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RESEARCH ARTICLE

First record of wood-rotting fungal diversity in dry deciduous forest of Savandurga, Karnataka, India

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Abstract

Wood-rotting fungi (WRF) are renowned for their ecological roles, medicinal properties and ligninolytic capabilities. A survey was conducted from April 2023 to December 2024 in the Savandurga dry deciduous forest, Ramanagara district of Bengaluru, Karnataka, India, an area characterised by dense bamboo groves, shrubs and diverse tree species. The study aimed to collect, identify and document WRF using an integrative approach to morphological analysis. The survey identified 32 wood-rotting fungal species associated with different hosts, which includes *Arcyria denudata* Fr., *Auricularia auricula-judae* (Bull.) Quél., *Coprinellus disseminatus* (Pers.) J.E. Lange, *Cantharellus spathularia* (Schwein.) Schwein., *Daldinia concentrica* (Bolton) Ces. & De Not., *Entonaema splendens* (Berk. & M.A. Curtis) Lloyd, *Fomitopsis quercina* (L.) Spirin & Miettinen, *Fulvifomes robiniae* (Murrill) Murrill, *Fuscoporia gilva* (Schwein.) T. Wagner & M. Fisch., *Ganoderma adspersum* (Schulzer) Donk, *G. applanatum* (Pers.) Pat., *G. gibbosum* (Blume & T. Nees) Pat., *G. lucidum* (Curtis) P. Karst., *G. sessile* Murrill, *Pseudofavolus tenuis* (Fr.) G. Cunn., *Inonotus obliquus* (Fr.) Pilát, *Lentinus polychrous* Lév., *Collybia nuda* (Bull.) Z.M. He & Zhu L. Yang, *Marasmius haematocephalus* (Mont.) Fr., *Microporus xanthopus* (Fr.) Kuntze, *Lentinus sajor-caju* (Fr.) Fr., *Fabisporus sanguineus* (L.) Zmitr., *Schizophyllum commune* Fr., *Stemonitis splendens* Rostaf., *Trametes gibbosa* (Pers.) Fr., *Earliella scabrosa* (Pers.) Gilb. & Ryvarden, *Xylaria hypoxylon* (L.) Grev., *X. longipes* Nitschke and *X. polymorpha* (Pers.) Grev., were new reports to Savandurga and *Candolleomyces asiaticus* Asif, Izhar, Niazi & Khalid and *Cellulariella acuta* (Berk.) Zmitr. & Malysheva are reported for the first time from India. Macro– and microscopic characteristics provide information about the diversity of wood-rotting fungi in the region.

Keywords: fungal systematics; host-pathogen interactions; Karnataka; medicinal fungi; polyporales

Introduction

Wood-rotting diversity refers to the variety of macrofungi capable of decomposing wood in a particular habitat or ecosystem, including those with medicinal properties. Counting the world's fungi has long been a topic of debate, with studies focusing on enumerating their diversity (1). Approximately 2.2 to 3.8 million fungal species exist in nature. This means that only about 4–7 % of fungi are currently known to science (2). An estimated 140000–160000 species, of which only about 30000–35000 species have been described scientifically (3, 4). Approximately 1200–1500 new mushroom species are described each year globally, indicating that a large portion of mushroom biodiversity remains undocumented (5). Polypores represent a diverse group of fungi that primarily function as wood decomposers. Their spore-producing structures are housed within tubes that open into multiple pores (poly-pores), similar to boletes (6). These fungi play a vital role in forest ecosystems by recycling energy and aiding forest regeneration. While most are wood degraders, some act as forest pathogens and others form ectomycorrhizal symbiotic relationships. Their basidiocarps serve as a food source and habitat for various organisms, including invertebrates, vertebrates and even humans, who utilise them for both nutrition and medicinal purposes. Despite extensive research on polypore diversity and phylogenetic relationships, a comprehensive understanding of their large-scale distribution and species composition remains incomplete (7). Wood-decaying polypores, classified as basidiomycetes capable of breaking down lignocellulose, play a crucial role in decomposing forest debris, including fallen trunks, branches and stumps (8). These fungi use enzymatic and non-enzymatic reactions to break down lignified cell structures in coarse woody materials. However, they can also cause significant damage to tree roots and standing trunks, ultimately compromising the mechanical integrity of wood (9). Wood is primarily composed of cellulose, hemicellulose and lignin, with lignin being the second most abundant biopolymer in the biosphere (10). Moreover, recent epidemiological studies suggest that mushrooms may offer protective effects against various types of cancer. The study aimed to document and characterise the diversity of wood-rotting fungi (WRF) in the Savandurga dry deciduous forest, Bengaluru, Karnataka, India, using morphological and microscopic analyses to identify species associated with different woody hosts and provide baseline data on their distribution and taxonomy.

Where e is evenness, H is the Shannon diversity index and S is the number of species.

Results

The survey of wood-rotting fungi in the Savandurga forest yielded remarkable diversity, uncovering 32 species. This discovery significantly enhances the taxonomic richness of *Fulvifomes* and underscores its potential ecological and medicinal importance. The study also recorded several notable species, including *Arcyria denudata* Fr., *Auricularia auricula-judae* (Bull.) Quél., *Candolleomyces asiaticus* Asif, Izhar, Niazi & Khalid, *Cellulariella acuta* (Berk.) Zmitr. & Malysheva, *Coprinellus disseminatus* (Pers.) J.E. Lange, *Cantharellus spathularia* (Schwein.) Schwein., *Daldinia concentrica* (Bolton) Ces. & De Not., *Entonaema splendens* (Berk. & M.A. Curtis) Lloyd, *Fomitopsis quercina* (L.) Spirin & Miettinen, *Fulvifomes robiniae* (Murrill) Murrill, *Fuscoporia gilva* (Schwein.) T. Wagner & M. Fisch., *Ganoderma adspersum* (Schulzer) Donk, *G. applanatum* (Pers.) Pat. *G. gibbosum* (Blume & T. Nees) Pat., *G. lucidum* (Curtis) P. Karst., *G. sessile* Murrill, *Pseudofavolus tenuis* (Fr.) G. Cunn., *Hypoxylon lenormandii* Berk. & M.A. Curtis, *Inonotus obliquus* (Fr.) Pilát, *Lentinus polychrous* Lév., *Collybia nuda* (Bull.) Z.M. He & Zhu L. Yang, *Marasmius haematocephalus* (Mont.) Fr., *Microporus xanthopus* (Fr.) Kuntze, *Lentinus sajor-caju* (Fr.) Fr., *Fabisporus sanguineus* (L.) Zmitr., *Schizophyllum commune* Fr., *Stemonitis splendens* Rostaf., *Trametes gibbosa* (Pers.) Fr., *Earliella scabrosa* (Pers.) Gilb. & Ryvarden, *Xylaria hypoxylon* (L.) Grev., *X. longipes* Nitschke and *X. polymorpha* (Pers.) Grev. (Table 1). The samples were catalogued (SJUBS01 to SJUBS032) and stored under low-humidity conditions in the Department of Botany, St. Joseph's University, Bengaluru, Karnataka.

The fungal species distribution reveals that Xylariaceae is the most dominant family (35 %), highlighting its vital ecological role as both saprotrophic and endophytic fungi. Polyporaceae (11 %) and Hymenochaetaceae (10 %) also show strong representation, reflecting their prominence among wood-decaying fungi. Families such as Ganodermataceae (6 %), Psathyrellaceae (7 %) and Acritiaceae (9 %) exhibit a moderate occurrence, suggesting their adaptability across various habitats. In contrast, Auriculariaceae (2 %) and Fomitopsidaceae (3 %) appear less frequently, likely due to their specific ecological preferences or limited sampling. The presence of Schizophyllaceae (5 %) and Marasmiaceae (5 %) further demonstrates the diversity of Basidiomycota, while Stemonitidaceae (1 %) emerges as the least common family (Fig. 2). The Simpson and Shannon diversity indices for Savandurga forest

Table 1. Diversity and host associations of fungal species with different types of wood rot

Sl. No.	Fungal species	Accession no.	No. of individual spp.	Host	Type of rot
1	*Arcyria denudata* Fr.	SJUBS06	60	Silver oak	Moulds
2	*Auricularia auricula-judae* (Bull.) Quél.	SJUBS07	13	*Delonix regia* and *Albizia*	White rot
3	*Candolleomyces asiaticus* Asif, Izhar, Niazi & Khalid	SJUBS08	45	*Enterolobium*	-
4	*Cellulariella acuta* (Berk.) Zmitr. & Malysheva	SJUBS09	7	*Eucalyptus* sp.	White rot
5	*Coprinellus disseminatus* (Pers.) J.E. Lange	SJUBS13	60	*Delonix regia*	White rot
6	*Cantharellus spathularia* (Schwein.) Schwein.	SJUBS14	39	*Mangifera indica* and *Acacia*	White rot
7	*Daldinia concentrica* (Bolton) Ces. & De Not.	SJUBS15	59	*Albizia, Swietenia, Acacia, Tamarind* and *Mangifera*	Soft rot
8	*Entonaema splendens* (Berk. & M.A. Curtis) Lloyd	SJUBS29	3	*Albizia*	White stem rot
9	*Fomitopsis quercina* (L.) Spirin & Miettinen	SJUBS30	19	Coconut, *Acacia* and *Terminalia*	Brown rot
10	*Fulvifomes robiniae* (Murrill) Murrill	SJUBS32	15	*Peltophorum*	White rot
11	*Fuscoporia gilva* (Schwein.) T. Wagner & M. Fisch.	SJUBS31	35	*Eucalyptus*	White rot
12	*Ganoderma adspersum* (Schulzer) Donk	SJUBS01	8	*Tamarind* and *Terminalia*	White heart rot
13	*Ganoderma applanatum* (Pers.) Pat.	SJUBS02	12	*Acacia, Albizia* and *Annona*	White root rot
14	*Ganoderma gibbosum* (Blume & T. Nees) Pat.	SJUBS03	8	*Pterocarpus* and sliver oak	White butt rot
15	*Ganoderma lucidum* (Curtis) P. Karst.	SJUBS04	9	*Swietenia robusta*	White rot
16	*Ganoderma sessile* Murrill	SJUBS05	7	*Swietenia robusta* and silver oak	Butt rot
17	*Pseudofavolus tenuis* (Fr.) G. Cunn.	SJUBS16	10	Silver oak and *Mangifera*	White rot
18	*Hypoxylon lenormandii* Berk. & M.A. Curtis	SJUBS17	98	*bamboo*	White rot
19	*Inonotus obliquus* (Fr.) Pilát	SJUBS18	6	*Eucalyptus* sp. and *Acacia* sp.	White Heart rot
20	*Lentinus polychrous* Lév.	SJUBS19	8	*Ficus, Acacia* and *Pongamia*	White rot
21	*Collybia nuda* (Bull.) Z.M. He & Zhu L. Yang	SJUBS20	6	Soil surface, *Pongamia*	White rot
22	*Marasmius haematocephalus* (Mont.) Fr.	SJUBS21	32	*Bamboo* and leaf litters	Brown rot
23	*Microporus xanthopus* (Fr.) Kuntze	SJUBS22	38	Silver oak	White rot
24	*Lentinus sajor-caju* (Fr.) Fr.	SJUBS23	25	*Pongamia*	White rot
25	*Fabisporus sanguineus* (L.) Zmitr.	SJUBS24	24	*Mangifera*	White rot
26	*Schizophyllum commune* Fr.	SJUBS25	32	*Dalbergia, Bamboo, Albizia saman*	Sap rot
27	*Stemonitis splendens* Rostaf.	SJUBS26	6	*Delonix, Acacia* and *Sterculia urens*	Soft rot
28	*Trametes gibbosa* (Pers.) Fr.	SJUBS27	13	*Delonix regia*	White rot
29	*Earliella scabrosa* (Pers.) Gilb. & Ryvarden	SJUBS28	5	*Ficus, Delonix regia*	White rot
30	*Xylaria hypoxylon* (L.) Grev.	SJUBS10	42	*Tamarind*	Root rot
31	*Xylaria longipes* Nitschke	SJUBS11	13	*Terminalia*	Root rot
32	*Xylaria polymorpha* (Pers.) Grev.	SJUBS12	71	*Silver oak* and fallen wood logs	Root rot

Materials and Methods

Study area

Savandurga forest is situated in the Ramanagara district of Bengaluru, Karnataka, lying between latitudes 12°15' N and 12°35' N and longitudes 77°5' E and 78° E, covering an area of 27 km^2. Savandurga has diverse ecological features; the temple's base is surrounded by a forest with thick bamboo groves and dense shrubs. Some parts of the forest have now been converted into an herbal plantation and are open for exploration. The forest is home to nearly 60 species of trees. Many of these trees are used for local herbal medicines. Savandurga has a seasonally dry tropical climate. The hot weather season, from March to May, is characterized by low humidity. The southwest monsoon, from June to September, is a period of moist, cloudy and rainy weather. The northeast monsoon season, from October to December, is also notable. Additionally, the cold winter season, from December to February, is a distinct period. The maximum temperature is 36 °C in April, while the minimum is 8 °C in December. Savandurga, the degraded forest, considered a shrub and tree savanna of the *Anogeissus–Chloroxylon–Acacia* series, is highly diverse, recording over 59 tree and 119 shrub species. *Acacia* sp., *Adina* sp., *Albizia* sp., *Annona* sp., *Anogeissus* sp., *Azadirachta* sp., *Bombax* sp., *Butea* sp., *Caesalpinia* sp., *Bambusa* sp., *Abutilon* sp., *Tamarind* sp., *Dalbergia* sp., *Peltophorus* sp., *Swietenia* sp. and *Aristolochia* sp. are the major tree species (11).

Survey and collection

A fungal survey was conducted between April 2023 and December 2024 in Savandurga to collect fungal specimens. Three permanent sample plots, each measuring 100 × 100 m, were established at distinct locations, Manchanabele Falls, Dabbaguli and Manchanabele (Fig. 1), following the methodology of previous fungal studies (12, 13). Three permanent sample plots, each measuring 25 × 25 m (Belt Transect), were established at different locations within the areas. From the sampling site, the sporocarps were collected, labelled and identified by type of rot, macro-morphological traits. Field visits were conducted during the pre-monsoon (April–May) and monsoon (June–December) seasons to document fungal specimens. This involved collecting sporocarps, labelling, identifying rot characteristics, photographing and recording macro-morphological traits and substrate details on an illustrated data sheet. The survey covered a total area of 15 km^2 across three climatic seasons and additional fungal samples were opportunistically collected from areas outside the fixed plots. Collected specimens were placed in paper bags, transported to the laboratory and either air-dried or oven-dried. They were then stored in polythene zip covers under low-humidity conditions.

Microscopic analysis and identification

Identification was based on both macro- and microscopic morphological characteristics, utilising identification keys (14, 15). Microscopic analysis was performed by cutting sections with sharp blades, mounting them in 5 % potassium hydroxide (KOH) and observing them under a light microscope equipped with an Eos 600D camera. Images of basidiospores, basidia and cystidia were captured and measured (16). The current taxonomic names of the identified fungal specimens were verified using MycoBank and Index Fungorum.

Data analysis

The frequency of occurrence for each species was calculated by the following formula, as suggested by the Shannon diversity index (17).

$$H = -\sum (n/N) \log_e (n/N)$$

H = the diversity index

N = the total number of individuals of all the species and

n = the total number of individuals of the species

Simpson's Index of Diversity was calculated (18).

Simpson Index of Diversity = 1-D

$$D = \sum n(n-1)/N(N-1)$$

n = Total number of organisms of a particular species

N = Total number of organisms of all species

D = Simpson's index

With the help of the values of the diversity index, the evenness was also calculated (19).

$$e = H/\log S$$

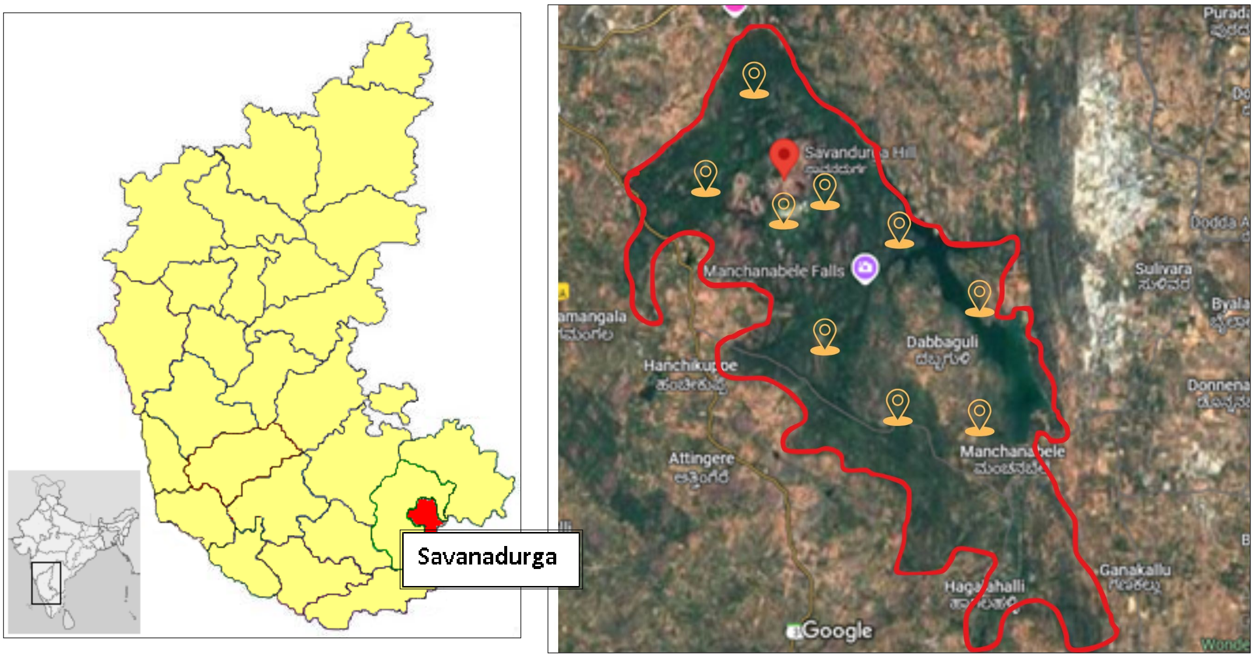

Fig. 1. Study area: Savandurga dry deciduous forest, Bengaluru.

