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COMMUNICATION

CONTRIBUTION TO THE MACROMYCETES OF WEST BENGAL, INDIA: 51–56

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Contribution to the macromycetes of West Bengal, India: 51–56

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Abstract: The West Bengal is a treasure house for macro-fungal diversity due to its varied geo-climatic conditions. Detailed macroscopic and microscopic characterization was made to identify the collected specimens. Altogether six species belonging to the family Xylariaceae (three species), Hypoxylaceae (one species), Ascobolaceae (one species) and Pyrenomataceae (one species) were collected from different corners of the state. Literature survey revealed that all of the collected taxa represent their first detailed description and distributional record from the state. A comprehensive macro-morphological description, field photographs along with microscopic observations are provided. The outcome of the present study will enrich data related to the diversity of macrofungi from the state West Bengal.

Keywords: Ascomycota, fungi, morphology, taxonomy.

সংক্ষিপ্তসার: পশ্চিমবঙ্গ তার ভূ-প্রকৃতি ও জলবায়ুর বিভিন্নতার জন্য বৃহৎ ছত্রাক বৈচিত্র্যের এক উৎকৃষ্ট ভান্ডার। সংগৃহীত ছত্রাক সমূহের নমুনাগুলি সনাক্তকরণের জন্য বৃহৎ ও আণুবীক্ষণিক চরিত্রাবলির পর্যবেক্ষণ করা হয়েছে। রাজ্যের বিভিন্ন প্রান্ত থেকে সংগৃহীত মোট ছয়টি প্রজাতির উপস্থাপনা বর্তমান গবেষণা পত্রে রয়েছে। এই প্রজাতিসমূহের গোত্রগুলি হল- জাইলারিয়াসি (তিনটি প্রজাতি), হাইপোক্সিলেসি (একটি প্রজাতি), অ্যাসকোবোলেসি (একটি প্রজাতি) এবং পাইরোনিম্যাটেসি (একটি প্রজাতি)। উপযোগী প্রকাশিত গ্রন্থ ও গবেষণাপত্র অধ্যয়নের মাধ্যমে জানা যায় বর্তমানে আলোচিত ছয়টি প্রজাতির ব্যাপ্তি এই রাজ্য থেকে সর্বপ্রথম নথিভুক্ত ও বিস্তারিত ভাবে বর্ণিত হল। আণুবীক্ষণিক পর্যবেক্ষণের সাথে সাথে দৃষ্টিগোচর বৃহৎ অঙ্গ সংস্থানিক চরিত্রাবলির বিস্তারিত বর্ণনা এবং সংশ্লিষ্ট প্রজাতির বাসস্থানসহ আলোকচিত্র বর্তমান গবেষণাপত্রে পরিবেশিত হয়েছে। এই গবেষণার ফলাফল পশ্চিমবঙ্গের বৃহৎ ছত্রাক বৈচিত্র্যের তথ্যভান্ডার কে সমৃদ্ধ করবে।

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INTRODUCTION

West Bengal possesses diverse phytogeographical realms, spreading through its coastal to subalpine regions, due to its varied ecological conditions like altitude, temperature, edaphic factors, etc. Thus, vegetation of this state is greatly diversified from its east to west and north to south. These wide arrays of geomorphology, climatic variations and vegetation structure make conducive for the luxuriant growth of macrofungi (Acharya et al. 2017a; Tarafder et al. 2017).

