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Cover: Digital illustration of Smooth-coated Otter *Lutrogale perspicillata* by Dupati Poojitha. Reference from the picture taken by Rana & Sugandhi.

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ARTICLE

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New distribution records and taxonomic studies of ascomycetous fungi *Xylaria* and *Daldinia* (Ascomycota: Xylariales: Xylariaceae) in Karnataka, India

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Abstract: The family Xylariaceae represents a diverse assemblage of ascomycetous fungi, widely recognised for their prolific production of secondary metabolites with potent bioactive properties, including antimicrobial, anticancer, and immunomodulatory compounds. A mycological survey was conducted from June 2023 to August 2024 across various ecological niches in Karnataka, India, to document the diversity of Xylariaceae. Extensive morphological, anatomical, and taxonomic investigations led to the identification of 16 fungal taxa distributed across two genera: *Daldinia* (3 species), *Xylaria* (12 species) and *Sphaeria* (1 species). The species of *Daldinia* were confirmed as *D. childiae* J.D.Rogers & Y.M.Ju, *D. concentrica* (Bolton) Ces. & De Not., and *D. eschscholtzii* (Ehrenb.) Rehm, while the *Xylaria* taxa included *X. curta* Fr., *X. carpophila* (Pers.) Fr., *X. castorea* Berk., *X. cornu-damae* (Schwein.) Berk., *X. apiculata* Cooke, *X. ellisii* Tanney, Seifert & Y.M.Ju, *X. frustulosa* (Berk. & M.A.Curtis) Cooke, *X. hypoxylon* (L.) Grev., *Sphaeria kegeliana* Lév., *X. longipes* Nitschke, *X. nigripes* (Klotzsch) Cooke, *X. polymorpha* (Pers.) Grev., *X. telfairii* (Berk.) Sacc., These species were predominantly found colonizing decayed wood, lignified stumps, and decomposing leaf litter. Notably, *D. childiae*, *X. curta*, *X. ellisii*, *X. frustulosa*, *X. kegeliana* are reported for the first time in Karnataka, whereas *X. telfairii* and *X. cornu-damae* constitute new records for India. This study significantly enhances our understanding of the taxonomy, systematics, and biogeography of Xylariaceae in the Indian subcontinent, providing valuable insights into their classification, substrate preferences, and ecological distribution.

Keywords: Fungal diversity, morphological survey, morphological taxonomy, secondary metabolites, substrate specificity, wood decay fungi.

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INTRODUCTION

Ascomycota, a large taxonomic group of fungi, encompasses numerous genera that play crucial roles in forest ecosystems. Xylariaceae is a diverse and ecologically important family within the Ascomycota (Suwannasai et al. 2023). The family Xylariaceae, belonging to the phylum Ascomycota, includes approximately 85 genera and over 1,300 species worldwide (Patel & Krishnappa 2017). Among these, *Xylaria* and *Daldinia* species are particularly significant, as they contribute to the decomposition of wood and organic matter (Rogers 1979). Most representatives of the genus *Xylaria* are considered saprophytes, though they may exhibit varying degrees of parasitism, typically associated with stems and leaves and less frequently with fruits (Canon et al. 2019). *Xylaria* species associated with termite nests are predominantly found in Africa and Asia, particularly in regions dominated by the termite species from the subfamily Macrotermitinae (Wangsawat et al. 2021). Despite their ecological importance, many xylariaceous fungi remain poorly understood, especially in the underexplored Western Ghats, a biodiversity hotspot, despite known ascomycete numbers having nearly doubled in recent years (Karun & Sridhar 2015). The present study focuses on the diversity, distribution, taxonomy, and substrate specificity of *Xylaria* and *Daldinia* within the eco-regions, including the Western Ghats of Karnataka, India.

MATERIALS AND METHODS

Sample collection

Fieldwork was conducted from June 2023 to August 2024 across a range of forest ecosystems with diverse climatic conditions, including moist and dry deciduous forests, scrublands, wetlands, and arid to semi-arid regions in the districts of Davanagere, Bengaluru, Kodagu, Shivamogga, and Chikkamagaluru in Karnataka (Figure 1). Fungal specimens were collected in sterile, zip-lock bags and transported to the laboratory for analysis. The morphological features of Xylariaceae members were carefully examined and documented, followed by the drying and preservation of each specimen individually in plastic bags.

Morphological characterization

Transverse sections of fungal specimens were prepared and mounted in lactophenol, cotton blue, and stained with iodine reagent to observe the features of perithecia, asci, and ascospores. A 5–10% potassium hydroxide (KOH) solution was used to soften the fungal tissues; after rinsing with water using a dropper or pipette, the KOH was replaced with the appropriate stains. Morphological characteristics of all specimens were examined under a light microscope equipped with a Canon EOS 600D camera (Nagadesi 2018; Bharath et al. 2025). Measurements were recorded, and species were identified using standard taxonomic literature. (Dennis 1956, 1957, 1958; Thind & Waraitch 1969; Martin 1970; Thind & Dargan 1975, 1978, 1979; Kar & Gupta 1978; Dargan 1980; Rogers et al. 1987, 1988).

RESULTS

A total of 144 fungal samples were collected from various eco-regions and biodiversity hotspots of Karnataka, among which 16 fungal taxa were identified, including three species of *Daldinia,* one species of *Sphaeria* and twelve species of *Xylaria*. Comprehensive morphological and anatomical analyses confirmed the identity of three *Daldinia* species as *D. childiae D. concentrica,* and *D. eschscholtzii.* The 12 *Xylaria* species were identified as *X. curta*, *X. carpophila*, *X. castorea*, *X. cornu-damae*, *X. apiculata*, *X. ellisii*, *X. frustulosa*, *X. hypoxylon*, *X. longipes*, *X. nigripes*, *X. polymorpha*, *X. telfairii*, and one *S. kegeliana.* These taxa were found inhabiting various substrates, including living trees, decayed wood, stumps, organic-matter-rich soil, and leaf litter, across different locations in Karnataka (Table 1). Significantly, this study reports *D. childiae, X. curta*, *X. ellisii*, *X. frustulosa*, and *S. kegeliana* for the first time from Karnataka, whereas *X. telfairii* and *X. cornu-damae* are documented as new records for India. These findings provide new insights into the diversity and distribution of Xylariaceae in the region, contributing to the broader understanding of their taxonomy and systematics.

The collected specimens have been submitted to the Museum, Department of Botany in St. Joseph's University, Bengaluru, with accession numbers such as SJCCBOT031, SJCCB032, SJCCB033, SJCCB034, SJCCB038, SJCCB039, SJCCB041, SJCCB042, SJCCB043, SJCCB044, SJCCB048, SJCCB049, SJCCB053, SJCCB065, SJCCB055, and SJCCB066 accordingly. These sixteen species have been described and illustrated based on their morphological and anatomical features, along with their substrate records.