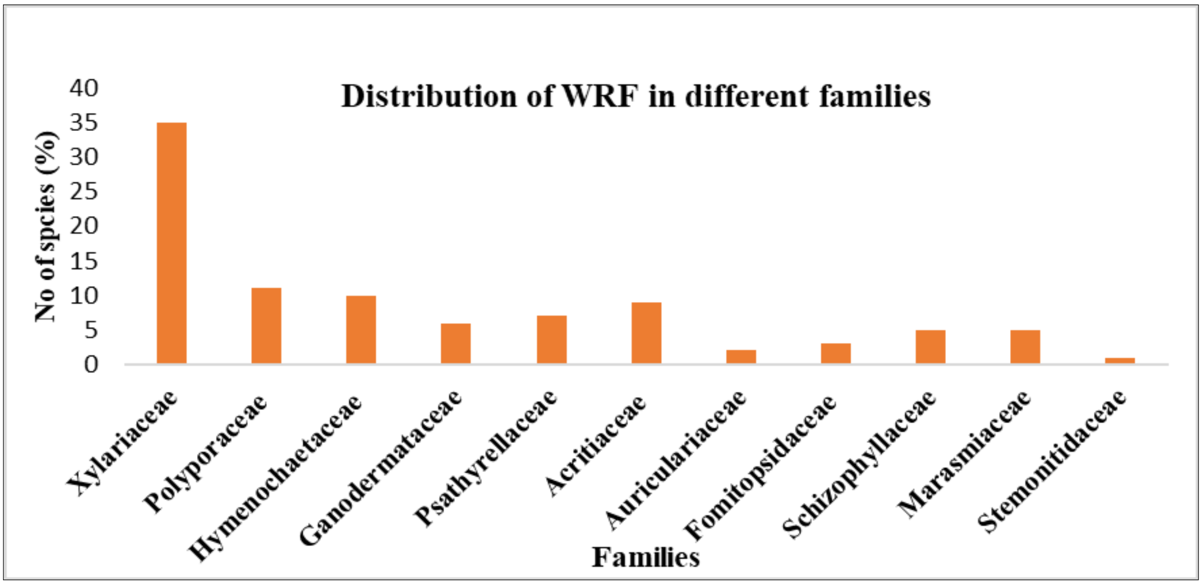

Fig. 2. Distribution of wood rotting fungi in different families in the forest of Savandurga.

Table 2. Comparative diversity analysis of wood rotting fungi across Savandurga forest

No. of species (s)	Total no. of individuals (N)	Shannon diversity index (H)	Simpson diversity index (1-D)	Evenness (E_H)
32	828	0.016	0.98	0.010

were recorded as 0.98 and 0.016 respectively, with an evenness value of 0.010 (Table 2). The findings contribute significantly to understanding their ecological significance, medicinal potential and host-pathogen interactions, thereby expanding knowledge of fungal biodiversity and conservation in the Savandurga ecosystem.

Taxonomy

Auricularia auricula-judae **(Bull.) Quél.**

The fruiting body is found on the stem of *Albizia* and *Delonix regia* trees; the fruiting body is attached to a very small base, cup, or ear-shaped structure, blackish brown in colour, azonate, smooth and elastic and the surface velvety, measuring about 3–4 cm. The pileus surface is grey in colour, smooth, even, entire and velvety. The pore surface is brown in colour and smooth in texture, feeling like jelly (gelatinous) when dry. Tomentose hairs are present on the lower side and the edges are folded inwards, measuring approximately 3 cm in length and 3 cm in width. Trimitic hyphae, generative hyphae, hyaline, thin-walled, branched, 3 µm in diameter. The binding hyphae are brownish, thick-walled, branched and 3.3 µm in diameter. Skeletal hyphae are hyaline brown in colour, thick-walled and 6 µm in diameter. Spores are pale yellow to white in colour, thick-walled, globular-shaped, measuring about 4–5 × 1.5–2 µm (Fig. 3).

Arcyria denudata **Fr.**

The fruiting body is found on a dead silver oak tree, sporangia are stipitate, sporangia densely gregarious, appearing crowded when dehisced, cylindrical, tapering upward, brick-red, fading to brownish with age, stipe rugose longitudinally, filled with spore-like cells, hypothallus dark brown, rotate, peridium fugacious, capillitium elastic, brick red or reddish brown. Spores are spherical to slightly oval with a rough texture due to fine warts or spines. The capillitium within the sporangium is highly elastic, intricately branched and typically matches the pinkish or reddish color of the sporangium, forming a delicate, net-like structure. The sporangium wall is thin and fragile, often breaking apart as the spores mature (Fig. 4).

Cellulariella acuta **(Berk.) Zmitr. & Malysheva**

The fruiting body is found on dead trees of Eucalyptus, Tamarind and *Albizia* stems, annual to perennial, flabelliform, broadly attached with a contracted base; some fruiting bodies are found sub-sessile (short stipe); from the upper surface, the fruiting body appears centrally stipitate, white when young later turns into cream to ochraceous, measuring up to 30 × 25 × 4 cm broad. The upper surface is soft to the touch, coriaceous when fresh and flexible when dried, exhibiting concentric zonation. The colour ranges from white to cream to tan, with a dirty brownish, clay-coloured hue. The margin is thin, sharp and entire. Pore surface is mixed with deadaloid to lamellae up to 4–5 mm wide, tan colored, some are yellowish tin, lamellae are straight to wavy, they are deep towards the base, measuring up to 8–10 mm. Context cream to tan-yellowish color up to 9 mm thick. The hyphal system is trimitic, generative hyphae straight, thin-walled, pale yellow in colour, measuring up to 2–3.5 µm. Skeletal hyphae straight, thin-walled, pale yellowish up to 6.5–7.5 µm wide. Binding hyphae are highly branched and solid up to 5–6.5 µm. Spores are thin-walled, cylindrical, measuring about 6.5–8.5 × 2.5–3 µm in diameter (Fig. 5).

Candolleomyces asiaticus **Asif, Izhar, Niazi & Khalid**

The fruiting body was found on a dead tree of *Enterolobium*. The pileus of the mushroom measures 3.5–5.7 cm in diameter, ranging from plano-convex to applanate. It is hygrophanous, exhibiting colours ranging from light grey to brownish grey, with a subumbonate shape; however, some specimens have a slight depression at the centre. The disc is dull brown and shiny, with a silky fibrillose texture and the fibrils are concentrated at the centre. The pileus features radially translucent striations, especially prominent at the irregular margins, which split upon full maturity. The pileal veil is white, fragile and powdery, evanescent. The lamellae are broad and moderately close, adnate to adnexed, displaying shades from dull orange to brown with even and serrate edges. The stem is 5 cm long and 0.3 cm in diameter, cylindrical and equal, with a small, grainy bulb at its base. It is hollow and fragile, with a pruinose apex covered

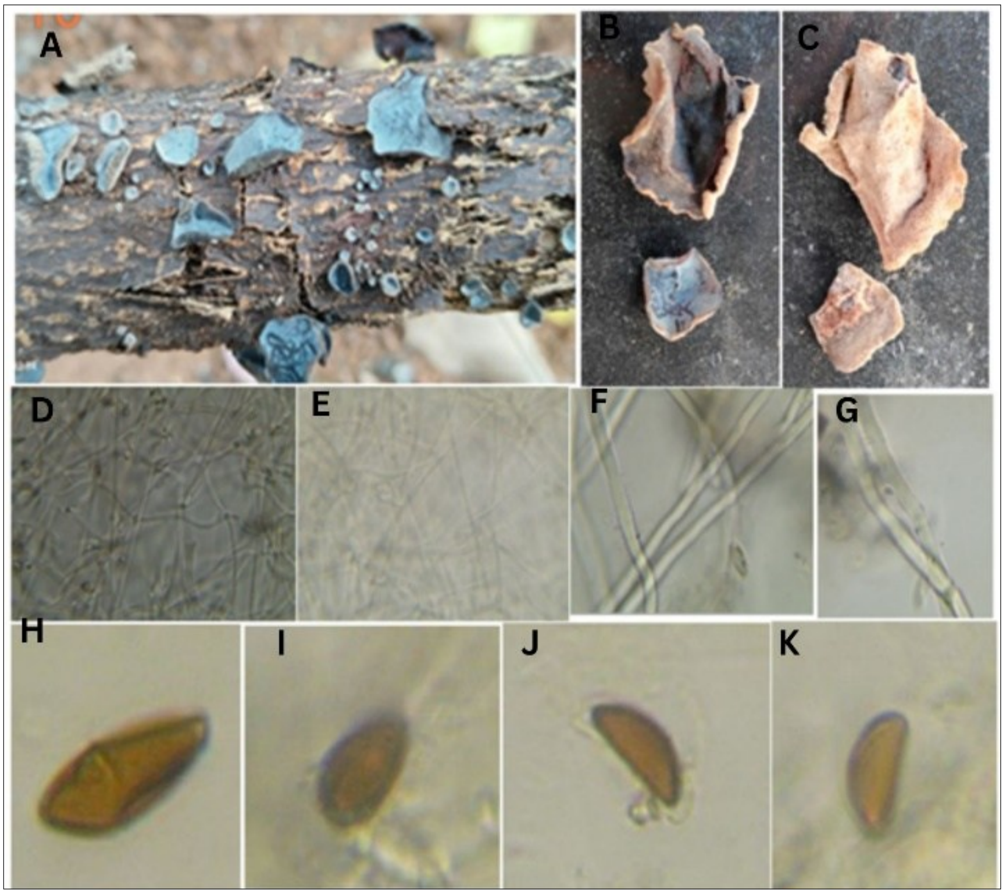

Fig. 3. *Auricularia auricula -judae:* A: Fruiting body on host, B: Upper surface, C: Lower surface, D–G: Hyphae at different dimensions (40x, 100x), H–K: Different shapes and size of spores (100x).

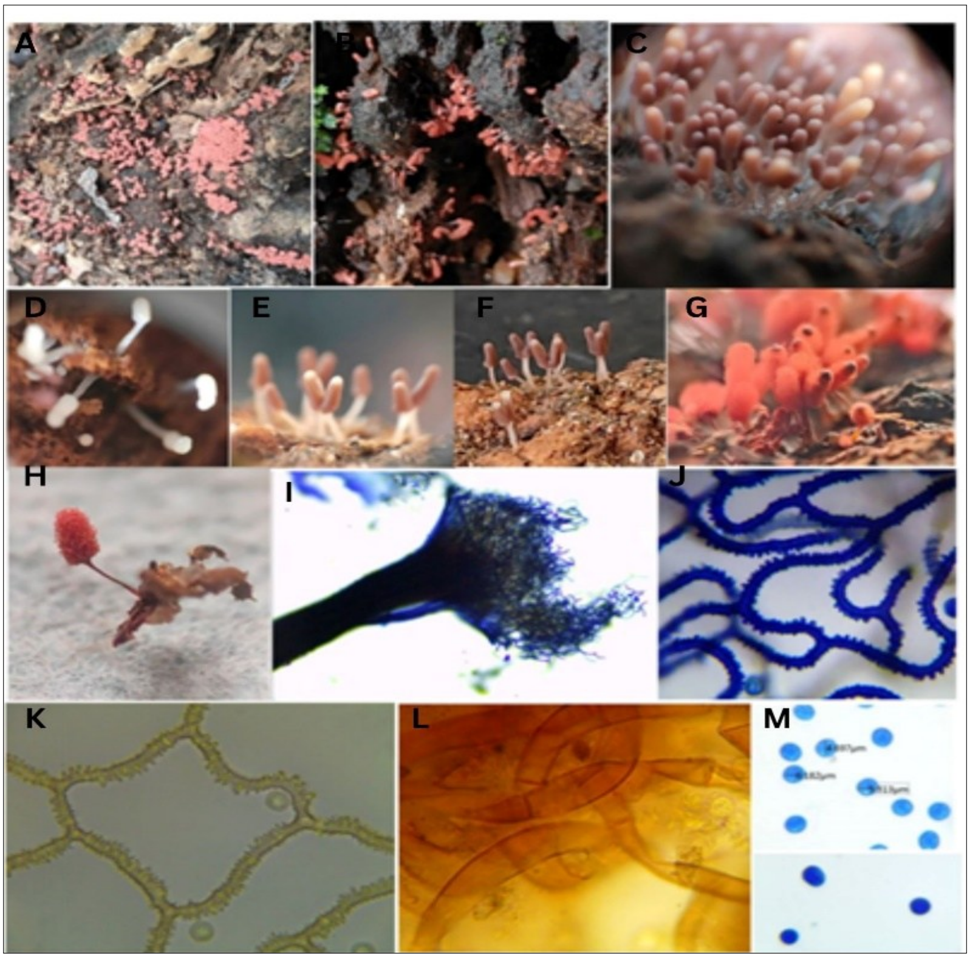

Fig. 4. *Arcyria denudata*: A–G: Fruiting body, H: Individual fruiting body, I: Sporulation, J–L: Different shapes of Hyphae, M: Different shapes of spores.

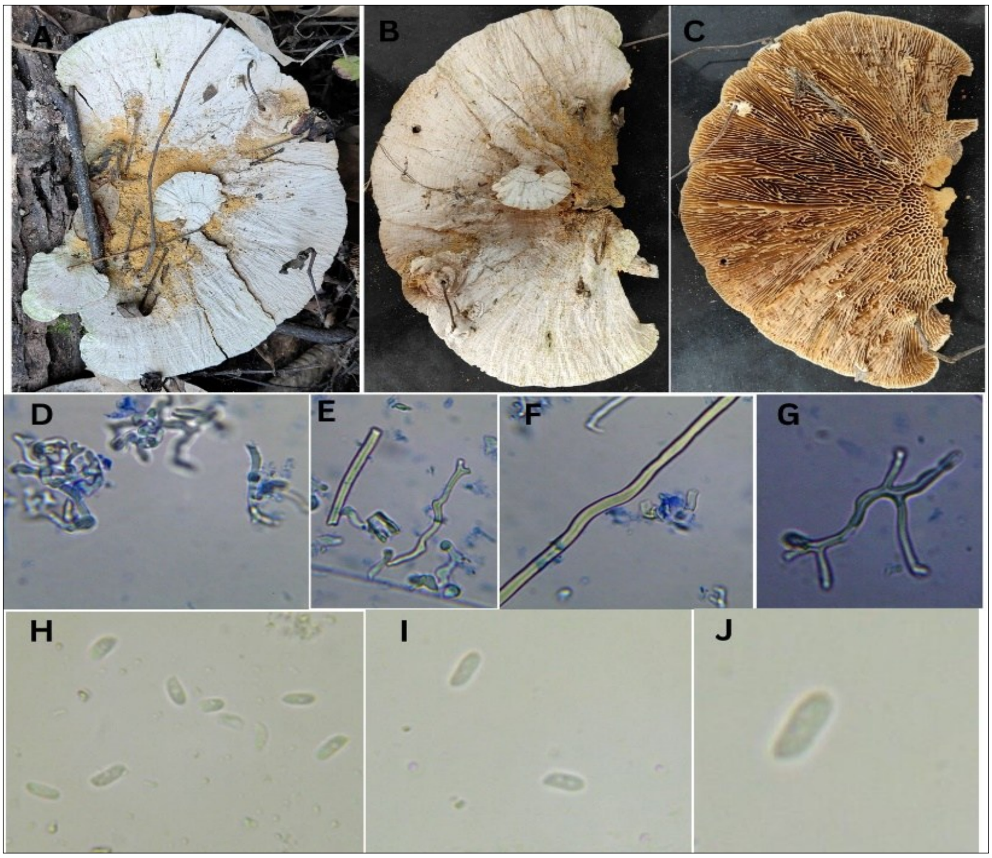

Fig. 5. *Cellulariella acuta:* A: Fruiting body on host, B: Upper surface, C: Lower surface, D-G: Different shapes of Hyphae, H-J: Different shapes of spores.

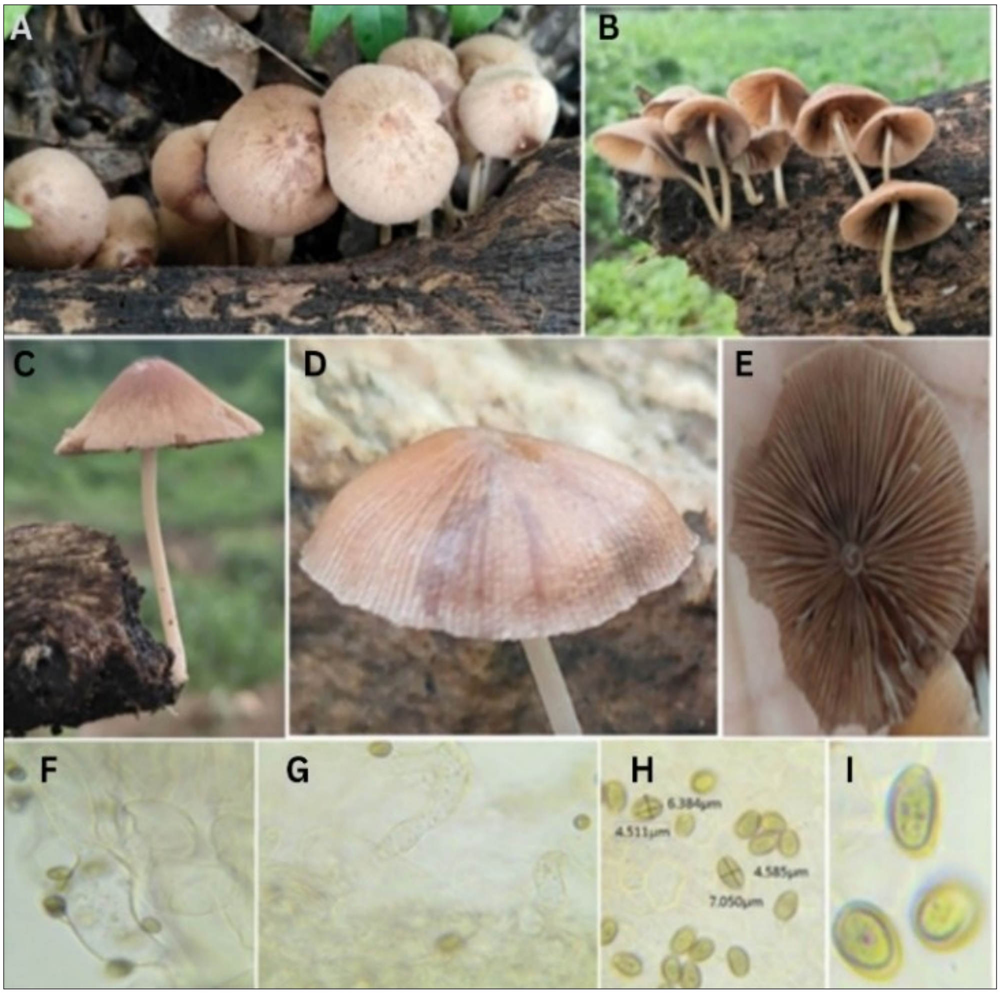

Fig. 6. *Candolleomyces asiaticus*: A–C: Fruiting body on host, D: Upper surface, E: Gill surface, F & G: Basidia, H & I: Different shapes of spores.

with white to greyish, evanescent fibrils. Basidiospores measure 4.5 µm × 6.5 µm are ellipsoid to oblong-ellipsoid and appear greyish red in 5 % KOH. Basidia are broadly clavate, hyaline, thick-walled and weakly granular. Cheilocystidia are hyaline, thick-walled, mostly lageniform to utriform, with a few being fusiform and having a tapered short to long stem at the base. They are abundant and smooth. Pleurocystidia and caulocystidia are absent and clamps are present (Fig. 6).

Coprinellus disseminatus **(Pers.) J.E. Lange**

The pileus is 2.5 cm in length and 4 cm in width. When younger, it is white in colour; as it matures, it turns grey and as it ages, it turns black in colour. The cap at first egg-shaped, then bell-shaped, margins are crenate/ scalloped. Lamellae are white, turning grey and then black as the spores matures. When fully mature, they do not dissolve into inky fluid. Stipe thin, hollow, white and fragile. They are found growing in tufts. Spores are 5.3 x 9.5 µm, elliptical, smooth; with a central pore. Basidia were present, surrounded by 4–6 brachybasidia. Cheilocystidia are cylindric. Pleurocystidia absent. Pileipellis is an epithelium with lageniform to subcapitate, thin-walled pileocystidia. Veil elements as more or less globose sphaerocysts. Clamp connections are absent (Fig. 7).

