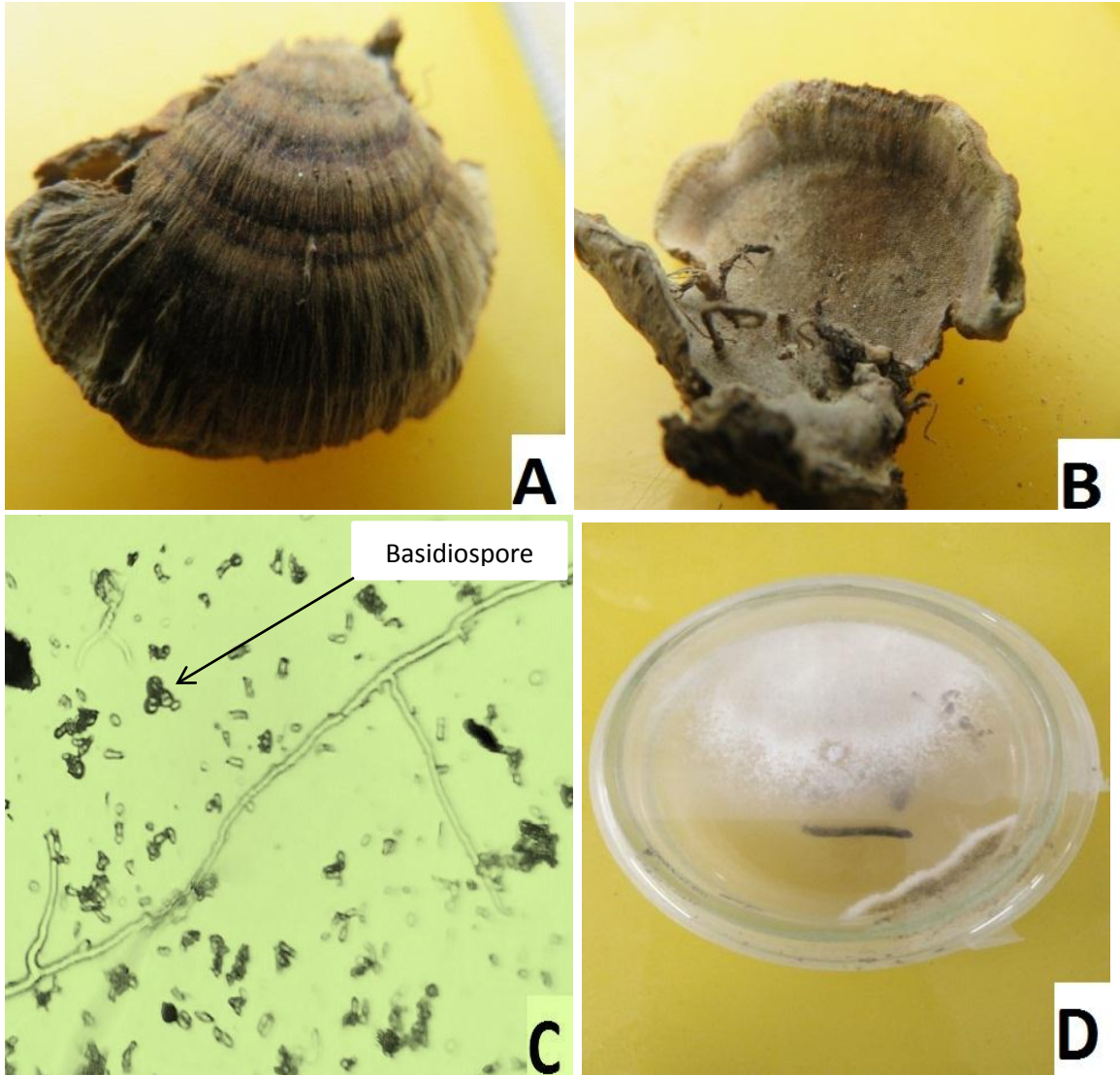
**Spore morphology:** Spore colour was black. Spore was thin walled, round shaped, scattered.

**Habitat:** The mushroom species was found on soil surface in Gajni forest that is the part of tropical deciduous forest is association with shal (*Shorea robusta*). The occurrence of a particular mushroom in specific habitat was abundant. Type of soil was clay and acidic. The moist weather of forest is affecting their distribution. During the collection the average relative humidity was 90% and temperature was 33°C.

**Biodiversity:** *Ganoderma japonicum* was found in Gajni forest under shepur district. Only 2 numbers of mushrooms of *Ganoderma japonicum* were found during collection. The frequency of its presence was 20% and the density was 3.25%.

**Cultural character:** The culture of *Ganoderma japonicum* was grown in PDA media. The growth pattern of mycelia was flat and irregular. Mycelial colour was grayish.

**Edibility:** It is reported as inedible but has medicinal values.



**Figure 27.** *Ganoderma japonicum*; A. Fruiting Body, B. Gill, C. Spore ( $\times 100$ ), D. Culture growth in PDA media.

## **28. Scientific Name: *Ganoderma annulare***

Family: Ganodermataceae

**Morphology:** Size of pileus was 8.1×7.5 cm. Pileus shape was concave. Color was cocoa. Surface character and zonation was dry in nature. Margin was incurved in shape (Figure 28). Texture of the fruiting body was brittle and woody. Spore bearing surface was pores on hymenium.