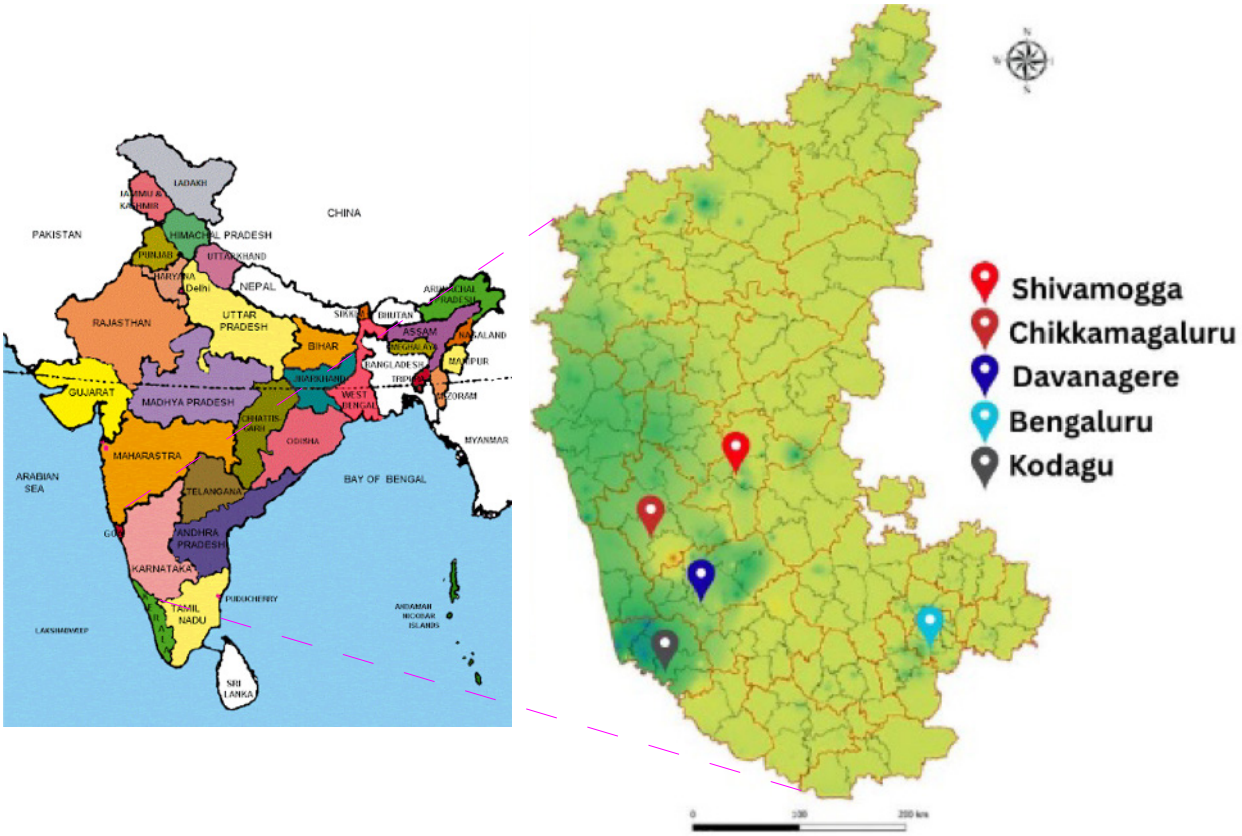

Figure 1. Map of Karnataka showing sampling districts.

Taxonomy

***Daldinia concentrica* (Bolton) Ces. & De Not., 1863**

The fruit bodies are 3–7 cm in diameter; brown, turn black and dense as they mature; sessile, broadly attached to the host, smooth, hard, and solitary, with a cushion-shaped, rounded appearance. Surface becomes cracked over time, revealing reddish-brown granules beneath. Spore-bearing surface consists of tiny perithecia embedded within the outer layer of the fruiting body. Flesh arranged in concentric layers, with slightly papillate ostioles. Asci cylindrical; ascospores dark brown to black, elliptical to fusiform, unicellular, with rounded ends, approximately 5–7 × 11–16 µm

Specimens examined: India, Karnataka, Lalbagh, Bengaluru, forest area, on dead and decayed wood of *Eucalyptus* tree, leaf litter, decayed twigs, decayed stumps, and stumps near humus-rich soil, heavily covered with decaying leaf litter. Coordinates: 12.948 °N & 77.588 °E, 5 August 2024, Bharath Kumar S. Acc. no.SJCCB065.

***Daldinia childiae* J.D. Rogers & Y.M. Ju, 1999 (Image 1)**

Fruit bodies about 0.8–2.5 cm wide, found in clusters on the dead wood of the Eucalyptus tree; nearly globose to hemispherical to irregularly shaped; greyish-white to pinkish-brown in colour, become greyish to blackish in colour. Conidia may appear as a whitish mass. The surface of a mature carbon ball appears finely dotted, with minute bumps. Perithecia are present just below the surface of the fruiting body. Alternating light and darker-coloured concentric zones are present when cut vertically. Ascospores are brown to black, unicellular, ellipsoid, with rounded ends, approximately 8.5–9 × 4.5–5 µm in diameter.

Specimens examined: India, Karnataka, Bannerugatta, Bengaluru, forest area, on decayed dead and decayed wood of *Eucalyptus* tree, leaf litter, decayed twigs, decayed stumps, leaf litter, and stumps near humus-rich soil, heavily covered with decaying leaf litter. Coordinates: 13.032 °N & 77.563 °E, 5 August 2024, Bharath Kumar S. Acc. No SJCCB055.

***Daldinia eschscholtzii* (Ehrenb.) Rehm, 1904**

The fruiting body exhibits considerable variability, ranging from hemispherical to placentiform shapes. It is sessile, solitary, short, stout, and smooth, measuring

Table 1. Morphological and habitat data of *Xylaria* and related fungal species.