Cantharellus spathularia **(Schwein.) Schwein.**

The fruiting body is found on dead trees of *Mangifera* and *Acacia*, clusters on dead Eucalyptus trees, gelatinous, jelly when fresh, rubbery at maturity, fertile head flattened and fan-like (Spathula- shape) and some are palmate. Fruiting bodies can vary in size, usually measuring up to 0.5–2.5 cm. The surface of the fruiting body is smooth, slightly wrinkled and folded, with a smoother surface and yellow to orange in colour. Basidiospores are cylindrical measuring up to 5–9.5 × 3–4.5 µm in diameter (Fig. 8).

Collybia nuda **(Bull.) Z.M. He & Zhu L. Yang**

The Pileus is 3.8 cm in length and the width is 6.8 cm, convex with an inrolled margin when young, becoming broadly convex to nearly flat, wavy margin in age; when fresh, usually dull purple or purplish with brown shades, fading to brownish. Lamellae attached to the stem, crowded; short-gills frequent; pale lavender to lilac, fading to buff or pinkish-buff. Stem length 5.6 cm and width is 4.4 cm; equal, enlarged toward the base; dry; finely fibrillose; pale purple or colored like the gills; becoming pale brownish in age, basal mycelium ranging from white to lilac or purple. Spore prints pinkish. Spores 5.5-8 x 3–4 µm; ellipsoid; finely verrucose; hyaline in KOH. Basidia present, clavate; 4-sterigmate, cystidia absent, clamp connections present (Fig. 9).

Daldinia concentrica **(Bolton) Ces. & De Not.**

The fruiting bodies found on dead woods of *Albizia, Swetaenium, Acacia,* Tamarind and *Mangifera*, typically measure 3–7 cm in diameter. They start out brown and turn black and dense as they mature. These sessile structures are broadly attached to the host, smooth, hard and solitary, with a cushion-shaped, rounded appearance. The surface becomes cracked over time, revealing

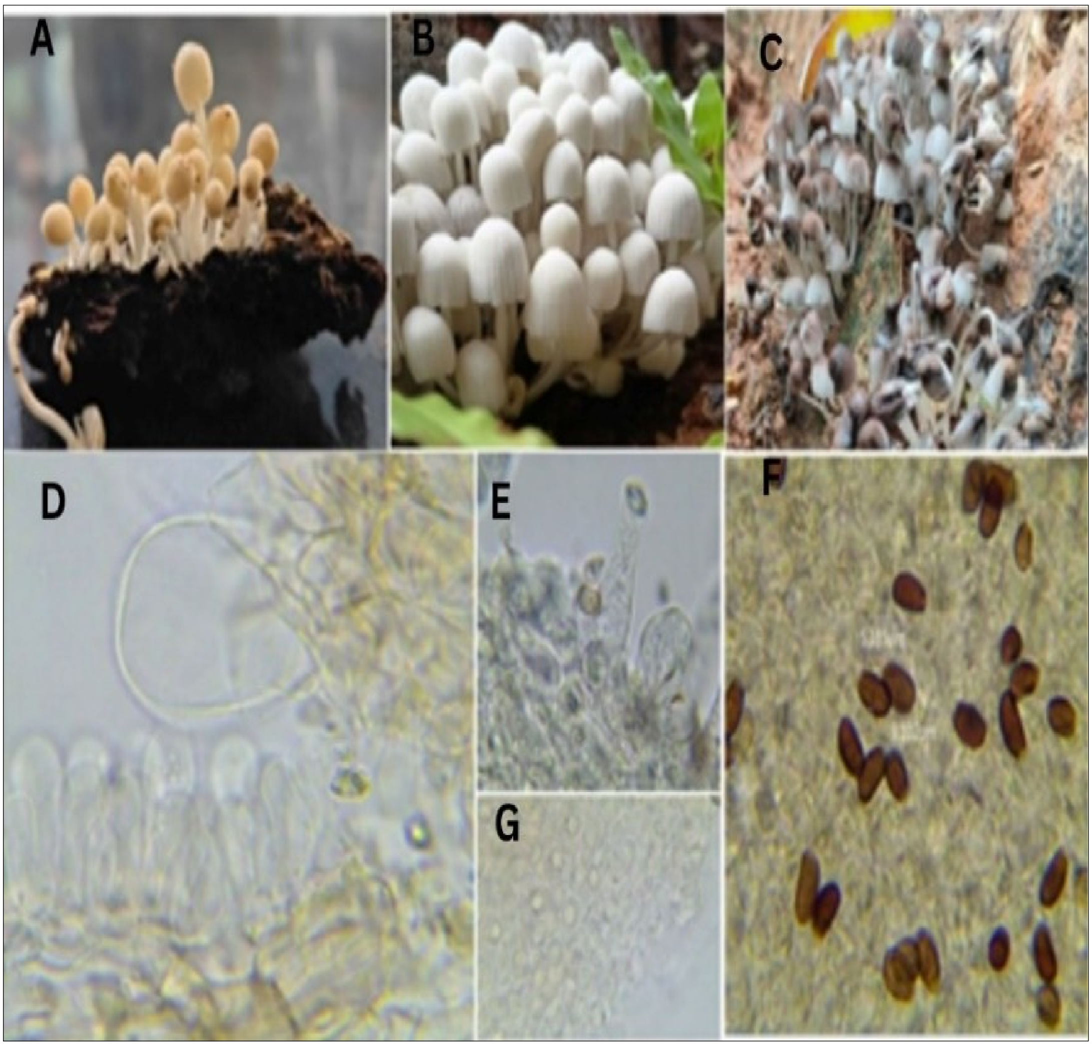

Fig. 7. *Coprinellus disseminatus*: A, B: Fruiting body at young stage, C: Mature stage, D: Clavate to pyriform cystidia, E: Basidia and Utriform cystidia, F: Spores, G: Pileipellis cellular elements (100x).

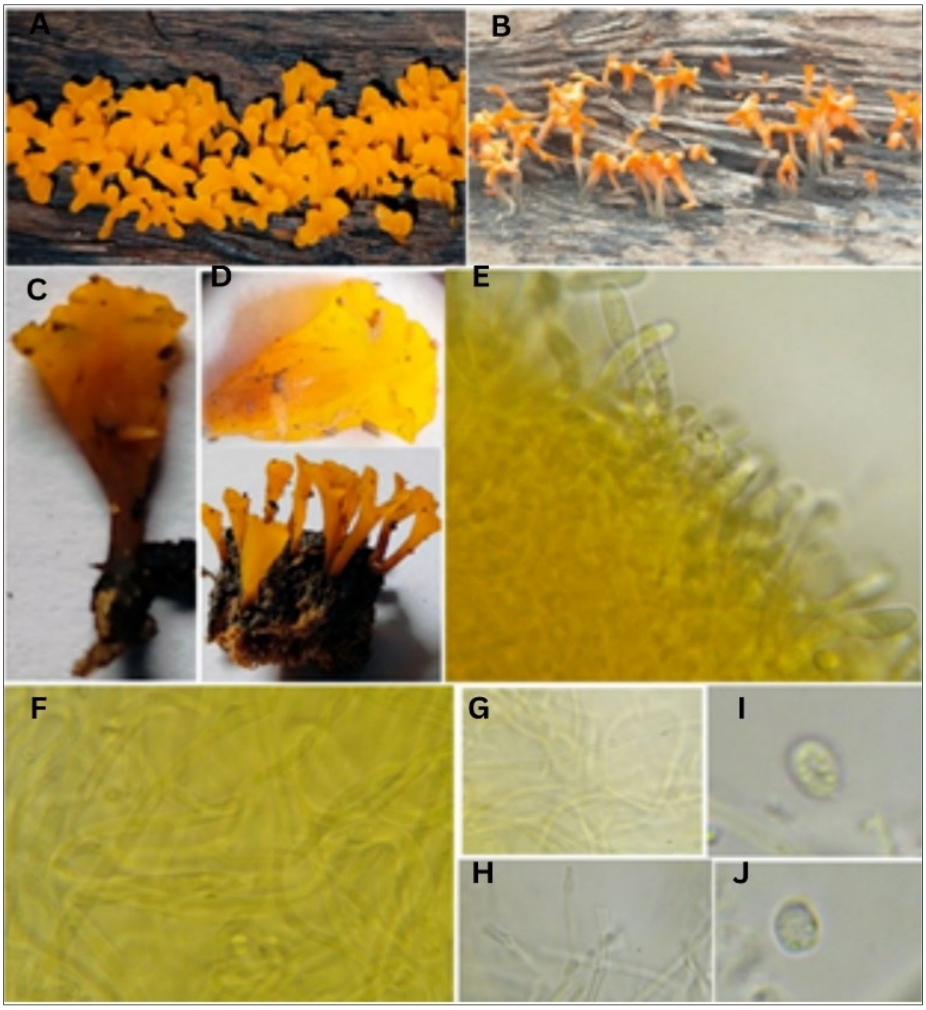

Fig. 8. *Cantharellus spathularia:* A & B: Fruiting body, C & D: Individual fruiting body, E & F: Basidia, G & H: Different shapes of Hyphae, I & J: Different shapes of spores.

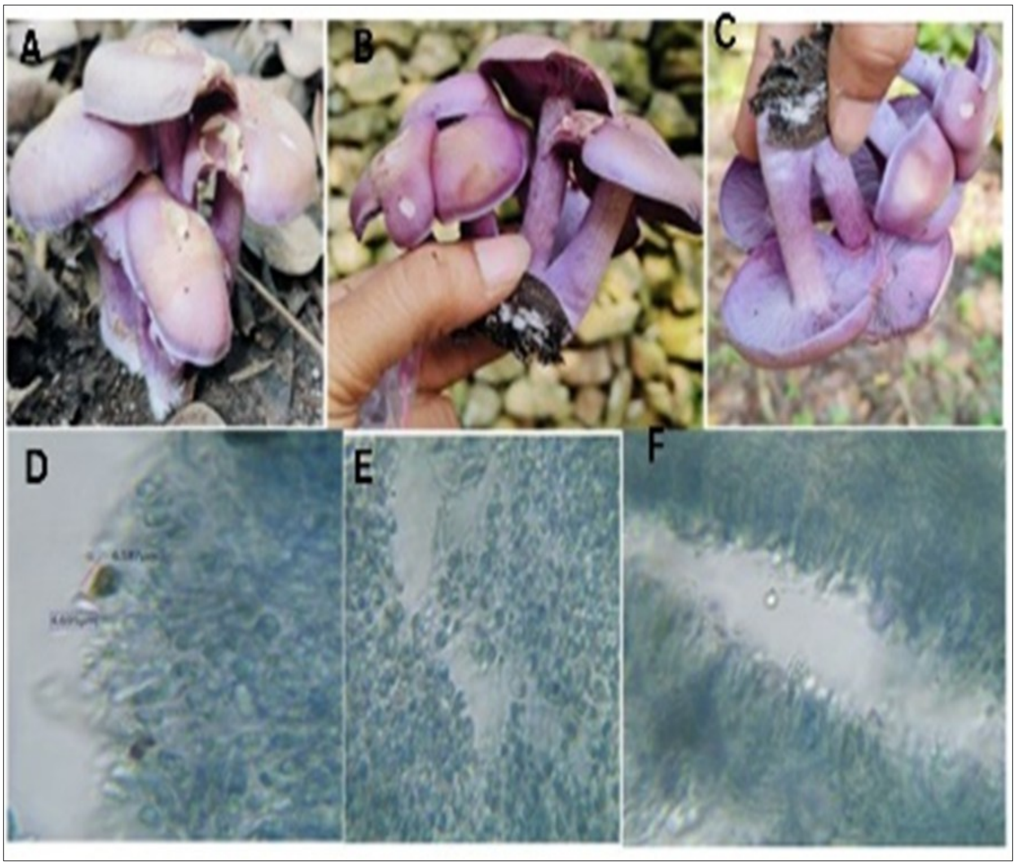

Fig. 9. *Collybia nuda*: A–C: Fruiting body, D: Spores, E: Pileipellis cellular elements, F: Basidia (100x).

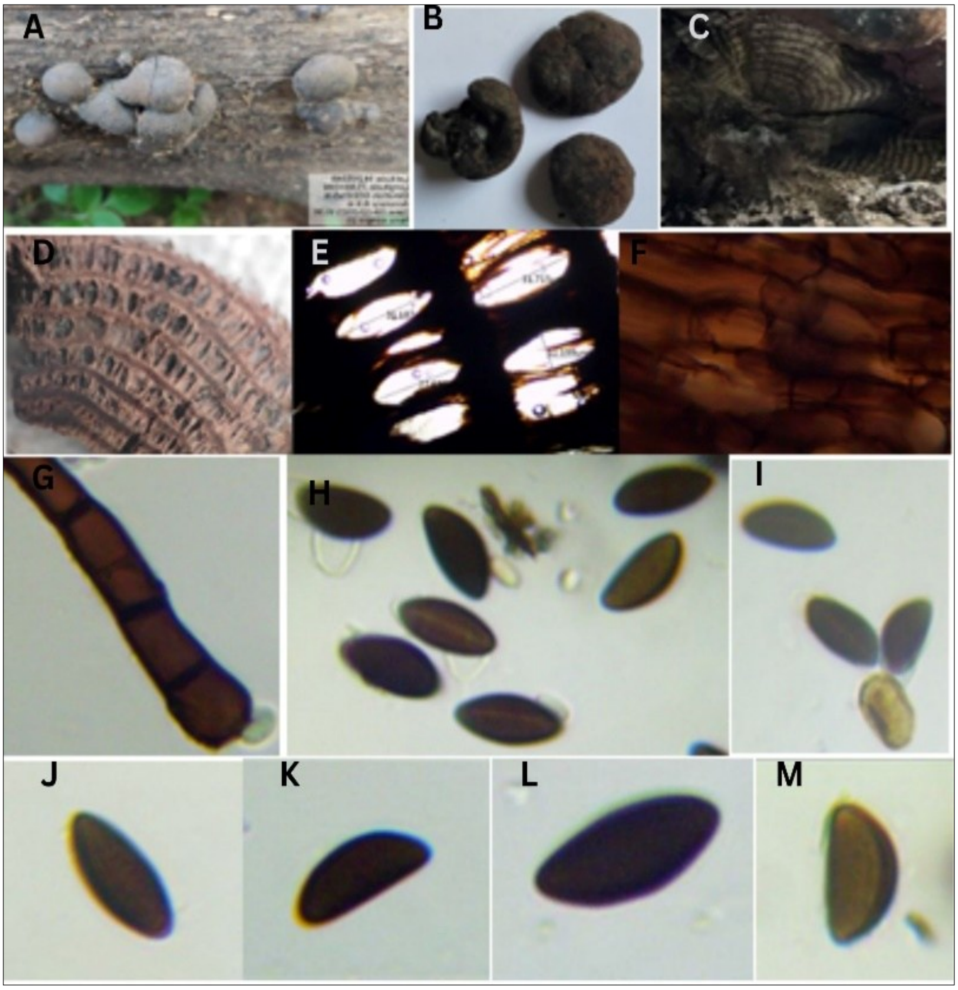

Fig. 10. *Daldenia concentrica*: A: Fruiting body on host, B: Individual fruiting body, C: Lower surface, D: Concentric zones (Perithecia), E: Perithecia under microscope, F: Inner surface, G: Hyphae, H–M: Different shapes of spores.

reddish-brown granules beneath. The spore-bearing surface consists of tiny chambers called perithecia, embedded within the outer layer of the fruiting body. The flesh is arranged in concentric layers, with slightly papillate ostioles. The asci are cylindrical; the ascospores are dark brown to black, elliptical to fusiform, unicellular, with rounded ends and measure approximately 5–7 × 11–16 µm (Fig. 10).

Entonaema splendens **(Berk. & M.A. Curtis) Lloyd**

The fruiting body is found on a fallen *Albezia* twig, globose, at maturity irregularly shaped with a short basal connective attached to the substrate, hollow inside, the fruiting body is filled with liquid and the fruiting body surface is bright yellow in colour, measuring about 3–5 × 2–6 diameter. The upper surface will lose its color if handled when it is young. The inner surface and core are filled with a gelatinous liquid substance that is released when the stroma is punctured. Perithecia 04–0.5 mm, measuring about 15–18 µm diameter. Ascospores are dark brown ellipsoids with blunt ends, with a straight germ slit measuring up to 10–11.5–4.5–6 µm in diameter (Fig. 11).

Earliella scabrosa **(Pers.) Gilb. & Ryvarden**

Fruiting body is found on dead *Ficus* and *Delonix regia* tree trunk, effused-reflexed to recuperate, sessile, broadly horizontally attached to the host, dimidiate, often imbricate, more radially reguse, sulcate, glabrous, pale brownish, ochraceous with darker zones, becoming dull red to reddish brown, finally turns to blackish, margin white, thin, sharp, pileus measuring about 11–15 × 6–7 cm in diameter. Upper surface is deeper colored, wood buff, with a reddish to black crust, sharply delimited, uneven, pale distal part, entirely pale ochraceous with reddish brown spots, margin white in full growth. Lower surface pale to deep ochraceous, often dull, straw color when fresh, pores are radially elongated. Hyphal system trimitic: Generative hyphae hyaline, clamped, densely branched, measuring about 2–3.5 µm diameter. Skeletal hyphae wide appear in the flesh, colourless, aseptate, branched and look like generative hyphae, measuring about 3.5–4.5 µm wide. Binding hyphae are thick and highly branched, measuring about 1.5–3 µm diameter. Spores white, smooth, ellipsoid to subcylindric, thin-walled, guttate and measuring up to 9.5–13 × 2.5–3.5 µm diameter (Fig. 12).

Fomitopsis quercina **(L.) Spirin & Miettinen**

Fruiting body is found on dead Coconut, *Acacia* and *Terminalia* stem; basidiocarp perennial, gregarious, fused laterally, effused, broadly sessile, semi-circular, strongly attached to the substrate, woody and very hard, measuring about 15 × 5 × 6 cm broad. Upper surface of the cap is broadly convex, slightly raised near the base, whitish when fresh, greyish to brownish at maturity, turns black with age, smooth at the margin, doughnut-shaped, if cut, inner parts are deep brownish to greyish, light ochraceous mycelium outgrowth produced at maturity. Pore surface white to brownish, flat to oblique, white to brownish in colour, ochraceous, irregular, elongated-lamellate, deadaloid-gill-like pore surface, pore walls thick, pore opening 3.5-4 mm wide, not bruising, tubes up to 3.5 cm deep. Context: whitish, up to 11.5 cm thick, turns black in KOH solution. Hyphal system trimitic: Generative hyphae- thin-walled, hyaline, with clamps, brownish in colour, measuring 2–4.5 µm diameter. Binding hyphae- torturous with short branches, thick-

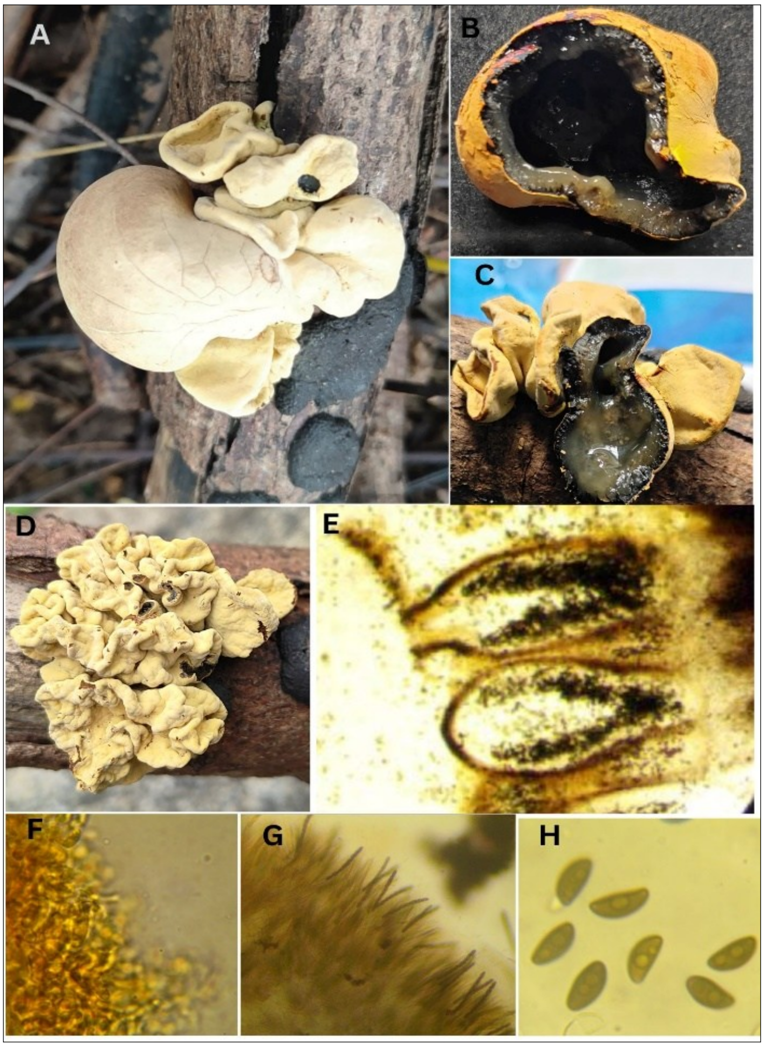

Fig. 11. *Entonaema splendens*: A: Fruiting body on host, B & C- Inner surface, D: mature fruiting body, E: Perithecia, F: Inner surface, G: Asci, H: Spores.