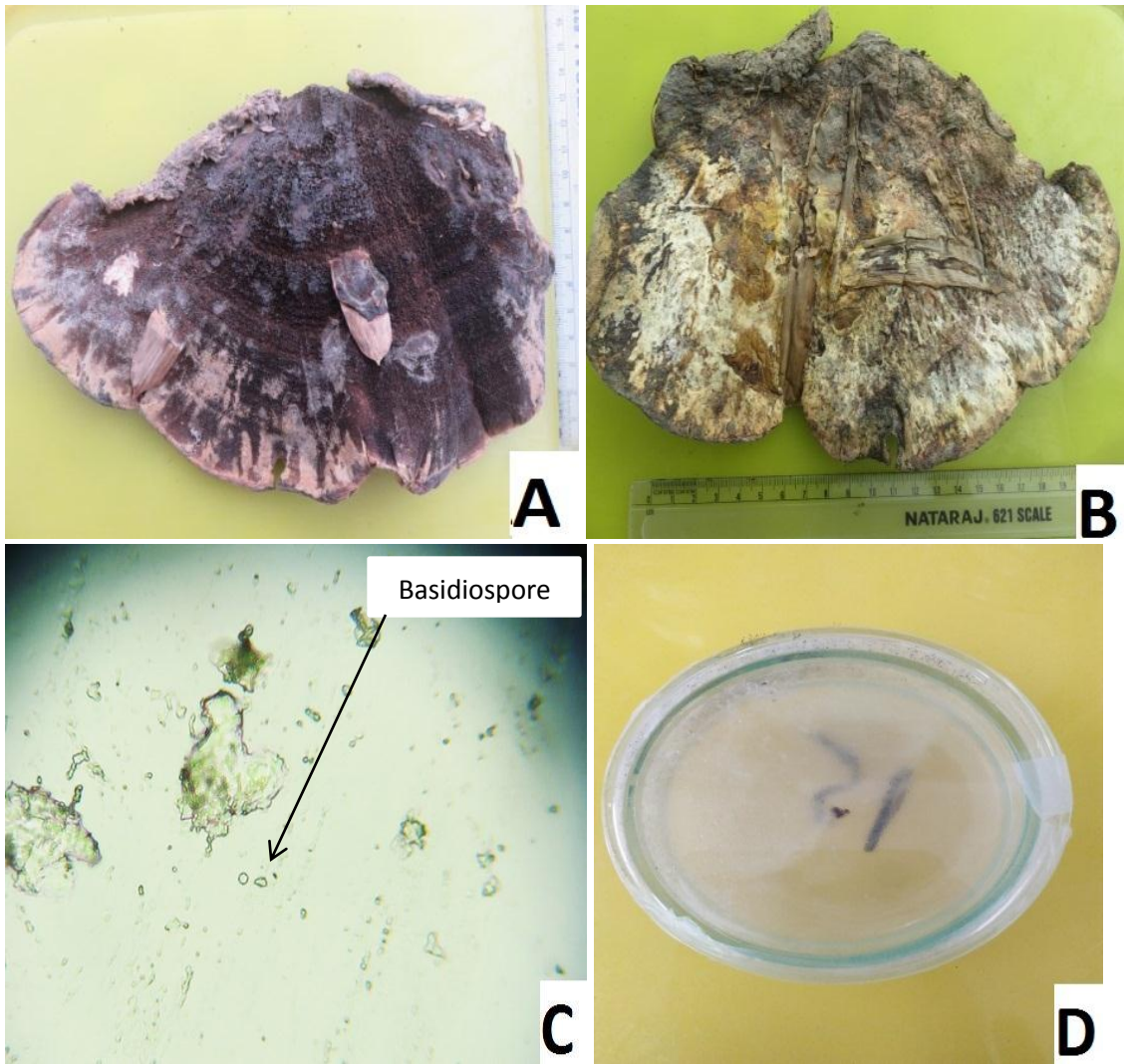
**Spore morphology:** Spore colour was slightly black. Spore was single walled, irregular shaped, scattered.

**Habitat:** The mushroom species was found on soil surface in Gajni forest that is the part of tropical deciduous forest is association with shal (*Shorea robusta*). The occurrence of a particular mushroom in specific habitat was unabundant. Type of soil was clay and acidic. The moist weather of forest is affecting their distribution. During the collection the average relative humidity was 90% and temperature was 33°C.

**Biodiversity:** *Ganoderma annulare* was found in Gajni forest under sherpur district. In total 3 numbers of mushrooms of *Ganoderma annulare* were found during collection. The frequency of its presence was 50% and the density was 5.50%.

**Cultural character:** The culture of *Ganoderma annulare* was grown in PDA media. The growth pattern of mycelia was flat and irregular. Mycelial colour was whitish.

**Edibility:** It is reported as inedible but has medicinal values.



**Figure 28.** *Ganoderma annulare*; A. Fruiting Body, B. Gill, C. Spore ( $\times 100$ ), D. Culture growth in PDA media.

## **29. Scientific Name: *Ganoderma pfeifferi***

Family: Ganodermataceae

**Morphology:** Size of pileus was 8.1 × 7.5 cm. Friting body is brittle and woody in texture. Pileus shape was incurved (Figure 29). Color was cocoa. Surface character and zonation was dry in nature. Margin was incurved in shape. Spore bearing surface was pores on hymenium.