The genus *Xylaria* under the family Xylariaceae can easily be identified by their cardinal anatomical features including the perithecial ascomata embedded in the dark coloured stromata, cylindrical asci with an amyloid apical ring, ascospores with dark coloured complex multi-layered walls with a germ slit and asexual morph during maturation (Rogers 2000). The most of the species are growing on several substrates like fallen leaves, petioles, herbaceous stems, dung, grasses, seeds, fruits, wood and soil, preferably grow on rotten wood (Rogers et al. 1986; Hashemi et al. 2014). Recent studies revealed that the family Xylariaceae is one of the largest and most diverse family among Ascomycota, which comprised 85 genera and more than 1350 species (Daranagama et al. 2017). Both the genera *Daldinia* and *Hypoxylon*, belonging to the family Hypoxylaceae have some common characters like presence of nodulisporium-like asexual morph and geniculosporium-like asexual morph respectively (Daranagama et al. 2017). But *Daldinia* can easily be distinguished from the genus *Hypoxylon* by having distinctly zonate inner entostroma. The genera *Ascobolus* and *Scutellinia* belonging two different families Ascobolaceae and Pyrenomataceae respectively are differentiated by bright coloured apothecia with marginal septate hairs and ellipsoid ascospores with irregular ornamentation and less bright apothecia without any marginal hairs and dark purplish brown ascospores with reticulate fissure. Moreover, *Ascobolus* are coprophilous where *Scutellinia* are lignicolous.

The present work is the continuation of series of papers dealing with the macro-fungal diversity of West Bengal (Acharya et al. 2017a, b, c; Tarafder et al. 2017; Bera et al. 2018; Saha et al. 2018). In this communication, six species belonging to the Ascomycetes group viz. *Xylaria arbuscula* Sacc., *Xylaria multiplex* (Kunze) Fr., *Xylaria nigripes* (Klotzsch) Cooke, *Daldinia childiae* J.D. Rogers & Y.M. Ju, *Ascobolus scatigenus* (Berk. & M.A. Curtis) Brumm., and *Scutellinia jungneri* (Henn.) Clem., collected from the state, are reported herein with their detailed macro-morphological characters.

MATERIAL AND METHODS

Macrofungal specimens were collected during monsoon and post monsoon period (June–October) from different forest and forest fringe areas of West Bengal. During fieldwork, digital photographs of the samples were taken in their habitat and their macro-morphological and habitat features were noted. The standard identifying protocol, colour photographs, and macro-morphological features of each specimen were taken in the field. Collected specimens were wrapped with tissue paper and kept in separate boxes for avoiding mixing of spores. Finally, the collected specimens were carefully withered in a hot air drier until the moisture was minimal. Microscopic features were observed with Carl Zeiss AX10 Imager A1 phase contrast microscope from thin handmade sections of the dried ascocarps by staining with Congo red, and Melzer's reagent. Microscopic features were photographed with microscope mounted digital camera. Thirty measurements of ascospores were taken from each sample for calculating dimensions of ascospores. Length/breadth ratio denotes the Q value. Mean Q value (Q_m) was measured by dividing sum of Q value by total number of spores observed. Specimens were identified by using standard taxonomic keys and literatures (Seaver et al. 1961; Brummelen 1967; Schumacher 1990; Stadler et al. 2014; Daranagama et al. 2017). Methuen Handbook of Colour (Kornerup & Wanscher 1978) was followed for colours terms and codes. The voucher specimens were preserved (Pradhan et al. 2015) and deposited at the Calcutta University Herbarium (CUH).

RESULTS

During the exploration of macro-fungal diversity of West Bengal, numerous specimens were collected of which six species of Phylum Ascomycota had been identified, among them three species belonging to the genus *Xylaria*, one species under *Daldinia*, one belongs to *Ascobolus* and the remaining one is from *Scutellinia*.

TAXONOMY

Xylaria arbuscula Sacc., *Michelia* 1(2): 249 (1878) (Image 1)

Specimen examined: CUH AM612, 14.vii.2017, 58.047°N & 133.240°E, elevation 46m, Tufanganj-I, Cooch Behar District, West Bengal, India, coll. D. Das, E. Tarafder, K. Acharya & A. Roy.

