

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

M. I. Romainul¹, F. M. Aminuzzaman^{2*} and M. S. M. Chowdhury³

^{1, 2, 3} Department of Plant Pathology, Faculty of Agriculture, Sher-e-Bangla Agricultural University, Sher-e-Bangla Nagar, Dhaka-1207, Bangladesh

Authors' contributions

This work was carried out in collaboration with all authors. Author MIR carried out the research and wrote the first draft of the manuscript. FMA designed, supervised and edited the manuscript. All authors read and approved the final manuscript.

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.

Keywords: Tropical moist deciduous forest, Biodiversity, Mushroom, Bangladesh

*Corresponding author E-mail: aminsaupp@yahoo.com;

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 found 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 hectares about 0.81% of total landmass of the country and 7.8% of the country's forest land are bestowed with tropical moist deciduous forests. Tropical moist deciduous forest region is under about 80% of Bangladesh's rainfalls 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 4,780mm (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, morphologically characterize 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 to October, 2013 and 2014. The survey was conducted in Dhaka, Gazipur, Bogra, Rajshahi, Pabna, Jaipurhat, and Dinajpur biosphere reserved areas, which are 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

70 meters (78 ft.). Rajshahi is located at 24°22'00" N (Latitude), 88°36'00" E (Longitude) and it has an
 71 average elevation of 31 meters (101 ft.). Pabna is located at 24°00'00" N (Latitude), 89°15'00" E
 72 (Longitude) and it has an average elevation of 8 meters (26 ft.). Jaipurhat is located at 25.1° N
 73 (Latitude), 89.02° E (Longitude) and it has an average elevation of 29 meters (94.25 ft.). Dinajpur is
 74 located at 25°37'37" N (Latitude), 88°38'19" E (Longitude) and it has an average elevation of 34
 75 meters (111 ft.). The collection sites were forests, university campus, residential area, botanical
 76 garden, parks and nearby villages of those above mentioned areas of tropical moist deciduous forest
 77 region (Figure 1).

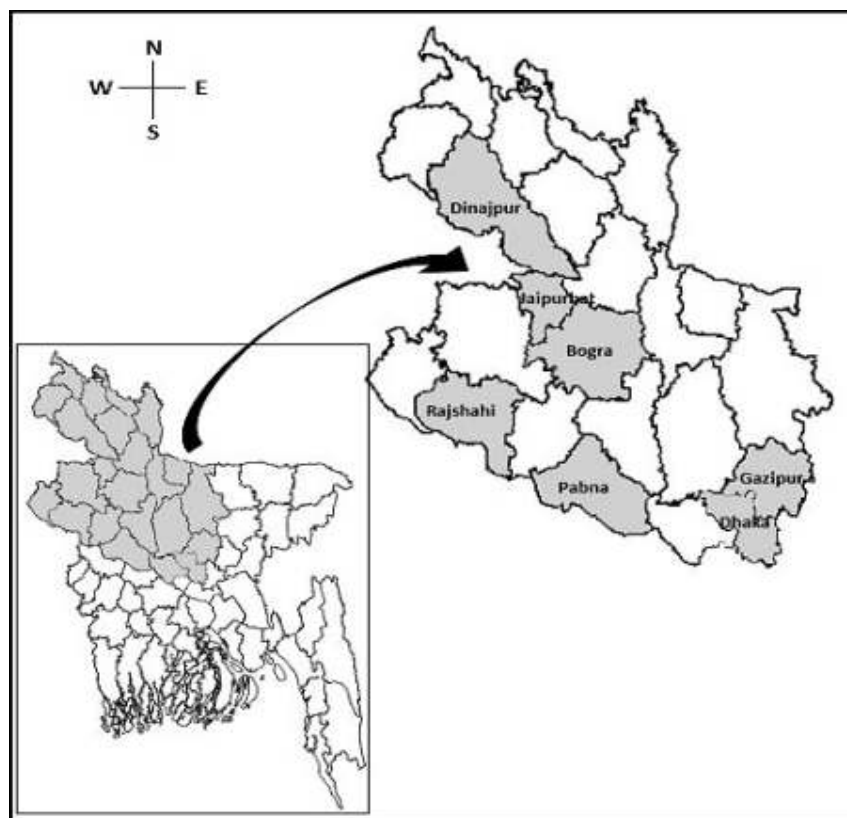


Figure 1: Survey area of tropical moist deciduous forest region of Bangladesh

82 **2.2. Collection of mushroom samples:** The collection was made following the method of Hailing
 83 [4]. Systematic and periodical survey of different locations and other habitats were done in the tropical
 84 moist deciduous forest region of the country. Necessary materials and equipment such as isolation kit,
 85 slants, isolation chamber, data recording sheet, digital camera for photography, digging equipment,
 86 heat convector card board were arranged and collection of samples were usually made during day
 87 time and field characteristics of mushrooms were recorded in the data sheet which was prepared
 88 following Molina *et al.*, [5]. Then the specimens were dried in hot air oven at 40-50°C and stored in air
 89 tight containers with silica gel for further microscopic studies. Spotted mushrooms were minutely
 90 inspected in their natural habitats and brought to laboratory for detailed study. Photographs were
 91 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 spores 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., *Collybia* sp. and *Mycena* sp. These genera are 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-Ilpil (*Leucaena leucocephala*) and Golden shower (*Acacia auriculiformis*) trees; Habit: Scattered; Type of association: Root associated; Forest

131 type: Leveled; Constancy of occurrence in specific habitat: Abundant; Type of soil: Sandy soil in
132 nature; Weather at the time of collection: Literally dry weather around the habitat

133

134 ***Ganoderma boninense***

135 **Family:** Ganodermataceae

136 **Common name:** Young resinous polypore mushroom

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

138 **Length:** 07cm

139 **Width:** 0.9cm

140 **Spore diameter (Average):** Length: 4.9µm; Width: 4.12µm

141 **Spore shape:** Single walled, smooth and more or less circular

142 **Cap of the carpophore:** Size: 7.0 cm x 5.3cm; Shape: Flat

143 **Pileus:** Color: Center is orange in color with white boarder; Margin: Regular in shape

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

145 **Flesh odor:** Unpleasant

146 **Ecological features:** Locality found: Rajshahi University, Rajshahi, Tropical Moist Deciduous Forest
147 region, Bangladesh; Habitat: On root of the Bamboo (*Bambuseae*) tree; Habit: Caespitose cluster and
148 closely merged with the root; Type of association: Root associated; Forest type: Leveled; Constancy
149 of occurrence in specific habitat: **Not abundant**; Type of soil: Loamy soil in nature; Weather at the time
150 of collection: Less moist weather around the habitat

