

# Biodiversity and morphological characterization of mushrooms at the tropical moist deciduous forest region of Bangladesh

## ABSTRACT

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 forest regions of Bangladesh. This investigation was conducted 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. A total of fifty samples were collected and identified to fourteen genera and twenty four species. The predominant genera were *Ganoderma* sp., *Lepiota* sp., *Marasmius* sp. and *Collybia* sp. The entire mushroom flora and its morphological characteristics have been described and illustrated. This is the first investigation on mushroom flora associated with tropical moist deciduous forest region of Bangladesh.

Key words: Tropical moist deciduous forest, Biodiversity, Mushroom, Bangladesh

## 1. Introduction

The term "Mushroom" is used mainly for the fruiting body produce by the macro-fungi and these are Ascomycota and Basidiomycota, some are edible and many are poisonous and non-edible. More than 10,000 species of mushrooms are present in and around the world and about 2000 of them are considered as edible [1]. Along with the cultivated mushrooms, wild mushrooms also have profound biological as well as economical features and have a great impact along with the beneficiaries' of human-kind. Mushroom have high nutritional value along with high proteins, vitamins, minerals, fibers, trace elements content and even low or more or less no calories and cholesterol contents. Now-a-days, they are considered as an ideal food item. Besides these, mushrooms are the sources of various bioactive substances like, antibacterial, antifungal, antiviral, anti-parasitic, antioxidant, anti-inflammatory, anti-proliferative, anticancer, anti-tumor, cytotoxic, DNA damaging, anti-HIV, hypo-cholesterolemic, anti-diabetic, anti-coagulant, hepato-protective, insecticidal properties and an efficient tool for recycling of organic wastes [2]. Along with the beneficial impacts to mankind, large number of mushroom species is the wood-rotter's, which are causing serious damage to the forest trees [2]. That is why it is causing considerable economic loss to timber industry every year. Besides, some are toxic, even deadly when eaten [3]. Bangladesh is a sub-tropical country. Depending on location, nature and type of management, there are four broad categories of forest in Bangladesh namely mangrove forest, tropical evergreen and semi evergreen forest, tropical moist deciduous forest and village forest.

A number of species of mushrooms are grown mainly during the rainy season, on almost all types of soils, on decaying organic matter, wooden stumps, etc. naturally. The climate and the forest vegetation of the tropical moist deciduous forest region of Bangladesh, supports the growth and reproduction of various mushroom flora. According to Bangladesh forest department, the central and

northern districts covering an area of 120000 hector about 0.81% of total landmass of the country and 7.8% of the countries forest land are bestowed with tropical moist deciduous forests. Tropical moist deciduous forest region is under about 80% of Bangladesh's rain falls area during the monsoon season extending from June to September and the mean annual rain fall for these region of Bangladesh is ranged between 3,280 and 4,780 mm (129.1 and 188.2 inch) per year. The mean daily temperature ranged between 38°C and 41°C (100.4°F and 105.8°F) with relative humidity ranged from lower in March between 55% and 81% to higher in July between 94% and 100%. Winds are mostly from the north and northwest area in the monsoon, blowing gently at 1 to 3 kilometers per hour (0.6 to 1.9 mph). Thus, the northern region of Bangladesh was expected to furnish with diverse macro fungal population.

The search for diverse macro fungal population in the country is important as the demand and consumer preference of mushrooms for utilization among the people and farmers in the country is increasing day by day. Discovery of new biomolecules from mushrooms controlling human and crop diseases and pests is a challenging field of study. The purpose of the present survey was to collect morphological characterization and preserve macro fungal species present in the tropical moist deciduous forest region of Bangladesh.

## **2. Materials and Methods**

**2.1. Survey on wild mushrooms:** The survey and collection of different wild mushrooms were done after the rainy season starting from July 2013 to October 2013 and July 2014 to October 2014. The survey was conducted in Dhaka, Gazipur, Bogra, Rajshahi, Pabna, Jaipurhat, and Dinajpur biosphere reserved area, which is situated in tropical moist deciduous forest region of Bangladesh. According to the National Mapping Organization of Bangladesh, Dhaka is located at 23°42'37" N (Latitude), 90°24'26" E (Longitude) and it has an average elevation of 4 meters (13.12 ft.). Gazipur is located at 24.00°N (Latitude), 90.43°E (Longitude) and it has an average elevation of 10 meters (32.8 ft.). Bogra is located at 24°51'00" N (Latitude), 89°22'00" E (Longitude) and it has an average elevation of 24 meters (78 ft.). Rajshahi is located at 24°22'00" N (Latitude), 88°36'00" E (Longitude) and it has an average elevation of 31 meters (101 ft.). Pabna is located at 24°00'00" N (Latitude), 89°15'00" E (Longitude) and it has an average elevation of 8 meters (26 ft.). Jaipurhat is located at 25.1° N (Latitude), 89.02° E (Longitude) and it has an average elevation of 29 meters (94.25 ft.). Dinajpur is located at 25°37'37" N (Latitude), 88°38'19" E (Longitude) and it has an average elevation of 34 meters (111 ft.). The collection sites were forests, university campus, residential area, botanical garden, parks and nearby villages of those above mentioned areas of tropical moist deciduous forest region (Figure 1).

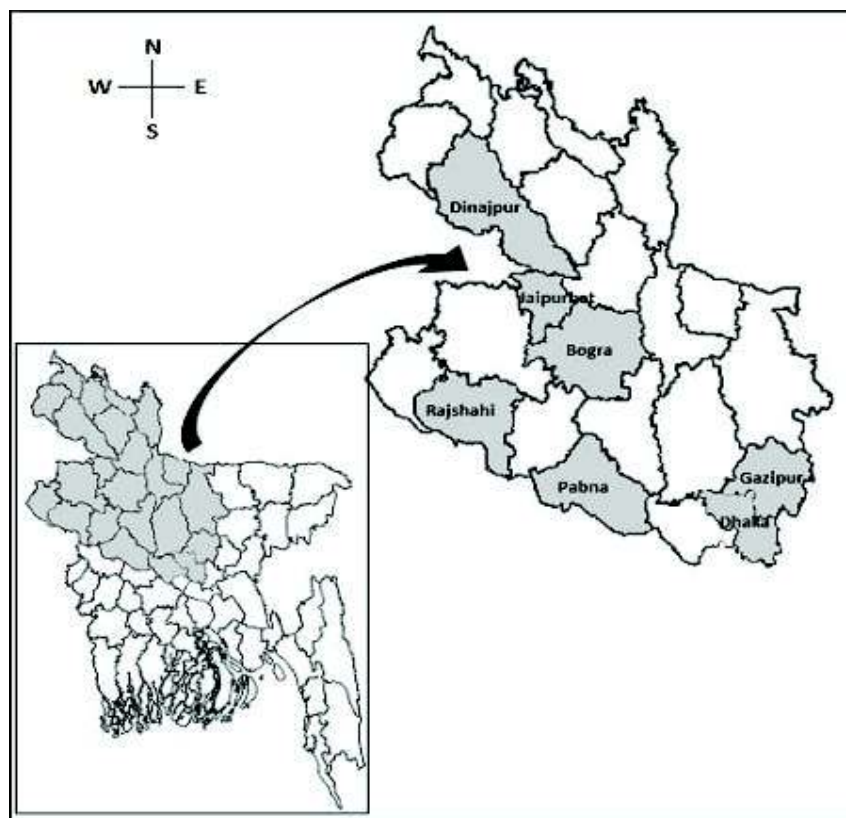


Figure 1: Survey area of tropical moist deciduous forest region of Bangladesh

**2.2. Collection of mushroom samples:** The collection was made following the method of Hailing [4]. Systematic and periodical survey of different locations and other habitats were done in the tropical moist deciduous forest region of the country. Necessary materials and equipment such as isolation kit, slants, isolation chamber, data recording sheet, digital camera for photography, digging equipment, heat convector card board were arranged and collection of samples were usually made during day time and field characteristics of mushrooms were recorded in the data sheet which was prepared following Molina *et al.*, [5]. Then the specimens were dried in hot air oven at 40-50°C and stored in air tight containers with silica gel for further microscopic studies. Spotted mushrooms were minutely inspected in their natural habitats and brought to laboratory for detailed study. Photographs were taken by means of a Sony Cyber-shot Digital Camera with power of 14.2 megapixels.