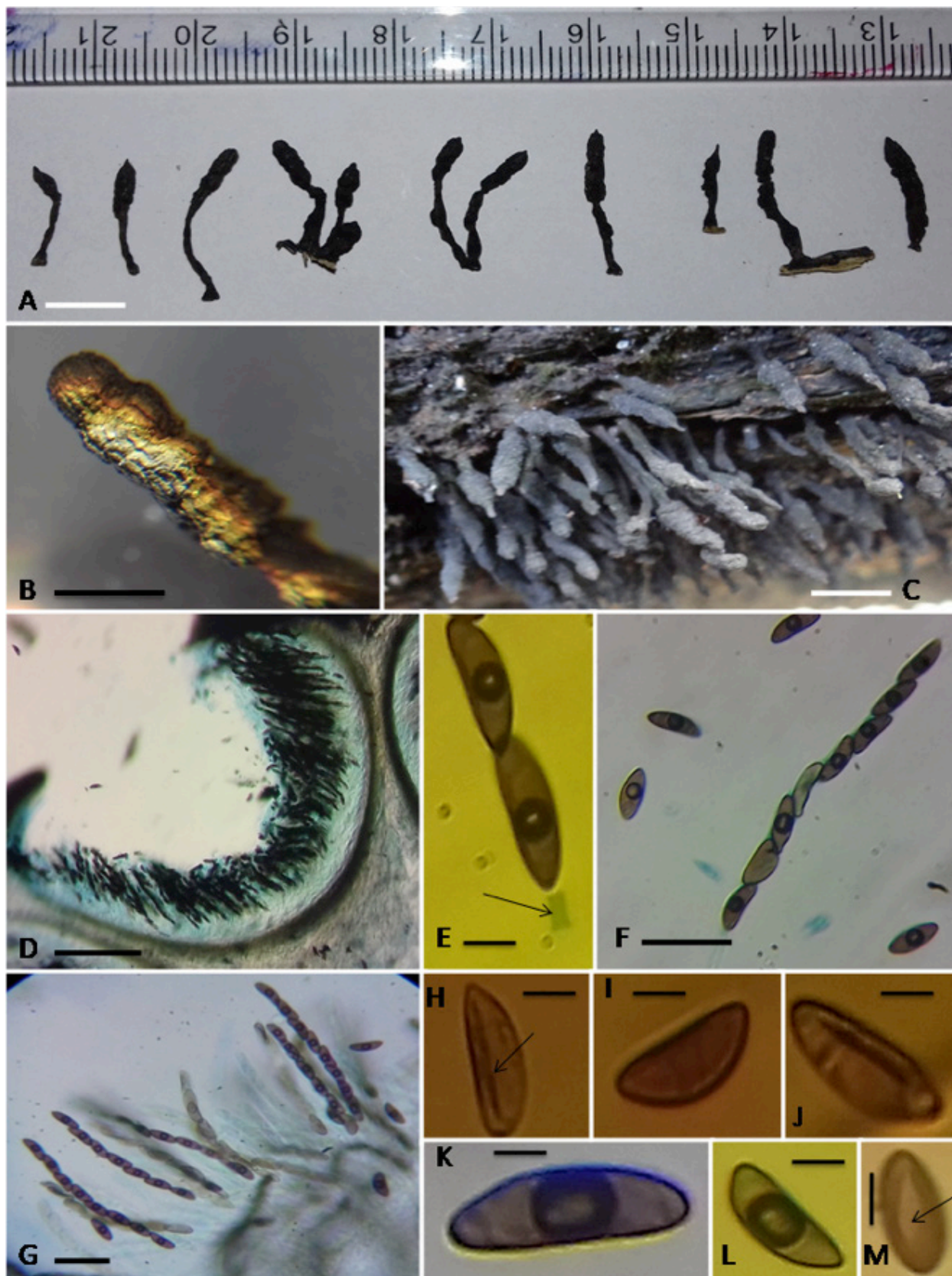


Image 1. *Xylaria arbuscula* Sacc.: A—Specimen picture, scale 10mm | B—Surface of ascomata, scale 5mm | C—Habitat, scale 10mm | D—Perithecium, scale 100µm | E—Ascus apical ring blueing in Melzer's reagent (black arrow), scale 5µm | F—Ascus containing eight ascospores, scale 25µm | G—Several asci arise from perithecium, scale 25µm | H—M—Ascospores (black arrows show the germ slit), scale 5µm.