151

152 ***Ganoderma tsugae***

153 **Family:** Ganodermataceae

154 **Common name:** Reishi mushroom

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

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

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

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

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

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

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

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

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

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

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

167 **Ecological features:** Locality found: Sujanagar, Pabna; Nature: Saprotrophic or parasitic; Habitat: On
168 soil, in the bark of Golden shower (*Acacia auriculiformis*) tree; Habit: Scattered; Type of association:
169 Closely root associated; Forest type: Leveled; Constancy of occurrence in specific habitat: Abundant;

170 Type of soil: loamy soil in nature; Weather at the time of collection: Literally dry weather around the
171 habitat

172

173 ***Ganoderma zonatum***

174 **Family:** Ganodermataceae

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

176 **Color:** Young: White

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

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

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

180 **Spore diameter (Average):** Length: 6.63µm; Width: 4.47µm

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

182 **Pileus:** Color: Milky white to Creamy; Surface character and Zonation: Dry in nature

183 **Texture of the fruiting body:** Woody

184 **Flesh odor:** Pleasant

185 **Lamellae:** Absent; Pores color: Milky white in color; Pores shape: Broad; Pores spacing: Crowded;

186 Firmness: Solid or somewhat in fleshy

187 **Ecological features:** Locality found: Kalai, Jaipurhat; Nature: Parasitic; Habitat: On bark of the tree,

188 in an association with the Mahogany (*Swietenia mahogany*) trees; Habit: Closely associated on the

189 bark of the tree; Type of association: Scattered and somewhat caespitose cluster; Forest type:

190 Leveled; Constancy of occurrence in specific habitat: Not in abundant; Type of soil: Clay loam soil in

191 nature; Weather at the time of collection: Moderate moist weather around the habitat

192

193 ***Ganoderma applanatum***

194 **Family:** Ganodermataceae

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

196 **Color:** Mature: Red with white color pores

197 **Length (Mature):** 6.4cm

198 **Width (Mature):** 3.5cm

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

200 **Spore diameter (Average):** Length: 7.46µm; Width: 6.0µm

201 **Spore shape:** Single walled, smooth and oblong or spherical

202 **Pileus:** Surface character and Zonation: Dry in nature; Margin: Incurved in shape

203 **Texture of the fruiting body:** Woody

204 **Flesh odor:** Disagreeable

205 **Pores color:** White

206 **Ecological features:** Locality found: Kalai, Jaipurhat; Nature: Parasitic; Habitat: On bark wood of the

207 tree, in an association with the Golden shower (*Acacia auriculiformis*) tree; Habit: Scattered; Type of

208 association: Closely associated; Forest type: Leveled; Constancy of occurrence in specific habitat:

209 Un-abundant; Type of soil: Loamy soil in nature; Weather at the time of collection: Moist weather
 210 around the habitat
 211
 212 ***Ganoderma resinaceum***
 213 **Family:** Ganodermataceae
 214 **Common name:** Bracket fungi or Reishi mushroom
 215 **Color:** Blackish with grayish color boarder (Mature)
 216 **Length:** Mature:06cm; Young: 05cm
 217 **Width:** Mature: 4.1cm; Young: 3.2cm
 218 **Spore bearing surface under cap:** Pores on hymenium
 219 **Spore diameter (Average):** Length: 14.9µm; Width: 10.0µm
 220 **Spore shape:** Single walled, smooth and ellipsoidal
 221 **Pileus:** Color: Whitish to Creamy; Surface character and Zonation: Smooth, leathery and moist in
 222 nature; Margin: Regular in shape
 223 **Texture of the fruiting body:** Spongy, leathery and woody
 224 **Flesh odor:** Unpleasant
 225 **Lamellae:** Absent; Pores color: White in color; Pores spacing: Crowded
 226 **Ecological features:** Locality found: Kalai, Jaipurhat; Habitat: On bark wood of the tree, in an close
 227 association with the Golden shower (*Acacia auriculiformis*) trees; Habit: Scattered; Type of
 228 association: Closely associated; Forest type: Leveled; Constancy of occurrence in specific habitat:
 229 Un-abundant; Type of soil: Loamy soil in nature; Weather at the time of collection: Moderately moist
 230 weather around the habitat
 231
 232 **Genus:** *Hebeloma* sp.
 233 *Hebeloma crustuliniforme*
 234 **Family:** Hymenogastraceae
 235 **Common name:** Poison pie or fairy cakes
 236 **Color:** White (Young); Creamy (Mature)
 237 **Length:** Mature: 6.2cm; Young: 3.7cm
 238 **Width:** Mature: 3.3cm; Young: 1.2cm
 239 **Spore bearing surface under cap:** Gills
 240 **Spore diameter (Average):** Length: 5.85µm; Width: 3.7µm
 241 **Spore shape:** Single walled, smooth and ellipsoidal
 242 **Cap of the carpophore:** Size: Mature: 3.3cm; Young: 1.2cm; Shape: Umbonateand flatten
 243 **Pileus:** Color: Creamy; Surface character and Zonation: Smooth and dry in nature; Margin: Regular
 244 **Texture of the fruiting body:** Soft and spongy
 245 **Flesh odor:** Pleasant
 246 **Lamellae:** Present; Gill attachment: Adnate; Gill color: Yellowish white; Gill shape and width:
 247 Moderately broad; Gill spacing: Close; Lamellulae: Present; Forking pattern: Branched

248 **Stipe:** Present; Size: Mature: 3.9cm; Shape: Bare; Position: Central; Surface characteristics: Dry and
 249 polished; Color: Creamy; Firmness: Solid but fleshy

250 **Ecological features:** Locality found: Botanical garden, Mirpur, Dhaka; Habitat: On soil and root of the
 251 tree; in an association with the stem of Bamboo (*Bambuseae*) tree; Habit: Scattered; Type of
 252 association: Close; Forest type: Leveled; Constancy of occurrence in specific habitat: Un-abundant;
 253 Type of soil: Sandy; Weather at the time of collection: Less moist weather

254

255 **Genus:** *Craterellus* sp.
 256 *Craterellus cornucopioides*

257 **Family:** Cantharellaceae

258 **Common name:** Black trumpet mushroom

259 **Color:** Violet (Young); Black with whitish color boarder (Mature)