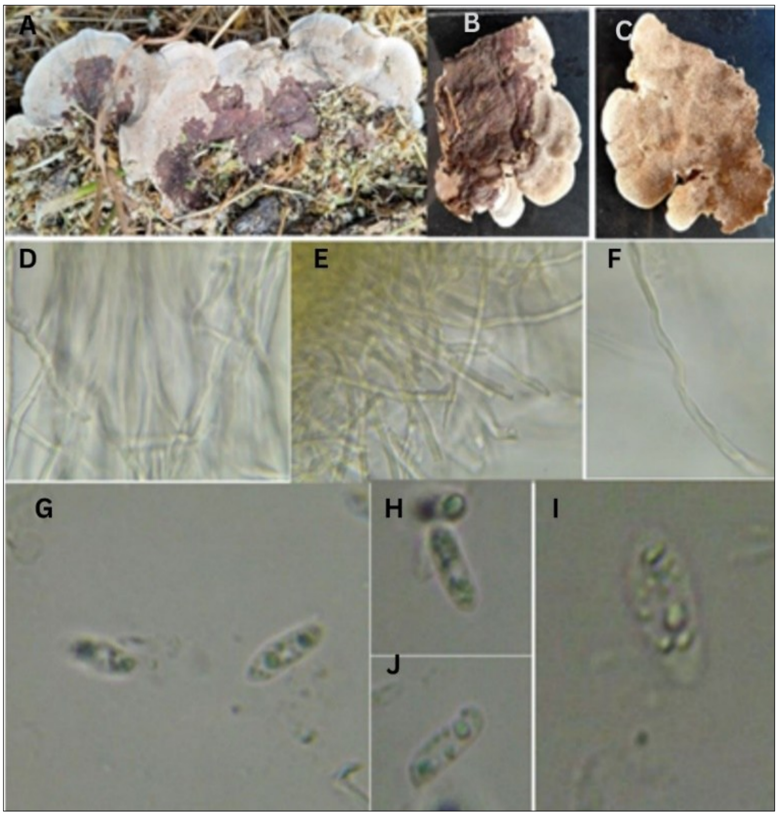

Fig. 12. *Earliella scabrosa:* A: Fruiting body on host, B: Upper surface, C: Lower surface, D–F: Hyphae at different dimensions (4x, 100x), G–J: Different shapes and size of spores (100x).

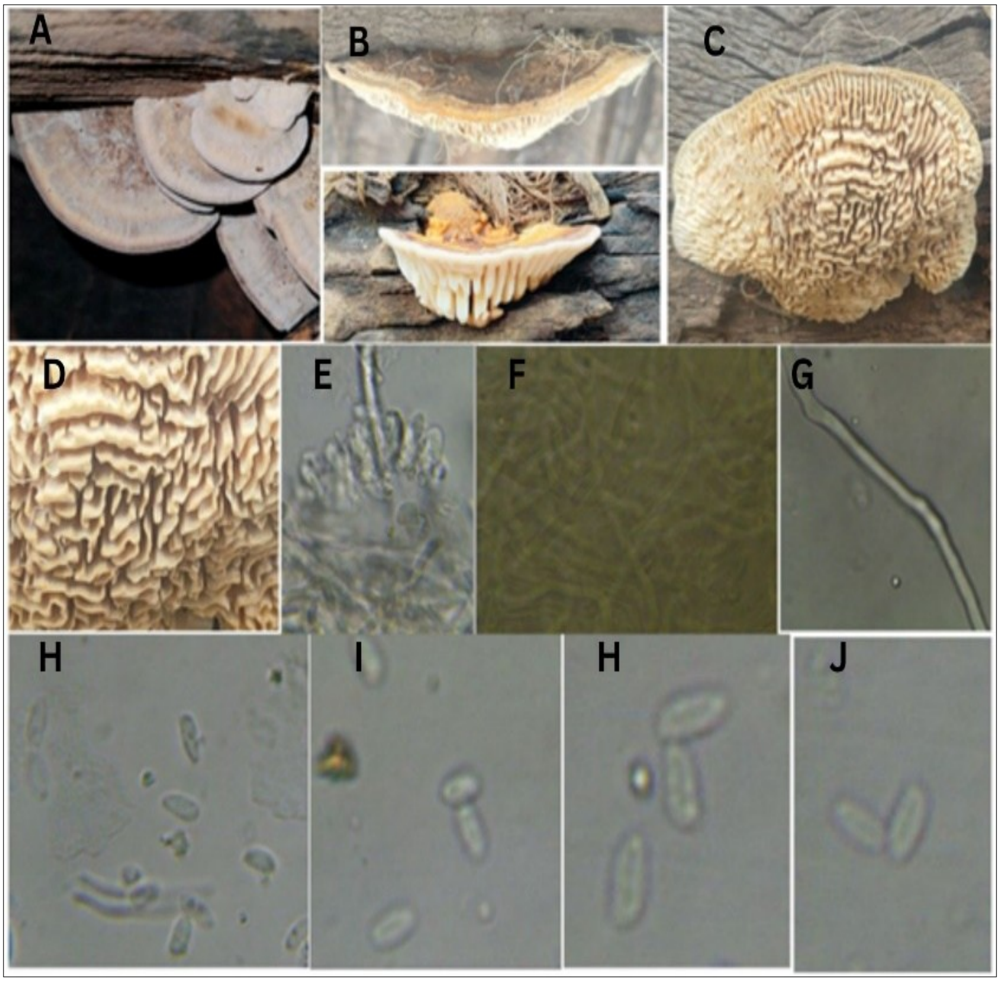

Fig. 13. *Fomitopsis quercina*: A: Fruiting body on host, B: Upper surface, C & D: Lower surface, E: Basidia, F & G: Hyphae, H & J: Spores.

walled, light golden brown in color. Skeletal hyphae dominating, thick-walled, solid, swollen with pointed apex, light brown color, measuring up to 3.5–6 µm. Basidia are projecting between skeletal hyphae, clavate with a basal clamp. Basidiospores are elliptical to cylindrical, hyaline, white, thin-walled, smooth, measuring about 5.5–6.5 × 3–3.5 µm (Fig. 13).

Fulvifomes robiniae **(Murrill) Murrill**

Fruiting body isfound on living trees of *Peltophorum, Ficus, Delonix regia* and *Acacia.* Perennial, sessile, woody, apiculate, semicircular, gregarious, irregularly bracket-shaped/kidney-shaped, flattened convex, cracked and concentrically furrowed, thick at the base and thin at the edges, brown to dark brownish black, often hosting algae, moss with age, measuring about 7–8 × 3–4 cm broad. Upper surface greyish brown, with age, becoming black, finely tomentose, deeply rimose, often appearing scaly, margin brownish yellow, older specimens concolorous with blackened, uneven. The lower surface is yellowish to reddish brown and the pores are circular, 7–8 per mm and reach up to the margin, thick and consist of entire dissepiments. Context light reddish brown, tubes are concolourous, woody, 1.5–2 cm thick, brown in KOH. Hyphal system dimitic: generative hyphae thick-walled, branched, simple, separate, brown in colour, measuring up to 3--3.5 µm, binding hyphae branched, light brown in colour, measuring up to 2–2.5 µm. hymenial setae present at the pore surface, dark brown in colour, broad at the base and pointed at the tip, measuring up to 15–25 µm in diameter. Basidiospores are ovoid to subglobose, reddish brown and smooth, measuring up to 9–13 × 5–6.5 µm (Fig. 14).

Fuscoporia gilva **(Schwein.) T. Wagner & M. Fisch**

Fruiting body is found on dead *Eucalyptus* tree, perennial, sessile, effused reflexed, solitary, dimidiate, tomentose to glabrous, dark yellowish to brown color, margin thin and white, zoneted, thin fruiting body, measuring about 12 × 7 × 1. Upper surface tomentose is glabrous, often reguse, zonate and margin thin, concolourous, even dark yellowish brown in color. Pore surface is even, dark brown and pores are circular, 6–7, with entire dissepiments. Context yellowish brown, zonate, fibrous, up to 0.8 cm thick, tube layer white, stuffed, dark reddish brown in KOH. Hyphal system dimitic; Generative hyphae thick-walled, branched, simple septate, pale yellowish brown measuring about 3.5-6.5 µm. skeletal hyphae thin-walled, yellowish brown, aseptate, measuring about 2.5–3.5 µm diameter. Basidia are broadly clavate, measuring about 7–10 × 3–6 µm broad. Basidiospores are ellipsoid to ovoid, hyaline and smooth, measuring about 4.5–5 × 3–3.5 µm diameter (Fig. 15).

Fabisporus sanguineus **(L.) Zmitr.**

The fruiting body is found on a *Mangifera* dead tree, annual and gregarious, dimidiate to flabelliform and attached to the substrate, with a semi-stipitate, stem-like base. Consistency is coriaceous when fresh, hard and elastic when dry, reddish orange in color, measuring up to 10 × 8 × 0.5 cm. Upper surface with darker zones are present first in orange and then turn to red colour, later often intensely red orange. Pore surface red orange to cinnabar. Pores are circular, 5–6 per mm, tubes in one layer, pores reach the margin and the margin is thin. Context 2-3 mm thick appearing cottony, blackening

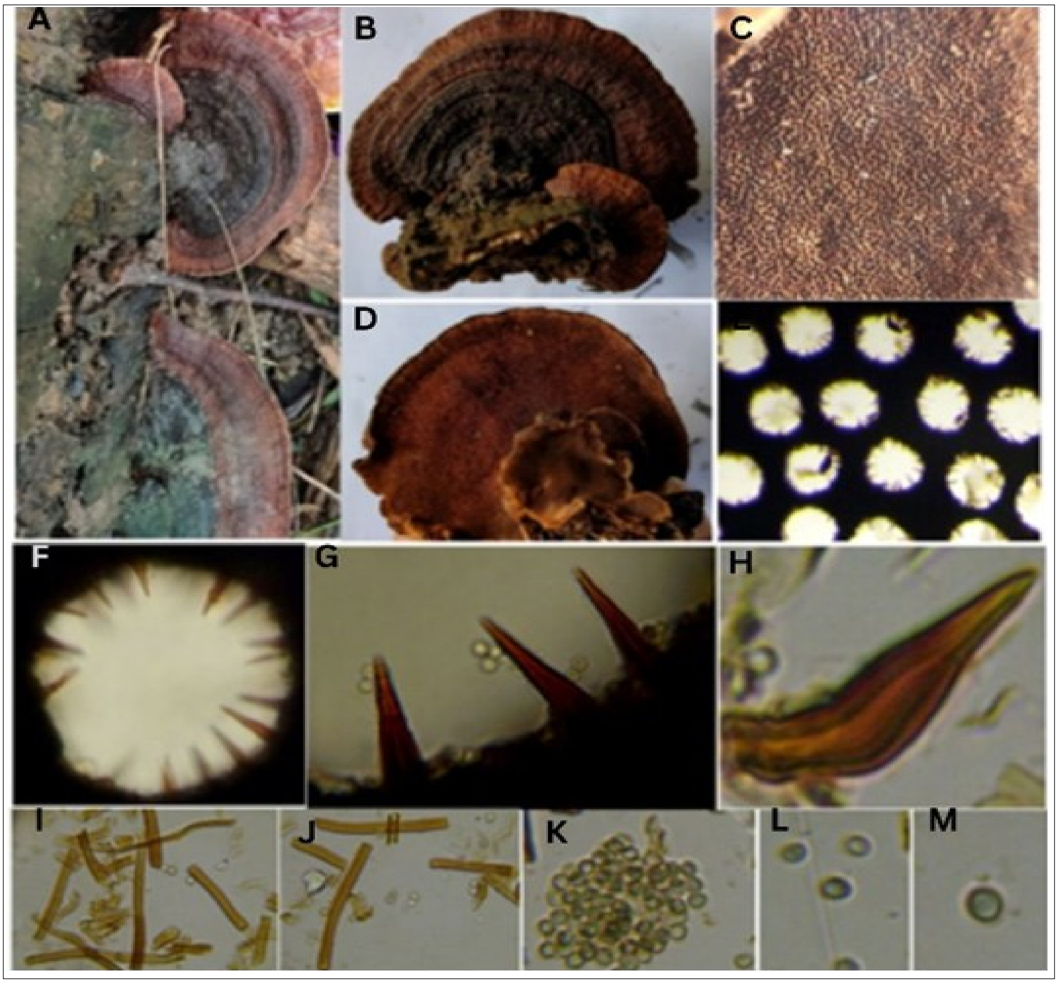

Fig. 14. *Fulvifomes robiniae:* A: Fruiting body on host, B: Upper surface, C, D: Lower surface, E: Pores under 20x, F, G, H: Hymenial cysidia under 20x, 40x, 100x, I, J: Hyphae, K–M: Different shapes and size of spores (100x).

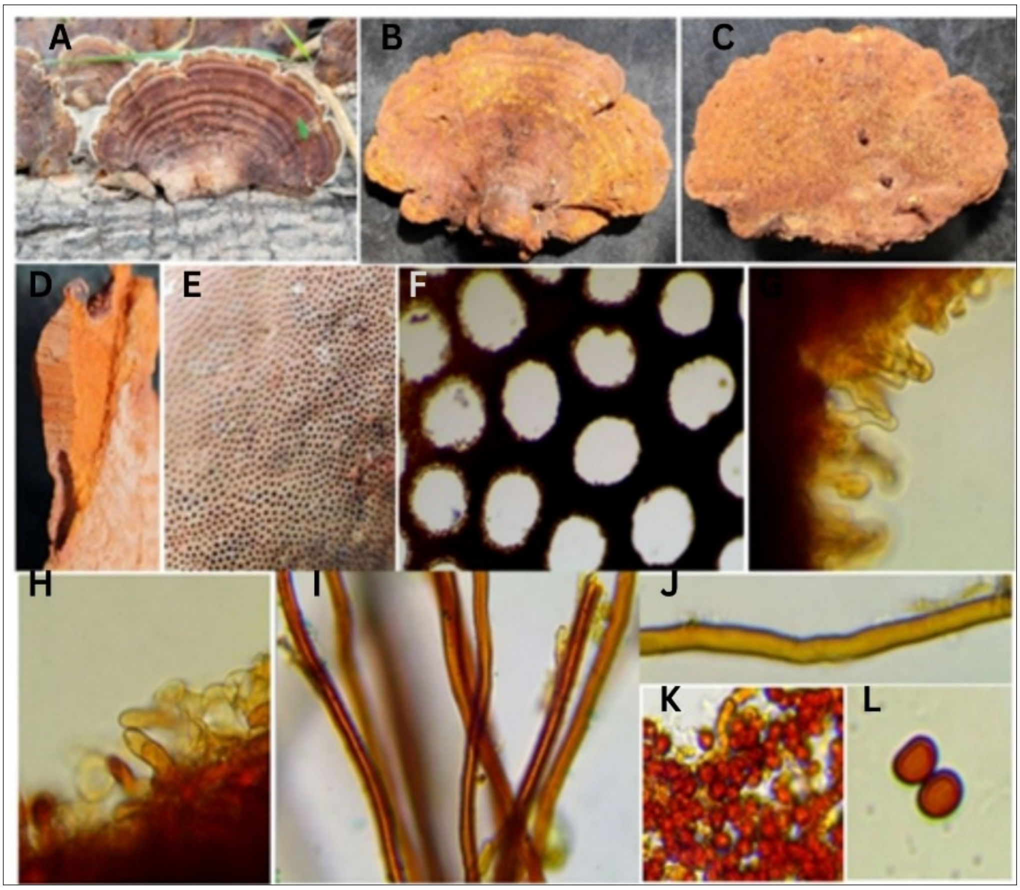

Fig. 15. *Fuscoporia gilva*: A: Fruiting body on host, B: Upper surface, C: Lower surface, D: Porous tube, E: Porous surface, F: Pores under (20x), G, H: Basidia, I, J: Hyphae under 100x, K, L: Different shapes and size of spores (100x).