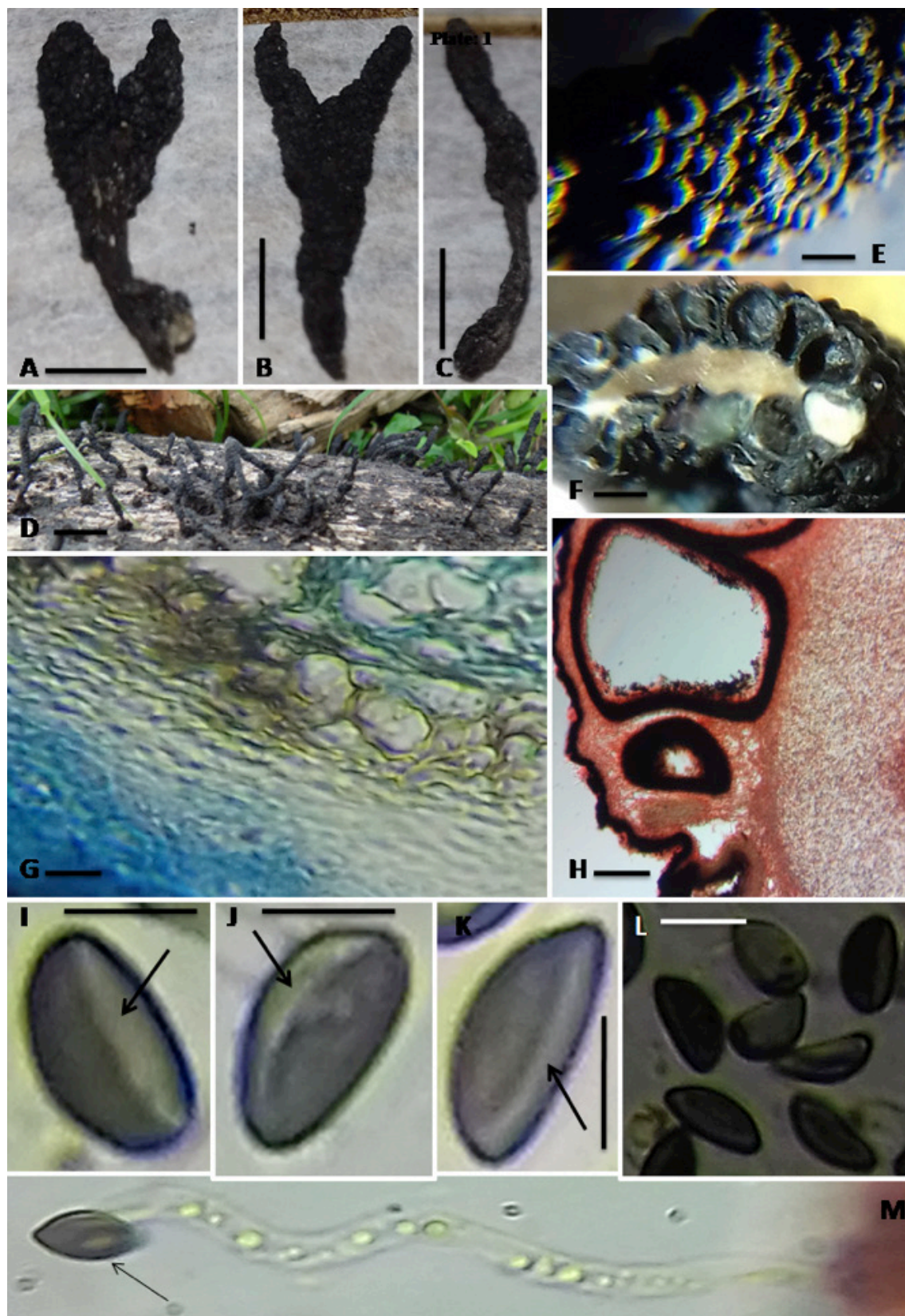


Image 2. *Xylaria multiplex* (Kunze) Fr.: A–C—Teleomorph of *X. multiplex* (Kunze) Fr. Nova Acta R., scale 5mm | D—Habitat, scale 5mm | E—Enlarged stromatal surface, scale 5mm | F—Perithecia in transverse section, scale 5mm | G—Outer entostroma, scale 50µm | H—Perithecia under microscope, scale 100µm | I–L—Ascospores with germ slits (black arrows), scale 5µm | M—Dehiscing ascus (black arrow shows an ascospore coming out from ascus).