	Species	Substrate	Stroma shape and colour	Co-ordinates	References
1	*Xylaria apiculata*	Bark of the Mahogany tree, decayed stumps,	Black in colour, pale coating, splits into vertical strations. 0.5–2.5 cm	14.166° N 75.033° E	**Pande et al. (**2012)
2	*X. carpophila*	Dead and Decayed wood of Silver Oak tree	Long, slender, and cylindrical to oval in shape. 5.5–7.5 cm, ending in a rounded to pointed apex. white, yellow to off-white	13.690° N 75.245° E	Swapna et al. (2008)
3	*X. castorea*	Decayed wood of *Samanea saman*, Ficus tree stumps	Solitary, unbranched, flattened to cylindrical, broadly Spathulate, tip acute to round, glabrous, brown to blackish brown in colour, 3.6 × 1–2 cm	14.3742° N 74.81142° E	**Pande et al. (**2012)
4	*X. cornu- damae*	Decayed wood, bark of *Acacia nilotica*	Grey to black to pimply, little large, branched, cylindrical young stage dusty whitish covering, surface powdery, 3.6 × 0.6 cm	14.364° N 74.884° E	New to the study area
5	*X. curta*	Leaf litter, decayed twigs, and stumps	Initially dark brown, they become much darker as they mature. External texture is rough and wrinkled, ranging in colour from black to golden brown, 3–6.5 cm	14.034° N 75.934° E	New to the study area
6	*X. ellisisii*	Soil surface, leaf litter, decayed twigs	Solitary, branched once, cylindrical to spathulate, apices broadly rounded, 3.5–5.6 × 0.8–1.1 cm. Surface irregularly flattened to wrinkled, frequently cracked, and black in colour,	14.641° N 75.531° E	New to the study area
7	*X. frustulosa*	Decayed wood, Bark of *Samanea saman*	Gregarious to confluent, semi-circular to irregular, flattened to pulvinate, dark brown in colour, 0.6–1.5 × 2–3.5 cm.	14.748° N 75.541° E	New to the study area
8	*X. hypoxylon*	Base of the Tamarind tree and decayed bark	Slender, sub-cylindrical to strap-shaped, and branched at the tip. Black colour on the lower side and a powdery white tip, 6–8 cm.	14.354° N 75.467° E	Karun & Sridhar (2015)
9	*X. kegeliana*	Soil surface, leaf litter, decayed twigs	Stroma 7–10 × 0.6 cm, creamish white in colour with black dotted lines, with a cracked, rough surface.	13.333° N 75.251° E	New to the study area
10	*X. longipes*	Decayed wood of *Acacia nilotica*	Club-shaped form and a short stipe. Tough and tapering to a rounded apex. At maturity, greyish-brown, turning black with age, and becomes crackly and scaly. 3.8 × 0.2–1.5 cm	13.313° N 75.737° E	Karun & Sridhar (2015)
11	*X. nigripes*	Decayed wood, bark, and leaf litter	Long, slender, and cylindrical, tapering to a club shape at the top. Smoky white to greyish-white but turns black, becoming crackly and scaly with age, 8–13.5 cm.	13.162° N 75.857° E	Karun & Sridhar (2015)
12	*X. polymorpha*	Decayed wood of a Silver Oak tree	Dark brown in colour, club-shaped with blunt, narrowed, whitish to black tips, varies from pale grey to dark black, finely dusted, swollen at top to bottom, finely wrinkled 4.5–8 × 0.5–1.4 cm	13.137° N 75.606° E	Karun & Sridhar (2015)
13	*X. telfairii*	Soil surface, leaf litter, decayed twigs	Cylindrical with rounded apices, unbranched, solitary, measuring about 2.4–3.5 × 0.9–1.4 cm thick, the stipe is black in colour, surface copper to cinnamon brown in colour, smooth.	12.947° N, 77. 585° E	New to the study Area
14	*Daldinia concentrica*	Dead and decayed wood of the Eucalyptus tree	They are brown and turn black and dense as they mature, sessile, hard, and solitary, with a cushion-shaped, rounded appearance. The surface becomes cracked over time, with reddish-brown granules beneath. 3–7 cm	12.948° N 77.588° E	Swapna et al. (2008)
15	*D. eschscholtzii*	Decayed Teak wood bark	The fruiting body has hemispherical to placentiform shapes. It is sessile, solitary, short, stout, and smooth, 2–5 cm, brown to black in colour. With age, the surface becomes varnished and develops granules.	13.012° N 77.570° E	Chutulo & Chalannavar (2020)
16	*D. childiae*	Dead and decayed wood of the Eucalyptus tree	Fruiting body is nearly globose to hemispherical, and some are often irregularly shaped. Greyish white to pinkish brown in colour, at maturity, the fruiting body becomes greyish to blackish in colour, 0.8–2.5 cm.	13.032° N 77.563° E	New to the study area

2–5 cm in diameter, with a brown to black colouration. As it ages, the surface becomes varnished and develops granules. The perithecia are small and tubular, featuring prominent internal zones with alternating light and dark concentric rings, and are dark brown in colour. The ascospores are brown to black, unicellular, ellipsoid, with rounded ends, measuring approximately 9–10 × 5–6 µm in diameter.

Specimens examined: India, Karnataka, Lalbagh, Bengaluru, forest area, observed on decayed *Teak* wood, bark, stumps, leaf litter, decayed twigs, decayed stumps, leaf litter, and stumps near humus-rich soil, heavily covered with decaying leaf litter. Coordinates: 13.012 °N & 77.570 °E, collected on 5 August 2024 by Bharath Kumar S. Acc. no.SJCCB065

***Xylaria apiculata* Cooke, 1879**

The fruiting bodies are slender and relatively small compared to other species, ranging from 0.5–2.5 cm in length and 0.3–0.4 cm in width. The fertile fruiting bodies

Image 1. ***Daldinia childiae*****: A–C—fruiting body attached to the host, individual fruiting body | D—fruiting body shows dots | E—concentric zones (10X) | F&G—Perithecia (40X) | H&I—different sizes and shapes of spores (100X). © Bharath Kumar S.**

are black, with a pale coating on the upper surface that splits into vertical striations. The interior tissues are white and softer than the black outer coating, while the stipes are often densely tomentose. Mature stromata are unbranched. The perithecia are globose, measuring 0.4–0.5 mm in diameter, with very finely papillate ostioles.

The stipe is small compared to the spore-bearing fruiting body, swelling in the centre. The ascospores are brown, unicellular, ellipsoid, and have broadly rounded ends, measuring 15–20 × 6–9 µm in diameter.

Specimens examined: India, Karnataka, Sagara, Shivamugga, forest area, observed on bark of *Mahogany* tree, decayed stumps, leaf litter, and stumps near humus-rich soil, heavily covered with decaying leaf litter. Coordinates: 14.166 °N & 75.033 °E, collected on 14 November 2023 by Bharath Kumar S. Acc. no. SJCCBOT031.

***Xylaria carpophila* (Pers.) Fr., 1849**

The fruiting bodies are long, slender, and cylindrical, with some branched and others unbranched, extending to a fertile portion that is cylindrical to oval in shape. They measure up to 5.5–7.5 cm in length, ending in a rounded to pointed apex. The texture is rough. When young, they are initially white, becoming yellow to off-white as they mature. The apical tip is rusty and yellow to off-white, and rounded. The perithecia are mammiform with papillate ostioles. The ascospores are pale yellow to pale brown, measuring up to 8–9 × 18–21 µm in diameter, and have a slightly bean-shaped structure.

Specimens examined: India, Karnataka, Thirthahalli, Shivamugga, forest area, observed on dead and decaying wood of the Silver oak tree, stumps near humus-rich soil, heavily covered with decaying leaf litter. Coordinates: 13.690 °N & 75.245 °E, collected on 14 November 2023 by Bharath Kumar S. Acc. no. SJCCBOT032.

***Xylaria castorea* Berk., 1855**

Fruiting body solitary to gregarious, unbranched, flattened to cylindrical, clavate, broadly spathulate, tip acute to round, entire stromata fertile, glabrous, plane to slightly enlarged, sessile, brown to blackish brown in colour, surface splitting into distinct plates, measuring up to 3–6 × 1–2 cm diam. Perithecia are