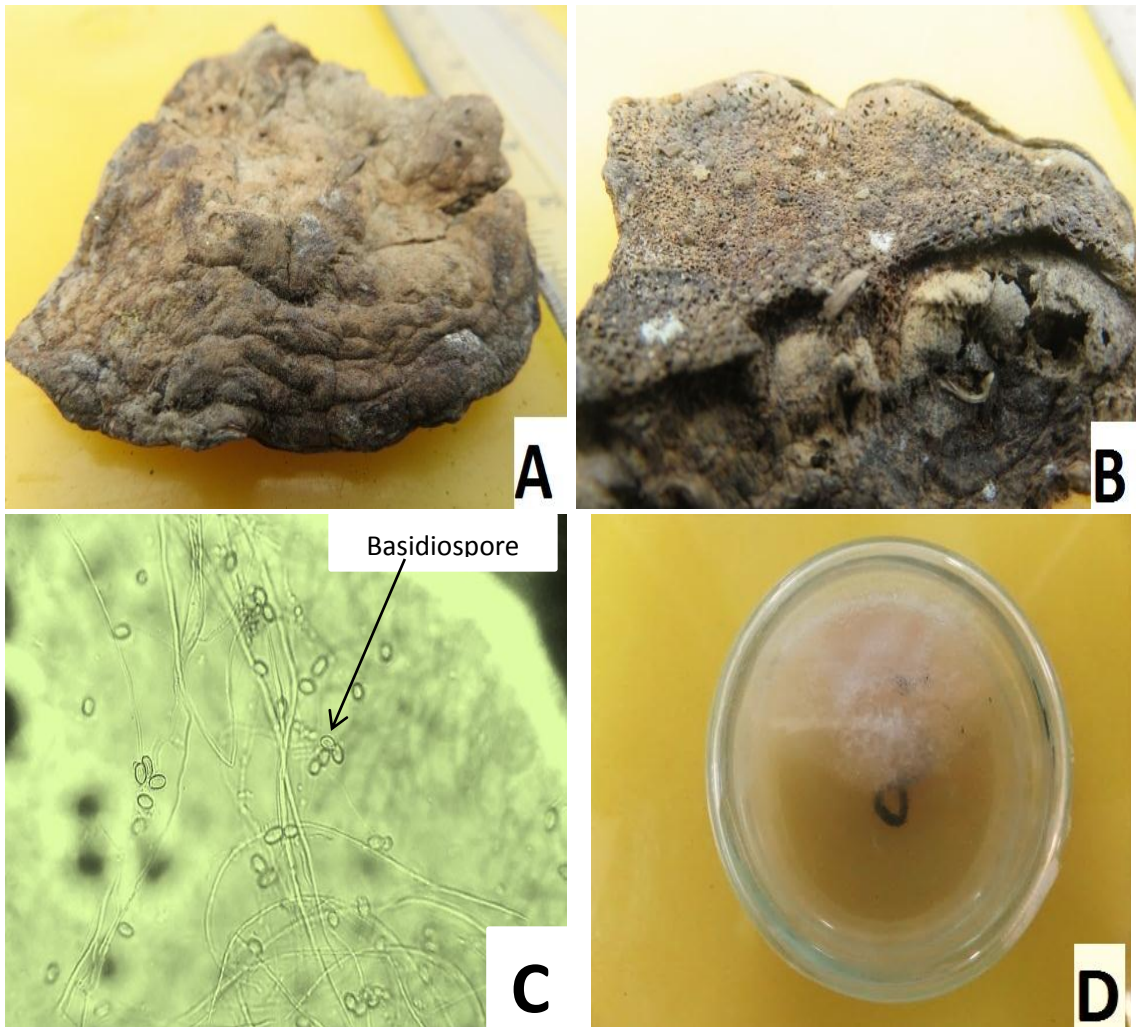
**Spore morphology:** Spore colour was light brown. Spore was thin walled, ovate shaped, scattered.

**Habitat:** The mushroom species was found on soil surface in Gajni forest that is the part of tropical deciduous forest is association with shal (*Shorea robusta*). The occurrence of a particular mushroom in specific habitat was unabundant. Type of soil was clay and acidic. The moist weather of forest is affecting their distribution. During the collection the average relative humidity was 90% and temperature was 33°C.

**Biodiversity:** *Ganoderma pfeifferi* was found in Gajni forest under sherpur district. 1 number of mushrooms of *Ganoderma pfeifferi* was found during collection. The frequency of its presence was 50% and the density was 3.61 %.

**Cultural character:** The culture of *Ganoderma pfeifferi* was grown in PDA media. The growth pattern of mycelia was flat and irregular. Mycelial colour was grayish.

**Edibility:** It is reported as inedible but has medicinal values.



**Figure 29.** *Ganoderma pfeifferi*; A. Fruiting Body, B. Gill, C. Spores ( $\times 100$ ), D. Culture growth in PDA media.



### **30. Scientific Name:** *Gymnopilus purpuratous*

Family: Strophariaceae

**Morphology:** Size of pileus was  $8.1 \times 7.5$  cm. Pileus shape was concave. Color was white. Surface character and zonation was soft, smooth in nature. Margin was slightly dentate, incurved in shape (Figure 30). Texture of the fruiting body was soft. Spore bearing surface was pores under the gills.

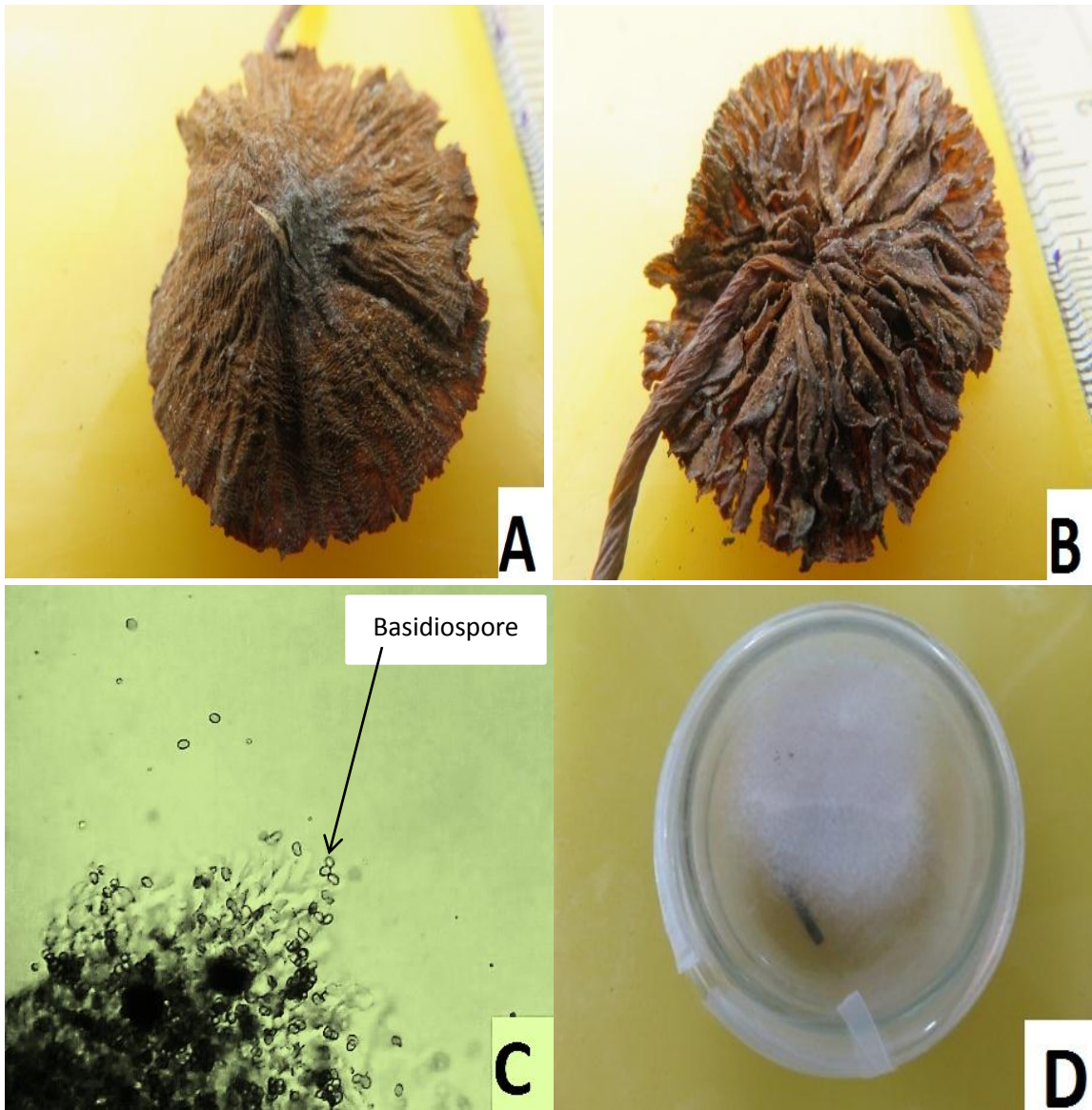
**Spore morphology:** Spore colour was blackish. Spore was thin walled, round shaped, clustered.