Teleomorph Stromata erect, 8–20 mm total height, stipitate. Stipe 4–15 mm long × 2–3 mm width, unbranched dark grey (1F1). Fertile part 4–12 mm high × 2–3 mm width, cylindrico-clavate with rounded to mucronate sterile apices, surface with several longitudinal cracks, dark grey (1F1). Outer entostroma tough, carbonaceous, interior solid. Perithecia globose to sub-globose 249–333 × 226–306 µm without or with slightly exposed outlines, Ostioles without papillae.

Ascospores (10.9–)13.3–14.5–16.6(–19.6) × (3.6–)3.9–4.6–5.3(–5.9) µm, (n=30 spores), $Q_m=3.15$, uniseriate ellipsoid-inequilateral with narrowly to broadly rounded ends, with no hyaline cellular appendage, dark brown (6F8), smooth, uni-guttulate, guttule central, conspicuous straight germ slit slightly less than the spore-length on the less convex side. Abnormal, pyriform ascospores with beaked ends also frequently found, these were not taken for measurements. Asci 72–111 µm long × 6–9 µm broad, cylindrical, 8-spored; stalk 36–71 µm long, with apical apparatus, tubular to urn-shaped, apical ring positive in Melzer's reagent. Outer entostroma textura prismatica type and inner entostroma textura angularis.

Habit and habitat: Ascomata grown gregariously on rotten wood having no host specificity. Saprotroph, lignicolous.

Notes: *Xylaria arbuscula* Sacc. is well characterized morphologically by its 8–20 mm erect ascomata, 4–5 mm long unbranched stipe, mucronate sterile apices and microscopically by having (11–)13.5–16.5(–19.6) × (3.6–)3.9–5.3(–5.9) µm sized, uniseriate, ellipsoid in-equilateral ascospores and straight germ slit. It has been described first from a green house in Italy and distribution is cosmopolitan having no such host specificity. The present taxon is satisfyingly harmonized with the species reported from New Zealand in spore size [(11–)13.5–16.5(–19.6) × (3.6–)3.9–5.3(–5.9) µm vs (11–)13–16(–19) × (4.0–)5.0–6.0(–7.5) µm], J+ apical ring of ascus, straight germ slit and wrinkled teleomorph in dry condition (Rogers et al. 2012). The same species reported from Iran shows slight mismatch in spore size with the present taxon [(10.9–)13.3–16.6(–19.6) × (3.6–)3.9–5.3(–5.9) µm vs 12–16(–17) × 5–6 µm] (Hashemi et al. 2014). *Xylaria arbuscula* Sacc., differs from its closely related species *Xylaria multiplex* (Kunze) Fr. in having 10–13(–14) × (4–)5(–6) µm sized ascospores and germ slit equal to the length of ascospore (Hashemi et al. 2014).

Xylaria multiplex (Kunze) Fr. Nova Acta R. Soc. Scient. Upsal., Ser. 3, 1(1): 127(1851) (Image 2)

Specimen examined: CUH AM611, 16.vii.2017, 73.674°N & 141.510°E, 49m, Buxa Tiger Reserve Forest, Alipurduar District, West Bengal, India, coll. K. Acharya, A. Roy, D. Das & E. Tarafder.

Teleomorph Stromata erect, mostly unbranched but sometimes branched towards the apex, 8–27 mm total height, stipitate; stipe very short to short, 3–11 mm long × 1–2 mm width, unbranched, dark grey(1F1). Fertile parts 4–25 mm high × 1–2.5 mm width, cylindrico-clavate with rounded to slightly fusoid fertile apices, surface roughened with several ostiolar ridges, dark grey(1F1); outer entostroma tough, highly carbonaceous, interior solid. Perithecia sub-globose, 239–530 × 138–340 µm, with slightly exposed outlines, ostioles with conspicuous papillae.