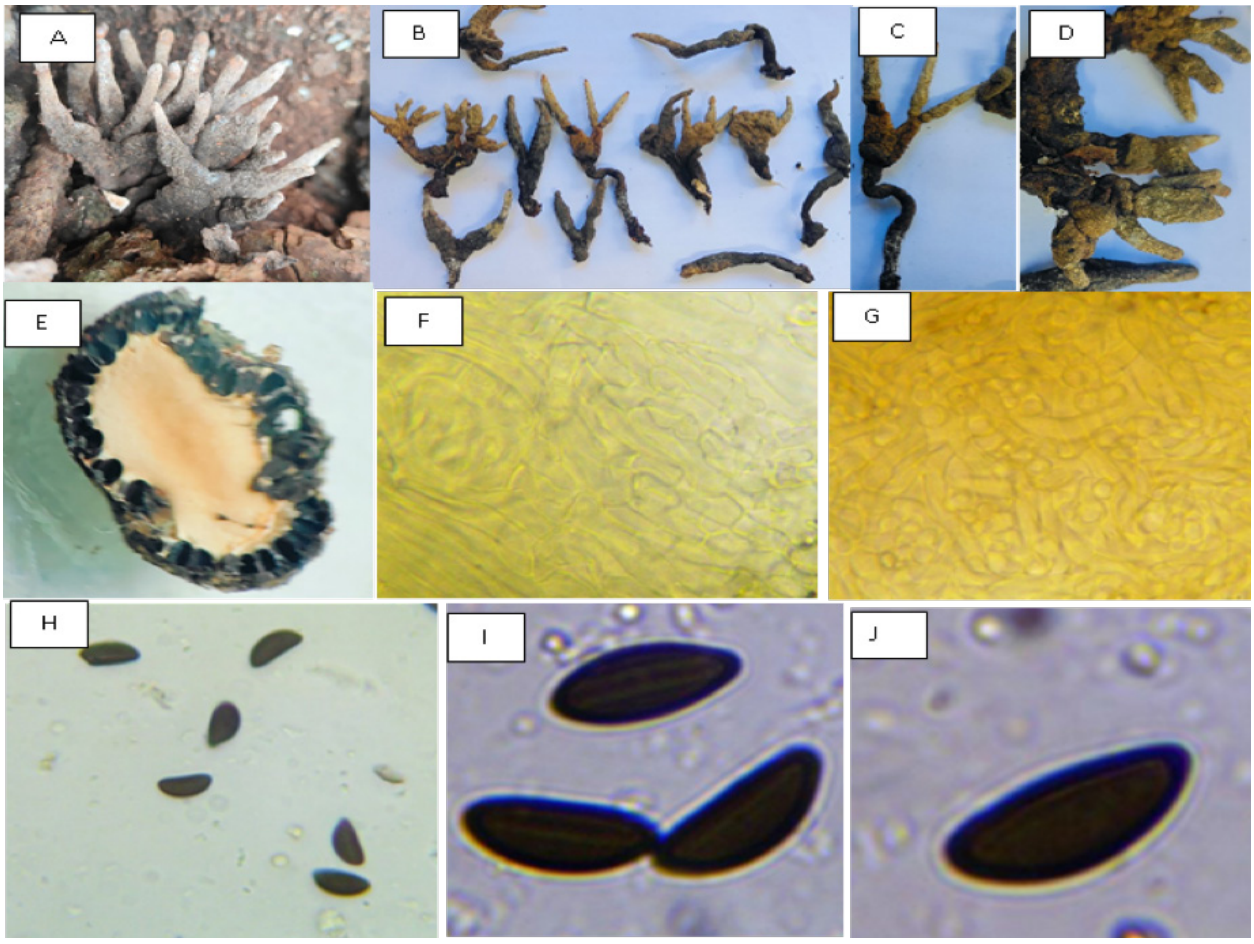

Image 2. ***Xylaria cornu-damae*****: A—fruiting body attached to the host | B—individual fruiting body | C&D—mature fruiting body | E—Perithecia (10X) | F&G—internal tissue (100X) | H–J—different size and shape of spores (100X). © Bharath Kumar S.**

completely immersed, 5–7 µm. Asci cylindrical, 8-spored. Ascospores are elliptical, equilateral to nearly symmetric, dark brown in colour, measuring up to 9.5–13 × 5.5–6.5 µm in diameter.

Specimens examined: India, Karnataka, Ranganathapura, Shivamugga, forest area, observed on decayed wood of *Albizia saman*, ficus tree stumps, leaf litter, decayed twigs, decayed stumps, leaf litter, and stumps near humus-rich soil, heavily covered with decaying leaf litter. Coordinates: 14.374 °N & 74.811 °E, collected on 14 November 2023 by Bharath Kumar S. Acc. no. SJCCBOT033.

***Xylaria cornu-damae* (Schwein.) Berk., 1873 (Image 2)**

The fruiting body is found on decaying wood of heartwood stumps. Fruiting body grey to black, pimply, little large, branched, cylindrical, young stage dusty whitish covering, surface powdery, often with whitish remains of the powdery coating of the grey to black, measuring up to 3.6 × 0.6 cm in diameter. Interior flesh white, and tough, perithecia at maturity fruiting body more are less spherical, just below the surface measuring about 45–50 × 3–5.5 µm with a long stipe. Asci 8-spored. Ascospores are fusiform, smooth, dark brown to black in colour, 15–30 × 4.5–6 µm.

Specimens examined: India, Karnataka, Siddapura, Shivamugga, forest area, observed on decayed wood, bark of *Acacia nilotica*, decayed stumps, leaf litter, and stumps near humus-rich soil, heavily covered with decaying leaf litter. Coordinates: 14.364 °N & 74.884 °E, collected on 14 November 2023 by Bharath Kumar S. Acc. no. SJCCBOT038.

***Xylaria curta* Fr., 1851 (Image 3)**

The fruiting bodies are found near the base of living hardwood tree trunks. Although they appear terrestrial, they are actually attached and grow in clusters, with some being solitary. They are sessile with elongated, flattened, cylindrical fertile parts that have a rounded apex. Initially dark brown, they become much darker as they mature. The external texture is rough and wrinkled, ranging in colour from black to golden brown, and measuring up to 3–6.5 cm in diameter. Meanwhile, the internal tissue is white to cream. The perithecia are immersed, measuring 0.2–0.5 mm in diameter, and have a papillate ostiole. The ascospores are dark brown, unicellular, smooth, uni-seriate, cylindrical, and ellipsoidal in shape, measuring up to 6–7 × 5.5–6.5 µm in diameter.

Specimens examined: India, Karnataka, Channagiri, Davanagere, forest area, observed on Leaf litter, decayed twigs, stumps near humus-rich soil, heavily covered with decaying leaf litter. Coordinates: 14.034 °N & 75.934 °E, collected on 7 October 2023 by Bharath Kumar S. Acc. no.SJCCBOT034.

***Xylaria ellisii* Tanney, Seifert & Y.M.Ju, 2020 (Image 4)**

The fruiting body is upright, solitary, and once-branched, with a cylindrical to spathulate shape. The apices are broadly rounded, dividing into a fertile head and a sterile stipe, measuring approximately 3.5–5.6 × 0.8–1.1 cm, including the stipe. The surface is irregularly flattened to wrinkled, often cracked, and black in colour, while the interior is white. The stipe is brownish-black in colour. Perithecia immersed, subglobose to globose, 0.4–0.6 mm diam. Osteoles pappilate. Ascospores are eight-spored, measuring 45–60 µm in diameter, and are cylindrical, arranged in a uniseriate manner. Ascospores are dark brown in colour, smooth, unicellular, ellipsoid-unequilateral, broadly rounded ends, measuring about 7–9.5 × 4.5–5.5 µm in diameter

Specimens examined: India, Karnataka, Kerebilachi, Davanagere, forest area, observed on soil surface, Leaf litter, decayed twigs, leaf litter, and stumps near humus-rich soil, heavily covered with decaying leaf litter. Coordinates: 14.641 °N & 75.531 °E, collected on 7 October 2023 by Bharath Kumar S. Acc. no. SJCCBOT039.

***Xylaria frustulosa* (Berk. & M.A.Curtis) Cooke, 1883 (Image 5)**

Fruiting body gregarious to confluent, semi-circular to irregular, flattened to pulvinate, dark brown in colour, measuring about 0.6–1.5 cm in height and 2–3.5 cm in width in diameter, attached to the substratum by a narrow central connective. Perithecia are numerous in number, the surface is dotted with ostioles, the interior is soft and black in colour. Perithecia globose to subglobose, measuring up to 0.2–0.3 mm diam. Asci with eight ascospores, hyaline, cylindrical, 35–40 × 3.5–5.5 µm with a long stipe. Ascospores are pale brown to black in colour, elliptical, measuring up to 5.5–6.2 × 2.5–3.5 µm in diameter.