260 **Length (Mature):** 7.4cm

261 **Width (Mature):** 3.8cm

262 **Spore diameter (Average):** Length: 4.46µm; Width: 3.96µm

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

264 **Cap of the carpophore:** Size: 3.4cm × 2.6cm; Shape: Infundibular

265 **Pileus:** Color: Pinkish and somewhat mixed; Surface character and Zonation: Smooth, leathery,
 266 sticky and moist; Margin: Incurved

267 **Texture of the fruiting body:** Brittle but moist in nature

268 **Flesh odor:** Pleasant

269 **Ecological features:** Locality found: Botanical garden, Mirpur, Dhaka; Habitat: On soil and root of the
 270 tree; in an association with the stem of Bamboo (*Bambuseae*) tree; Habit: Scattered; Type of
 271 association: Close; Forest type: Leveled; Constancy of occurrence in specific habitat: Un-abundant;
 272 Type of soil: Sandy; Weather at the time of collection: Moist weather

273

274 **Genus:** *Lepiota* sp.
 275 *Lepiota americana*

276 **Family:** Agaricaceae

277 **Common name:** Rogers mushroom

278 **Color:** Brown (Young); Brown or dark brown having pinkish spots or scales (Mature); Color changed
 279 from dark brown to black in the border region after one hour of collection

280 **Length:** Mature: 3.0cm to 4.5cm; Young: 4.0cm

281 **Width:** Mature: 3.8cm to 5.1cm; Young: 1.8cm

282 **Spore bearing surface under cap:** Gills

283 **Spore diameter (Average):** Length: 6.28µm; Width: 4.32µm

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

285 **Cap of the carpophore:** Size (Mature): 3.8cm to 5.1cm; Shape: Convex

286 **Pileus:** Color: Pinkish, brownish or mixed; Surface character and Zonation: Smooth and dry in nature;
 287 Margin: Regular

288 **Texture of the fruiting body:** Soft and spongy
 289 **Flesh odor:** Pleasant
 290 **Lamellae:** Present; Gill attachment: Emarginated; Gill color: Light brown; Gill shape: Broad; Gill
 291 spacing: Close; Lamellulae: Present; Forking pattern: Unbranched
 292 **Stipe:** Present; Size: 2.4cm × 5.8cm; Shape: Equal; Position: Central; Surface characteristics: Dry,
 293 glabrous and polished; Color: Grey to light brown; Firmness: Tubular
 294 **Annulus (position):** Present and single
 295 **Scale:** Present and brown in color
 296 **Umbo:** Present and convex well shaped
 297 **Ecological features:** Locality found: Botanical garden, Mirpur, Dhaka; Habitat: On soil; in an
 298 association with the mango (*Magifera indica*) tree; pH in soil: 5.6; Moisture: 7.0%; Temperature: 34°C;
 299 Habit: Scattered; Type of association: Distant; Forest type: Leveled; Constancy of occurrence in
 300 specific habitat: Un-abundant; Type of soil: Loam; Weather at the time of collection: Dry weather
 301
 302 ***Lepiota helveola***
 303 **Family:** Agaricaceae
 304 **Color:** White and creamy (Young); White and creamy with dark brown spots on cap and stipe
 305 (Mature)
 306 **Length (Mature):** 13cm to 15cm; Young: 8.0 cm
 307 **Width (Mature):** 6.0cm to 6.3cm; Young: 4.4cm
 308 **Spore bearing surface under cap:** Gills
 309 **Spore diameter (Average):** Length: 8.8µm; Width: 5.88µm
 310 **Spore shape:** Single walled, smooth and ellipsoid
 311 **Cap of the carpophore:** Size: 6.0cm to 6.3cm; Shape: Convex or flat
 312 **Pileus:** Color: White, creamy and brownish with brown spot; Surface character and Zonation:
 313 Smooth, scaly and dry in nature; Margin: Regular
 314 **Texture of the fruiting body:** Soft and spongy
 315 **Flesh odor:** Fragrant
 316 **Lamellae:** Present; Gill attachment: Free; Gill color: White; Gill shape: Broad; Gill spacing: Close;
 317 Lamellulae: Present; Forking pattern: Unbranched
 318 **Stipe:** Present; Size: 10.5cm; Shape: Clavate; Position: Central; Surface characteristics: Dry and
 319 glabrous; Color: Grey to light brown with dark brown spots; Firmness: Tubular;
 320 **Annulus (position):** Present and single
 321 **Scale:** Present and brown in color
 322 **Umbo:** Present and oyster shaped
 323 **Ecological features:** Locality found: Jahangirnagar University, Savar, Dhaka; Habitat: On humus;
 324 Habit: Solitary; Forest type: Mixed; Constancy of occurrence in specific habitat: Abundant; Weather at
 325 the time of collection: Moist weather
 326
 327 ***Lepiota aspera***
 328 **Family:** Agaricaceae

329 **Common name:** Freckled dapperling
 330 **Color:** Brown (Young and maturity)
 331 **Length:** 4.0cm
 332 **Width:** 1.5cm
 333 **Spore bearing surface under cap:** Gills
 334 **Spore diameter (Average):** Length: 3.77µm; Width: 3.6µm
 335 **Spore shape:** Single walled, smooth and cylindrical
 336 **Cap of the carpophore:** Size: 1.5cm; Shape: Campanulate
 337 **Pileus:** Color: Brownish; Surface character and Zonation: Scaly and dry in nature; Margin: Regular
 338 **Texture of the fruiting body:** Soft and spongy
 339 **Flesh odor:** Pleasant
 340 **Lamellae:** Present; Gill attachment: Free; Gill color: Pale light brown; Gill shape: Moderately broad;
 341 Gill spacing: Crowded; Lamellulae: Present; Forking pattern: Branched
 342 **Stipe:** Present; Size: 3.9cm; Shape: Equal; Position: Central; Surface characteristics: Dry but spiny
 343 scale present and pruinose; Color: Grey to light brown; Firmness: Solid
 344 **Ecological features:** Locality found: Sher-e-Bangla Nagar, Dhaka; Habitat: On humus; Habit:
 345 Scattered; Forest type: Leveled; Constancy of occurrence in **specific habitat:** Un-abundant; Type of
 346 soil: Clay loam; Weather at the time of collection: Moist weather
 347
 348 ***Macrolepiota procera***
 349 **Family:** Lepiotaceae
 350 **Color:** Creamy (Young); Creamy with dark brown scale (Mature)
 351 **Length:** 13cm
 352 **Width:** 7.0 cm
 353 **Spore bearing surface under cap:** Gills
 354 **Spore diameter (Average):** Length: 8.82µm; Width: 5.82µm
 355 **Spore shape:** Single walled, smooth and elongated, ellipsoid
 356 **Cap of the carpophore:** Size: Length: 7.0cm; Width: 0.8cm; Shape: Umbonate
 357 **Pileus:** Color: Creamy with spots; Surface character and Zonation: Smooth, scaly and dry in nature;
 358 Margin: Regular
 359 **Texture of the fruiting body:** Soft and spongy
 360 **Flesh odor:** Pleasant
 361 **Lamellae:** Present; Gill attachment: Free; Gill color: Pale white; Gill shape: Broad; Gill spacing: Close;
 362 Lamellulae: Present; Forking pattern: Unbranched
 363 **Stipe:** Present; Size: 11.5cm; Shape: Bulbous; Position: Central; Surface characteristics: Dry and
 364 polished; Color: White to light brown with spots; Firmness: Tubular and fleshy
 365 **Annulus (position):** Present and single
 366 **Scale:** Present and brown in color
 367 **Umbo:** Present and oyster shaped