**Habitat:** The mushroom species was found on soil surface in Gajni forest that is the part of tropical deciduous forest is association with shal (*Shorea robusta*). The occurrence of a particular mushroom in specific habitat was abundant. Type of soil was clay and acidic. The moist weather of forest is affecting their distribution. During the collection the average relative humidity was 90% and temperature was 33°C.

**Biodiversity:** *Gymnopilus purpuratous* was found in Gajni forest under shepur district. In total 5 numbers of mushrooms of *Gymnopilus purpuratous* were found during collection. The frequency of its presence was 35% and the density was 5.17%.

**Cultural character:** The culture of *Gymnopilus purpuratous* was grown in PDA media. The growth pattern of mycelia was flat and irregular round. Mycelial colour was white.

**Edibility:** Its edibility is not well known.



**Figure 30.** *Gymnopilus purpuratous*; A. Fruiting Body, B. Gill, C. Spore ( $\times 100$ ), D. Culture growth in PDA media.

**Table 2. Morphological characterization of basidiocarp and basidiospores of collected wild mushrooms from Gajni forest**

SI. NO	Species name	Characterization of basidiocarp	Characterization of Spore
1	<i>Ganoderma applanatum</i>	Size of Pileus was 12.5 × 9.8 cm. Pileus shape was Convex. Color was cocoa to brownish. Surface character and zonation was dry in nature. Margin was incurved in shape. Texture of the fruiting body was Corky. Pores on hymenium.	Spore colour was brown. Spores were thick walled, oblong shaped, smooth.
2	<i>Ganoderma lobatum</i>	Size of Pileus 8.3 × 9.8 cm. Pileus shape was Convex to irregular in shape. Pileus Color was mature coccoa brown. Surface character and zonation was dry in nature laccate, highly sulcate, brown of chestnut. Margin was incurved in shape, hard, acute. Texture of the fruiting body was woody and corky. Spore bearing surface under cap was pores on hymenium.	Spore colour was brown. Spores were thick walled, ovate shaped, smooth.
3	<i>Ganoderma lucidum</i>	Size of Pileus was 7.1 × 6.9 cm. Pileus shape was concave. Color was black with white stripe. Surface character and zonation was dry in nature. Margin was incurved in shape. Texture of the fruiting body was brittle and woody. Spore bearing surface under cap was pores on hymenium.	Spore colour was brown. Spores were thick walled, oval shaped, scattered.
4	<i>Ganoderma boninense</i>	Size of Pileus was 4.1 × 2.9 cm. Pileus shape was Concave. Color was White color, cap. Surface character and zonation was dry in nature. Margin was incurved in shape. Texture of the fruiting body was brittle and woody.	Spore colour was light brown. Spores were thin walled, round shaped.
5	<i>Ganoderma tsugae</i>	Size of Pileus was 3.8 × 3.1 cm. Color was brick red with white cap. Pileus shape was Conical. Surface character and zonation was dry in nature. Margin was Irregular in shape. Texture of the fruiting body was Brittle and woody. Pores on hymenium.	Spore colour was brown. Spores were thin walled, ovate shaped, scattered
6	<i>Ganoderma fornicatum</i>	Size of Pileus 6.5 × 4.5 cm. Pileus shape was slightly wavy and convex, blackish brown color. Surface and zonation was Brittle, brown and dry in nature. Margin was incurved in shape, thick and coffee color. Texture of the fruiting body is corky.	Spore colour was blackish. Spores were thin walled, oblong shaped.
7	<i>Ganoderma sinense</i>	Size of Pileus 7.5 × 6.5 cm. Pileus shape was slightly wavy, grissy red color. Surface and zonation was brittle and dry in nature. Margin was incurved in shape, thick and coffee color. Texture of the fruiting body is corky to woody. Pores on hymenium.	Spore colour was brown. Spores were thick walled, oval shaped, clustered.