**2.3. Identification of wild mushrooms:** The collected mushroom samples were identified on their morphological, macroscopic, physiological and ecological features according to the previously published documents by Arora, Singer, Singer [6, 7, 8]. The morphological parameters used for identification of mushrooms specimens were cap color, cap surface, cap margin, cap diameter, stipe length, gill attachment, gill spacing and spore diameter [9]. The spore diameter and the photograph of spore were calculated using the Motic microscope (Motic Images Plus 2.0) with the magnification of 40x. One mature and one immature (growing) mushroom were sampled for each collection to record

accurate information. Through comparing recorded characteristics the mushrooms were identified following Dickinson and John, Jorden, Pegler and Spooner [10, 11, 12].

### 3. Results

Through the investigation, 14 genera and 24 mushroom species were identified [Figure 2 to 6]. The identified genera were *Ganoderma* sp., *Hebeloma* sp., *Craterellus* sp., *Lepiota* sp., *Ramariopsis* sp., *Ampulloclitocybe* sp., *Lycoperdon* sp., *Volvariella* sp., *Russula* sp., *Termitomyces* sp., *Amanita* sp., *Marasmius* sp., *Collybiasp.* and *Mycena* sp. These genera were described below:

**Genus:***Ganoderma* sp.

***Ganoderma lucidum***

**Family:**Ganodermataceae

**Common name:**Lingzhi or Reishi mushroom

**Color:** Red (Young and mature stage)

**Length (Mature):** 13.5cm

**Width (Mature):** 9.6cm

**Spore bearing surface under cap:** Pores on hymenium

**Spore diameter (Average):** Length: 9.57µm; Width: 6.77µm

**Spore shape:** Single walled, smooth and ellipsoidal

**Cap of the carpophore:** Size: 9.6cm; Shape: Offset

**Pileus:** Color: Pinkish; Surface character and Zonation: Smooth, Silky, some kind of leathery having cracking property and dry in nature; Margin: Incurved in shape

**Texture of the fruiting body:** Brittle, tough, leathery and woody

**Flesh odor:** Pleasant

**Lamellae:** Pores present; Pores attachment: Free in nature; Pores color: Yellowish to white in color; Pores shape: Broad; Pores spacing: Crowded

**Stipe:** Present; Size: 11.8cm; Shape: Unequal; Position: Lateral; Surface characteristics: Dry and polished in nature; Color: Pink to chocolaty in color; Firmness: Solid or sometime in fleshy

**Ecological features:** Locality found: Gazipur, Dhaka, Tropical Moist Deciduous Forest region, Bangladesh; Habitat: On soil, in an association near the Ipil-Ipil (*Leucaena leucocephala*) and Golden shower (*Acacia auriculiformis*) trees; Habit: Scattered; Type of association: Root associated; Forest type: Leveled; Constancy of occurrence in specific habitat: Abundant; Type of soil: Sandy soil in nature; Weather at the time of collection: Literally dry weather around the habitat

***Ganoderma boninense***

**Family:**Ganodermataceae

**Common name:** Young resinous polypore mushroom

**Color:** Center is orange in color with white boarder

**Length:** 07cm

**Width:** 0.9cm

130 **Spore diameter (Average):** Length: 4.9µm; Width: 4.12µm  
 131 **Spore shape:** Single walled, smooth and more or less circular  
 132 **Cap of the carpophore:** Size: 7.0 cm x 5.3cm; Shape: Flat  
 133 **Pileus:** Color: Center is orange in color with white boarder; Margin: Regular in shape  
 134 **Texture of the fruiting body:** Soft and spongy  
 135 **Flesh odor:** Unpleasant  
 136 **Ecological features:** Locality found: Rajshahi University, Rajshahi, Tropical Moist Deciduous Forest  
 137 region, Bangladesh; Habitat: On root of the Bamboo (*Bambuseae*) tree; Habit: Caespitose cluster and  
 138 closely merged with the root; Type of association: Root associated; Forest type: Leveled; Constancy  
 139 of occurrence in specific habitat: Not in abundant; Type of soil: Loamy soil in nature; Weather at the  
 140 time of collection: Less moist weather around the habitat

141

142 ***Ganoderma tsugae***

143 **Family:** Ganodermataceae

144 **Common name:** Reishi mushroom

145 **Color:** Mature: Red in center with white boarder; Young: Yellow at the top with red in the bottom

146 **Length (Mature):** 8.5cm

147 **Width (Mature):** 9.3cm

148 **Spore bearing surface under cap:** Pores on hymenium

149 **Spore diameter (Average):** Length: 5.8µm; Width: 4.7µm

150 **Spore shape:** Single walled, smooth and oval

151 **Cap of the carpophore:** Size: 9.6cm x 5.3cm; Shape: Flat in the top around

152 **Pileus:** Color: Creamy; Surface character and Zonation: Leathery; Margin: Irregular in shape

153 **Texture of the fruiting body:** Brittle, leathery and woody

154 **Flesh odor:** Pleasant (chocolaty)

155 **Stipe:** Present; Size: 3cm; Shape: Unequal; Position: Central; Surface characteristics: Dry and  
 156 Polished in nature; Color: Pink to chocolaty in color; Firmness: Solid or sometime in erect

157 **Ecological features:** Locality found: Sujanagar, Pabna; Nature: Saprotrophic or parasitic; Habitat: On  
 158 soil, in the bark of Golden shower (*Acacia auriculiformis*) tree; Habit: Scattered; Type of association:  
 159 Closely root associated; Forest type: Leveled; Constancy of occurrence in specific habitat: Abundant;  
 160 Type of soil: loamy soil in nature; Weather at the time of collection: Literally dry weather around the  
 161 habitat

162

163 ***Ganoderma zonatum***

164 **Family:** Ganodermataceae

165 **Common name:** Lingzhi or Reishi mushroom

166 **Color:** Young: White

167 **Length (Young):** 3.4cm to 1.7cm

168 **Width (Young):** 3.3cm to 2.1cm

169 **Spore bearing surface under cap:** Pores present

170 **Spore diameter (Average):** Length: 6.63µm; Width: 4.47µm  
 171 **Spore shape:** Single walled, smooth and ellipsoidal  
 172 **Pileus:** Color: Milky white to Creamy; Surface character and Zonation: Dry in nature  
 173 **Texture of the fruiting body:** Woody  
 174 **Flesh odor:** Pleasant  
 175 **Lamellae:** Absent; Pores color: Milky white in color; Pores shape: Broad; Pores spacing: Crowded;  
 176 Firmness: Solid or somewhat in fleshy  
 177 **Ecological features:** Locality found: Kalai, Jaipurhat; Nature: Parasitic; Habitat: On bark of the tree,  
 178 in an association with the Mahogany (*Swieteniamahogani*) trees; Habit: Closely associated on the  
 179 bark of the tree; Type of association: Scattered and somewhat caespitose cluster; Forest type:  
 180 Leveled; Constancy of occurrence in specific habitat: Not in abundant; Type of soil: Clay loam soil in  
 181 nature; Weather at the time of collection: Moderate moist weather around the habitat

### 182 ***Ganoderma applanatum***

183 **Family:** Ganodermataceae  
 184 **Common name:** Lingzhi or Reishi mushroom  
 185 **Color:** Mature: Red with white color pores  
 186 **Length (Mature):** 6.4cm  
 187 **Width (Mature):** 3.5cm  
 188 **Spore bearing surface under cap:** Pores on hymenium  
 189 **Spore diameter (Average):** Length: 7.46µm; Width: 6.0µm  
 190 **Spore shape:** Single walled, smooth and oblong or spherical  
 191 **Pileus:** Surface character and Zonation: Dry in nature; Margin: Incurved in shape  
 192 **Texture of the fruiting body:** Woody  
 193 **Flesh odor:** Disagreeable  
 194 **Pores color:** White  
 195 **Ecological features:** Locality found: Kalai, Jaipurhat; Nature: Parasitic; Habitat: On bark wood of the  
 196 tree, in an association with the Golden shower (*Acacia auriculiformis*) tree; Habit: Scattered; Type of  
 197 association: Closely associated; Forest type: Leveled; Constancy of occurrence in specific habitat:  
 198 Un-abundant; Type of soil: Loamy soil in nature; Weather at the time of collection: Moist weather  
 199 around the habitat

### 201 ***Ganoderma resinaceum***

202 **Family:** Ganodermataceae  
 203 **Common name:** Bracket fungi or Reishi mushroom  
 204 **Color:** Blackish with grayish color boarder (Mature)  
 205 **Length:** Mature: 06cm; Young: 05cm  
 206 **Width:** Mature: 4.1cm; Young: 3.2cm  
 207 **Spore bearing surface under cap:** Pores on hymenium  
 208 **Spore diameter (Average):** Length: 14.9µm; Width: 10.0µm  
 209