368 **Ecological features:** Locality found: Jahangirnagar University, Savar, Dhaka; Habitat: On humus;
 369 Habit: Solitary; Forest type: Mixed; Constancy of occurrence in specific habitat: Un-abundant;
 370 Weather at the time of collection: Moist weather
 371

372 **Genus:** *Ramariopsis* sp.
 373 *Ramariopsis kunzei*
 374 **Family:** Clavariaceae
 375 **Common name:** White coral
 376 **Color:** White (Young and mature)
 377 **Length (Mature):** 5.2cm
 378 **Width (Mature):** 2.5 cm
 379 **Spore diameter (Average):** Length: 4.0µm; Width: 3.6µm
 380 **Spore shape:** Single walled, smooth and spherical
 381 **Texture of the fruiting body:** Soft, spongy and brittle
 382 **Flesh odor:** Unpleasant
 383 **Forking pattern:** Branched
 384 **Surface characteristics:** Dry
 385 **Color:** White
 386 **Firmness:** Fistulose and narrow

387 **Ecological features:** Locality found: Botanical garden, Mirpur, Dhaka; Habitat: On soil; in an
 388 association with the Ipil-Ipil (*Leucaena leucocephala*) and Golden shower (*Acacia auriculiformis*);
 389 Habit: Solitary and some others are caespitose cluster; Type of association: Distant and some are
 390 closely crowded; Forest type: Leveled; Constancy of occurrence in specific habitat: Un-abundant;
 391 Type of soil: Sandy; Weather at the time of collection: Moist weather
 392

393 **Genus:** *Ampulloclitocybe* sp.
 394 *Ampulloclitocybe clavipes*
 395 **Family:** Hygrophoraceae
 396 **Common name:** Club footed ditocybe
 397 **Color:** White (Young and mature)
 398 **Length:** Mature: 2.4cm; Young: 1.8cm
 399 **Width:** Mature: 1.4cm; Young: 0.6cm
 400 **Spore bearing surface under cap:** Gills
 401 **Spore diameter (Average):** Length: 4.56µm; Width: 4.56µm
 402 **Spore shape:** Single walled, smooth and spherical
 403 **Cap of the carpophore:** Size: Mature: 1.4cm; Young: 0.6cm; Shape: Ovate
 404 **Pileus:** Color: White; Surface character and Zonation: Smooth and dry in nature; Margin: Regular
 405 **Texture of the fruiting body:** Soft and spongy
 406 **Flesh odor:** Pleasant

407 **Lamellae:** Present; Gill attachment: Free; Gill color: White; Gill shape: Moderately broad; Gill spacing:
 408 Close; Lamellulae: Present; Forking pattern: Unbranched
 409 **Stipe:** Present; Size: 2.4cm; Shape: Bare; Position: Central; Surface characteristics: Dry and
 410 glabrous; Color: White and some became grey to light brown after one hour; Firmness: Solid and
 411 tubular
 412 **Ecological features:** Locality found: Botanical garden, Mirpur, Dhaka; Habitat: On soil; in an
 413 association with the Golden shower (*Acacia auriculiformis*); Habit: Scattered; Type of association:
 414 Distant; Forest type: Mixed; Constancy of occurrence in specific habitat: Un-abundant; Type of soil:
 415 Clay loam; Weather at the time of collection: Moderately moist weather
 416
 417 **Genus:** *Lycoperdon* sp.
 418 *Lycoperdon pyriforme*
 419 **Family:** Lycoperdaceae
 420 **Common name:** Pear-shaped puffball or stump puffball
 421 **Color:** White (Young and mature)
 422 **Length:** 1.15 cm
 423 **Width:** 1.3cm
 424 **Spore diameter (Average):** Length: 5.27µm; Width: 4.07µm
 425 **Spore shape:** Single walled, smooth and ellipsoid
 426 **Cap of the carpophore:** Size: 1.3cm; Shape: Flat
 427 **Pileus:** Color: White; Surface character and Zonation: Smooth
 428 **Texture of the fruiting body:** Soft and spongy
 429 **Flesh odor:** Pleasant
 430 **Firmness:** Solid but fleshy
 431 **Ecological features:** Locality found: Gazipur, Dhaka; Habitat: On bark wood of the tree; in an
 432 association with the stem of Bamboo (*Bambuseae*) tree; Habit: Scattered; Type of association: Close;
 433 Forest type: Leveled; Constancy of occurrence in specific habitat: Un-abundant; Type of soil: Loam;
 434 Weather at the time of collection: Moist weather
 435
 436 **Genus:** *Volvariella* sp.
 437 *Volvariella gloiocephala*
 438 **Family:** Pluteaceae
 439 **Common name:** Big sheath mushroom, rose-gilled grisette, or stubble rosegill
 440 **Color:** White (Young and mature)
 441 **Length:** 10.5cm
 442 **Width:** 6.8cm
 443 **Spore bearing surface under cap:** Gills
 444 **Spore diameter (Average):** Length: 10.5µm; Width: 10.1µm
 445 **Spore shape:** Single walled, smooth and ellipsoidal
 446 **Cap of the carpophore:** Size: 6.8cm; Shape: Ovate or flat