8	<i>Ganoderma tropicum</i>	Size of Pileus 7.5 × 6.5 cm. Pileus shape: Flat. Color was Dark red with white border. Surface character and zonation was Brittle, rugose, reddish brown and dry in nature. Margin was incurved in shape, thick and coffee color. Texture of the fruiting body is corky to woody. Pores on hymenium.	Spore colour was brown. Spores were thick walled, round shaped.
9	<i>Ganoderma lipsiense</i>	Size of Pileus was 6 × 4.5 cm. Pileus shape was Convex. Color was Dark brown to cocoa coloured. Surface character and zonation was Dry in nature, slightlyzonate, solitary, crust and rigid. Margin was incurved in shape. Margin thick, coffee colour. Texture of the fruiting body was Corky and tough. Spore bearing surface under cap was Pores on hymenium.	Spore colour was light brown. Spores were thin walled, oblong shaped.
10	<i>Ganoderma</i> sp	Size of Pileus was 3.8 × 2.4 cm. Pileus shape was fingure like. Color was upper portion coccoa and lower portion brick red. Surface character and zonation was dry in nature. Margin was incurved in shape. Spore bearing surface under cap was Pores on hymenium.	Spore colour was blackish. Spores were thick walled, round shaped.
11	<i>Ganoderma calidophilum</i>	Size of Pileus was 7.1 × 6.9 cm. Pileus shape was Concave. Color was red. Surface character and zonation was dry in nature. Margin was incurved in shape. Texture of the fruiting body was Brittle and woody. Spore bearing surface under cap was Pores on hymenium.	Spore colour was brown. Spores were thick walled, oblong shaped, scattered.
12	<i>Ganoderma japonicum</i>	Size of Pileus was 3.1 × 2.5 cm. Pileus shape was Concave. Color was cocoa. Surface character and zonation was dry in nature. Margin was incurved in shape. Texture of the fruiting body was Brittle. Spore bearing surface was Pores on hymenium.	Spore colour was blackish. Spores were thin walled, round shaped.
13	<i>Ganoderma annulare</i>	Size of Pileus was 8.1 × 7.5 cm. Pileus shape was concave. Color was cocoa. Surface character and zonation was dry in nature. Margin was incurved in shape. Texture of the fruiting body was Brittle and woody. Spore bearing surface was pores on hymenium.	Spore colour was slightly black. Spores were thin walled.
14	<i>Ganoderma pfeifferi</i>	Size of Pileus was 8.1 × 7.5 cm. Friting body is breetle and woody in texture. Pileus shape was incurved. Color was cocoa. Surface character and zonation was dry in nature. Margin was incurved in shape. Spore bearing surface was Pores on hymenium.	Spore colour was light brown. Spores were thin walled, ovate shaped.
15	<i>Ganoderma</i> sp	Size of Pileus was 3.5 × 2.4 cm. Pileus shape was oval. Color was coccoa and blackish. Surface character and zonation was dry in nature. Spore bearing surface under cap was Pores on hymenium.	Spore colour was blackish. Spores were thin walled, round shaped.

<b>16</b>	<i>Ganoderma orbiforme</i>	Size of Pileus 6.3 × 3.8 cm. Pileus shape was convex to irregular in shape. Pileus color was cocoa brown. Surface character and zonation was dry in nature. Margin was Incurved in shape, hard, acute. Texture of the fruiting body was woody and corky. Spore bearing surface under cap was Pores on hymenium.	Spore colour was blackish. Spores were thick walled, ovate shaped, smooth.
<b>17</b>	<i>Trametes elegans</i>	Size of Basidiocarp was 2.3 × 3.7 cm. Pileus (cap) was brown and creamy. Shape of cap was flat and cap edge was undulating. Light yellow color scale was present on the cap. The white and brown color macro pores were present under the cap. The surface characters were dry in nature. The texture of the fruiting body was hard, brittle and woody.	Spore colour was light brown. Spores were thick walled, irregular round shaped.
<b>18</b>	<i>Trametes versicolor</i>	Size of Pileus was 4 × 3.5 cm. Pileus shape was convex. Color was brown to white coloured. Margin was Incurved in shape. Margin thick, cream colour. Texture of the fruiting body was Corky and tough. Spore bearing surface under cap was Pores on hymenium. Pores color was Milky. Pore spacing was crowded.	Spore colour was blackish. Spores were thick walled, elongated shape.
<b>19</b>	<i>Polyporus</i> sp	Size of fruting body was 4.5 × 2.8 cm. Color was yellow, soft and fleasy. Pileus was cup shaped. Gill attachment was Free. Volva was absent.	Spore colour was slightly brown. Spores were thin walled, round.
<b>20</b>	<i>Agaricus bitorquis</i>	Size of fruting body was 3.1 × 4.5 cm. Pileus (cap) was white colour and ovate, edge was round but slightly wavy. Hymenophores were absent. Regular white color gills were present underside of the cap. Ring or anal was absent on the stipe and volva was absent.	Spore colour was brown. Spores were thin walled, round shaped, scattered.
<b>21</b>	<i>Agaricus arvensis</i>	Size of fruting body was 1.5×2.1 cm. Pileus (cap) was white and round smooth. Hymenophores were absent. White color gills were present underside of the cap. Ring or anal was absent on the stipe and volva was absent on the lower part of the stipe.	Spore colour was brown. Spores were thick walled, conicle shaped, scattered.
<b>22</b>	<i>Amanita muscaria</i>	Size of fruting body was 4.5 × 3.5 cm. Pileus was blackish white, round, smooth and ellipsoid. Hymenophores were absent. Regular white color gills (lamellae) were present underside of the cap. Ring or anal was absent on the stipe and volva was absent.	Spore colour was light brown. Spores were thin walled, round shaped.
<b>23</b>	<i>Amanita excels</i>	Size of fruting body was 4.5 × 3.5 cm. Pileus was blackish, corcky and Ellipsoid. Hymenophores were absent. Regular blackish color gills (lamellae) were present underside of the cap. Ring or anal was absent on the stipe and volva was absent.	Spore colour was slightly brown. Spores were thick walled.
<b>24</b>	<i>Russula</i>	Size of fruting body was 2.5 × 1.5 cm. Pileus shape was Funnel shape. Color was Pink to red. Texture of the fruiting body was Soft	Spore colour was blackish. Spores