Specimens examined: India, Karnataka, Shanthi Sagar, Davanagere, forest area, observed on decayed wood, bark of Albizia saman, decayed stumps, leaf litter, and stumps near humus-rich soil, heavily covered with decaying leaf litter. Coordinates: 14.7488 °N & 75.541 °E, collected on 7 October 2023 by Bharath Kumar S. Acc. no. SJCCBOT041.

***Xylaria hypoxylon* (L.) Grev., 1824**

The fruiting bodies are found on the trunk of a tamarind tree. They are slender, sub-cylindrical to strap-

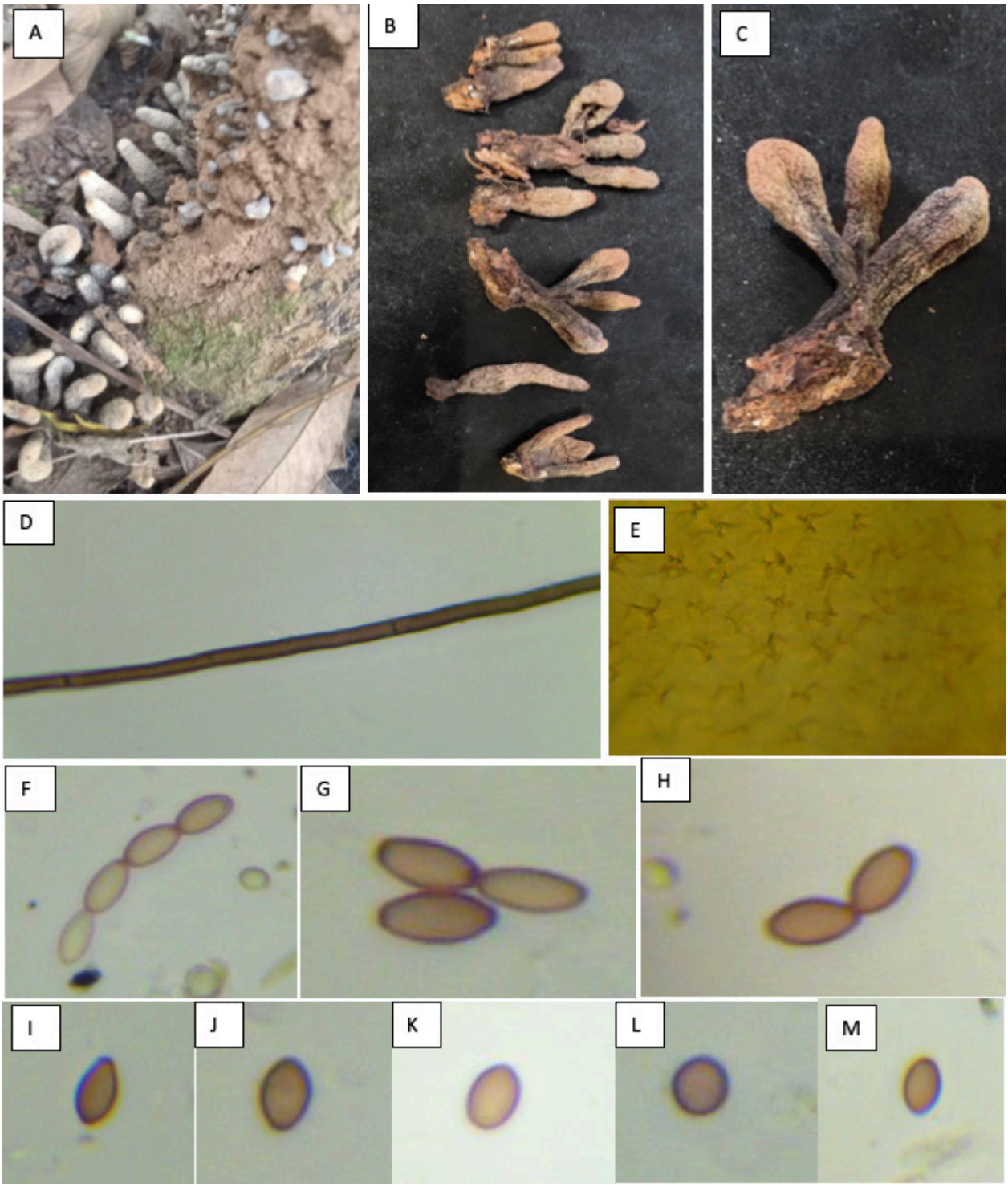

Image 3. *Xylaria curta*: A—fruiting body attached to the host | B—individual fruiting body with stipe | C—mature fruiting body | D—Hyphae (100X) | E—inner tissue (100X) | F–M—different size and shape of spores (100X). © Bharath Kumar S.

shaped, and may be branched at the tip. These structures can be solitary or gregarious, with a black colour on the lower side and a powdery white tip, reaching heights of up to 6–8 cm. The perithecia are fully immersed, and the surface of the fertile portion is tuberculate, with longitudinal splits up to 0.4–0.5 mm in size. The asci are cylindrical, and the ascospores are black, uniseriate, and slightly bean-shaped, measuring 4.8–6.3 × 11.3–12.6