447 **Pileus:** Color: Creamy, brownish and some are mixed; Surface character and Zonation: Smooth and
 448 dry in nature; Margin: Incurved
 449 **Texture of the fruiting body:** Soft and spongy
 450 **Flesh odor:** Disagreeable after half an hour of collection
 451 **Lamellae:** Present; Gill attachment: Free; Gill color: Pale white; Gill shape: Broad; Gill spacing: Close;
 452 Lamellulae: Present; Forking pattern: Branched
 453 **Stipe:** Present; Size: 9.2cm; Shape: Clavate; Position: Central; Surface characteristics: Dry and
 454 glabrous; Color: White to creamy; Firmness: Tubular and narrow
 455 **Volva:** Present
 456 **Ecological features:** Locality found: Sujanagar, Pabna; Habitat: On soil; in an association with the
 457 Mahogany (*Swietenia mahogani*) tree; Habit: Scattered; Type of association: Close; Forest type:
 458 Leveled; Constancy of occurrence in specific habitat: Un-abundant; Type of soil: Loam; Weather at
 459 the time of collection: Moist weather
 460 **Note:** Started rotting after half an hour of collection
 461
 462 **Genus:** *Russula* sp.
 463 *Russula nobilis*
 464 **Family:** Russulaceae
 465 **Common name:** Beechwoodsickener
 466 **Color:** Red and white mixture (Young and mature)
 467 **Length:** 4.8cm
 468 **Width:** 5.3cm
 469 **Spore bearing surface under cap:** Gills
 470 **Spore diameter (Average):** Length: 8.78µm; Width: 7.6µm
 471 **Spore shape:** Single walled, smooth and spherical
 472 **Cap of the carpophore:** Size: 6.0cm × 5.3cm; Shape: Convex
 473 **Pileus:** Color: Reddish; Surface character and Zonation: Dry and rough in nature; Margin: Regular
 474 **Texture of the fruiting body:** Soft and spongy
 475 **Flesh odor:** Aromatic
 476 **Lamellae:** Present; Gill attachment: Free and some are emarginated; Gill color: White; Gill shape:
 477 Broad; Gill spacing: Close; Lamellulae: Present; Forking pattern: Unbranched
 478 **Stipe:** Present; Size: 3.8cm; Shape: Bare; Position: Central; Surface characteristics: Dry and
 479 polished; Color: Creamy; Firmness: Tubular and fleshy
 480 **Ecological features:** Locality found: Sujanagar, Pabna; Habitat: On soil; in an association with the
 481 Golden shower (*Acacia auriculiformis*) tree; Habit: Scattered; Type of association: Close; Forest type:
 482 Leveled; Constancy of occurrence in specific **habitat:** Un-abundant; Type of soil: Loam; Weather at
 483 the time of collection: Moderately moist weather
 484
 485 **Genus:** *Termitomyces* sp.
 486 *Termitomyces heimii*

487 **Family:** Lyophyllaceae
 488 **Color:** White (Young and mature)
 489 **Length:** 21.1cm
 490 **Width:** 12cm
 491 **Spore bearing surface under cap:** Gills
 492 **Spore diameter (Average):** Length: 14.0µm; Width: 10.8µm
 493 **Spore shape:** Single walled, smooth and cylindrical as well as ellipsoid
 494 **Cap of the carpophore:** Size: 12cm; Shape: Convex
 495 **Pileus:** Color: Creamy; Surface character and Zonation: Smooth and dry in nature; Margin: Regular
 496 **Texture of the fruiting body:** Soft and spongy
 497 **Flesh odor:** Fragrant
 498 **Lamellae:** Present; Gill attachment: Adnexed; Gill color: White; Gill shape: Broad; Gill spacing:
 499 Crowded; Lamellulae: Present; Forking pattern: Unbranched
 500 **Stipe:** Present; Size: 20.0cm; Shape: Bulbous; Position: Central; Surface characteristics: Dry and
 501 polished; Color: Creamy; Firmness: Solid; Scale: Present and white in color
 502 **Ecological features:** Locality found: Dinajpur sadar, Habitat: On humus; near the mango (*Mangifera*
 503 *indica*) tree; Habit: Scattered; Type of association: Distant; Forest type: Leveled; Constancy of
 504 occurrence in specific habitat: Un-abundant; Type of soil: Clay loam; Weather at the time of collection:
 505 More moist weather
 506
 507 **Genus:** *Amanita* sp.
 508 *Amanita muscaria*
 509 **Family:** Amanitaceae
 510 **Common name:** Fly agaric
 511 **Color:** Red (Young and mature)
 512 **Length:** 4.2cm
 513 **Width:** 2.5cm
 514 **Spore bearing surface under cap:** Gills
 515 **Spore diameter (Average):** Length: 4.8µm; Width: 3.28µm
 516 **Spore shape:** Single walled, smooth and ellipsoid
 517 **Cap of the carpophore:** Size: 2.5cm; Shape: Convex
 518 **Pileus:** Color: Pinkish; Surface character and Zonation: Smooth and dry in nature; Margin: Regular
 519 **Texture of the fruiting body:** Spongy
 520 **Flesh odor:** Pleasant
 521 **Lamellae:** Present; Gill attachment: Free; Gill color: White; Gill shape: Moderately broad; Gill spacing:
 522 Crowded; Lamellulae: Present; Forking pattern: Branched
 523 **Stipe:** Present; Size: 4.3cm; Shape: Equal; Position: Central; Surface characteristics: Dry and
 524 polished; Color: Pinkish; Firmness: Solid; Annulus (position): Present and single; Scale: Present and
 525 reddish to pinkish in color