210 **Spore shape:** Single walled, smooth and ellipsoidal  
 211 **Pileus:** Color: Whitish to Creamy; Surface character and Zonation: Smooth, leathery and moist in  
 212 nature; Margin: Regular in shape  
 213 **Texture of the fruiting body:** Spongy, leathery and woody  
 214 **Flesh odor:** Unpleasant  
 215 **Lamellae:** Absent; Pores color: White in color; Pores spacing: Crowded  
 216 **Ecological features:** Locality found: Kalai, Jaipurhat; Habitat: On bark wood of the tree, in an close  
 217 association with the Golden shower (*Acacia auriculiformis*) trees; Habit: Scattered; Type of  
 218 association: Closely associated; Forest type: Leveled; Constancy of occurrence in specific habitat:  
 219 Un-abundant; Type of soil: Loamy soil in nature; Weather at the time of collection: Moderately moist  
 220 weather around the habitat  
 221  
 222 **Genus:** *Hebelomasp.*  
 223 *Hebelomacrustuliniforme*  
 224 **Family:** Hymenogastraceae  
 225 **Common name:** Poison pie or fairy cakes  
 226 **Color:** White (Young); Creamy (Mature)  
 227 **Length:** Mature: 6.2cm; Young: 3.7cm  
 228 **Width:** Mature: 3.3cm; Young: 1.2cm  
 229 **Spore bearing surface under cap:** Gills  
 230 **Spore diameter (Average):** Length: 5.85µm; Width: 3.7µm  
 231 **Spore shape:** Single walled, smooth and ellipsoidal  
 232 **Cap of the carpophore:** Size: Mature: 3.3cm; Young: 1.2cm; Shape: Umbonateand flatten  
 233 **Pileus:** Color: Creamy; Surface character and Zonation: Smooth and dry in nature; Margin: Regular  
 234 **Texture of the fruiting body:** Soft and spongy  
 235 **Flesh odor:** Pleasant  
 236 **Lamellae:** Present; Gill attachment: Adnate; Gill color: Yellowish white; Gill shape and width:  
 237 Moderately broad; Gill spacing: Close; Lamellulae: Present; Forking pattern: Branched  
 238 **Stipe:** Present; Size: Mature: 3.9cm; Shape: Bare; Position: Central; Surface characteristics: Dry and  
 239 polished; Color: Creamy; Firmness: Solid but fleshy  
 240 **Ecological features:** Locality found: Botanical garden, Mirpur, Dhaka; Habitat: On soil and root of the  
 241 tree; in an association with the stem of Bamboo (*Bambuseae*) tree; Habit: Scattered; Type of  
 242 association: Close; Forest type: Leveled; Constancy of occurrence in specific habitat: Un-abundant;  
 243 Type of soil: Sandy; Weather at the time of collection: Less moist weather  
 244  
 245 **Genus:** *Craterellus sp.*  
 246 *Craterellus cornucopioides*  
 247 **Family:** Cantharellaceae  
 248 **Common name:** Black trumpet mushroom  
 249 **Color:** Violet (Young); Black with whitish color boarder (Mature)

250 **Length (Mature):** 7.4cm  
 251 **Width (Mature):** 3.8cm  
 252 **Spore diameter (Average):** Length: 4.46µm; Width: 3.96µm  
 253 **Spore shape:** Single walled, smooth and cylindrical  
 254 **Cap of the carpophore:** Size: 3.4cm × 2.6cm; Shape: Infundibular  
 255 **Pileus:** Color: Pinkish and somewhat mixed; Surface character and Zonation: Smooth, leathery,  
 256 sticky and moist; Margin: Incurved  
 257 **Texture of the fruiting body:** Brittle but moist in nature  
 258 **Flesh odor:** Pleasant  
 259 **Ecological features:** Locality found: Botanical garden, Mirpur, Dhaka; Habitat: On soil and root of the  
 260 tree; in an association with the stem of Bamboo (*Bambuseae*) tree; Habit: Scattered; Type of  
 261 association: Close; Forest type: Leveled; Constancy of occurrence in specific habitat: Un-abundant;  
 262 Type of soil: Sandy; Weather at the time of collection: Moist weather  
 263  
 264 **Genus:** *Lepiota* sp.  
 265 *Lepiota americana*  
 266 **Family:** Agaricaceae  
 267 **Common name:** Rogers mushroom  
 268 **Color:** Brown (Young); Brown or dark brown having pinkish spots or scales (Mature); Color changed  
 269 from dark brown to black in the border region after one hour of collection  
 270 **Length:** Mature: 3.0cm to 4.5cm; Young: 4.0cm  
 271 **Width:** Mature: 3.8cm to 5.1cm; Young: 1.8cm  
 272 **Spore bearing surface under cap:** Gills  
 273 **Spore diameter (Average):** Length: 6.28µm; Width: 4.32µm  
 274 **Spore shape:** Single walled, smooth and ellipsoid  
 275 **Cap of the carpophore:** Size (Mature): 3.8cm to 5.1cm; Shape: Convex  
 276 **Pileus:** Color: Pinkish, brownish or mixed; Surface character and Zonation: Smooth and dry in nature;  
 277 Margin: Regular  
 278 **Texture of the fruiting body:** Soft and spongy  
 279 **Flesh odor:** Pleasant  
 280 **Lamellae:** Present; Gill attachment: Emarginated; Gill color: Light brown; Gill shape: Broad; Gill  
 281 spacing: Close; Lamellulae: Present; Forking pattern: Unbranched  
 282 **Stipe:** Present; Size: 2.4cm × 5.8cm; Shape: Equal; Position: Central; Surface characteristics: Dry,  
 283 glabrous and polished; Color: Grey to light brown; Firmness: Tubular  
 284 **Annulus (position):** Present and single  
 285 **Scale:** Present and brown in color  
 286 **Umbo:** Present and convex well shaped  
 287 **Ecological features:** Locality found: Botanical garden, Mirpur, Dhaka; Habitat: On soil; in an  
 288 association with the mango (*Magifera indica*) tree; pH in soil: 5.6; Moisture: 7.0%; Temperature: 34°C;

Habit: Scattered; Type of association: Distant; Forest type: Leveled; Constancy of occurrence in specific habitat: Un-abundant; Type of soil: Loam; Weather at the time of collection: Dry weather

***Lepiota helveola***

**Family:** Agaricaceae

**Color:** White and creamy (Young); White and creamy with dark brown spots on cap and stipe (Mature)

**Length (Mature):** 13cm to 15cm; Young: 8.0 cm

**Width (Mature):** 6.0cm to 6.3cm; Young: 4.4cm

**Spore bearing surface under cap:** Gills

**Spore diameter (Average):** Length: 8.8µm; Width: 5.88µm

**Spore shape:** Single walled, smooth and ellipsoid

**Cap of the carpophore:** Size: 6.0cm to 6.3cm; Shape: Convex or flat

**Pileus:** Color: White, creamy and brownish with brown spot; Surface character and Zonation: Smooth, scaly and dry in nature; Margin: Regular

**Texture of the fruiting body:** Soft and spongy

**Flesh odor:** Fragrant

**Lamellae:** Present; Gill attachment: Free; Gill color: White; Gill shape: Broad; Gill spacing: Close; Lamellulae: Present; Forking pattern: Unbranched

**Stipe:** Present; Size: 10.5cm; Shape: Clavate; Position: Central; Surface characteristics: Dry and glabrous; Color: Grey to light brown with dark brown spots; Firmness: Tubular;

**Annulus (position):** Present and single

**Scale:** Present and brown in color

**Umbo:** Present and oyster shaped

**Ecological features:** Locality found: Jahangirnagar University, Savar, Dhaka; Habitat: On humus; Habit: Solitary; Forest type: Mixed; Constancy of occurrence in specific habitat: Abundant; Weather at the time of collection: Moist weather