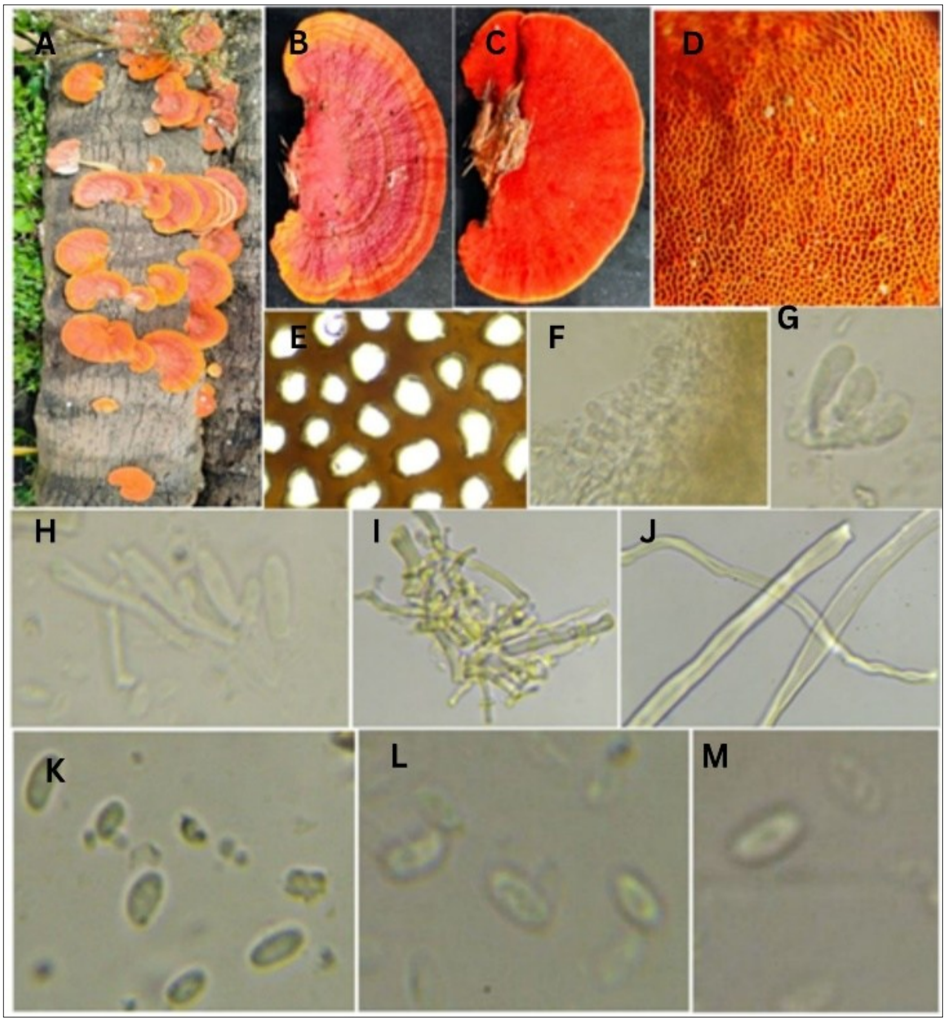

Fig. 16. *Fabisporus sanguineus:* A: Fruiting body, B: Upper surface, C–E: Lower surface at 10x, 20x, 40x, F–H: Basidia, I, J: Hyphae, K–M: Different shapes and size of spores (100x).

in KOH. Hyphal system is trimitic: generative hyphae hyaline and thin and thin walled with clamps, transparent color, measuring about 2–3.5 µm. Skeletal hyphae are thick-walled, unbranched and without septa. Binding hyphae thick-walled, solid with shirt branches, 2.5–3.5 µm diameter. Spores are short, cylindrical to ovate with smooth, hyaline, measuring about 4.5–5 × 2.5–3 µm (Fig. 16).

***Ganoderma lucidum* (Curtis) P. Karst**

The fruiting body is found on *Swietenia robusta* tree trunk is annual, dimidiate and often has a lateral stem, typically reniform in shape. The collected pileus is small to medium-sized, measuring up to 9.5 × 5.2 × 0.8 cm and is woody, even and light brown in colour. The upper surface is radially rugose and concentrically sulcate, with a light reddish-brown or mahogany hue. The margin is sterile, thick and blunt or acute, white in colour and 0.8 cm thick. The stem is lateral, vertical, cylindrical, typically long and tortuous, measuring 8.4 cm in length and 2 cm in thickness, with a reddish-black colour. The pore surface ranges from creamish white to yellow, with small, round, somewhat irregular pores, 4–7 per mm, extending up to the margin. The pore tubes are whitish-brown and 0.5 mm thick. The context is thick, with greater thickening toward the stem and ochraceous brown to dark brown in colour. The hyphal system is trimitic, with hyaline, thin-walled, clamped and septate generative hyphae measuring 2–4.5 µm in diameter. The skeletal hyphae are aseptate, lacking clamps, very long compared to the generative and binding hyphae, measuring up to 4–7 µm in diameter, with scanty branching and golden in colour. The binding hyphae are a septate, without clamps, branched, tortuous, with limited growth and thinner than the generative and skeletal hyphae, measuring 1.5–3 µm in diameter, golden brown in colour. The basidiospores are sub-ovoid with a truncate apex, smooth, thin and wide, measuring 8–13 × 4–7 µm (Fig. 17).

***Ganoderma sessile* Murrill**

Fruiting bodies on living *Swietenia* tree trunks are annual, sessile, laccate and reddish brown in color, often with wrinkled margins. Fruiting bodies on stumps are tough and leathery, with clusters of round to half-moon-shaped conks attached to the woody roots. Individual fruiting bodies measure up to 15-20 × 10-15 cm in diameter and 3-4 cm thick and are darker brownish red in colour with white margins. The upper layer is irregular, with a thin crust that ranges in colour from red to mahogany to ochraceous and when young, concentric zones form with a white edge. Pore surface is originally white and darkens to brown with age and handling. Pores are small, visible to the naked eye, uneven, form circular to angular up to 4–5 per mm and pore tubes are brown in colour, 5-6 mm deep. The context is cream-coloured, thick and of the same length as the tubes. The hyphal system is trimitic, with generative hyphae with clamp connections measuring up to 2.5–3.2 µm in diameter. Skeletal hyphae are pale yellow, thick-walled and measure up to 5–6 µm in diameter. Binding hyphae are pale yellow and thick-walled, ranging up to 5.2–5.8 µm in diameter. No cystidia or setae were detected. Basidiospores are less ellipsoid and have a brown, truncated end, measuring up to 8.4 –13 × 5 –7.5 µm (Fig. 18).

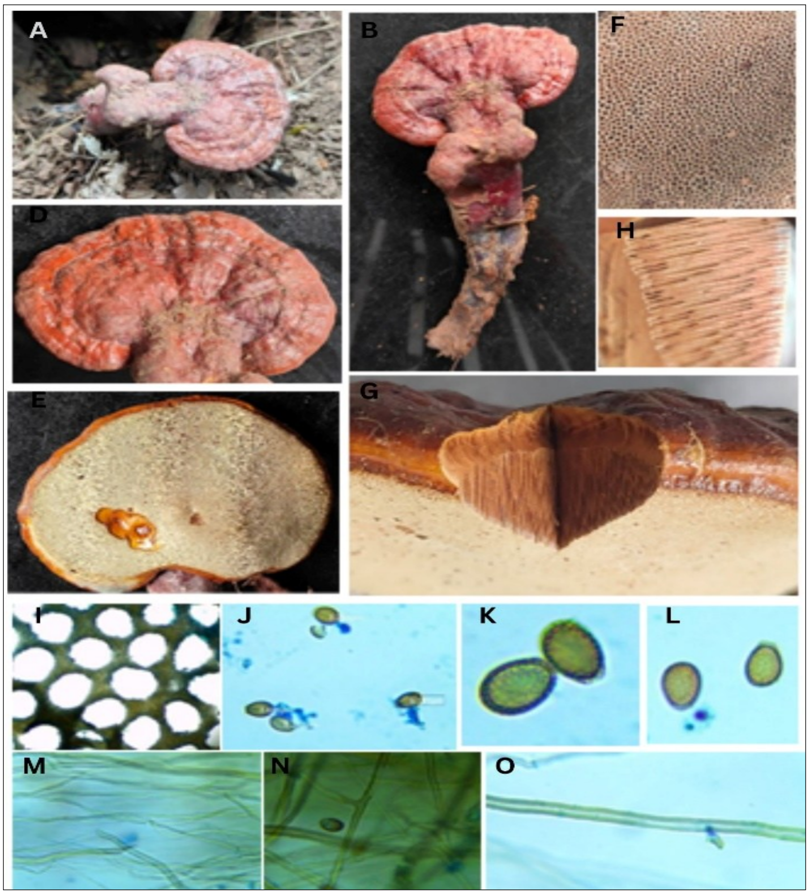

Fig. 17. *Ganoderma lucidum*: A: Fruiting body on host, B & C: Upper surface, D: Lower surface, E: Context with pore tubes, F: Pores, G & H: Pore tubes, I: Pores under microscope, J–L: Different shapes of spores, M–O: Hyphae.

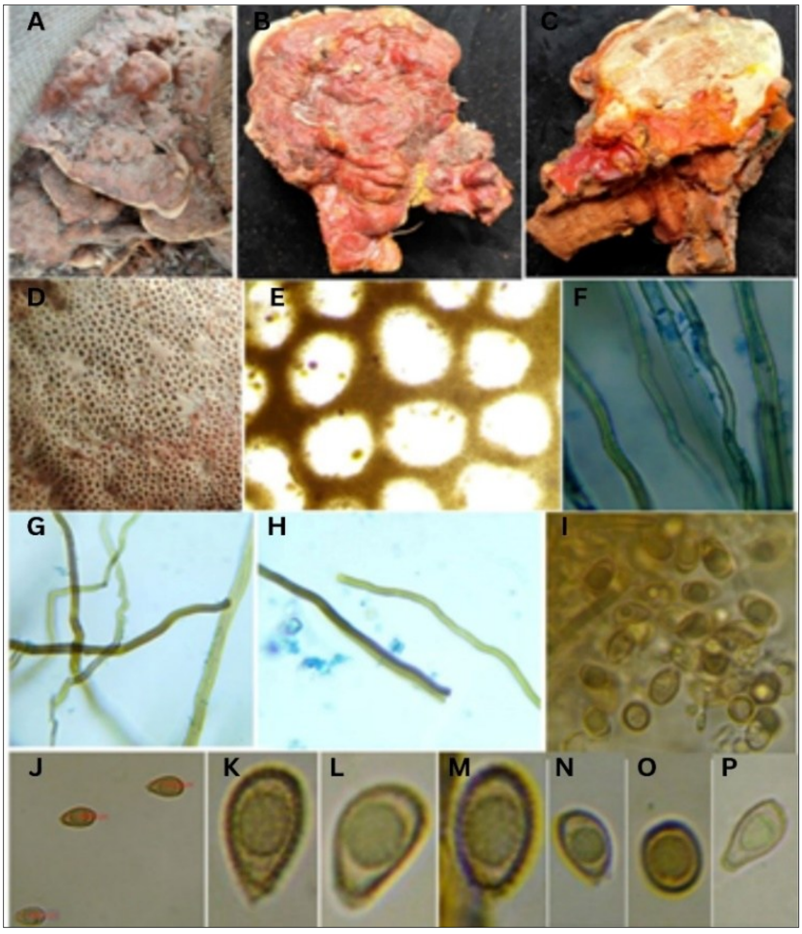

Fig. 18. *Ganoderma sessile*: A: Fruiting body on host, B: Upper surface, C: Lower surface, D: Pores, E: Pores under microscope, F–H: Different shapes of hyphae, I: Group of spores, J–P: Different shapes of spores.

Ganoderma gibbosum **(Blume & T. Nees) Pat**

The fruiting body found on dead trees of *Pterocarpus* and silver oak, annual, sessile, attached with a significantly constricted base, spathulate, non-laccate, woody and light brown in shade, measuring up to 6 × 7 and up to 3 cm thick at the base. The upper surface is firm, several layers thick, light brown in colour and even. A crust overlies the pellis, with concentric zones, an even, concolourous edge and a thickness of up to 2 cm. The lower surface is light brown, with round to sub circular pores 4–5. Context is up to 2.5 cm thick, dry and duplex, with a brown lower layer and a dark brown upper layer. Hyphal system is trimitic. The generative hyphae are hyaline, brown, thin walled and measure up to1.6–2.8 µm in diameter. Skeletal hyphae have thin brown walls and can measure up to 4–5.5 µm in diameter. The skeletal hyphae are linked with brown binding hyphae with strong walls and many branches, measuring up to 2.6–5.8 µm in diameter. Basidiospores are ellipsoid to elongate, brown to light brown in colour and measure up to 6.5–7.8 × 9.5–10.3 µm in diameter (Fig. 19).

Ganoderma adspersum **(Schulzer) Donk**

Fruiting body is found on Tamarind tree trunk and *Terminalia* dead wood, perennial, sessile, attached with a broad base, applanate, up to 10 × 8 × 7 thick in compound basidiocarps, even, zonated, different colours of zones are present, reddish brown in colour. Upper surface is tuberculate to sulcate, dark brown and covered with a crust which is white in section, margin rounded, thick and whitish in colour. Pore surface whitish in colour, immediately discolour when handling the specimen to umber to reddish brown, pore is small, circular, regular, 3–4 per mm. Context is thick, homogeneous, reddish brown in colour, up to 4 mm thick, pore tubes are dark reddish brown layered, up to 5 mm deep. The hyphal system is trimitic; the generative hyphae are inconspicuous, thin-walled with clamps, 2.5–4.5 µm in thickness, brown in colour. Skeletal hyphae dense, thick walled, brown, non-septate, 3.5–5.8 µm in diameter, branched, brown in colour, few binding hyphae are present, branched, orbiforme, dark brown, clusters difficult to separate. Cystidia absent. Basidiospores are ellipsoid, truncate at the distal end, colour yellowish brown, measuring up to 8.7–0.5 × 5–7.8 µm (Fig. 20).

Ganoderma applanatum **(Pers.) Pat**

The fruit body is found on the dead trees of *Acacia, Albizia* and *Annona,* perennial, dimidiate, flabelliform and sessile with a broad attachment base. It has a non-laccate, woody texture that is uneven, hard and wavy at the margin, displaying an irregular and concentrically zoned appearance with bumps and ridges. The color is greyish black and it measures approximately 12 × 8 × 1 cm thick. The upper surface is hard, several layers thick and ranges from brown to greyish brown in color. It is tuberculate, concentrically ridged and grooved, with a somewhat radially folded and irregularly ruptured crust. The margin is soft, 0.8 cm thick, round and uniform in color. The lower surface starts white and turns greyish yellow to brown with age, with small, circular to sub-circular pores that are initially white and light brown, 4-5 per mm. The context is up to 1.6 cm thick, dry, duplex, with the lower layer greyish-orange and the upper layer greyish-orange, woody. The hyphal system is trimitic: the generative hyphae are thin-walled and collarless with clamp connections, measuring about 2.5–3.5 µm; skeletal hyphae are thin-walled, greyish-brown and measure 3.6–7.5 µm; binding

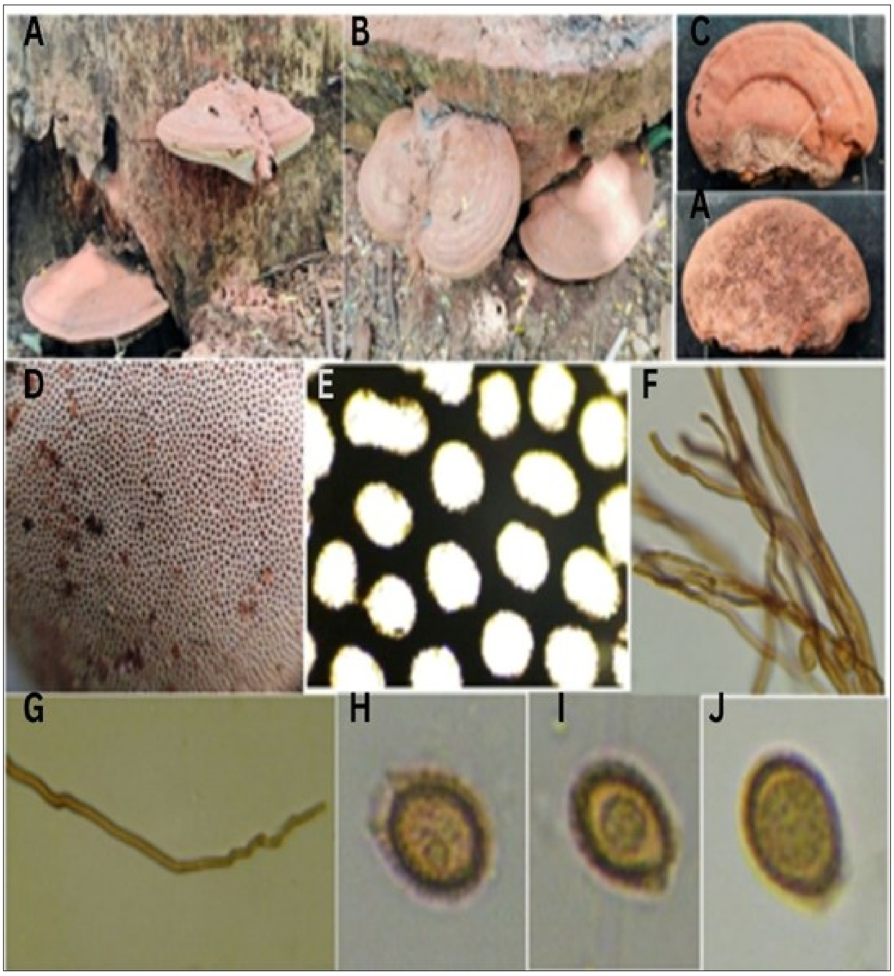

Fig. 19. *Ganoderma gibbosum:* A & B: Fruiting body on host, C: Upper surface and lower surface, D: Pores, E: Pores under microscope, F & G: Different shapes of hyphae, H–J: Different shapes of spores.

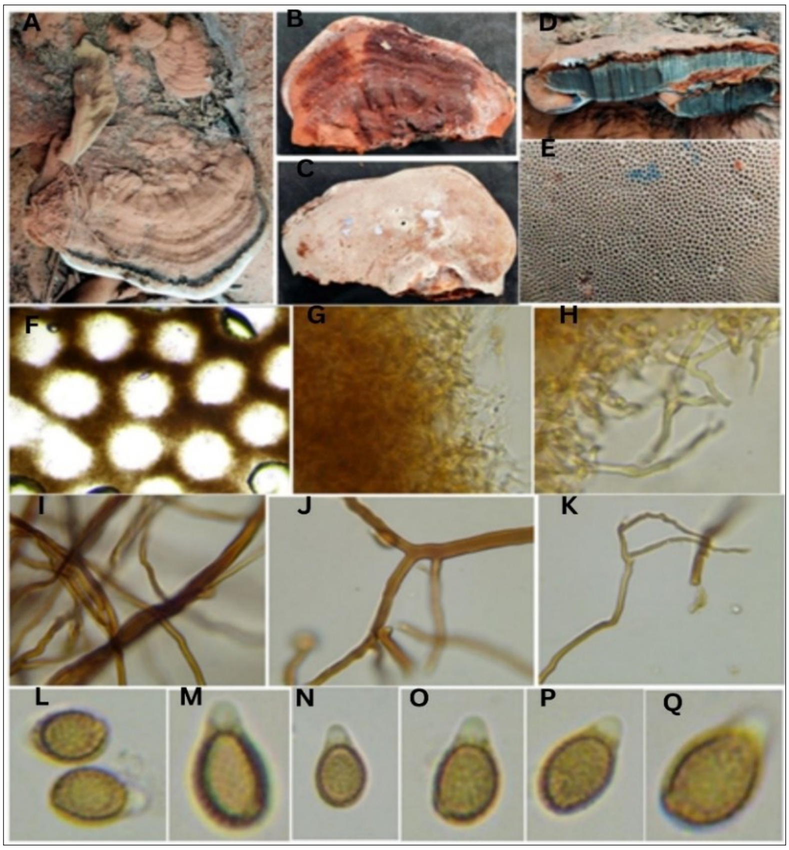

Fig. 20. *Ganoderma adspersum*: A: Fruiting body on host, B: Upper surface, C: Lower surface, D: Pores tubes, E: Pores, F: Pores under microscope, G–K-: Different shapes of hyphae, L–Q: Different shapes of spores.