526 **Ecological features:** Locality found: Sher-e-Bangla Nagar, Dhaka; Habitat: On humus; Habit:
527 Scattered; Forest type: Leveled; Constancy of occurrence in specific habitat: Un-abundant; Type of
528 soil: Loam; Weather at the time of collection: Moderately moist weather
529
530 **Genus:** *Marasmius* sp.
531 *Marasmius confertus*
532 **Family:** Marasmiaceae
533 **Color:** Pink and purple (Young and mature)
534 **Length:** 5.5cm
535 **Width:** 2.1cm
536 **Spore bearing surface under cap:** Gills
537 **Spore diameter (Average):** Length: 4.28µm; Width: 3.9µm
538 **Spore shape:** Single walled, smooth and oval
539 **Cap of the carpophore:** Size: 1.8cm to 2.1cm; Shape: Flat
540 **Pileus:** Color: Pinkish; Surface character and Zonation: Glabrous and dry in nature; Margin: Incurved
541 **Texture of the fruiting body:** Soft
542 **Flesh odor:** Pleasant
543 **Lamellae:** Present; Gill attachment: Adnexed; Gill color: White; Gill shape: Moderately broad; Gill
544 spacing: Crowded; Lamellulae: Present; Forking pattern: Unbranched
545 **Stipe:** Present; Size: 5.0cm; Shape: Radicating; Position: Central; Surface characteristics: Dry and
546 glabrous; Color: White to pinkish; Firmness: Narrow
547 **Ecological features:** Locality found: Sher-e-Bangla Nagar, Dhaka; Habitat: On humus; Habit:
548 Solitary; Forest type: Leveled; Constancy of occurrence in specific habitat: Abundant; Type of soil:
549 Loam; Weather at the time of collection: Moist weather
550
551 *Marasmius elegans*
552 **Family:** Marasmiaceae
553 **Common name:** Velvet parachute
554 **Color:** Pink and purple (Young and mature)
555 **Length:** 4.5cm
556 **Width:** 1.3cm
557 **Spore bearing surface under cap:** Gills
558 **Cap of the carpophore:** Size: 1.3cm; Shape: Convex
559 **Pileus:** Color: Brownish; Surface character and Zonation: Smooth; Margin: Regular
560 **Texture of the fruiting body:** Soft and spongy
561 **Flesh odor:** Pleasant
562 **Lamellae:** Present; Gill attachment: Adnate; Gill color: Pale reddish; Gill shape: Narrow; Gill spacing:
563 Close; Lamellulae: Present; Forking pattern: Branched
564 **Stipe:** Present; Size: 4.5cm to 4.8cm; Shape: Bare; Position: Central; Surface characteristics: Dry
565 and glabrous; Color: White to light brown; Firmness: Solid

566 **Ecological features:** Locality found: Ramna park, Dhaka; Habitat: On humus; Habit: Scattered;
 567 Forest type: Leveled; Constancy of occurrence in habitat: Abundant; Type of soil: Loam; Weather at
 568 the time of collection: Moist weather
 569
 570 ***Marasmius oreades***
 571 **Family:** Marasmiaceae
 572 **Common name:** California fungi or Scotch bonnet
 573 **Color:** Brown (Young and mature)
 574 **Length:** 2.2cm to 2.5cm
 575 **Width:** 1.3cm to 1.4cm
 576 **Spore bearing surface under cap:** Gills
 577 **Spore diameter (Average):** Length: 11.05µm; Width: 7.75µm
 578 **Spore shape:** Single walled, smooth and ellipsoid
 579 **Cap of the carpophore:** Size: 1.2cm to 1.5cm; Shape: Convex
 580 **Pileus:** Color: Brownish; Surface character and Zonation: Glabrous and dry in nature; Margin:
 581 Regular
 582 **Texture of the fruiting body:** Soft
 583 **Flesh odor:** Pleasant
 584 **Lamellae:** Present; Gill attachment: Adnate; Gill color: Pale brown; Gill shape: Narrow; Gill spacing:
 585 Close; Lamellulae: Present; Forking pattern: Branched
 586 **Stipe:** Present; Size: 2.2cm to 2.5cm; Shape: Bare; Position: Central; Surface characteristics: Dry and
 587 glabrous; Color: Grey to light brown; Firmness: Solid
 588 **Umbo:** Present and oyster shaped
 589 **Ecological features:** Locality found: Ramna park, Dhaka; Habitat: On bark wood of the tree; Habit:
 590 Solitary; Type of association: Close; Forest type: Leveled; Constancy of occurrence in specific habitat:
 591 Un-abundant; Type of soil: Loam; Weather at the time of collection: Moist weather
 592
 593 **Genus:** *Collybia* sp.
 594 ***Collybia cookei***
 595 **Family:** Tricholomataceae
 596 **Color:** White (Young and mature)
 597 **Length:** 5.0cm
 598 **Width:** 2.5cm
 599 **Spore bearing surface under cap:** Gills
 600 **Spore diameter (Average):** Length: 7.8µm; Width: 6.46µm
 601 **Spore shape:** Single walled, smooth and elongated
 602 **Cap of the carpophore:** Size: 1.5cm to 2.5cm; Shape: Convex
 603 **Pileus:** Color: White; Surface character and Zonation: Smooth; Margin: Regular
 604 **Texture of the fruiting body:** Spongy
 605 **Flesh odor:** Fragrant

Lamellae: Present; Gill attachment: Adnate; Gill color: White; Gill shape: Moderately broad; Gill spacing: Crowded; Lamellulae: Present; Forking pattern: Unbranched
Stipe: Present; Size: 4.5cm to 5.0cm; Shape: Bare; Position: Central; Surface characteristics: Dry and glabrous; Color: White; Firmness: Solid
Ecological features: Locality found: Sher-e-Bangla Nagar, Dhaka; Habitat: On the bark wood of the tree; in an association with the Mahogany (*Swietenia mahogani*) and Eucalyptus (*Eucalyptus citriodora*) tree; Habit: Solitary; Type of association: Close; Forest type: Leveled; Constancy of occurrence in specific habitat: Abundant; Type of soil: Loam; Weather at the time of collection: Moist weather
Genus: *Mycena* sp.
Mycena alba
Family: Mycenaceae
Common name: Tropical white mushroom
Color: White (Young and mature)
Length: 1.0cm
Width: 2.1cm
Spore bearing surface under cap: Gills
Spore diameter (Average): Length: 5.32µm; Width: 4.43µm
Spore shape: Single walled, smooth and elongated
Cap of the carpophore: Size: 2.0cm to 2.1cm, Shape: Conical
Pileus: Color: Creamy, Surface character and Zonation: Smooth, Margin: Regular
Texture of the fruiting body: Soft and spongy
Flesh odor: Fragrant
Lamellae: Present; Gill attachment: Adnate; Gill color: White; Gill shape: Moderately broad; Gill spacing: Close; Lamellulae: Present; Forking pattern: Branched
Stipe: Present; Size: 1.0cm; Shape: Bare; Position: Lateral; Surface characteristics: Dry and polished; Color: White and creamy; Firmness: Solid
Ecological features: Locality found: Botanical garden, Mirpur, Dhaka; Habitat: On bark wood of the tree; in an association with the Mahogany (*Swietenia mahogani*) and Eucalyptus (*Eucalyptus citriodora*) tree; Habit: Solitary; Type of association: Close; Forest type: Leveled; Constancy of occurrence in specific habitat: Un-abundant; Type of soil: Loam; Weather at the time of collection: Moderately moist weather