***Lepiota aspera***

**Family:** Agaricaceae

**Common name:** Freckled dapperling

**Color:** Brown (Young and maturity)

**Length:** 4.0cm

**Width:** 1.5cm

**Spore bearing surface under cap:** Gills

**Spore diameter (Average):** Length: 3.77µm; Width: 3.6µm

**Spore shape:** Single walled, smooth and cylindrical

**Cap of the carpophore:** Size: 1.5cm; Shape: Campanulate

**Pileus:** Color: Brownish; Surface character and Zonation: Scaly and dry in nature; Margin: Regular

**Texture of the fruiting body:** Soft and spongy

**Flesh odor:** Pleasant

330 **Lamellae:** Present; Gill attachment: Free; Gill color: Pale light brown; Gill shape: Moderately broad;  
 331 Gill spacing: Crowded; Lamellulae: Present; Forking pattern: Branched  
 332 **Stipe:** Present; Size: 3.9cm; Shape: Equal; Position: Central; Surface characteristics: Dry but spiny  
 333 scale present and pruinose; Color: Grey to light brown; Firmness: Solid  
 334 **Ecological features:** Locality found: Sher-e-Bangla Nagar, Dhaka; Habitat: On humus; Habit:  
 335 Scattered; Forest type: Leveled; Constancy of occurrence in specificHabitat: Un-abundant; Type of  
 336 soil: Clay loam; Weather at the time of collection: Moist weather  
 337  
 338 ***Macrolepiota procera***  
 339 **Family:** Lepiotaceae  
 340 **Color:** Creamy (Young); Creamy with dark brown scale (Mature)  
 341 **Length:** 13cm  
 342 **Width:** 7.0 cm  
 343 **Spore bearing surface under cap:** Gills  
 344 **Spore diameter (Average):** Length: 8.82µm; Width: 5.82µm  
 345 **Spore shape:** Single walled, smooth and elongated, ellipsoid  
 346 **Cap of the carpophore:** Size: Length: 7.0cm; Width: 0.8cm; Shape: Umbonate  
 347 **Pileus:** Color: Creamy with spots; Surface character and Zonation: Smooth, scaly and dry in nature;  
 348 Margin: Regular  
 349 **Texture of the fruiting body:** Soft and spongy  
 350 **Flesh odor:** Pleasant  
 351 **Lamellae:** Present; Gill attachment: Free; Gill color: Pale white; Gill shape: Broad; Gill spacing: Close;  
 352 Lamellulae: Present; Forking pattern: Unbranched  
 353 **Stipe:** Present; Size: 11.5cm; Shape: Bulbous; Position: Central; Surface characteristics: Dry and  
 354 polished; Color: White to light brown with spots; Firmness: Tubular and fleshy  
 355 **Annulus (position):** Present and single  
 356 **Scale:** Present and brown in color  
 357 **Umbo:** Present and oyster shaped  
 358 **Ecological features:** Locality found: Jahangirnagar University, Savar, Dhaka; Habitat: On humus;  
 359 Habit: Solitary; Forest type: Mixed; Constancy of occurrence in specific habitat: Un-abundant;  
 360 Weather at the time of collection: Moist weather  
 361  
 362 **Genus: *Ramariopsis* sp.**  
 363 ***Ramariopsis kunzei***  
 364 **Family:** Clavariaceae  
 365 **Common name:** White coral  
 366 **Color:** White (Young and mature)  
 367 **Length (Mature):** 5.2cm  
 368 **Width (Mature):** 2.5 cm  
 369 **Spore diameter (Average):** Length: 4.0µm; Width: 3.6µm

370 **Spore shape:** Single walled, smooth and spherical  
 371 **Texture of the fruiting body:** Soft, spongy and brittle  
 372 **Flesh odor:** Unpleasant  
 373 **Forking pattern:** Branched  
 374 **Surface characteristics:** Dry  
 375 **Color:** White  
 376 **Firmness:** Fistulose and narrow  
 377 **Ecological features:** Locality found: Botanical garden, Mirpur, Dhaka; Habitat: On soil; in an  
 378 association with the Ipil-Ipil (*Leucaena leucocephala*) and Golden shower (*Acacia auriculiformis*);  
 379 Habit: Solitary and some others are caespitose cluster; Type of association: Distant and some are  
 380 closely crowded; Forest type: Leveled; Constancy of occurrence in specific habitat: Un-abundant;  
 381 Type of soil: Sandy; Weather at the time of collection: Moist weather  
 382  
 383 **Genus:** *Ampulloclitocybe* sp.  
 384 *Ampulloclitocybe clavipes*  
 385 **Family:** Hygrophoraceae  
 386 **Common name:** Club footed ditocybe  
 387 **Color:** White (Young and mature)  
 388 **Length:** Mature: 2.4cm; Young: 1.8cm  
 389 **Width:** Mature: 1.4cm; Young: 0.6cm  
 390 **Spore bearing surface under cap:** Gills  
 391 **Spore diameter (Average):** Length: 4.56µm; Width: 4.56µm  
 392 **Spore shape:** Single walled, smooth and spherical  
 393 **Cap of the carpophore:** Size: Mature: 1.4cm; Young: 0.6cm; Shape: Ovate  
 394 **Pileus:** Color: White; Surface character and Zonation: Smooth and dry in nature; Margin: Regular  
 395 **Texture of the fruiting body:** Soft and spongy  
 396 **Flesh odor:** Pleasant  
 397 **Lamellae:** Present; Gill attachment: Free; Gill color: White; Gill shape: Moderately broad; Gill spacing:  
 398 Close; Lamellulae: Present; Forking pattern: Unbranched  
 399 **Stipe:** Present; Size: 2.4cm; Shape: Bare; Position: Central; Surface characteristics: Dry and  
 400 glabrous; Color: White and some became grey to light brown after one hour; Firmness: Solid and  
 401 tubular  
 402 **Ecological features:** Locality found: Botanical garden, Mirpur, Dhaka; Habitat: On soil; in an  
 403 association with the Golden shower (*Acacia auriculiformis*); Habit: Scattered; Type of association:  
 404 Distant; Forest type: Mixed; Constancy of occurrence in specific habitat: Un-abundant; Type of soil:  
 405 Clay loam; Weather at the time of collection: Moderately moist weather  
 406  
 407 **Genus:** *Lycoperdon* sp.  
 408 *Lycoperdon pyriforme*  
 409 **Family:** Lycoperdaceae

410 **Common name:** Pear-shaped puffball or stump puffball  
 411 **Color:** White (Young and mature)  
 412 **Length:** 1.15 cm  
 413 **Width:** 1.3cm  
 414 **Spore diameter (Average):** Length: 5.27µm; Width: 4.07µm  
 415 **Spore shape:** Single walled, smooth and ellipsoid  
 416 **Cap of the carpophore:** Size: 1.3cm; Shape: Flat  
 417 **Pileus:** Color: White; Surface character and Zonation: Smooth  
 418 **Texture of the fruiting body:** Soft and spongy  
 419 **Flesh odor:** Pleasant  
 420 **Firmness:** Solid but fleshy  
 421 **Ecological features:** Locality found: Gazipur, Dhaka; Habitat: On bark wood of the tree; in an  
 422 association with the stem of Bamboo (*Bambuseae*) tree; Habit: Scattered; Type of association: Close;  
 423 Forest type: Leveled; Constancy of occurrence in specific habitat: Un-abundant; Type of soil: Loam;  
 424 Weather at the time of collection: Moist weather  
 425  
 426 **Genus:** *Volvariella* sp.  
 427 *Volvariella gloiocephala*  
 428 **Family:** Pluteaceae  
 429 **Common name:** Big sheath mushroom, rose-gilled grisette, or stubble rosegill  
 430 **Color:** White (Young and mature)  
 431 **Length:** 10.5cm  
 432 **Width:** 6.8cm  
 433 **Spore bearing surface under cap:** Gills  
 434 **Spore diameter (Average):** Length: 10.5µm; Width: 10.1µm  
 435 **Spore shape:** Single walled, smooth and ellipsoidal  
 436 **Cap of the carpophore:** Size: 6.8cm; Shape: Ovate or flat  
 437 **Pileus:** Color: Creamy, brownish and some are mixed; Surface character and Zonation: Smooth and  
 438 dry in nature; Margin: Incurved  
 439 **Texture of the fruiting body:** Soft and spongy  
 440 **Flesh odor:** Disagreeable after half an hour of collection  
 441 **Lamellae:** Present; Gill attachment: Free; Gill color: Pale white; Gill shape: Broad; Gill spacing: Close;  
 442 Lamellulae: Present; Forking pattern: Branched  
 443 **Stipe:** Present; Size: 9.2cm; Shape: Clavate; Position: Central; Surface characteristics: Dry and  
 444 glabrous; Color: White to creamy; Firmness: Tubular and narrow  
 445 **Volva:** Present  
 446 **Ecological features:** Locality found: Sujanagar, Pabna; Habitat: On soil; in an association with the  
 447 Mahogany (*Swietenia mahogani*) tree; Habit: Scattered; Type of association: Close; Forest type:  
 448 Leveled; Constancy of occurrence in specific habitat: Un-abundant; Type of soil: Loam; Weather at  
 449 the time of collection: Moist weather