Ascospores (8.3–)8.6–9.2–9.9(–10.6) × (3.3–)3.3–3.3–3.3–3.6 µm, (n=30 spores) $Q_m=2.7$ uniseriate ellipsoid-inequilateral with narrowly to broadly rounded ends, without hyaline cellular appendage, dark brown (6F8), smooth, multi-guttulate, conspicuous straight germ slit equal to the spore-length on the less convex side. Abnormal, ascospores with beaked ends also found frequently. Asci cylindrical, 8-spored, difficult to measure. Outer entostroma textura prismatica type 38–76 µm wide and inner entostroma textura angularis.

Habit and habitat: Ascomata grown gregariously on rotten wood. Having no host specificity. Saprotroph.

Notes: *Xylaria multiplex* (Kunze) Fr. is characterized morphologically by its dark grey (1F1) coloured erect, unbranched to branched, stipitate stromata with a fusoid apices and anatomically in its spore size (5.9–)6.6–10.6(–12.6) × (3.3–3.6) µm and germ slit equals to spore length. The species is a tropical species distributed throughout the tropical region of world. The present taxon nicely matches with the previously reported Indian taxon from Western Ghats, Karnataka in spore size (8.3–)8.6–9.2–9.9(–10.6) × (3.3–)3.3–3.3–3.3–3.6 µm vs 8.9–10.8 × 3.9–4.7 µm] (Karun et al. 2015). *Xylaria multiplex* (Kunze) Fr. differs from its closely related species *X. longipes* Nitschke, in having cylindrical, dull black coloured fruit-body with elevated, grooved stromal surface and having a short stipe and sigmoid germ slit (Karun et al. 2015).

Xylaria nigripes (Klotzsch) Cooke, Grevillea 11(59): 89 (1883) (Image 3)

Specimen examined CUH AM297, 21.viii.2012, 77.947°N & 125.076°E, 10m, Rajbhavan, Kolkata, West Bengal, India, coll. K. Acharya.