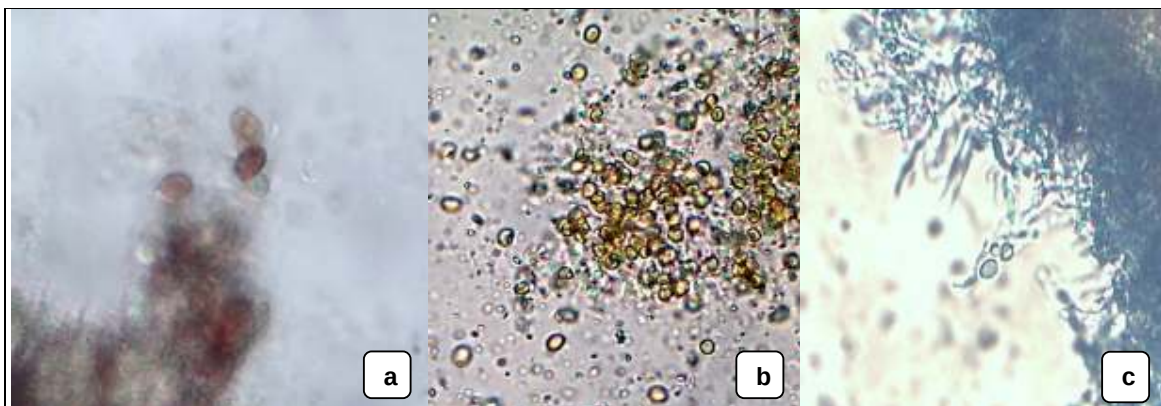
Figure2: Fruiting body of collected mushrooms; a. *Ganoderma lucidum*; b. *Ganoderma boninense* (Growing stage); c. *Ganoderma tsugae*; d. *Ganoderma zonatum* (Young stage); e. *Ganoderma applanatum*; f. *Ganoderma resinaceum*; g. *Hebeloma crustuliniforme*; h. *Craterellus cornucopioides*; i. *Lepiota americana*

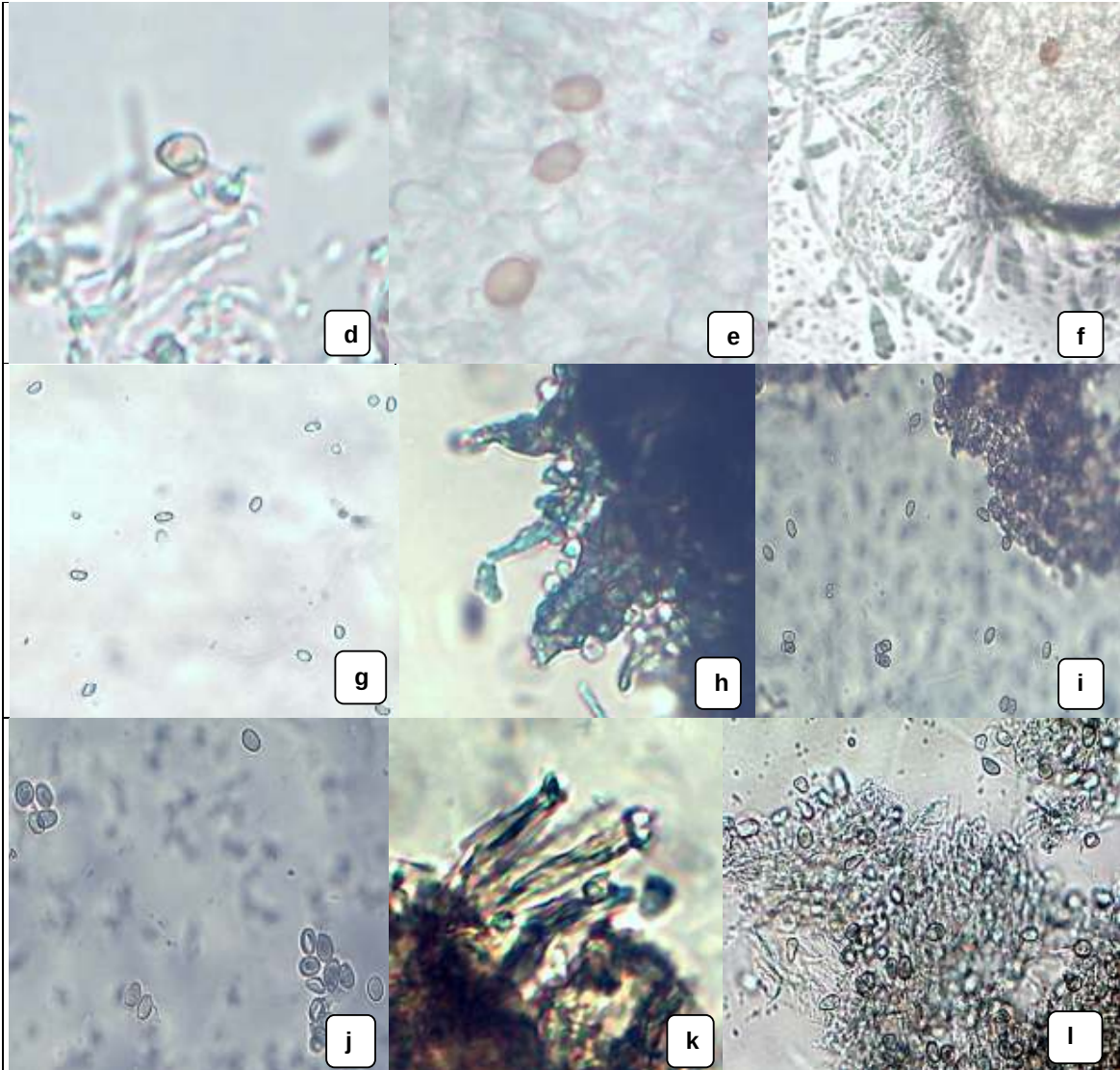


Figure3: Fruiting body of collected mushrooms; a. *Lepiota helveola*; b. *Lepiota aspera*; c. *Macrolepiota procera*; d. *Ramariopsis kunzei*; e. *Ampulloclitocybe clavipes*; f. *Lycoperdon pyriforme*; g. *Volvariella gloiocephala*; h. *Russula nobilis*; i. *Termitomyces heimii*