450 **Note:** Started rotting after half an hour of collection  
 451  
 452 **Genus:** *Russula* sp.  
 453 *Russula nobilis*  
 454 **Family:** Russulaceae  
 455 **Common name:** Beechwoodsickener  
 456 **Color:** Red and white mixture (Young and mature)  
 457 **Length:** 4.8cm  
 458 **Width:** 5.3cm  
 459 **Spore bearing surface under cap:** Gills  
 460 **Spore diameter (Average):** Length: 8.78µm; Width: 7.6µm  
 461 **Spore shape:** Single walled, smooth and spherical  
 462 **Cap of the carpophore:** Size: 6.0cm × 5.3cm; Shape: Convex  
 463 **Pileus:** Color: Reddish; Surface character and Zonation: Dry and rough in nature; Margin: Regular  
 464 **Texture of the fruiting body:** Soft and spongy  
 465 **Flesh odor:** Aromatic  
 466 **Lamellae:** Present; Gill attachment: Free and some are emarginated; Gill color: White; Gill shape:  
 467 Broad; Gill spacing: Close; Lamellulae: Present; Forking pattern: Unbranched  
 468 **Stipe:** Present; Size: 3.8cm; Shape: Bare; Position: Central; Surface characteristics: Dry and  
 469 polished; Color: Creamy; Firmness: Tubular and fleshy  
 470 **Ecological features:** Locality found: Sujanagar, Pabna; Habitat: On soil; in an association with the  
 471 Golden shower (*Acacia auriculiformis*) tree; Habit: Scattered; Type of association: Close; Forest type:  
 472 Leveled; Constancy of occurrence in specific Habitat: Un-abundant; Type of soil: Loam; Weather at  
 473 the time of collection: Moderately moist weather  
 474  
 475 **Genus:** *Termitomyces* sp.  
 476 *Termitomyces heimii*  
 477 **Family:** Lyophyllaceae  
 478 **Color:** White (Young and mature)  
 479 **Length:** 21.1cm  
 480 **Width:** 12cm  
 481 **Spore bearing surface under cap:** Gills  
 482 **Spore diameter (Average):** Length: 14.0µm; Width: 10.8µm  
 483 **Spore shape:** Single walled, smooth and cylindrical as well as ellipsoid  
 484 **Cap of the carpophore:** Size: 12cm; Shape: Convex  
 485 **Pileus:** Color: Creamy; Surface character and Zonation: Smooth and dry in nature; Margin: Regular  
 486 **Texture of the fruiting body:** Soft and spongy  
 487 **Flesh odor:** Fragrant  
 488 **Lamellae:** Present; Gill attachment: Adnexed; Gill color: White; Gill shape: Broad; Gill spacing:  
 489 Crowded; Lamellulae: Present; Forking pattern: Unbranched

490 **Stipe:** Present; Size: 20.0cm; Shape: Bulbous; Position: Central; Surface characteristics: Dry and  
 491 polished; Color: Creamy; Firmness: Solid; Scale: Present and white in color  
 492 **Ecological features:** Locality found: Dinajpursadar, Habitat: On humus; near the mango (*Magifera*  
 493 *indica*) tree; Habit: Scattered; Type of association: Distant; Forest type: Leveled; Constancy of  
 494 occurrence in specific habitat: Un-abundant; Type of soil: Clay loam; Weather at the time of collection:  
 495 More moist weather  
 496  
 497 **Genus:** *Amanita* sp.  
 498 *Amanita muscaria*  
 499 **Family:** Amanitaceae  
 500 **Common name:** Fly agaric  
 501 **Color:** Red (Young and mature)  
 502 **Length:** 4.2cm  
 503 **Width:** 2.5cm  
 504 **Spore bearing surface under cap:** Gills  
 505 **Spore diameter (Average):** Length: 4.8µm; Width: 3.28µm  
 506 **Spore shape:** Single walled, smooth and ellipsoid  
 507 **Cap of the carpophore:** Size: 2.5cm; Shape: Convex  
 508 **Pileus:** Color: Pinkish; Surface character and Zonation: Smooth and dry in nature; Margin: Regular  
 509 **Texture of the fruiting body:** Spongy  
 510 **Flesh odor:** Pleasant  
 511 **Lamellae:** Present; Gill attachment: Free; Gill color: White; Gill shape: Moderately broad; Gill spacing:  
 512 Crowded; Lamellulae: Present; Forking pattern: Branched  
 513 **Stipe:** Present; Size: 4.3cm; Shape: Equal; Position: Central; Surface characteristics: Dry and  
 514 polished; Color: Pinkish; Firmness: Solid; Annulus (position): Present and single; Scale: Present and  
 515 reddish to pinkish in color  
 516 **Ecological features:** Locality found: Sher-e-Bangla Nagar, Dhaka; Habitat: On humus; Habit:  
 517 Scattered; Forest type: Leveled; Constancy of occurrence in specific habitat: Un-abundant; Type of  
 518 soil: Loam; Weather at the time of collection: Moderately moist weather  
 519  
 520 **Genus:** *Marasmius* sp.  
 521 *Marasmius confertus*  
 522 **Family:** Marasmiaceae  
 523 **Color:** Pink and purple (Young and mature)  
 524 **Length:** 5.5cm  
 525 **Width:** 2.1cm  
 526 **Spore bearing surface under cap:** Gills  
 527 **Spore diameter (Average):** Length: 4.28µm; Width: 3.9µm  
 528 **Spore shape:** Single walled, smooth and oval  
 529 **Cap of the carpophore:** Size: 1.8cm to 2.1cm; Shape: Flat

530 **Pileus:** Color: Pinkish; Surface character and Zonation: Glabrous and dry in nature; Margin: Incurved  
 531 **Texture of the fruiting body:** Soft  
 532 **Flesh odor:** Pleasant  
 533 **Lamellae:** Present; Gill attachment: Adnexed; Gill color: White; Gill shape: Moderately broad; Gill  
 534 spacing: Crowded; Lamellulae: Present; Forking pattern: Unbranched  
 535 **Stipe:** Present; Size: 5.0cm; Shape: Radicating; Position: Central; Surface characteristics: Dry and  
 536 glabrous; Color: White to pinkish; Firmness: Narrow  
 537 **Ecological features:** Locality found: Sher-e-Bangla Nagar, Dhaka; Habitat: On humus; Habit:  
 538 Solitary; Forest type: Leveled; Constancy of occurrence in specific habitat: Abundant; Type of soil:  
 539 Loam; Weather at the time of collection: Moist weather  
 540  
 541 ***Marasmius elegans***  
 542 **Family:** Marasmiaceae  
 543 **Common name:** Velvet parachute  
 544 **Color:** Pink and purple (Young and mature)  
 545 **Length:** 4.5cm  
 546 **Width:** 1.3cm  
 547 **Spore bearing surface under cap:** Gills  
 548 **Cap of the carpophore:** Size: 1.3cm; Shape: Convex  
 549 **Pileus:** Color: Brownish; Surface character and Zonation: Smooth; Margin: Regular  
 550 **Texture of the fruiting body:** Soft and spongy  
 551 **Flesh odor:** Pleasant  
 552 **Lamellae:** Present; Gill attachment: Adnate; Gill color: Pale reddish; Gill shape: Narrow; Gill spacing:  
 553 Close; Lamellulae: Present; Forking pattern: Branched  
 554 **Stipe:** Present; Size: 4.5cm to 4.8cm; Shape: Bare; Position: Central; Surface characteristics: Dry  
 555 and glabrous; Color: White to light brown; Firmness: Solid  
 556 **Ecological features:** Locality found: Ramna park, Dhaka; Habitat: On humus; Habit: Scattered;  
 557 Forest type: Leveled; Constancy of occurrence in habitat: Abundant; Type of soil: Loam; Weather at  
 558 the time of collection: Moist weather  
 559  
 560 ***Marasmius oreades***  
 561 **Family:** Marasmiaceae  
 562 **Common name:** California fungi or Scotch bonnet  
 563 **Color:** Brown (Young and mature)  
 564 **Length:** 2.2cm to 2.5cm  
 565 **Width:** 1.3cm to 1.4cm  
 566 **Spore bearing surface under cap:** Gills  
 567 **Spore diameter (Average):** Length: 11.05µm; Width: 7.75µm  
 568 **Spore shape:** Single walled, smooth and ellipsoid  
 569 **Cap of the carpophore:** Size: 1.2cm to 1.5cm; Shape: Convex