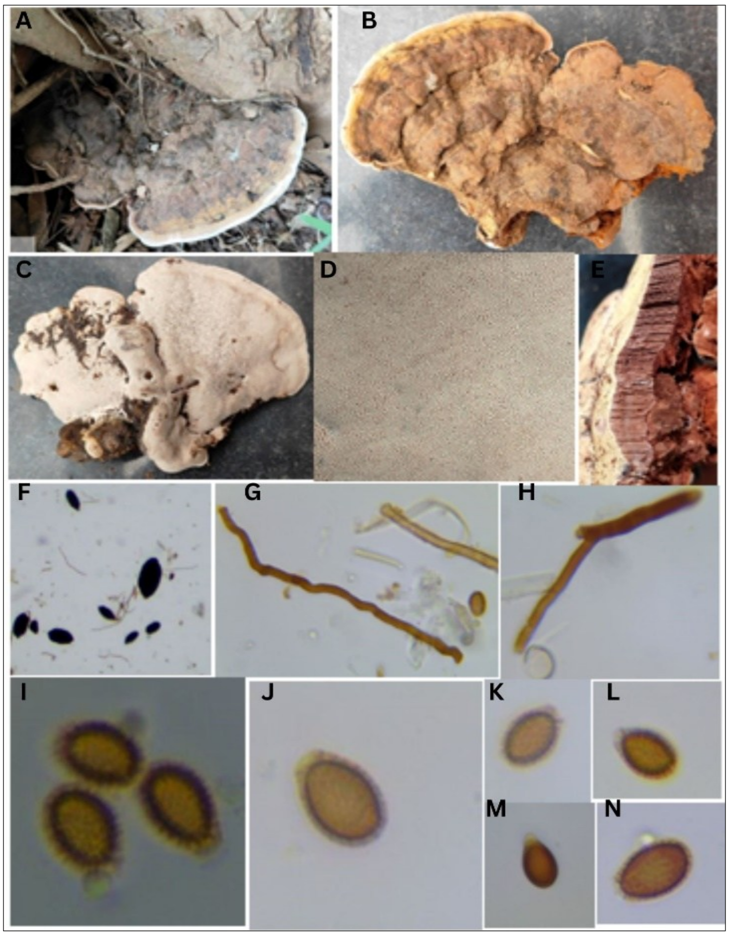

Fig. 21. *Ganoderma applanatum:* A : Fruiting body on host, B & C: Upper surface and lower surface, D: Pores, E: Pore tubes, F: Cystidia, G & H: Hyphae, I–N: Different shapes of spores.

hyphae are thick-walled, frequently branched at the apex, septate and brown to greyish, measuring up to 3.4–4.5 µm in width. Basidiospores are ellipsoid, truncate at one end, ranging from greyish orange to light orange, with some greyish-brown and measure up to 6.5–8.5 × 4.1–6.2 µm (Fig. 21).

***Hypoxylon lenormandii* Berk. & M.A. Curtis**

Fruiting body is found on fallen bamboo twigs, glomerate to effused-pulvinate, usually confluent, surface greyish to brown, looking like brown granules, conspicuous perithecial mounds, exposing a black layer surface at the tip of the stromata, measuring up to 8–15 × 6–9 mm in diameter, pigment blood colour in KOH solution. The tissue below the perithecial layers is dark brown to blackish, perithecia spherical to obovoid, measuring up to 0.3–0.7 × 0.2–0.4 mm in total length. Ascospores are dark brown, unicellular, ellipsoid, in equilateral, narrowly rounded ends, slightly sigmoid, convex, measuring about 10–16 × 4–5 µm in diameter (Fig. 22).

***Inonotus obliquus* (Pers.:Fr.) Pilat**

Fruiting body is found on living Eukalyptus and *Acacia* tree trunks, annual, effused, developing beneath the bark of tamarind tree, eventually rupturing the bark, hard, brittle when dry, firmly cracked, easily separable, margin fertile, yellowish brown at young and turns blacks at maturity, measuring up to 25 × 9 cm diameter. The pore surface is powdery and dark reddish brown. The pores are circular, 7–8 per mm, thick and the tube is dark reddish brown and brittle. Context bright yellowish brown, corky, up to 3.5 cm thick, turns brown in KOH solution. The hyphal system is monomitic: generative hyphae are thick-walled, branched, brown and measure up to 3–6.5 µm in diameter. Basidia clavate, 8–12 × 7–8 µm. Hymeneal setae scattered, ventricose, measuring up to 6–7 × 3–5 µm diameter. Basidiocarps pale brownish, broadly ellipsoid to ovoid, measuring 7–9 × 4–5.5 µm diameter (Fig. 23).

***Lentinus polychrous* Lév.**

Fruiting bodyi s found on dead tress of *Ficus*, *Acacia* and *Pongamia*. Pileus initially convex, becoming flat with age, slightly depressed center, surface: rough, covered with scales that are more concentrated towards the center, white to light tan when young and turns light brown at maturity, margin wavy and sometimes lobed, often slightly inrolled in young specimens. Lamellae: decurrent, crowded white to cream, turning yellowish as they age, stipe is 4.3 cm long and 1.3 cm thick, cylindrical, often slightly thicker at the base, smooth or slightly fibrillose. Spores are ellipsoid to cylindrical 4.5 x 5.5 µm, smooth, hyaline (translucent) in KOH solution, Basidia are club-shaped, cystidia absent, hyphae in the cap cuticle are interwoven, septate and have

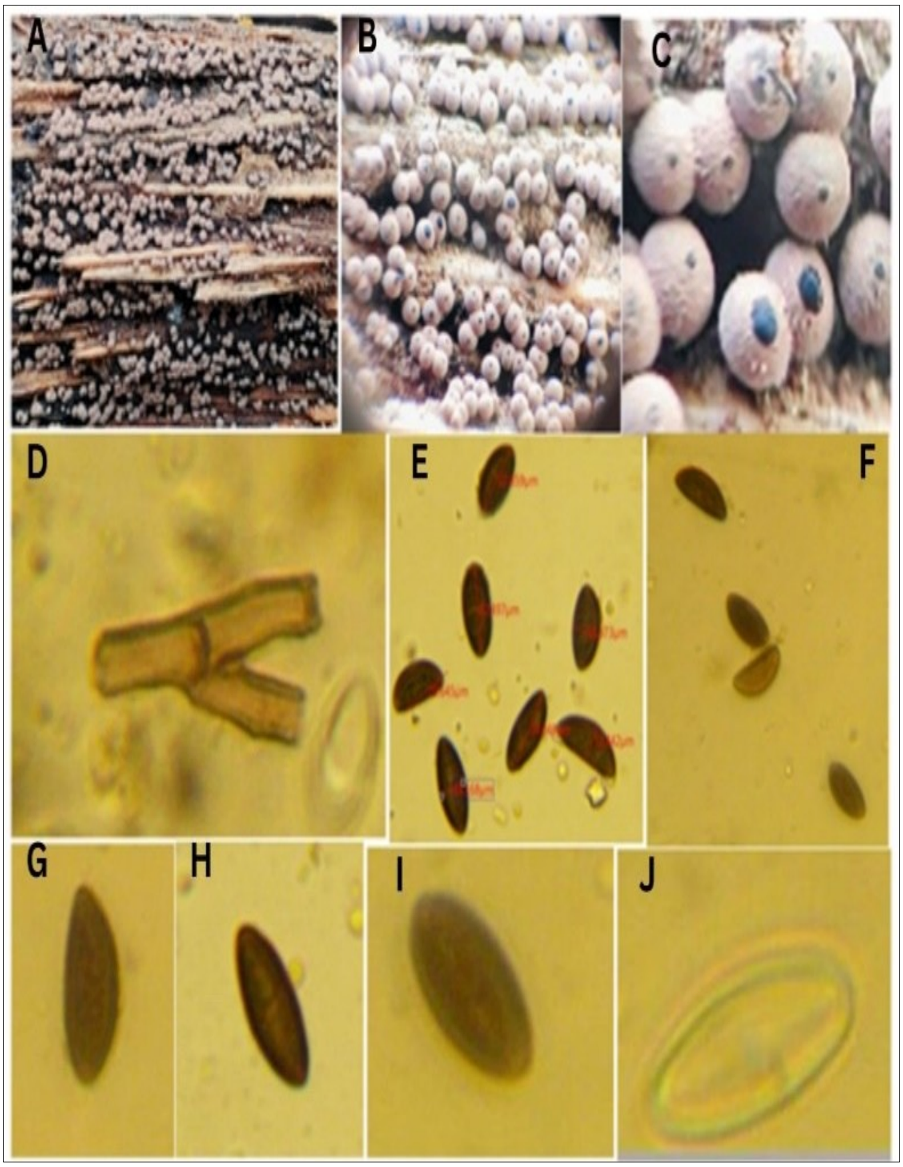

Fig. 22. *Hypoxylon lenormandii:* A–C: Fruiting body on host, D: Hyphae, E: Spores with measurement, F–J: Different shapes and size of spores (100x).

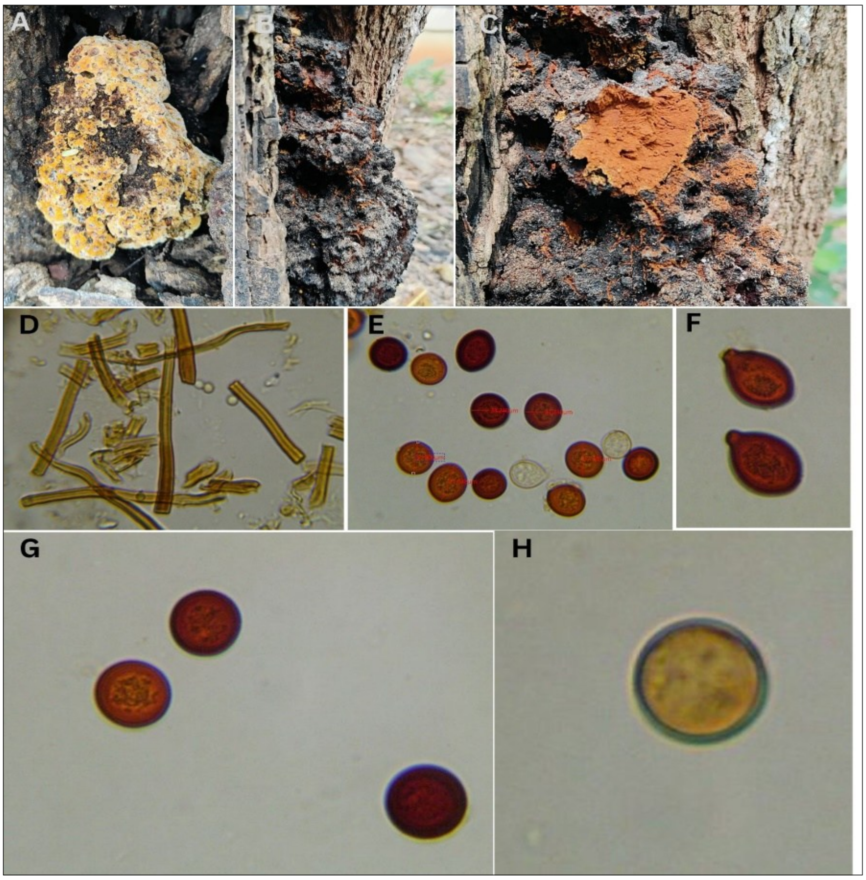

Fig. 23. *Inonotus obliquus*: A & B: Fruiting body on host, C: Dried fruiting body, D: Hyphae, E: Group of spores, F–H: Different shapes of spores.

Fig. 24. *Lentinus polychrous*: A & B: Fruiting body on host, C: Upper surface, D: Gill surface, E: Basidia, F–H: Different shapes of spores.

clamp connections (Fig. 24).

Lentinus sajor-caju **(Fr.) Fr.**

The fruiting body found on the *Pongamia* tree, the fruiting body (cap) is convex, semi-circular, stipitate, annual, arising in a small, gregarious group, imbricate and confluent, attached laterally with a broad base, flabelliform, coriaceous and soft and flexible while fresh and leathery when dry, even. Radially wrinkled, margin thin, milky white, measuring about 6 cm long. Pileus surface is milky white in colour, soft, even and flexible, measuring about 6 cm in length and 6.5 cm in width. Gilles' surface is creamish white in color; gills are closely spaced, fine, narrow threads, connected as on a net. Stipe/ stem: The stipe is off-center or lateral, short and thick and matches the cap in colour, slender, fibrous and elastic, hyphal system didimitic: generative simple aseptate hypha, branched, blue in colour up to 3.4 µm in diameter. The binding hyphae are blue in color, thick-walled and 5.2 µm in diameter. The basidiophore is blue in colour, cylindrical, measuring about 2–3.5 × 6.5 µm (Fig. 25).

Marasmius haematocephalus (**Mont.) Fr.**

The fruiting body is found on bamboo twigs and leaf litters, solitary, umbonate, glabrous, more sulcate, delicate with a thin, dark pink, conical cap, margin ribbed. Gills are widely spaced (20–28 lamellae), pale yellowish pink at the lower surface, stipe thin, wiry, horny, dark brown, shiny, measuring up to 4–5 cm long, 0.5–1 mm thick, margin thin concolorous, entire. Basidiospores are ellipsoid, smooth, hyaline and thin-walled, measuring up to 7–9 × 3–4.5 µm (Fig. 26).

Microporus xanthopus **(Fr.) Kuntze**

Fruiting body found on fallen twigs of silver oak tree, annual, found in small groups, centrally stipitate, margin wavy and lobed, often deeply incised, irregularly developed fruiting body appears almost flabelliform, radially furrowed and tough to coriaceous. Upper surface glabrous, shiny when fresh, duller when dry, yellow brown to chestnut color, numerous narrow concentric zones, alternating dark and light colors, margin thin and wavy, measuring up to 8–11 cm in diameter and 1–2 mm thick. Pore surface cream to pale buff, pure white towards the margin, pores entire, very minute, almost visible to the naked eye, 8–9 per mm. Stipe round, glabrous, tubular, light yellowish to light brown, up to 3–7 cm height and 4–9 mm thick, slightly expanded upwards and expanded to a disc-like base; pores are surrounded to the stipe. Hyphal system is trimitic: generative hyphae thin-walled and with clamps, moderately branched, light brown in color, measuring about 2.5–5 µm diameter. Skeletal hyphae, hyaline, thick-walled, dominating, measuring about 5–6 µm diameter. Binding hyphae torturous, solid, thick-walled, strongly corralloid, finely branched, measuring about 1.5–3 µm. Spores hyaline, cylindrical, often slightly bent, smooth, measuring about 5–7.5 × 2.5–3.5 (Fig. 27).

Pseudofavolus tenuis **(Fr.) G. Cunn.**

Fruiting body is found on dead trees of silver oak and *Mangifera* tree twigs, sessile, slightly ascending, flabelliform, short resupinate foot (short stint), glabrous, narrowly sulcate, often radially rugulose, pale fawn to tan, greyish, thin, margin greyish white, measuring up to 8 × 6 × 0.4 cm broad. The upper surface is pale greyish to pale brown and turns black with older age. It is uneven, corky, coriaceous, concentrically straight to zonate and the margin is entire and thin. The pore surface is greyish to creamish; pores are hexagonal structure, 1–2 per mm, regularly arranged. Hyphal system trimitic: generative hyphae, clamped, septate, thick, pale yellow, measuring about

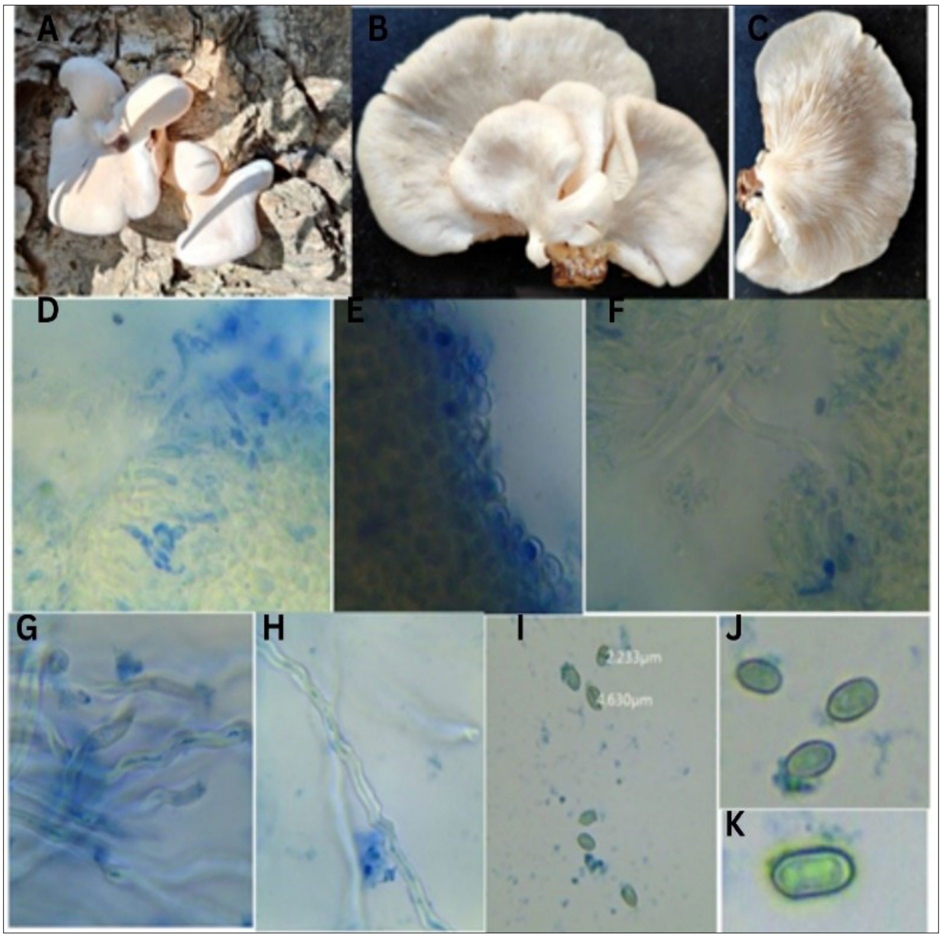

Fig. 25. *Lentinus sajor-caju:* A: Fruiting body on host, B: Upper surface, C: Gill surface, D–F: Basidia, G & H: Different shapes of hyphae, I–K: Different shapes of spores.

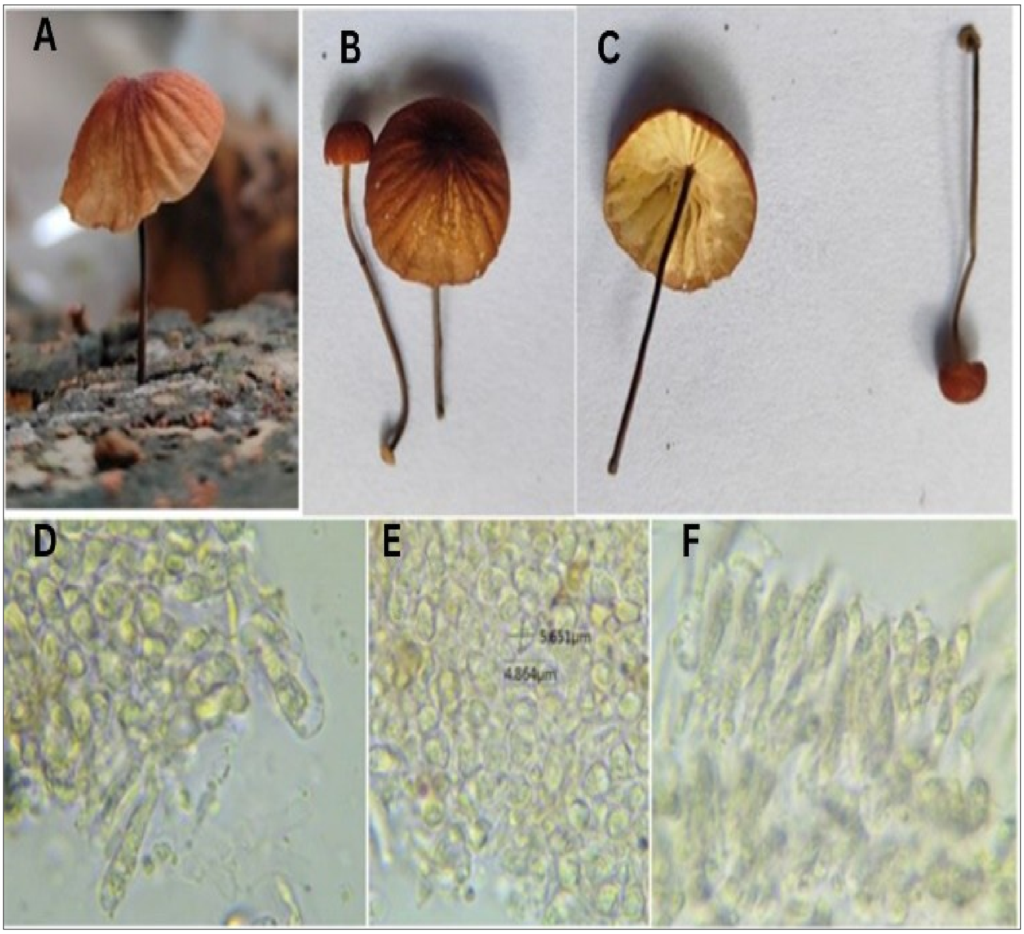

Fig. 26. *Marasmius haematocephalus*: A: Fruiting body on host, B: Upper surface, C: Gill surface, D–F: Basidia and spores.