	<i>nobilis</i>	and spongy. Stipe was Present. Ring or anal was absent on the stipe and volva was absent on the lower part of the stipe.	were thick walled.
25	<i>Lactariou deliciosus</i>	Size of fruting body was 3 × 3.5 cm. Pileus was pinkish, ovate and edge was round but slightly wavy. Hymenophores were absent. Regular pinkish color gills (lamellae) were present underside of the cap. Ring or anal was absent on the stipe and volva was absent on the lower part of the stipe.	Spore colour was light brown. Spores were thin walled, round shaped, scattered.
26	<i>Volvariella goloicephala</i>	Size of fruting body was 10.5 × 6.8 cm. Pileous color was White (Young and mature), soft and fleasy. Gill attachment was Free. Shape was Ovate or flat. Pileus Color was Creamy, brownish. Volva was present on the lower part of the stipe.	Spore colour was light brown. Spores were thin walled, elliptical shaped, scattered.
27	<i>Volvariella speciosa</i>	Size of fructification was 4.2 × 2.4 cm. Pileus was brown and creamy colour, flat and edge was smooth and striate. Cream color scale was found on the cap. Beneth the cap hymenophores were present. Regular shaped light brown gills (lamellae) were present underside of the cap. Ring or anal was absent on the stipe and volva was absent on the lower part of the stipe.	Spore colour was blackish. Spores were thin walled, round shaped, clustered.
28	<i>Gymnopus iocephalus</i>	Size of fruting body was 4.1 × 2.5 cm. Pileus shape was funnel shape. Color was violet with white strip. Texture of the fruiting body was Soft and spongy. Spore bearing surface under cap was Gills. Stipe was Present. Ring or anal was absent on the stipe and volva was absent on the lower part of the stipe.	Spore colour was brown. Spores were thick walled, irregular round shaped, clustered.
29	<i>Tuber aestivum</i>	Size of Pileus was 8.1 × 7.5 cm. Pileus shape was Concave. Color was cocoa. Surface character and zonation was dry in nature. Margin was incurved in shape. Texture of the fruiting body was Brittle and woody. Spore bearing surface was Pores on hymenium.	Spore colour was blackish. Spores were thin walled, oval shaped, clustered.
30	<i>Gymnopilus purpuratous</i>	Size of Pileus was 8.1 × 7.5 cm. Pileus shape was Concave. Color was white. Surface character and zonation was soft, smooth in nature. Margin was slightly dentate, incurved in shape. Texture of the fruiting body was soft. Spore bearing surface was Pores under the gills.	Spore colour was blackish. Spores were thin walled, round shaped, clustered.

**Table 3. Ecological characterization of collected wild mushrooms from Gajni forest**

<b>Species name</b>	<b>Family</b>	<b>Frequency (%)</b>	<b>Density (%)</b>	<b>Occurrence</b>	<b>Utilization</b>
<i>Ganoderma applanatum</i>	Ganodermataceae	75	12.75	Abundant	Inedible, medicinal
<i>Ganoderma lobatum</i>	Ganodermataceae	50	10.75	Abundant	Inedible, medicinal
<i>Ganoderma lucidum</i>	Ganodermataceae	25	5.25	Unabundant	Edible, medicinal
<i>Ganoderma boninense</i>	Ganodermataceae	50	6.50	Abundant	Inedible, medicinal
<i>Ganoderma tsugae</i>	Ganodermataceae	60	10.20	Abundant	Inedible, medicinal
<i>Ganoderma fornicatum</i>	Ganodermataceae	50	7.75	Abundant	Inedible, medicinal
<i>Ganoderma sinense</i>	Ganodermataceae	30	5.25	Abundant	Inedible, medicinal
<i>Ganoderma tropicum</i>	Ganodermataceae	50	8.50	Abundant	Inedible, medicinal
<i>Ganoderma lipsiense</i>	Ganodermataceae	50	7.75	Abundant	Inedible, medicinal
<i>Ganoderma</i> sp	Ganodermataceae	20	3.25	Abundant	Inedible, medicinal
<i>Ganoderma calidophilum</i>	Ganodermataceae	60	10.50	Abundant	Inedible, medicinal
<i>Ganoderma japonicum</i>	Ganodermataceae	20	3.25	Unabundant	Inedible, medicinal
<i>Ganoderma annulare</i>	Ganodermataceae	50	5.5	Abundant	Inedible, medicinal

<i>Ganoderma pfeifferi</i>	Ganodermataceae	<b>50</b>	<b>3.5</b>	Abundant	Inedible, medicinal
<i>Ganoderma</i> sp	Ganodermataceae	<b>50</b>	<b>12.50</b>	Abundant	Inedible
<i>Ganoderma orbiforme</i>	Ganodermataceae	<b>50</b>	<b>12.50</b>	Abundant	Inedible
<i>Trametes elegans</i>	Polyporaceae	<b>55</b>	<b>5.25</b>	Abundant	Inedible
<i>Trametes versicolor</i>	Polyporaceae	<b>10</b>	<b>2.25</b>	Unabundant	Inedible, Poisonous
<i>Polyporus</i> sp	Polyporaceae	<b>10</b>	<b>2.25</b>	Unabundant	Inedible, Poisonous
<i>Agaricus bitorquis</i>	Agaricaceae	<b>70</b>	<b>20.25</b>	Abundant	Edible
<i>Agaricus arvensis</i>	Agaricaceae	<b>70</b>	<b>18.60</b>	Unabundant	Edible
<i>Amanita muscaria</i>	Amanitaceae	<b>25</b>	<b>7.45</b>	Abundant	Inedible
<i>Amanita excels</i>	Amanitaceae	<b>25</b>	<b>2.25</b>	Unabundant	Inedible
<i>Russula nobilis</i>	Russulaceae	<b>10</b>	<b>3.25</b>	Unabundant	Inedible
<i>Lactariou deliciosus</i>	Russulaceae	<b>50</b>	<b>10.75</b>	Abundant	Inedible
<i>Volvariella goloicephala</i>	Pluteaceae	<b>75</b>	<b>15.75</b>	Unabundant	Edible
<i>Volvariella speciosa</i>	Pluteaceae	<b>60</b>	<b>8.25</b>	Abundant	Edible
<i>Gymnopus iocephalus</i>	Marasmiaceae	<b>70</b>	<b>15.25</b>	Abundant	Inedible, Poisonous
<i>Tuber aestivum</i>	Tuberaceae	<b>20</b>	<b>2.25</b>	Abundant	Unknown
<i>Gymnopilus purpuratous</i>	Strophariaceae	<b>35</b>	<b>5.15</b>	Abundant	Unknown



In this survey 5 edible species, 15 inedible but medicinal species and 9 inedible, poisonous species were reported.

**Table 4. Economic importance of collected wild mushrooms**

<b>SI. No.</b>	<b>Importance</b>	<b>Total no. of species</b>
1.	Edible	<b>5</b>
2.	Medicinal	<b>15</b>
3.	Inedible, Poisonous and unknown importance	<b>9</b>

A wide range of mushrooms biodiversity was reported by Aminuzzaman and Das (2017) and Rubina *et al.* (2017). In another study Marjana *et al.* (2018), Rashid *et al.* (2016), Rahman *et al.* (2016), and Romainul *et al.* (2015) reported various species of mushrooms among the different forest region in Bangladesh.