570 **Pileus:** Color: Brownish; Surface character and Zonation: Glabrous and dry in nature; Margin:  
 571 Regular  
 572 **Texture of the fruiting body:** Soft  
 573 **Flesh odor:** Pleasant  
 574 **Lamellae:** Present; Gill attachment: Adnate; Gill color: Pale brown; Gill shape: Narrow; Gill spacing:  
 575 Close; Lamellulae: Present; Forking pattern: Branched  
 576 **Stipe:** Present; Size: 2.2cm to 2.5cm; Shape: Bare; Position: Central; Surface characteristics: Dry and  
 577 glabrous; Color: Grey to light brown; Firmness: Solid  
 578 **Umbo:** Present and oyster shaped  
 579 **Ecological features:** Locality found: Ramna park, Dhaka; Habitat: On bark wood of the tree; Habit:  
 580 Solitary; Type of association: Close; Forest type: Leveled; Constancy of occurrence in specific habitat:  
 581 Un-abundant; Type of soil: Loam; Weather at the time of collection: Moist weather  
 582  
 583 **Genus:** *Collybia* sp.  
 584 *Collybia cookei*  
 585 **Family:** Tricholomataceae  
 586 **Color:** White (Young and mature)  
 587 **Length:** 5.0cm  
 588 **Width:** 2.5cm  
 589 **Spore bearing surface under cap:** Gills  
 590 **Spore diameter (Average):** Length: 7.8µm; Width: 6.46µm  
 591 **Spore shape:** Single walled, smooth and elongated  
 592 **Cap of the carpophore:** Size: 1.5cm to 2.5cm; Shape: Convex  
 593 **Pileus:** Color: White; Surface character and Zonation: Smooth; Margin: Regular  
 594 **Texture of the fruiting body:** Spongy  
 595 **Flesh odor:** Fragrant  
 596 **Lamellae:** Present; Gill attachment: Adnate; Gill color: White; Gill shape: Moderately broad; Gill  
 597 spacing: Crowded; Lamellulae: Present; Forking pattern: Unbranched  
 598 **Stipe:** Present; Size: 4.5cm to 5.0cm; Shape: Bare; Position: Central; Surface characteristics: Dry and  
 599 glabrous; Color: White; Firmness: Solid  
 600 **Ecological features:** Locality found: Sher-e-Bangla Nagar, Dhaka; Habitat: On the bark wood of the  
 601 tree; in an association with the Mahogany (*Swieteniamahogani*) and Eucalyptus (*Eucalyptus*  
 602 *citriodora*) tree; Habit: Solitary; Type of association: Close; Forest type: Leveled; Constancy of  
 603 occurrence in specific habitat: Abundant; Type of soil: Loam; Weather at the time of collection: Moist  
 604 weather  
 605  
 606 **Genus:** *Mycena* sp.  
 607 *Mycena alba*  
 608 **Family:** Mycenaceae  
 609 **Common name:** Tropical white mushroom

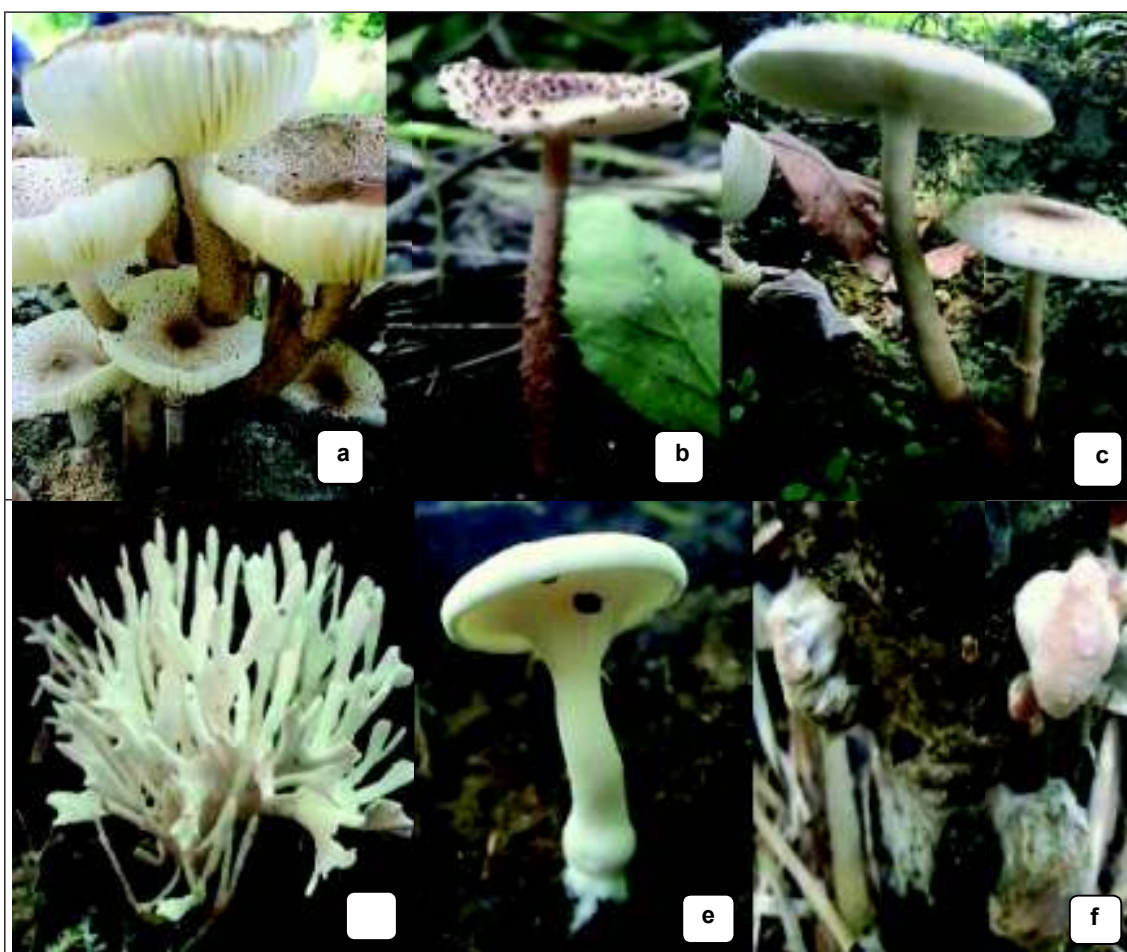
610 **Color:** White (Young and mature)  
 611 **Length:** 1.0cm  
 612 **Width:** 2.1cm  
 613 **Spore bearing surface under cap:** Gills  
 614 **Spore diameter (Average):** Length: 5.32µm; Width: 4.43µm  
 615 **Spore shape:** Single walled, smooth and elongated  
 616 **Cap of the carpophore:** Size: 2.0cm to 2.1cm, Shape: Conical  
 617 **Pileus:** Color: Creamy, Surface character and Zonation: Smooth, Margin: Regular  
 618 **Texture of the fruiting body:** Soft and spongy  
 619 **Flesh odor:** Fragrant  
 620 **Lamellae:** Present; Gill attachment: Adnate; Gill color: White; Gill shape: Moderately broad; Gill  
 621 spacing: Close; Lamellulae: Present; Forking pattern: Branched  
 622 **Stipe:** Present; Size: 1.0cm; Shape: Bare; Position: Lateral; Surface characteristics: Dry and polished;  
 623 Color: White and creamy; Firmness: Solid  
 624 **Ecological features:** Locality found: Botanical garden, Mirpur, Dhaka; Habitat: On bark wood of the  
 625 tree; in an association with the Mahogany (*Swietenia mahogani*) and Eucalyptus (*Eucalyptus*  
 626 *citriodora*) tree; Habit: Solitary; Type of association: Close; Forest type: Leveled; Constancy of  
 627 occurrence in specific habitat: Un-abundant; Type of soil: Loam; Weather at the time of collection:  
 628 Moderately moist weather  
 629