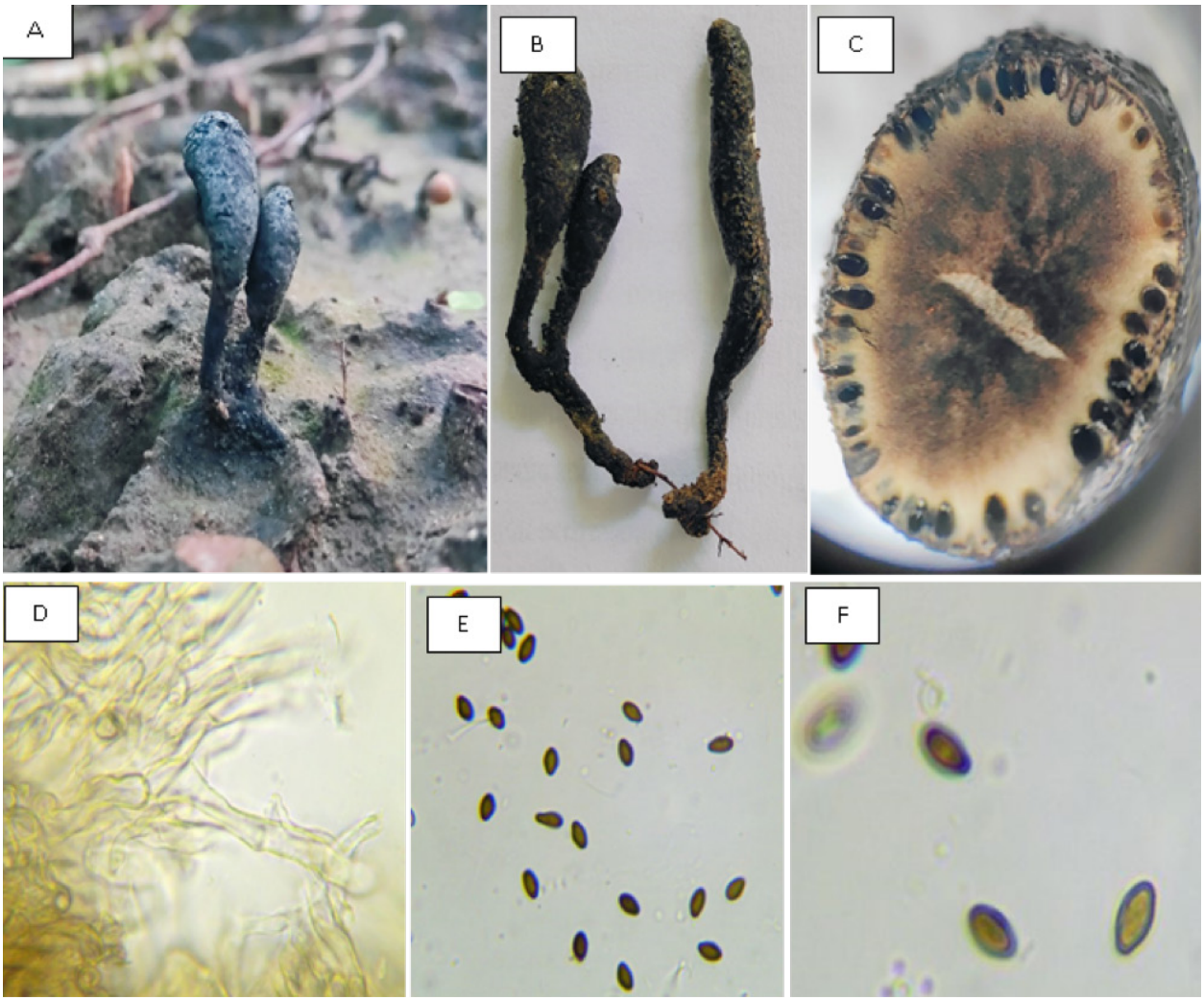

Image 4. ***Xylaria ellisii*****: A—fruiting body attached to soil surface | B—individual fruiting body | C—Perithecia | D—internal tissue | E&F—different size and shape of spores. © Bharath Kumar S.**

µm. The spores are equatorially flattened on one side and rounded on the other, giving them a distinctive banana-like shape.

Specimens examined: India, Karnataka, Nallur, Davanagere, forest area, observed on the base of a Tamarind tree and decayed bark, stumps near humus-rich soil, heavily covered with decaying leaf litter. Coordinates: 14.354 °N & 75.467 °E, collected on 7 October 2023 by Bharath Kumar S. Acc. no. SJCCBOT042.

Xylaria kegeliana **(Lév.) Fr., 1851 (Image 6)**
Current name: ***Sphaeria kegeliana*** **Lév.**

The fruiting body is found on the soil surface and on decayed wood. Stroma about 7–10 × 0.6 cm in diameter, fruiting bodies are creamish-white in colour with black dotted lines, with a cracked, rough surface, with a long rooting stipe up to ¾ of the total length, measuring up to 5–6 cm, smooth and wrinkled in structure. Perithecia are globose to irregular in shape with a small stalk. Asci 7-spored, interior flesh golden yellow in colour. Ascospores are small, elliptical, subglobose, smooth, golden brown to black at maturity, measuring about 4–6 × 2–3µm in diameter.

Specimens examined: India, Karnataka, Kuduregundi, Chikkamagaluru, forest area, observed on Soil surface, leaf litter, decayed twigs, decayed stumps, leaf litter, and stumps near humus-rich soil, heavily covered with decaying leaf litter. Coordinates: 13.333 °N & 75.251 °E, collected on 15 September 2023 by Bharath Kumar S. Acc. no. SJCCBOT043.

Xylaria longipes **Nitschke, 1867**

The fruiting bodies are found in groups, with a club-shaped form and a short stipe. They are tough and taper

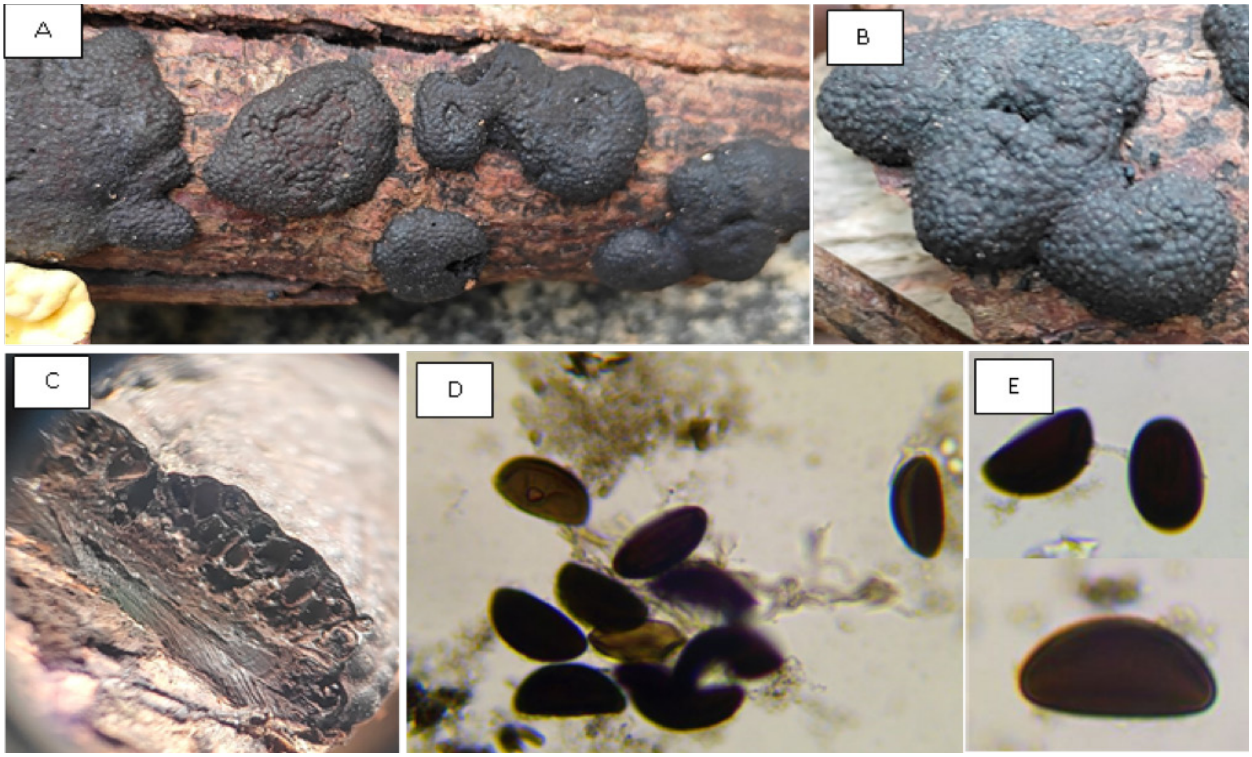

Image 5. ***Xylaria frustolosa*****: A—fruiting body attached to the host | B—individual fruiting body | C—Perithecia (10X) | D–F—different sizes and shapes of spores (100X). © Bharath Kumar S.**

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.

Specimens examined: India, Karnataka, Halase, Chikkamagaluru forest area, observed on Decayed wood of *Acacia nilotica*, leaf litter, and stumps near humus-rich soil, heavily covered with decaying leaf litter. Coordinates: 13.313 °N & 75.737 °E, collected on 5 September 2023 by Bharath Kumar S. Acc. no. SJCCBOT044.

Xylaria nigripes **(Klotzsch) Cooke, 1883**

The fruiting bodies were found growing singly or in groups, with a stipitate structure that is long, slender, and cylindrical, tapering to a club shape at the top. They can reach heights of 8–13.5 cm, with a diameter of 7–18 mm, and a stipe length of 6–10.5 cm. The surface is initially smoky white to greyish-white but turns black, becoming crackly and scaly with age. The perithecia have a papillate ostiole, and the asci contain eight spores. The ascospores are brown to black, ellipsoid, with rounded ends, smooth, and measure up to 8–11 × 3–5 µm in diameter.