In the present study 15 species of *Ganoderma* were recorded. Among 15 species, *Ganoderma applanatum* were recorded in association with shal tree with the density of 75% and density of 12.75%. It was first found in 1905 by American mycologist named William Murrill. This species was also reported in China and India. Moncalvo and Ryvardeen published a world list of *Ganoderma* species. The study considered the species described in last 200 years listing 386 names for Ganodermataceae as whole. Taxonomy and diversity of *Ganoderma* species was also reported in Maharashtra India by Bhosle *et al.* (2010).

Furthermore, *Ganoderma lucidum* and *Ganoderma lobatum* both were reported with the frequency of 25%, 50% and density of 5.25%, 10.75% respectively in Gajni forest under the tropical deciduous forest of Bangladesh. They were also reported in India and Nigeria. It was supported by Aminuzzaman and Das (2017) and Rubina *et al.* (2017). In another study Marjana *et al.* (2018) found *Ganoderma lucidum* in Kaptai, Rangamati of Chittagong Hill tracts under tropical evergreen and semi-evergreen forest of Bangladesh. In other study Romainul *et al.* (2015) found *Ganoderma lobatum* species under tropical moist deciduous forest region of Bangladesh. But Das and Aminuzzaman (2017) described the species from Bogra district under social forest region of Bangladesh. Ryvardeen, (1995) studied the morphology of 53 specimens of *Ganoderma lucidum* from Norway and he found large variation among the species.

*Ganoderma boninense* and *Ganoderma tsugae* was reported in Gajni forest with the frequency of 50%, 60% and the density was 6.5%, 10.20% respectively. But

this species was also found in national botanical garden (Rubina *et al.*, 2017) and tropical moist deciduous forest region of Bangladesh (Rumainul *et al.*, 2015). Aminuzzaman and Das (2017) found this species in social forest region of Bogra, Bangladesh with a frequency of 75% and a density of 43.5%. The pathogenicity of *Ganoderma boninense* was examined (Cooper *et al.*, 2011). These species were also reported by Hushiarian *et al.* (2013) and Vyas *et al.* (2014) in India.

On the other hand, *Ganoderma fornicatum* was identified in association with shal tree with a density of 7.75% and frequency of 50%. It was also reported by Mohanty *et al.* in India. *Ganoderma sinense* was identified in association with shal tree with a density of 5.25% and the frequency of 30%. This genus was also found in the western part of Maharashtra in India (Bhosle *et al.*, 2010) in India.

The frequency of *Ganoderma tropicum* and *Ganoderma lipsiense* were 50%, 50% and density were 8.5%, 7.75% respectively was reported in Gajni forest region. These mushroom species were found in different areas of tropical moist deciduous forest region of Bangladesh by Rumainul *et al.* (2015). Taxonomy and diversity of *Ganoderma lipsiense* and *Ganoderma tropicum* was also reported in China (Wang *et al.*, 2012) and in India (Dwivedi *et al.*, 2012; Thiribhuvanamala *et al.*, 2011; Ram *et al.*, 2010) *Ganoderma lipsiense* was also reported from India in association with *Dalbergia sissoo* plant (Bhosle *et al.*, 2010).

Two unidentified species of *Ganoderma* sp. was also found in the forest area with the frequency of 50%, 20% and density of 12.50% and 3.25%. These species was also reported in China and India by Wang *et al.* (2012) and Dwivedi *et al.* (2012).

*Ganoderma calidophilum* and *Ganoderma japonicum* was found in Gajni forest with the frequency of 60%, 20% and density of 10.5%, 3.25%. This mushroom

species was found in deciduous forest regions of Bangladesh by Rumainul *et al.* (2015) and also found in Maharashtra in India by (Bhosle *et al.*, 2010).

*Ganoderma fornicatum* was also found in the forest area with the frequency of 50% and density was 7.75%. This species was also reported in China and India by Wang *et al.* (2012) and Dwivedi *et al.* (2012) reported in N.W. Himalaya.

*Ganoderma annulare* and *Ganoderma feifferi* was found in Gajni forest with the frequency of 50% and density of 5.5%, 3.61% and this macrofungi was also reported by Rumainul *et al.* (2016) from Bangladesh and from Maharashtra in India by Bhosle *et al.* (2010). This fungus was also reported from Nigeria, China, Thailand and India. Geographical distribution of *Ganoderma annulare* is also reported in Pan tropical species originally described from Venezuela, French Guyana (Steyaert, 1980), China, New Guinea and Egypt Bilgrami *et al.* (1991).

Two species of *Agaricaceae* such as *Agaricus bitorquis* and *Agaricus arvensis* was identified in association with the root zone of shal tree and soil surface having the frequency of 70%, 50% and density of 20.25% and 18.60%, respectively in the Gajni forest area. The top most density of *Agaricus bitorquis* was 20.25% was observed in this survey. Furthermore, the genus *Agaricus* was also reported in south western region of Bangladesh as described by Rahaman *et al.* (2016). *Agaricaceae* was reported first by Sathe and Rahalkar (1983), providing a very exhaustive list of fungi from India and Nepal. The genus *Agaricus* species was also reported by Tibuhwa (2011) in Tanzania. Gray (1997) reported that *Agaricus campestris* as common wild mushrooms in Europe and America.

Two species of *Pluteaceae*, namely *Volvariella golocephala* and *Volvariella speciosa* was detected in Gajni forest in an association with humus having the

frequency of 75%, 60% and density of 8.25% and 15.75% respectively. The top most frequency of *Volvariella goloicephala* was 75% was observed at the time of the survey. The species *Volvariella goloicephala* and *Volvariella speciosa* was also previously reported from the other part of tropical moist deciduous forest region of Bangladesh on the humus of moist soil as stated by Romainul *et al.* (2015). The genus *Volvariella* was also reported by Natrajan and Kumar (1986) in N.W. Himalaya.

Three species under the Polyporaceae family were identified as- *Trametes elegans*, *Trametes versicolor* and *Polyporus* sp. The frequency of *Trametes elegans* was 55% and the density was 5.25%. *Trametes elegans* was found on dead wood of shal tree in Gajni forest. *Trametes versicolor* and *Polyporus* sp was found with the frequency of 10% and density of 2.25% for both species. *Trametes versicolor* was also reported in and around Bangalore (Karnataka) of India and found medicinal importance (Pushpa *et al.*, 2012). This genus has a widespread distribution and contains fifty species (Kirk *et al.*, 2008). This genus was also found in India (Thiribhuvanamala *et al.*, 2011) reported this species.