Fig. 27. *Microporus xanthopus:* A: Fruiting body on host, B: Upper surface, C: Lower surface, D: Pores, E: Pores under microscope, F: Basidia, G–I: Different shapes of Hyphae and spores.

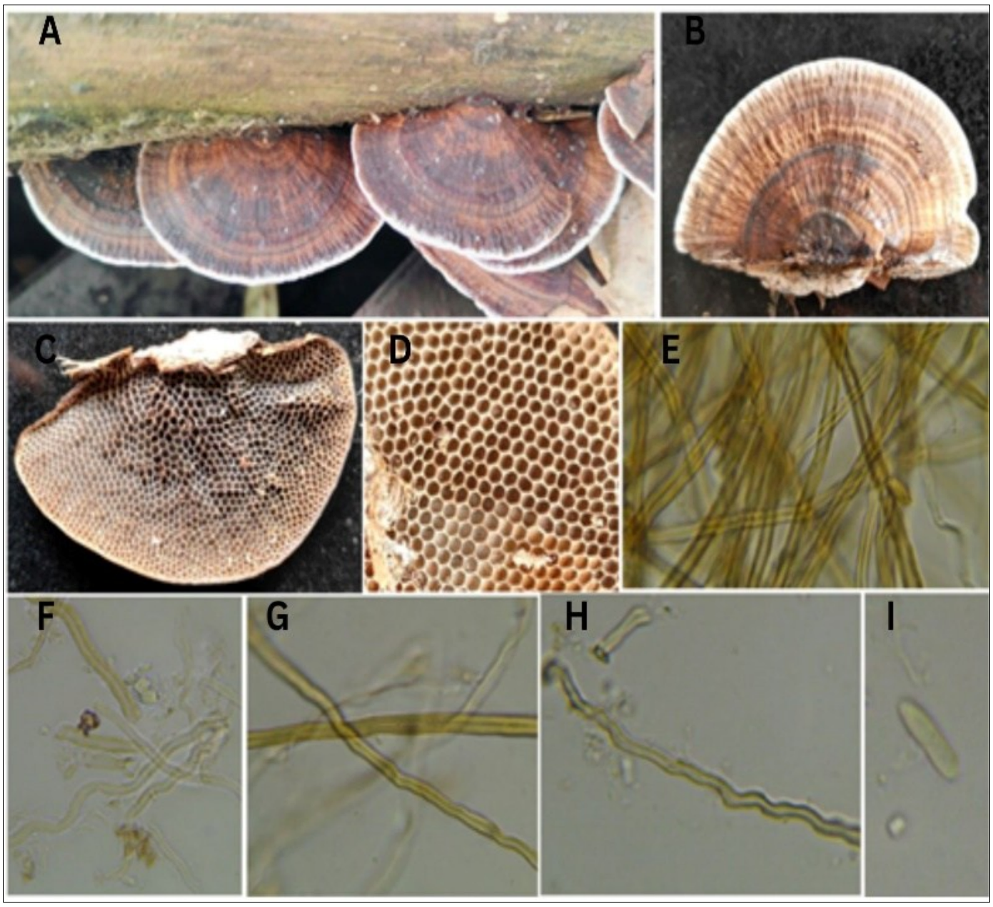

Fig. 28. *Pseudofavolus tenuis:* A: Fruiting body on host, B: Upper surface, C, D: Lower surface, E-H: Hyphae, I: Spores (100x).

2.5–5 µm. Skeletal hyphae pale yellowish brown, thick walled, unbranched, unlimited, measuring about 3–6.5 µm diameter. Binding hyphae are very thick yellowish brown in color, measuring about 1–2 µm diameter. Basidiospores are white to cream in color, smooth, subcylindric, slightly curved, obtuse and thin-walled, measuring about 9–13 × 3.5–5.5 µm (Fig. 28).

Stemonites splendens **Rostaf**

Fruiting body found on dead trees of *Delonix regia, Acacia* and *Sterculia urens*. Thick clusters of sporangia; tall, slender, cylindrical sporangia that are grouped together, forming a dense, forest-like structure, stipitate, peridium evanescent. The stalk is hollow, reddish brown, widened at the base and dark brown to shiny black when mature. The stalk is long, dark brown to black, sturdy and rigid and supports the sporangium. Spores are spherical measuring 5.5 × 6.5 µm, ornamented with fine spines or warts, dark chocolate brown, capillitium, thread-like network, darkly pigmented filaments (Fig. 29).

Schizophyllum commune **Fr.**

The fruiting body is found on *Dalbargia, Bamboo* and *Albizia saman* stem, sessile attached with a broad base without stalk, the fruiting body has undulating waves of tightly packed corals, split gills, varying from creamy yellow to pale white in colour. Flabelliform, uneven, smooth, elasticity when it is young. The cap is 3 cm wide with a dense spongey body texture, creamish white in color, measuring about 2.6 cm in length and 3 cm in width. Rough texture, uneven, white tomentose, glabrous. Pore surface is greyish white in color. The width of the gills is closely spaced, fine, thread-like structures. Slender, fibrous elastic gills are not too close or narrow. Hyphal system is didimitic generative simple septate hyphae, branched pale yellow in color up to 3 µm in diameter. Skeletal hyphae pale yellow in color, thick-walled 8 µm in diameter, clamp connection present. The basidiospore pale yellow, sub-elliptical and cylindrical, measuring about 2—3 × 3.5–4 µm (Fig. 30).

Trametes gibbosa **(Pires.) Fr.**

The fruiting body found on dead tree of *Delonix regia*, pilus annual, pileate, applanation, sessile to dimidiate, semi-circular, tough, coriaceous, pale brown to a greenish color, measuring about 12 × 6 × 1.5 cm broad, thick at the base and thin near the margin. Upper surface tomentose to glabrous at the young stage, zonate, glabrous with age, white in colour when fresh and young, then ochraceous to pale brown to olivaceous, often greenish at the base due to algae, margin sharp. The pore surface is white to pale pink to straw-colored in old age. Pores are distinctly radially elongated, with age spores splitting into lamellate 1–2 per mm, tube layer concolorous. Hyphal system trimitic: generative hyphae with clamps, hyaline, thin-walled, branched, white, measuring up to 2.5–4.5 µm diameter. Skeletal hyphae thick-walled, non-septate, hyaline, white, 4.5–8 µm diameter. The binding hyphae are thick-walled, solid and hyaline, existing between the binding and generative hyphae, measuring up to 2.5–3 µm diameter. Basidia are clavate with a basal clamp. Basidiospores are cylindrical to oblong ellipsoid, smooth, measuring up to 4.5–5.5 × 2–2.5 µm broad (Fig. 31).

Xylaria hypoxylon **(L.)**

Fruiting body is found on the trunk of a Tamarind tree, slender, subcylindrical to strap-shaped, branched at the tip, solitary or gregarious, black in color on the lower side and powdery white at the tip of the stromata, measuring up to 6–8 cm in height. Perithecia completely immersed, surface of fertile portion is tuberculate, with longitudinal short splitting up to 0.4–0.5 mm in size. Asci are cylindrical

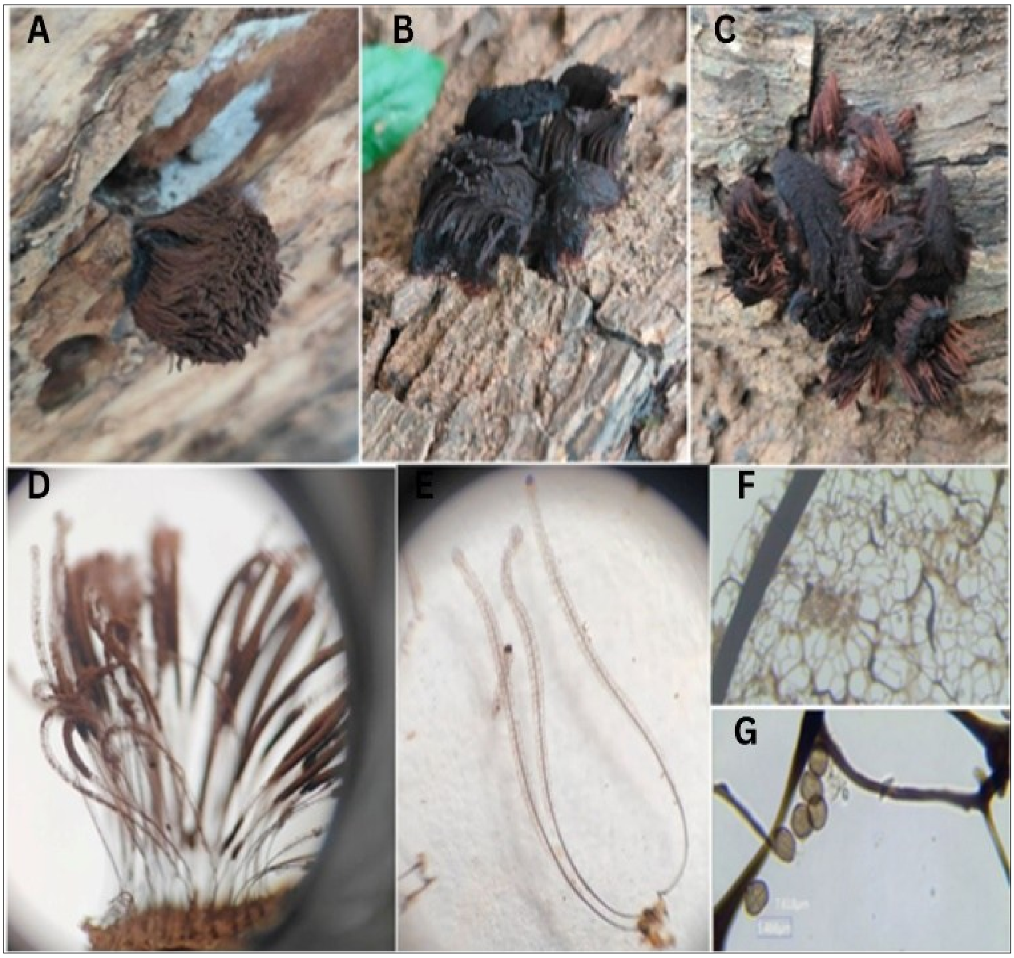

Fig. 29. *Stemonites splendens*: A–C: Fruiting body on host, D & E: Fruiting body under 10x, F & G: Spores.

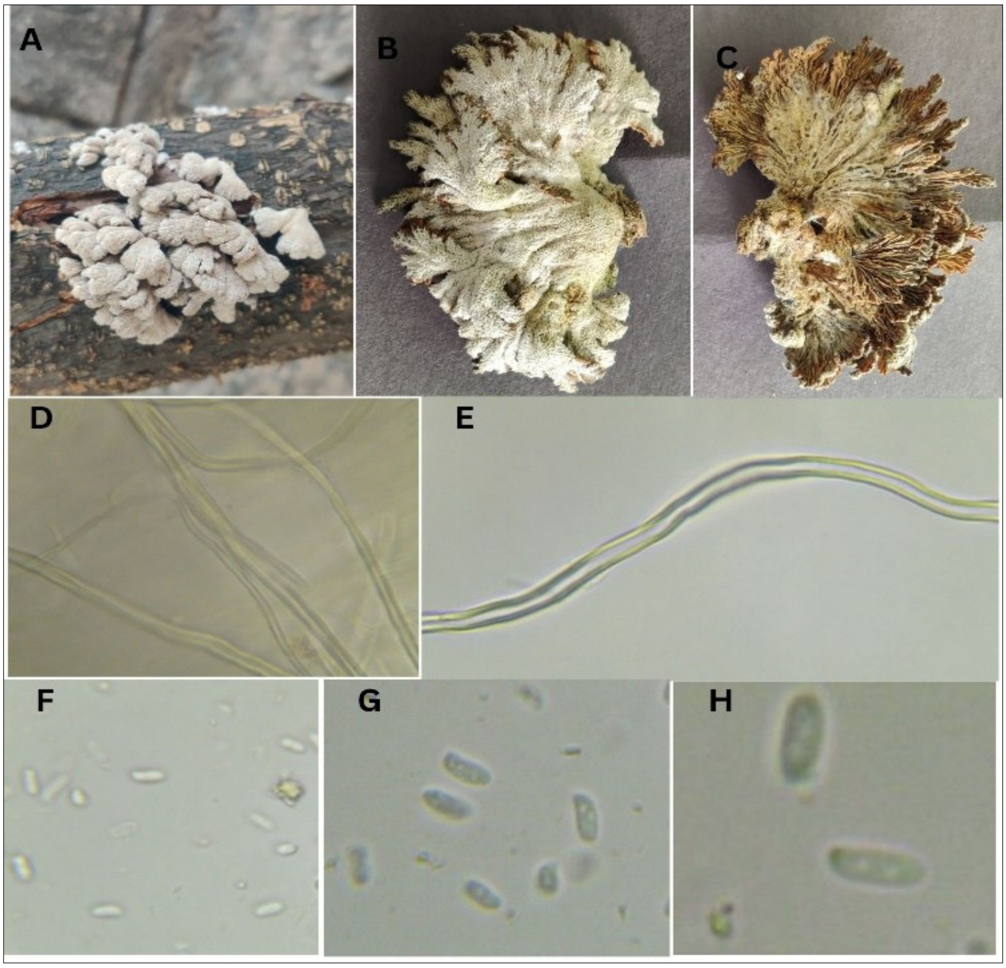

Fig. 30. *Schizophyllum commune:* A-C: Fruiting body, D & E: Hyphe, F–H: Different shapes and size of spores (100x).

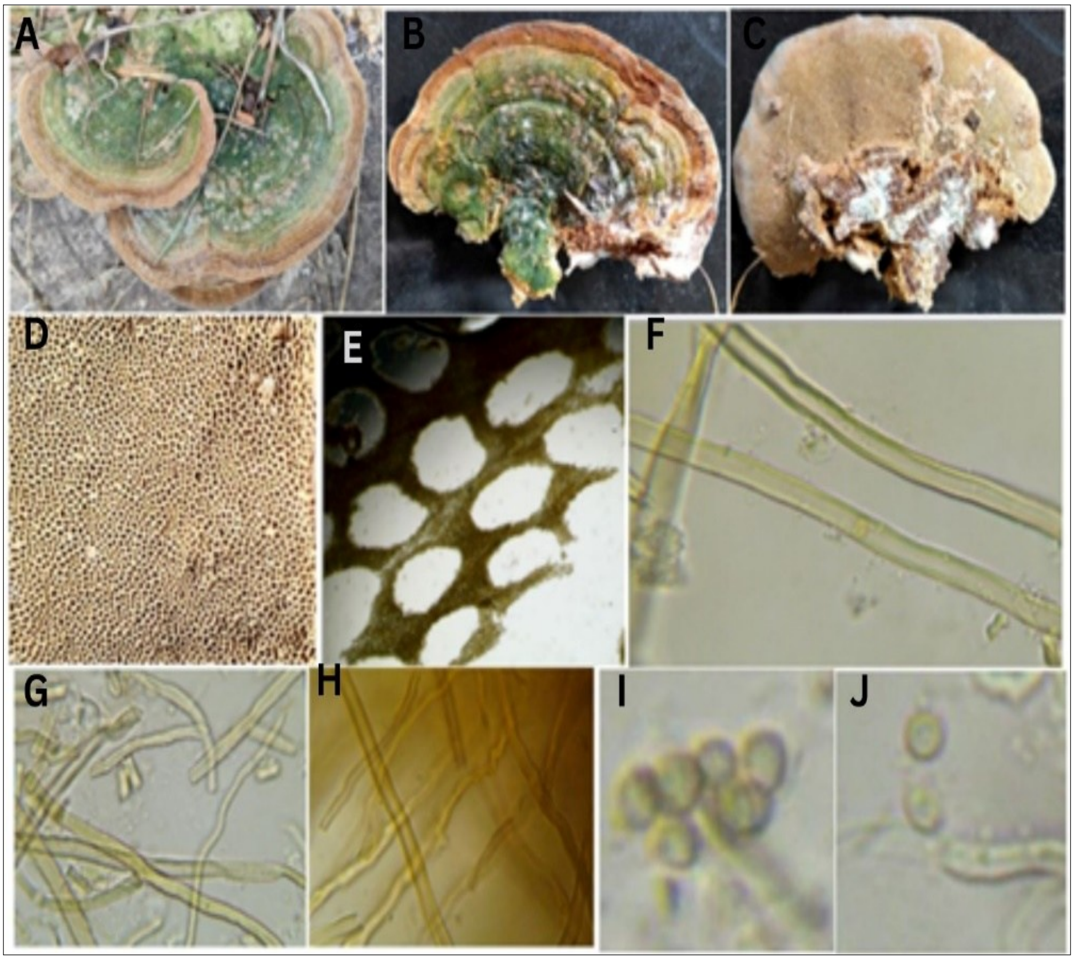

Fig. 31. *Trametes gibbosa:* A: Fruiting body on host, B: Upper surface, C: Lower surface, D: Porous surface, E: Pores under 20x. F–H: Hyphae under 100x. I & J: Different shapes and size of spores (100x).