Specimens examined: India, Karnataka, Belur, Chikkamagaluru forest area, observed on decayed wood, bark, leaf litter, and stumps near humus-rich soil, heavily covered with decaying leaf litter. Coordinates: 13.162 °N & 75.857 °E, collected on 5 September 2023 by Bharath Kumar S. Acc. no. SJCCBOT048.

Xylaria polymorpha **(Pers.) Grev., 1824**

The fruiting bodies are finger-like in structure, dark brown in colour, and found near decaying trees. Though appearing terrestrial, they are actually attached to buried wood and grow in groups. Fruiting body is generally club-shaped with blunt, narrowed, whitish to black tips, pale grey to dark black, finely dusted, smooth, and dry. The interior surface is white and tough. At maturity, the fruiting body remains club-shaped, swollen from top to bottom, with a finely wrinkled surface, and can measure up to 4.5–8 × 0.5–1.4 cm in size. The perithecia are black, sub-spherical, measuring up to 0.4–1.2 mm in diameter. The asci are arranged in a single layer just below the surface and are long, cylindrical, and stipitate. The ascospores are purple to brown in color, smooth, and slightly bean-shaped to double-shaped, measuring

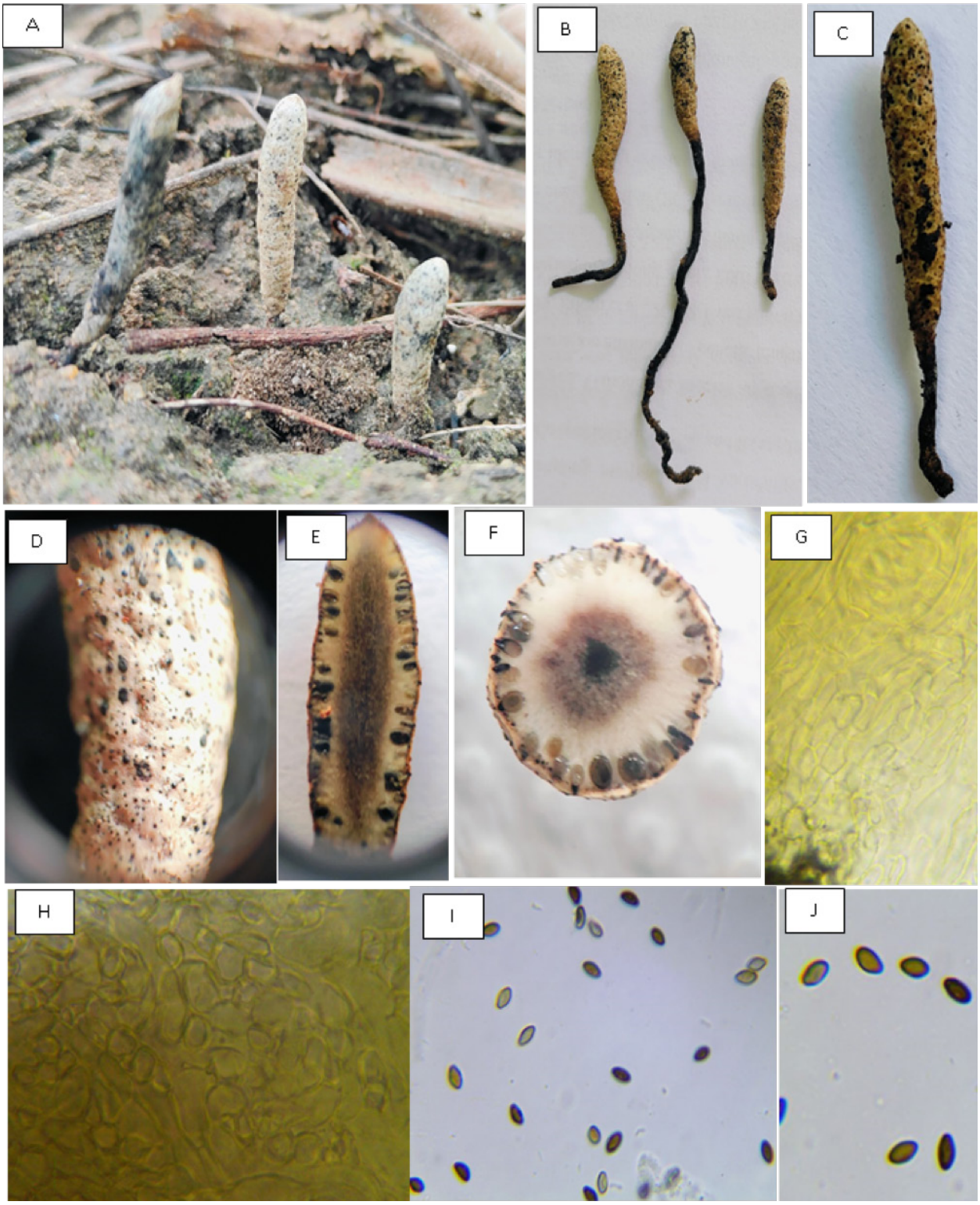

Image 6. *Xylaria kegeliana*: A—fruiting body attached to the host | B—individual fruiting body with long wrinkled stipe | C—mature fruiting body | D—fruiting body showing black dots | E—longitudinal section showing perithecia (10X) | F—Perithecia | G& H—internal tissue (40X) | H–J—different size and shape of spores (100X). © Bharath Kumar S.