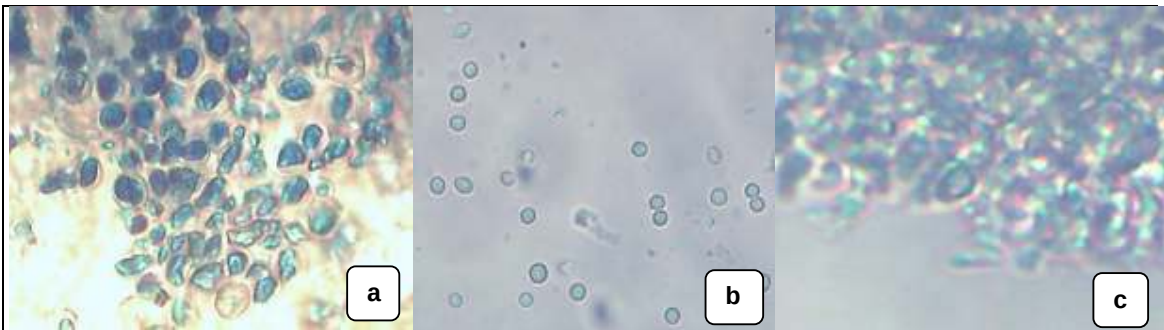


Figure 4: Fruiting body of collected mushrooms; a. *Amanita muscaria*; b. *Marasmius confertus*; c. *Marasmius elegans*; d. *Marasmius oreades*; e. *Collybia cookii*; f. *Mycena alba*





653 Figure 5: Spores of the collected mushrooms; a. *Ganoderma lucidum*; b. *Ganoderma boninense*; c.
 654 *Ganoderma tsugae*; d. *Ganoderma zonatum*; e. *Ganoderma applanatum*; f. *Ganoderma resinaceum*;
 655 g. *Hebeloma crustuliniforme*; h. *Craterellus cornucopioides*; i. *Lepiota americana*; j. *Lepiota helveola*,
 656 k. *Lepiota aspera*; l. *Macrolepiota procera*



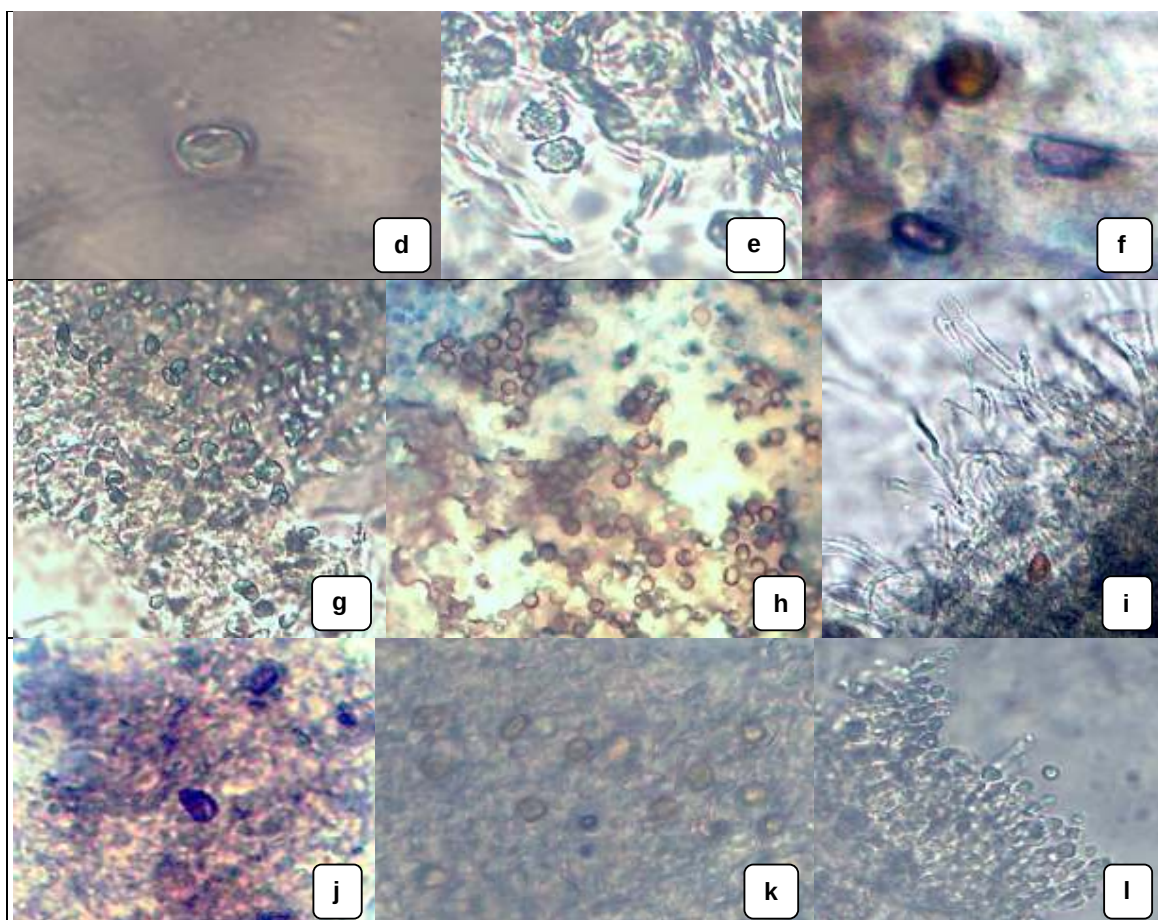


Figure 6: Spores of the collected mushrooms; a. *Ramariopsis kunzei*; b. *Ampulloclitocybe clavipes*; c. *Lycoperdon pyriforme*; d. *Volvariella gloiocephala*; e. *Russula nobilis*; f. *Termitomyces heimii*; g. *Amanita muscaria*; h. *Marasmius confertus*; i. *Marasmius elegans*; j. *Marasmius oreades*;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

4. Discussion

Mushrooms alone are represented by about 41,000 species [13]. Due to their beneficial properties as well as the economic importance, it increases the interest to the modern research. The occurrence of 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, sawdust, 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 each of the genera *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* is widespread but rarely distributed in north temperate areas [51]. On the other hand, *Mycena* sp. was also reported in India [20]. The surveys of different locations were done in the rainy season. Most mushrooms are found in forest areas, in field areas, on branches of trees, and some time in waste land areas; although they may be found throughout the year.

5. Conclusion

This is the first investigation of mushroom biodiversity at tropical moist deciduous forest region of Bangladesh. Through this investigation, identified 24 species from those selected areas will provide an outline to the farmers as well as consumers of Bangladesh for the further utilization of mushrooms considering the increasing economic demand day by day. Moreover, 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.

COMPETING INTERESTS

Authors have declared that no competing interests exist regarding the publication of this paper.

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