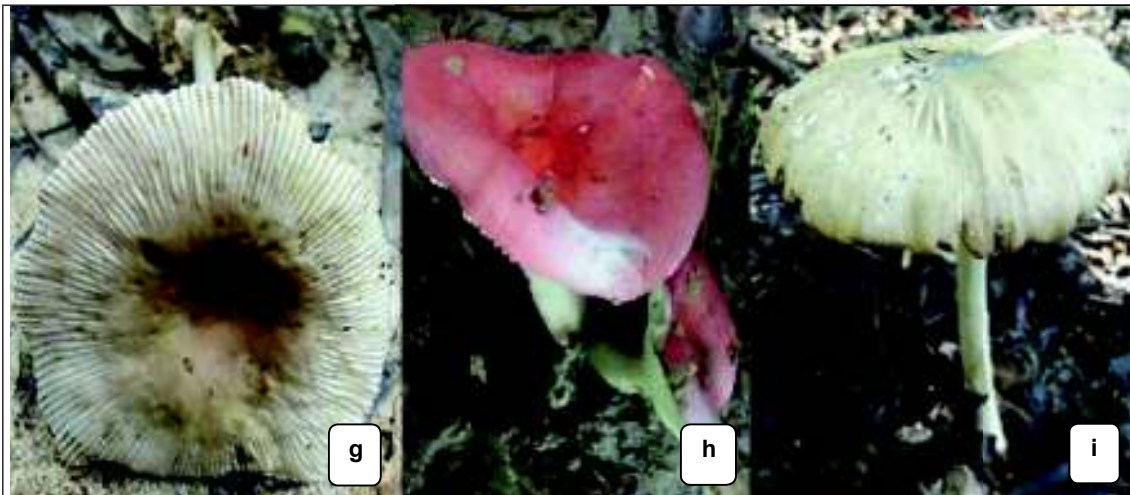




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631 Figure 2: Fruiting body of collected mushrooms; a. *Ganoderma lucidum*; b. *Ganoderma boninense*  
 632 (Growing stage); c. *Ganoderma tsugae*; d. *Ganoderma zonatum* (Young stage); e. *Ganoderma*  
 633 *applanatum*; f. *Ganoderma resinaceum*; g. *Hebeloma crustuliniforme*; h. *Craterellus cornucopioides*; i.  
 634 *Lepiota americana*





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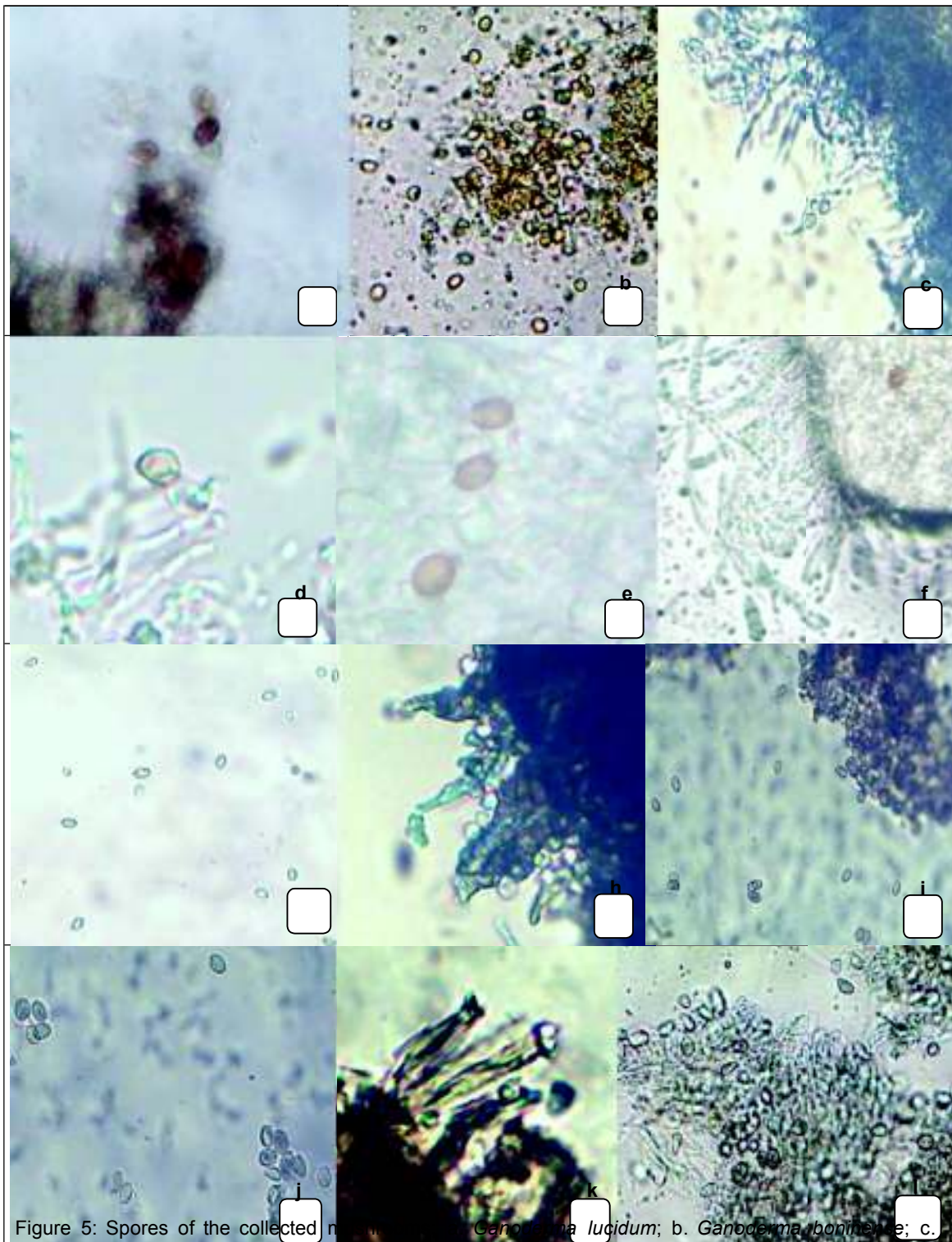
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Figure 3: Fruiting body of collected mushrooms; a. *Lepiota helveola*; b. *Lepiota aspera*; c. *Macrolepiota procera*; d. *Ramariopsis kunzei*; e. *Ampulloclitocybe clavipes*; f. *Lycoperdon pyriforme*; g. *Volvariella gloiocephala*; h. *Russula nobilis*; i. *Termitomyces heimii*