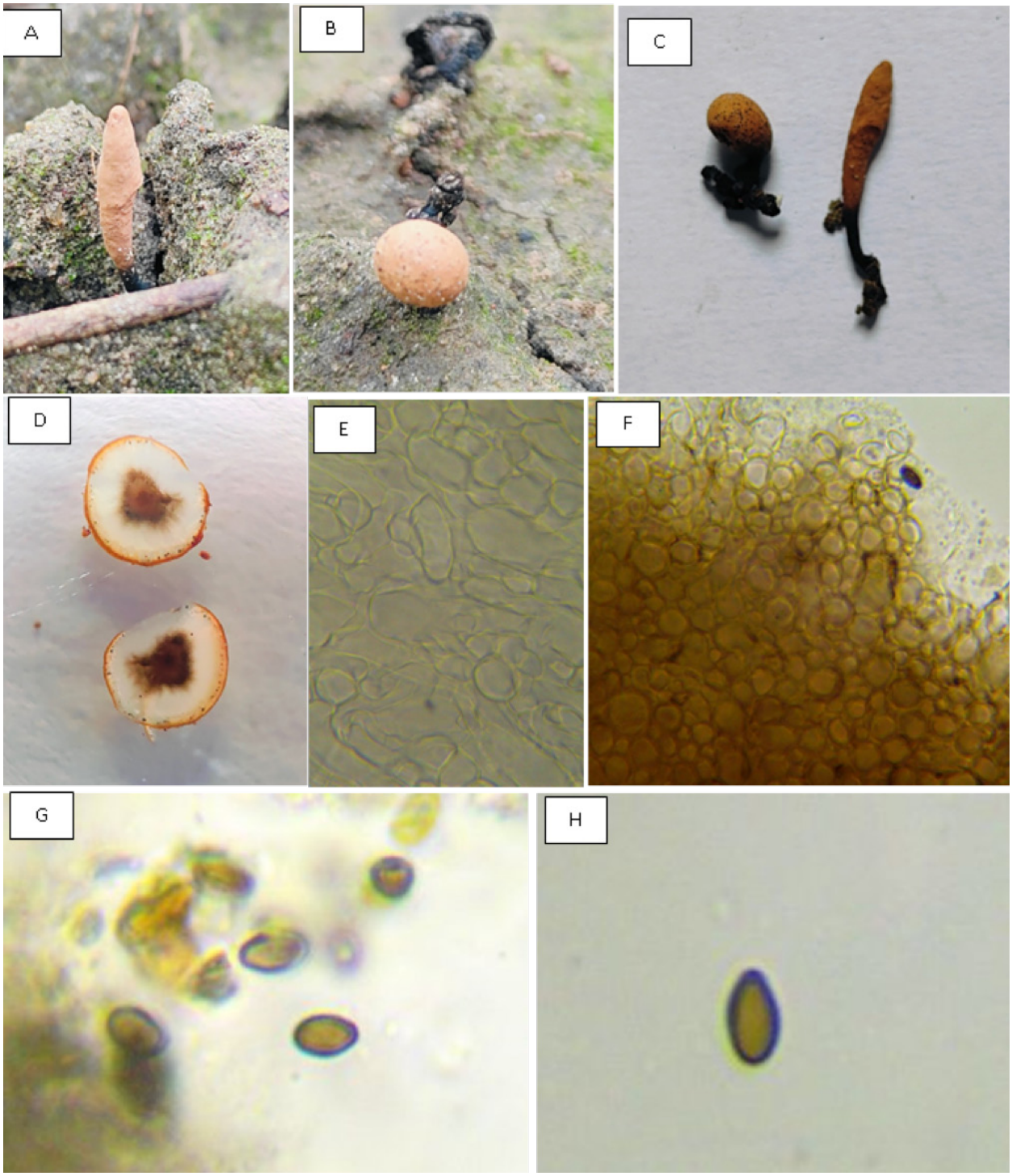

Image 7. *Xylaria telifairii*: A &B—fruiting body attached to the host | C—individual fruiting body | D—Perithecia (10X) | E & F—internal tissue (40X) | G&H—different sizes and shapes of spores (100X). © Bharath Kumar S.

10.5–14.8 × 2.8–4.2 µm in diameter.

Specimens examined: India, Karnataka, Moodigere, Chikkamagaluru, forest area, observed on decayed wood of a Silver Oak tree near humus-rich soil, heavily covered with decaying leaf litter. Coordinates: 14.354 °N & 75.467 °E, collected on 5 September 2023 by Bharath Kumar S. Acc. no. SJCCBOT049.

***Xylaria telfairii* (Berk.) Sacc., 1882 (Image 7)**

Fertile fruiting body is cylindrical with rounded apices,

unbranched, solitary, measuring about 2.4–3.5 cm in total length and 0.9–1.4 cm thick. Stipe is black in colour, measuring up to 1.3 cm in length. External surface copper to cinnamon brown in colour, smooth, internally white to cream in colour and hollow. Perithecia are completely immersed. Asci eight-spored, cylindrical, stipitate, urn-shaped, measuring up to 3–4.5 µm. Ascospores are ellipsoid, equilateral, dark brown in colour, unicellular, smooth, measuring up to 17–23 × 5–6 µm.

Specimens examined: India, Karnataka, Bannerugatta, Bengaluru, forest area, observed on soil surface, leaf litter, decayed twigs, leaf litter, and stumps near humus-rich soil, heavily covered with decaying leaf litter. Coordinates: 12.947 °N & 77.585 °E, collected on 3 September 2023 by Bharath Kumar S. Acc. no. SJCCBOT053.

DISCUSSION

The present study explores the morphological diversity of *Daldinia* and *Xylaria* species collected from various forested regions of Karnataka, India. The detailed examination of their macroscopic and microscopic characteristics offers valuable insights into their taxonomy and habitat preferences. A total of 24 species of *Xylaria* have been previously reported from the Western Ghats and the west coast regions of Maharashtra, Karnataka, Kerala, and Tamil Nadu (Karun & Sridhar 2015). In the current study, 12 species of *Xylaria* have been identified from Chikkamagaluru, Shivamugga, Davanagere, Kodugu, and Bengaluru. *Xylaria longipes* and *X. polymorpha* have been reported to grow on dead logs/stubs (Karun & Sridhar 2015). In the present compilation, *X. longipes* was found on the bark of the *Neltuma juliflora* tree, whereas *X. polymorpha* was found in association with a living Tamarind tree. *X. carpophila* has been documented from humus-rich soil and leaf litter in the Panchmahal district of Gujarat (Koyani et al. 2016). In our study, *X. carpophila* was collected from dead and decaying wood of the silver oak tree in Shivamugga District, Karnataka. Species such as *X. telfairii* and *Xylaria ellisii* were frequently found on heavily decomposed material, highlighting their role as key decomposers in forest ecosystems. Meanwhile, *X. apiculata* and *X. frustulosa* were observed on the bark of both living and decaying trees, suggesting possible host specificity, as noted in the previous studies (Stadler et al. 2013). In the present study, *X. apiculata* was found on the bark of mahogany trees, decayed stumps, *X. frustulosa* on decayed wood and bark of *Albizia saman, X. telfairii,* and *X. ellisii* on the soil surface, leaf litter, and decayed twigs, indicating their adaptability to diverse substrates. *Xylaria castorea* was originally described from New Zealand (Berk. 1855). This study marks the first report of *X. castorea* from Karnataka, India. *X. cornu-damae* found on coarse woody debris from National Military Park and Devil's Den State Park, northwestern Arkansas, Saudi Arabia (Alshammari & Stephenson 2018). In this present study, *X. cornu-damae* was found on decayed wood of *Albizia saman*, *Ficus religiosa* stump, Shivamugga, a patch of Western Ghats, Karnataka, India.

Daldania concentrica and *D. childiae* were found on dead wood of *Enterlobium saman* from Kondapalli forest, Andhra Pradesh, Eastern Ghat, India (Srinivasarao & Nagadesi 2021). In this study, the presence of *D. concentrica* and *D. childiae* was found on dead and decayed wood of the *Eucalyptus* tree in Bannerugatta Biological Park, Bengaluru, Karnataka, India. *Daldania concentrica* and *D. eschscholtzii* were reported by Rajput et al. (2015), while *D. childiae* was first described from Gujarat (Koyani et al. 2016) and later from the Darapalli and Kondapalli Reserve forests of the Eastern Ghats in Andhra Pradesh (Srinivasarao & Nagadesi 2021). In this study, *D. childiae* is reported for the first time from Karnataka, India. Overall, this research enhances our understanding of *Xylariaceae* diversity in India, emphasising the need for continued documentation of Xylariaceous fungi across various forest ecosystems. Future molecular studies could further validate species identities and offer deeper insights into their phylogenetic relationships and ecological functions.

CONCLUSION

In conclusion, the survey of the family Xylariaceae conducted across Karnataka from June 2023 to August 2024 has significantly expanded the understanding of the biodiversity and taxonomic importance of this group. Out of 144 collected fungal samples, 16 were identified based on morphology, which included three species of the genus *Daldinia*, 12 species of *Xylaria*, and one species of *Sphaeria,* demonstrating the diversity of this group in the region. The discovery of *D. childiae, X. curta*, *X. ellisii*, *X. frustulosa*, *and S. kegeliana is reported for the first time in Karnataka, whereas X. telfairii and X. cornu-damae constitute new records for India, highlighting* the distribution and diversity of this region. These findings not only enrich the taxonomic knowledge of the Xylariaceae but also open up possibilities for future studies on the bioactive compounds and medicinal properties associated with these fungi.

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