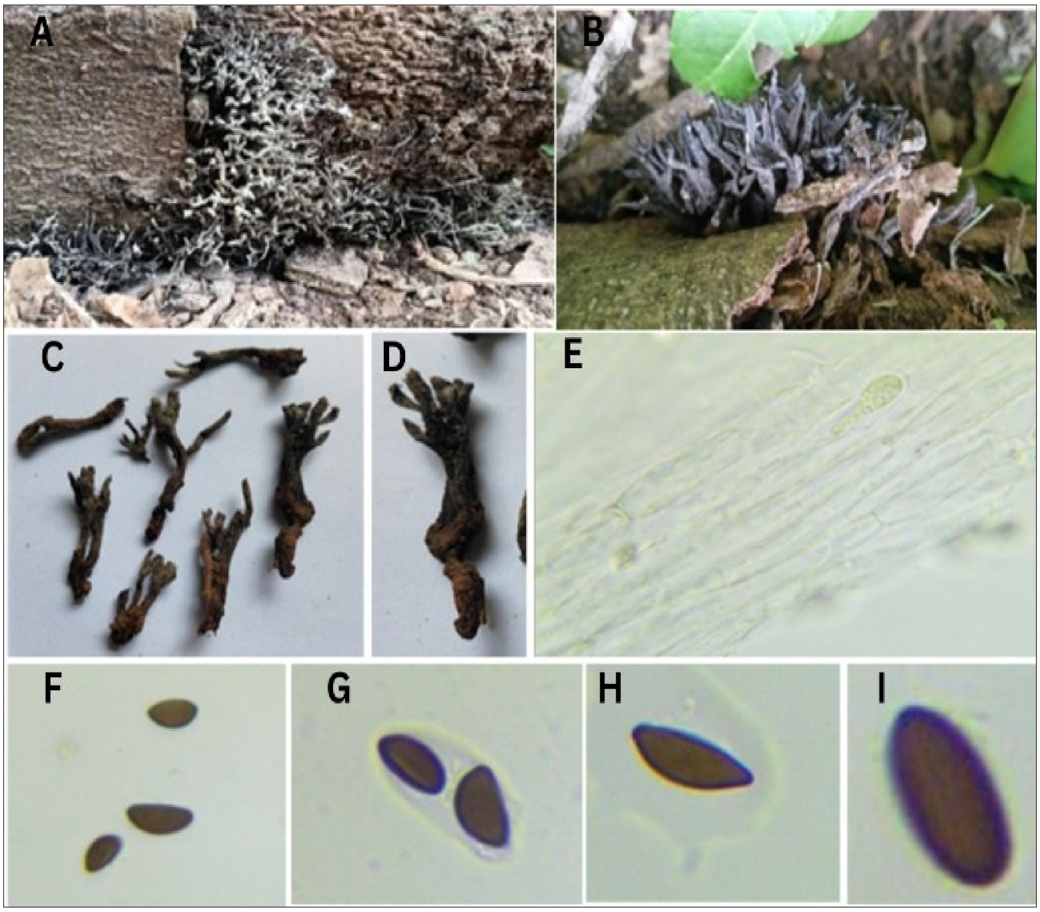

Fig. 32. *Xylaria hypoxylon:* A & B: Fruiting body on host, C & D: Individual fruiting body, E- Inner tissue, F–I: Different shapes of hyphae and spores.

and ascospores are black in colour, uniseriate, slightly bean shaped, 4.8–6.3 × 11.3–12.6 µm in diameter, unequatorial at one side and rounded on the other side (banana blended) (Fig. 32).

***Xylaria polymorpha* (pers.) Grev.**

Fruiting body is found on an *Acacia* sp. fallen dead wood log, finger like forms with a dark black coating, structure found on near the base of decaying hardwood appearing terrestrial but actually attached to buried wood, gowning in clusters. More are less club shaped, with blunt narrowed, whitish black tip; elsewhere pale to dark grey, surface finely dusted, smooth, dry, interior surface white and tough when young at maturity more or less club shaped, with rounded tip, some are irregularly, flattened, swollen towards the top or bottom, dark black in colour, surface dry, finely wrinkled, up to 5–7.5 cm long and 0.8–1.2 cm thick. Perithecia black, sub-spherical, 0.5–0.9 mm diameter. Arranged in a single dense layer just below the surface. Asci are cylindrical, long and stipitate. Ascospores are purple, brown, aseptate, smooth, slightly bean to double shape in structure, measuring up to 10.6 –15.2 × 2.6 – 4.8 µm in diameter (Fig. 33).

***Xylaria lingipes* Nitschke**

The fruiting bodies are found on a *Terminalia* tree trunk in groups, with a club-shaped form and a short stipe. They are tough and taper to a rounded apex. At maturity, their surface is greyish brown, turning black with age and becomes crackly and scaly. They measure approximately 3–8 cm in length and 0.2–1.5 cm in diameter. The perithecia are 0.5–1 mm in diameter with a papillate ostiole and the asci are long and stipitate. The ascospores are brown to black, smooth and fusiform with a slit running through them, measuring about 4–7.5 × 11–15 µm (Fig. 34).

Discussion

WRF are essential contributors to wood degradation, nutrient turnover and overall ecosystem balance. A survey carried out in the Savandurga dry deciduous forest from April 2023 to March 2024 identified 32 WRF species through detailed morphological analysis. Prominent species such as *Ganoderma lucidum*, *Schizophyllum commune* and *Xylaria polymorpha* reflect the rich diversity and host specificity of the region's fungal community. These

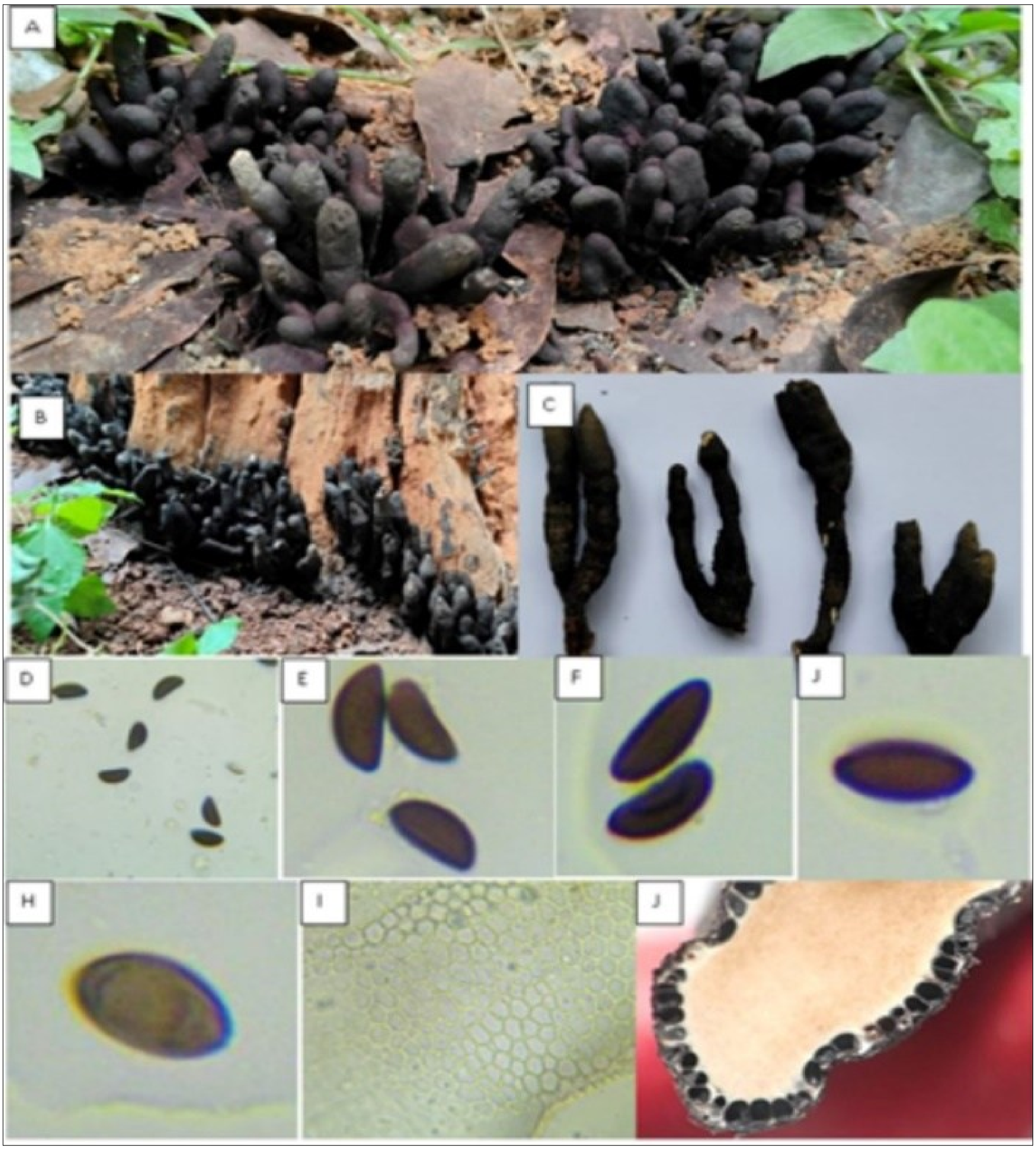

Fig. 33. *Xylaria polymorpha*: A & B: Fruiting body on host, C: Individual fruiting body, D–H: Different shapes of spores, I: Inner tissue, J: Perithecia.

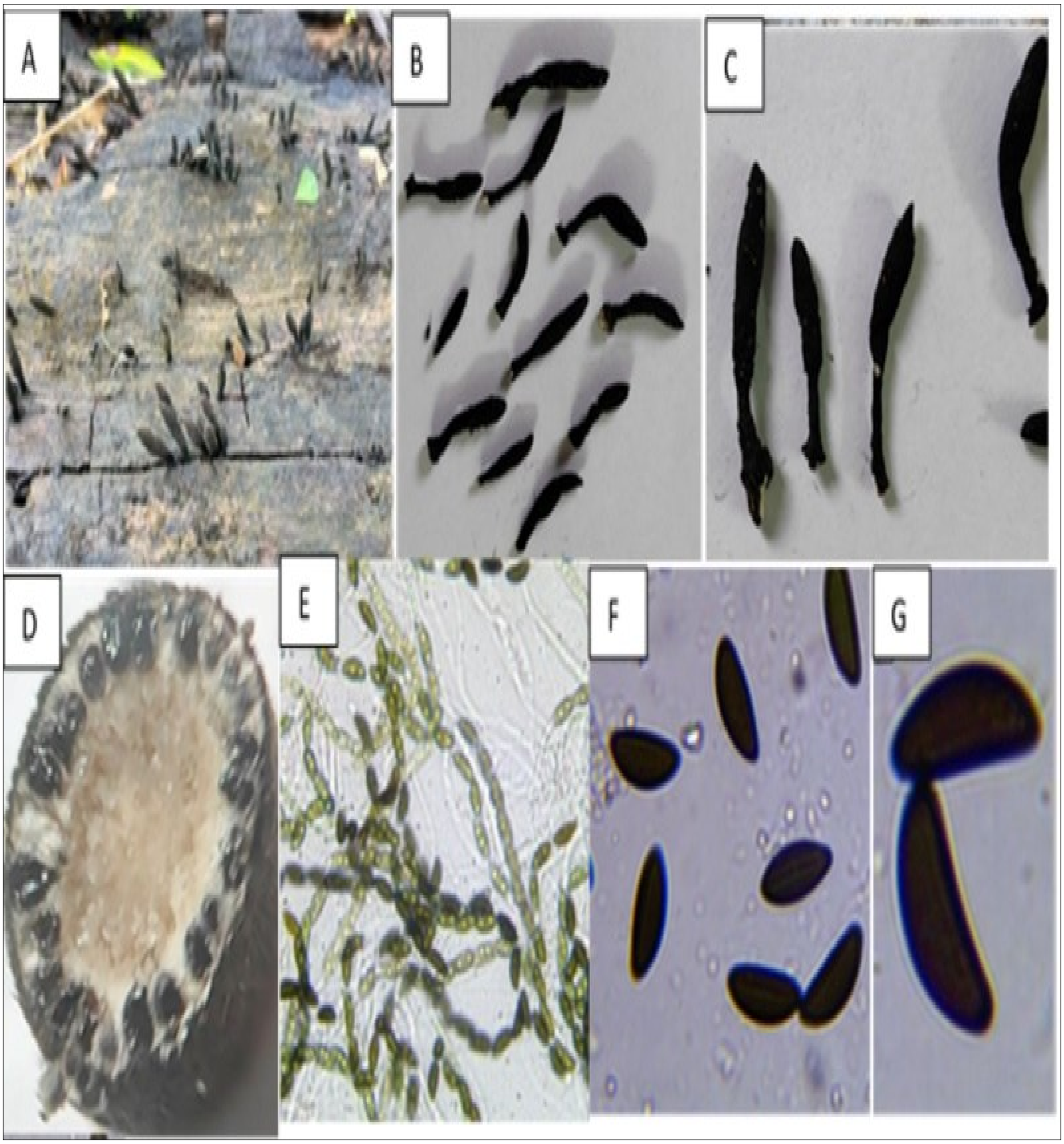

Fig. 34. *Xylaria lingipes:* A: Fruiting body on host, B & C: Individual fruiting body, D: Perithecia, E: Asci, F & G: Different shapes of spores.

results emphasise the ecological significance and biotechnological potential of WRF in promoting forest resilience and sustainability.

In the evergreen forests of the Shivamogga and Chikkamagaluru districts of the Western Ghats, Karnataka, a remarkable diversity of *Ganoderma* species was revealed, with a total of 14 species identified (20). In contrast, our study from the Savandurga dry deciduous forest, Ramanagara district, recorded 32 species of wood-rotting fungi through detailed morphological analysis. These findings collectively highlight the ecological diversity and distributional variation of wood-rotting fungi across distinct forest types of Karnataka.

Xylaria hypoxylon exhibits antimicrobial potential, whereas *X. polymorpha* displays stronger antioxidant activity; both act effectively at concentrations of 50–400 µg/mL, highlighting their therapeutic promise (21). A novel laccase from *X. polymorpha* also degraded amoxicillin by 95.7 %, reducing toxicity and showing bioremediation potential (22). *Lenzites acuta*, reported from India, exhibits notable biocatalytic potential. Studies in Cameroon revealed that *L. acuta* and *Microporus xanthopus* possess strong enzymatic activities, with the latter excelling in cellulase production (23). *Daedalea quercina* and related species, such as *D. confragosa* var. tricolour, are notable for their bioactive metabolites, including newly discovered triterpenes and lanostane derivatives that exhibit pharmacological potential (24). *Pleurotus sajor-caju* is widely studied for its bioactive compounds, with recent research reporting strong nutritional, antioxidant, antibacterial and anticancer properties (25). *Auricularia auricula-judae* continues to demonstrate medicinal and nutritional significance, showing antioxidant activity, collagen-promoting effects and health benefits related to cardiovascular and intestinal function (26). *Xylaria nigripes*, traditionally used in Chinese medicine, shows sedative, antianxiety, antidepressant and antioxidant activities (27). *Xylaria longipes*, recorded in South India, produces bioactive diterpenes and exhibits anti-MRSA activity from both fruiting body and mycelial metabolites (28, 29).

Ganoderma gibbosum has been recorded across multiple tree hosts in Yunnan, China (30) and more recently reported on *Platanus* and *Prunus* as a wood-decay fungus in Korea (31). *Ganoderma sessile* inhibits tumor growth and pulmonary metastasis, underscoring its antitumor role (32). It also produces the highest polysaccharide yield among related *Ganoderma* species under submerged culture, supporting its application in dietary supplement production (33). *Pycnoporus sanguineus* polysaccharides accelerate diabetic foot ulcer healing (34). *Pycnoporus* extracts display cytotoxicity against lung and prostate cancer cell lines (35). *Candolleomyces asiaticus*, a new species described from Pakistan, was confirmed by molecular phylogeny as distinct within the genus (36). *Entonaema liquescens* produces characteristic liquid-filled stromata and was recently recorded on woody substrates in India (37, 38).

Phellinus robiniae (formerly *P. rimosus*) fruiting bodies yield higher polysaccharide, phenolic and flavonoid content than mycelium, with strong antioxidant and antibacterial activity, *Phellinus rimosus* is often treated as a synonym of *P. robiniae*, now considered under *Fulvifomes* (39). Extracts of *P. robiniae* (strain NTH-PR1) showed antioxidant and antibacterial activity, with fruiting bodies yielding higher polysaccharides, phenolics and flavonoids than mycelium (40). *Inonotus obliquus* (Chaga) continues to attract attention for its antitumor, hypoglycemic, antioxidant and immunomodulatory effects. Recent reviews confirm that polysaccharides (IOPS) and triterpenoids are primary active compounds, supporting their applications in diabetes and cancer therapy (41, 42).

Lentinus polychrous is an edible mushroom rich in phenolics, ergosterols, polysaccharides and proteins, exhibiting antioxidant, anti-inflammatory, anticancer, anti-estrogenic, anti-angiotensin and immunomodulatory properties (43). *Microporus xanthopus* produces diverse metabolites, including phenols, tannins, sesquiterpenoids, fatty acids, macrolides and steroid-like compounds (44). It exhibits strong antioxidant and anti-angiogenic effects, reducing blood vessel density by 55.45 % in a CAM assay, which indicates its potential anticancer properties (45). *Arcyria denudata* yields metabolites such as arcyroxocin B and dihydroarcyriacyanin A, some of which show cytotoxicity against Jurkat cells (46). *Dacryopinax spathularia* is a nutrient-rich, low-fat mushroom with immune-modulating, antioxidant, antimicrobial, anticancer and hepatoprotective properties. Its bioactive compounds include alkaloids, tannins, flavonoids, saponins, carotenoids and phenolics. The mushroom shows promise for use in functional foods, nutraceuticals and pharmaceuticals and sustainable cultivation can benefit tribal communities (47).

Coprinellus disseminatus is nutritionally rich, containing 9.72 % protein, essential amino acids (notably leucine) and 59.1 % polyunsaturated fatty acids dominated by linoleic acid (56.6 %). It also provides minerals (K, Ca, Mg, Fe) and phenolic compounds such as p-hydroxybenzoic and p-coumaric acids, highlighting its nutritional and medicinal value (48). *Hypoxylon lenormandii* produces seven unique azaphilone pigments, lenormandins A–G, identified using HPLC, NMR and mass spectrometry. These pigments are characteristic of *H. lenormandii*, with only trace levels found in *H. sublenormandii* and *H. jaklitschii* the latter confirmed as a new Sri Lankan species through molecular and morphological analyses (49).

Hexagonia tenuis was recorded on a silver oak tree in this study and previously on a living *Nerium odorum* plant in Burdwan, West Bengal, India, marking a new host record (50).

Conclusion

This study presents a comprehensive assessment of the wood-rotting fungal diversity in the Savandurga forest, particularly emphasising their ecological roles and medicinal potential. This study documented 32 notable fungal species, documented, among them *C. asiaticus* and *C. acuta* are reported for the first time from India. The remaining taxa are newly recorded from Savandurga; these include *A. denudata*, *A. auricula-judae, C. spathularia*, *D. concentrica*, *E. splendens*, *F. quercina*, *F. robiniae*, *F. gilva*, *G. adspersum*, *G. applanatum*, *G. gibbosum*, *G. sessile*, *H. lenormandii*, *I. obliquus*, *L. polychrous*, *C. nuda*, *M. haematocephalus*, *M. xanthopus*, *L. sajor-caju*, *F. sanguineus*, *S. splendens*, *T. gibbosa*, *E. scabrosa* , *X. hypoxylon*, *X. lingipes* and *X. polymorpha*. These findings significantly expand the known macrofungal distribution and contribute to the growing documentation of Indian mycobiota. Additionally, the medicinal properties exhibited by several recorded species emphasise their potential for pharmaceutical applications, as documented in the literature. The insights gained from this research enhance knowledge of fungal biodiversity and support conservation efforts in the Savandurga ecosystem, paving the way for future studies on their ecological functions and biotechnological potential.

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Authors' contributions

BKS, TK, NA and PKN collected the specimens. BKS conceptualised the study, designed the methodology, conducted field investigations and microscopic analyses and was involved in writing and editing the manuscript. TK assisted in experimental data development. SA contributed to data analysis. PKN reviewed, edited and improved the manuscript. All authors read and approved the final manuscript.

Compliance with ethical standards

Conflict of interest: The Authors do not have any conflicts of interest to declare.

Ethical issues: None

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