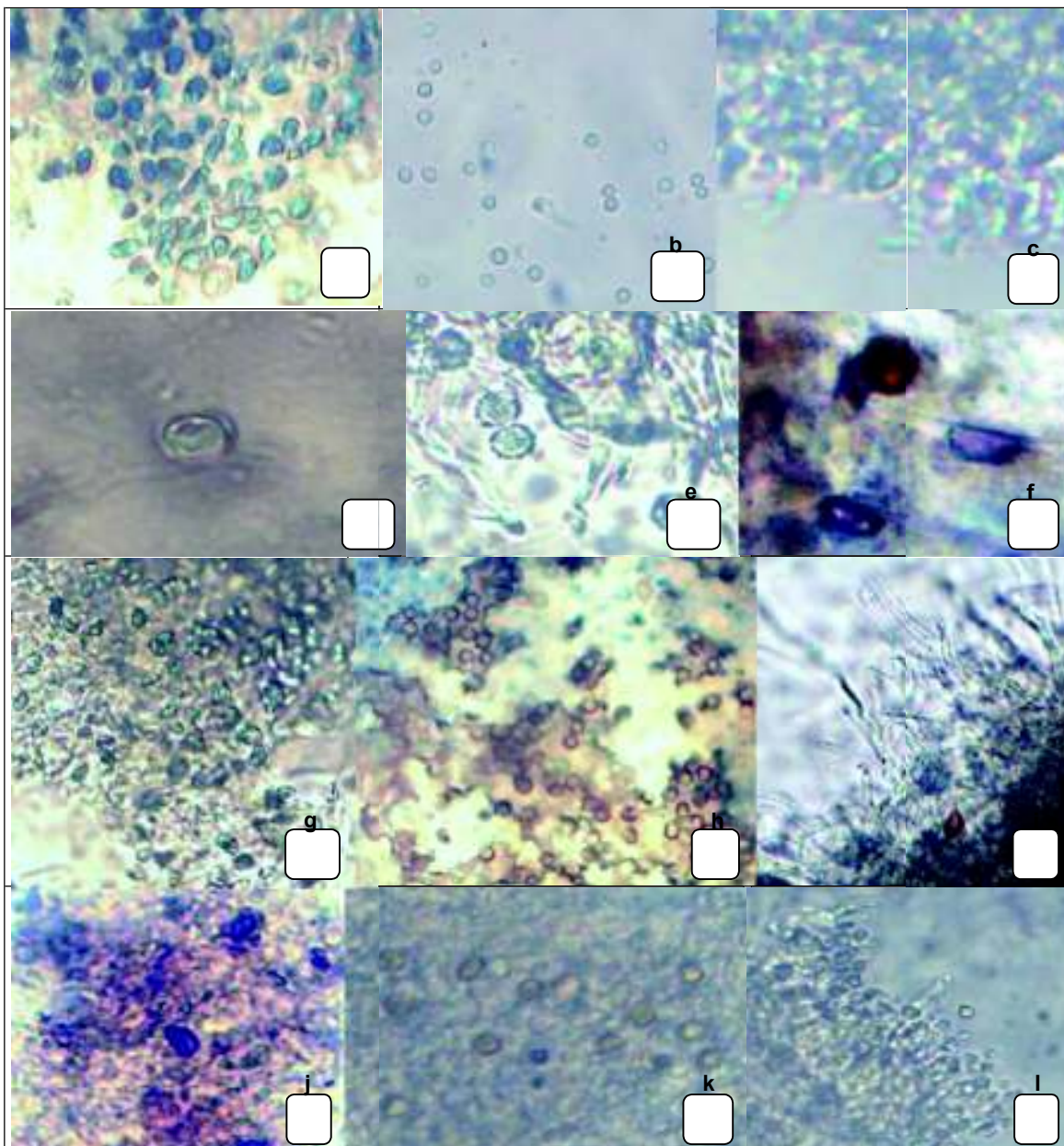


640 Figure 4: Fruiting body of collected mushrooms; a. *Amanita muscaria*; b. *Marasmius confertus*; c.  
641 *Marasmius elegans*; d. *Marasmius oreades*; e. *Collybia cookie*; f. *Mycena alba*  
642



643 Figure 5: Spores of the collected mushrooms; a. *Ganoderma lucidum*; b. *Ganoderma boninense*; c.  
644 *Ganoderma tsugae*; d. *Ganoderma zonatum*; e. *Ganoderma applanatum*; f. *Ganoderma resinaceum*;

645 g. *Hebeloma crustuliniforme*; h. *Craterellus cornucopioides*; i. *Lepiota americana*; j. *Lepiota helveola*,  
646 k. *Lepiota aspera*; l. *Macrolepiota procera*



647  
648 Figure 6: Spores of the collected mushrooms; a. *Ramariopsis kunzei*; b. *Ampulloclitocybe clavipes*; c.  
649 *Lycoperdon pyriforme*; d. *Volvariella gloiocephala*; e. *Russula nobilis*; f. *Termitomyces heimii*; g.  
650 *Amanita muscaria*; h. *Marasmius confertus*; i. *Marasmius elegans*; j. *Marasmius oreades*; k. *Collybia*  
651 *cookie*; l. *Mycena alba*

#### 652 4. Discussion

653 Mushrooms alone are represented by about 41,000 species [13]. Due to their beneficial properties as  
654 well as the economic importance, it increases the interest to the modern research. The occurrence of  
655 such familiar substrate as wood, litter and soil, implies a role for them in these micro habitats [14].

Usually in the rainy season (July to October), fleshy 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, along or soil, humus, dung, saw dust, charcoal heaps etc. [15].

An investigation was carried out to collect identify and preserve mushrooms from the tropical moist deciduous forest region in Bangladesh. Through this investigation, 14 genera and 24 species were identified including 6 species of *Ganoderma*, 4 species of *Lepiota*, 3 species of *Marasmius* and 1 species of each of the genera of *Collybia*, *Hebeloma*, *Craterellus*, *Ramariopsis*, *Ampulloclitocybe*, *Lycoperdon*, *Volvariella*, *Russula*, *Termitomyces*, *Amanita* and *Mycena*.

*Ganoderma* sp. was found at Rajshahi, Pabna, Jaipurhat and Dhaka district of the tropical moist deciduous forest region in Bangladesh. It was first found in 1905 by American mycologist named William Murrill [16]. This species was also reported in China [17] and India [18, 19, 20, 21]. Furthermore, *Ganoderma lucidum* and *Ganoderma appalantum* both were reported in India and Nigeria [19, 22,23] whereas, *Ganoderma boninense* and *Ganoderma tsugae* were reported by Hushiarian *et al.* [24] and Vyas *et al.* [25] accordingly. On the other hand, *Ganoderma resinaceum* was also reported by Mohanty *et al.* in India [26]. *Hebeloma* sp. was found at Dhaka district of the tropical moist deciduous forest region in Bangladesh, whereas, it was also common all over the world especially in Western Australia. It was also reported in the western United States [27]. The similar type of *Hebeloma crustuliniforme* was also reported by both Geml *et al.* and Romano *et al.* [28, 29]. Meanwhile, *Craterellus* sp. was found at Dhaka district whereas, the genus was described by some other researchers [30]. Later on the genus was more specified by the DNA studies [31]. During the investigation all *Lepiota* species were found at Dhaka district of Bangladesh, whereas, around 400 species were already identified all over the world and most of them are poisonous. The species was first reported in South Africa [32] and also reported in India [19, 20]. Furthermore, the similar genus of *Lepiota americana* was reported in India [33]. *Lepiota hevelvo* was reported by Sysouphanthong *et al.* [34]. On the other hand, *Lepiota aspera* was also reported from India and Philippines [34, 35] and *Macrolepiota procera* was reported in India and Burma [34, 36] as well. Throughout the investigation, *Ramariopsis* sp. was found in Dhaka district of the tropical moist deciduous forest region in Bangladesh. This genus has a widespread distribution and contains 44 species [37]. Two species of this genus were reported in Western Ghats, Kerala, India [38] whereas, *Ramariopsis kunzei* was also reported in Northeast Ohio [39].

*Ampulloclitocybe* sp., *Lycoperdon* sp. and *Volvariella* sp., were collected from Dhaka district of the tropical moist deciduous forest region in Bangladesh. The genus *Ampulloclitocybe* has three species and widely distributed [37] whereas, *Ampulloclitocybe clavipes* was also reported by Matheny *et al.* [40]. Recently, *Volvariella* sp. and *Lycoperdon* sp. were also reported from India [41, 20]. Furthermore, *Russula* sp., *Termitomyces* sp. and *Amanita* sp. were found to be distributed at Pabna, Dinajpur and Dhaka district respectively. The genera *Amanita* and *Russula* were reported in India [19,

20, 38], whereas, *Termitomyces* sp. was circumscribed by Roger Heim [42]. *Termitomyces* sp. was also found in India [20] and the morphological characterization and yield potential of *Termitomyces* sp. mushroom was studied at Gorakhpur forest division in India [43]. On the other hand, the similar genus of *Russula nobilis* and *Termitomyces hemii* species were reported by Pala *et al.* [44] and Dwivedi *et al.* [19] respectively. Furthermore, *Amanita muscaria* was also reported by Hawkeswood [45], Michelot and Melendez-howell [46] and Pala *et al.* [44].

In the Dhaka district of the tropical moist deciduous forest region in Bangladesh, all the three species of *Marasmius* sp. were found. It was also reported in Madagascar and Mascarenes by Antonín and Buyck [47]. The similar genus of *Marasmius confertus* and *Marasmius elegans* were also reported by Farook *et al.* [48] and Horton [49] accordingly. Furthermore, *Collybia* sp. and *Mycena* sp. was also found at Dhaka district of the tropical moist deciduous forest region in Bangladesh throughout the investigation. However, the genera *Collybia* and *Mycena* have nearly 3 species and 33 species, respectively [50]. The genus *Collybia* sp. has a widespread but rarely distributed in north temperate areas [51]. On the other hand, *Mycena* sp. was also reported in India [20].

## 5. Conclusion

The survey of different locations was done in rainy season. Most mushrooms are found in forest area, in field area, on branches of trees, and some time in waste land area; although they may be found throughout the year. This is the first investigation of mushroom biodiversity at tropical moist deciduous forest region of Bangladesh. Future investigation is also needed in different seasons as well as in different forest regions to identify the new exotic species of mushroom flora, which will represent a complete overview about the available mushroom flora in Bangladesh.

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