Two species of *Russulaceae* was recorded as *Russula nobilis* and *Lactariou deliciosus* with the frequency of 10%, 50% and density of 3.25% and 10.75% respectively. The genus *Russula* sp. was also reported from India. Seven species of *Russula* was recorded in Southern Kashmir Himalayas. *Russula brevipes* is widely distributed throughout North America, and mainly associated with species of *Abies*, *Picea*, *Tsuga* and *Pseudosuga*. *Russula brevipes* also forms ectomycorrhizal association with *Abies lacicarpa*. Two ectomycorrhizal species of genus *Russula* have been characterized and identified from Kashmir Himalaya using

morphological and molecular methods targeting its r DNA. A monograph on Russulaceae has been reported (Bhatt, 1986 and Lakhanpal, 2005).

Two species of Amanitaceae was recorded as *Amanita muscaria* and *Amanita excels* with the frequency of 25% and density of 7.45% and 2.25% respectively. It also previously reported from the other part of tropical moist deciduous forest regions- Dhaka, Gazipur, Bogra, Rajshahi, Pabna, Jaipurhat and Dinajpur of Bangladesh on the humus of moist soil as reported by Rumainul *et al.* (2015). In 1983, work was extended to different parts of Himachal Pradesh and 6 more species in Amanitaceae were collected bringing the total number to 18 in the N.W. Himalayas in India (Natrajan and Kummer, 1985). Chin (1988) recorded that twenty species of edible and poisonous mushrooms collected from forests in Sarawak, one of the poisonous mushrooms was *Amanita excels*.

One species of *Marasmiaceae* was recorded as *Gymnopus iocephalus* with the frequency of 70% and density of 15.25%. Marjana *et al.* (2018) found a species under this family. Rumainul *et al.* (2015) mentioned that in the Dhaka district of the tropical moist deciduous forest region in Bangladesh, all the three species of *Marasmius* sp. were found. It contains about 500 species (Kirk *et. al.*, 2008) and it was also reported in Madagascar as well as the Mascarenes (Antonín and Buyck, 2006). Rahaman *et al.* (2016) found *Marasmius oreades* in Koira of Khulna district. The species was scattered in distribution with unabundant in occurrence. Das *et al.* (2016) mentioned that three species of *Marasmius* such as *Marasmius oreades*, *Marasmius siccus* and *Marasmius haematocephalus*. It was also reported by Farook *et al.* (2011) and Horton (2016). The genus *Marasmius* surprisingly has been reported to be represented by just one species in the N.W. Himalaya by Kumar *et al.* (2013).

One species of *Tuber aestivum* under the Tuberales family was found in Gajni forest that is associated with forest tree and the frequency was 20% and density was 2.25%. Rashid *et al.* (2016) found this species with Mehogani tree in Barisal, Patuakhali, Borguna, Pirojpur, Jhalokhathi districts, which situated in the southern region of Bangladesh.

One species of *Gymnopilus purpuratous* under the Strophariaceae family was found in Gajni forest that is associated with shal tree and the frequency was 35% and density was 5.15%. Rashid *et al.* (2016) found this species with Mehogani tree in Barisal, Patuakhali, Borguna, Pirojpur, Jhalokhathi districts, which situated in the southern region of Bangladesh. Karwa and Rai (2010) tapping this fungi biodiversity in Central India.

## CHAPTER V

### SUMMARY AND CONCLUSION

The Survey was conducted to collect, preserve and identify wild mushrooms from the Gajni forest that is the part of tropical moist deciduous forest region in Bangladesh which is also known as shal forest as the most dominated tree is shal tree. In total of 32 wild mushroom samples were collected and identified to 29 species which belong to 9 families including 15 species of Ganodermataceae, 3 species of Polyporaceae, 2 species of Agaricaceae, 2 species of Amanitaceae, 2 species of Russulaceae, 2 species of Pluteaceae and 1 species each of the family Marasmiaceae, Tuberaceae and Strophariaceae. Identified species were *Ganoderma applanatum*, *Ganoderma lucidum*, *Ganoderma lobatum*, *Ganoderma boninense*, *Ganoderma tsugae*, *Ganoderma fornicatum*, *Ganoderma sinense*, *Ganoderma tropicum*, *Ganoderma lipsiense*, *Ganoderma sp*, *Ganoderma calidophilum*, *Ganoderma japonicum*, *Ganoderma annulare*, *Ganoderma feifferi*, *Ganoderma orbiforme*, *Trametes elegans*, *Trametes versicolor*, *Polyporus sp*, *Agaricus bitorquis*, *Agaricus arvensis*, *Amanita muscaria*, *Amanita excels*, *Russula nobilis*, *Lactariou deliciosus*, *Volvariella goloiocephala*, *Volvariella speciosa*, *Gymnopus iocephalus*, *Tuber aestivum* and *Gymnopilus purpuratus*.

Among all the species, the highest frequency was 75% recorded for *Volvariella goloiocephala*, *Ganoderma applanatum* and the highest density (20.25%) was found for *Agaricus bitorquis*. The evenness and species richness was found in Ganodermataceae family. The second dominated species was found in Polyporaceae family.

In this survey 5 edible species, 14 inedible but medicinal species and 10 inedible, poisonous species were reported. Fungal growth on PDA media was also done but the outcome is not satisfied. However, there is large number of mushrooms



whose economic importance is not known, further investigation help to exploit the useful metabolites from these mushrooms. This study emphasizes periodical survey with the changed climatic and environmental condition. For this periodic survey is essential. The work facilitates with the *Ganoderma* species is huge as it is reported with medicinal properties.

It becomes clear that mushroom diversity indicates the quality of ecosystem, when compared with the biodiversity in evergreen, semi evergreen, mangrove, moist deciduous forests this indicates that the mushroom flora varies from region to region. The diversity of geographical and climatic conditions prevalent in this forest makes the region a natural habitat of a number of mushrooms. And hence a timely research regarding isolation, identification and characterization of the existing mushroom flora is essential. The mushrooms grown in the wild plays an important role to maintain the forest ecosystem. This study thus recommends further study to explore the diversity and richness of the studied taxa in unstudied parts. This survey helps further continuation to refine the more findings with relevant information along with the present findings.

## CHAPTER VI

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