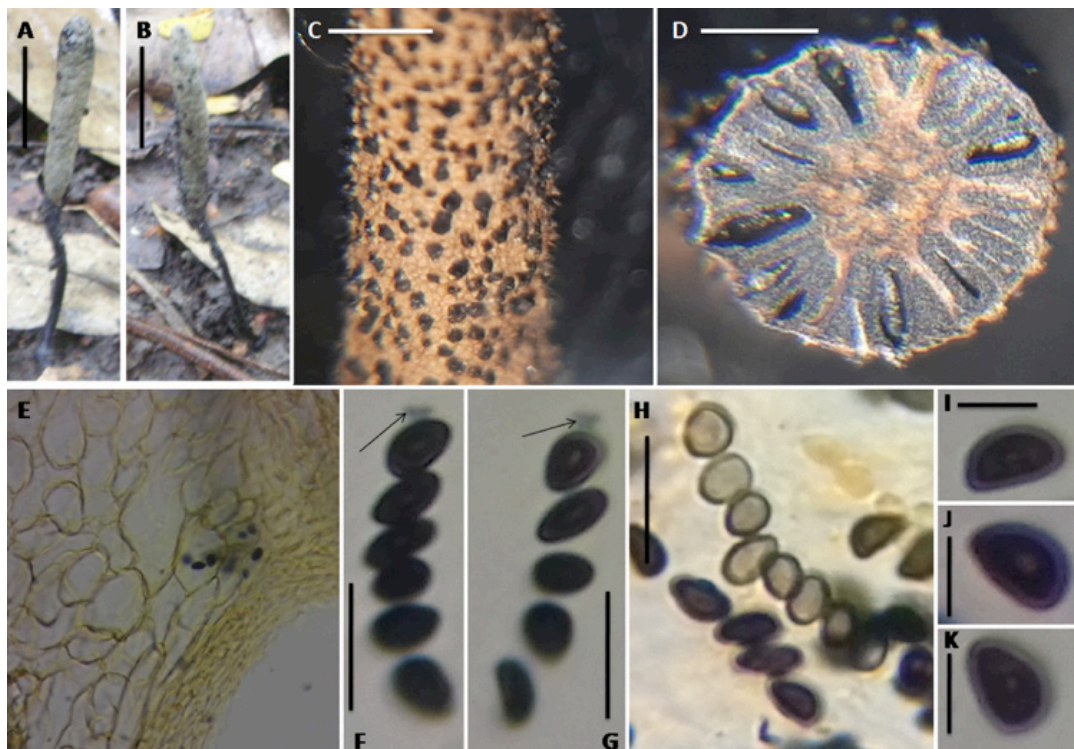


Image 3. *Xylaria nigripes* (Klotzsch) Cooke: A–B—Habitat, scale 15mm | C—Papillate ostioles on the stromatal surface, scale 1mm | D—Stromata in Transverse section, scale 1mm | E—Outer entostroma | F–G—Asci apical disc bluing in Melzer's reagent (black arrows point the apical disc), scale 15µm | H—Ascus containing eight ascospores, scale 15µm | I–K—Ascospores, scale 5µm.

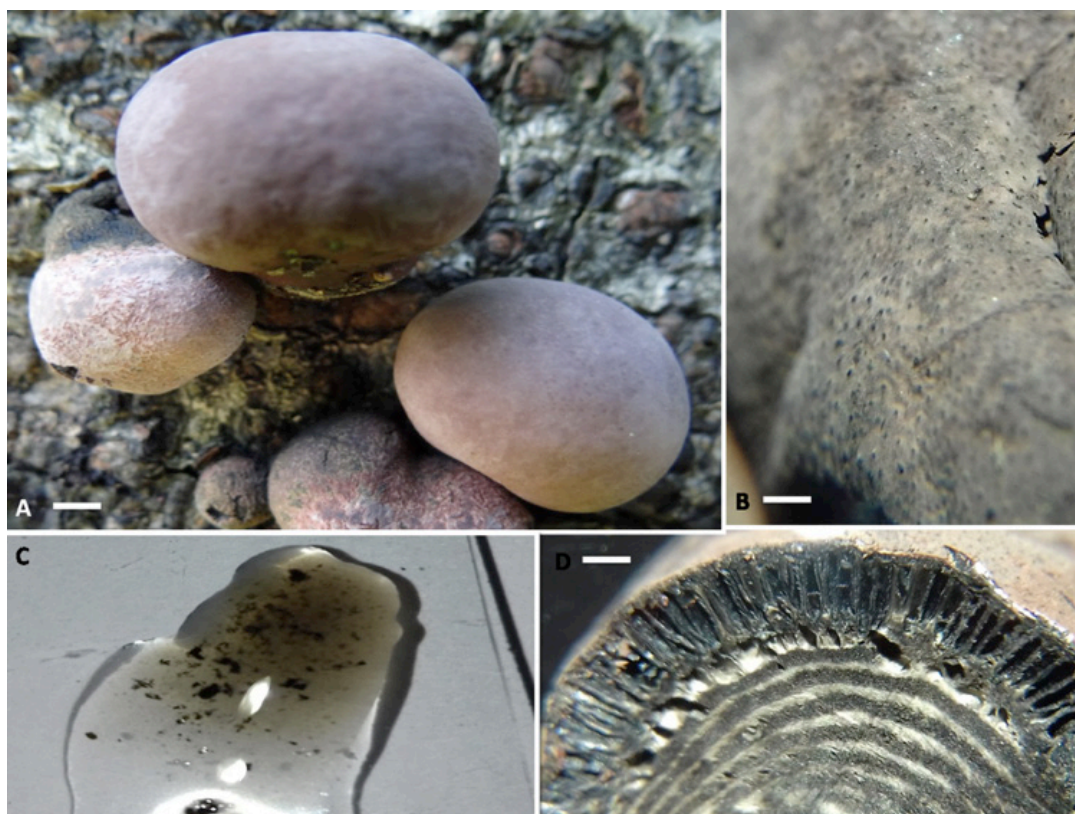


Image 4a. *Daldinia childiae* J.D. Rogers & Y.M. Ju: A—Habitat, scale 5mm | B—surface of the stromata, scale 5mm | C—KOH extractable pigment | D—Longitudinal section of the stromata showing perithecia along with darker and lighter zones of inner entostroma, scale 5mm.

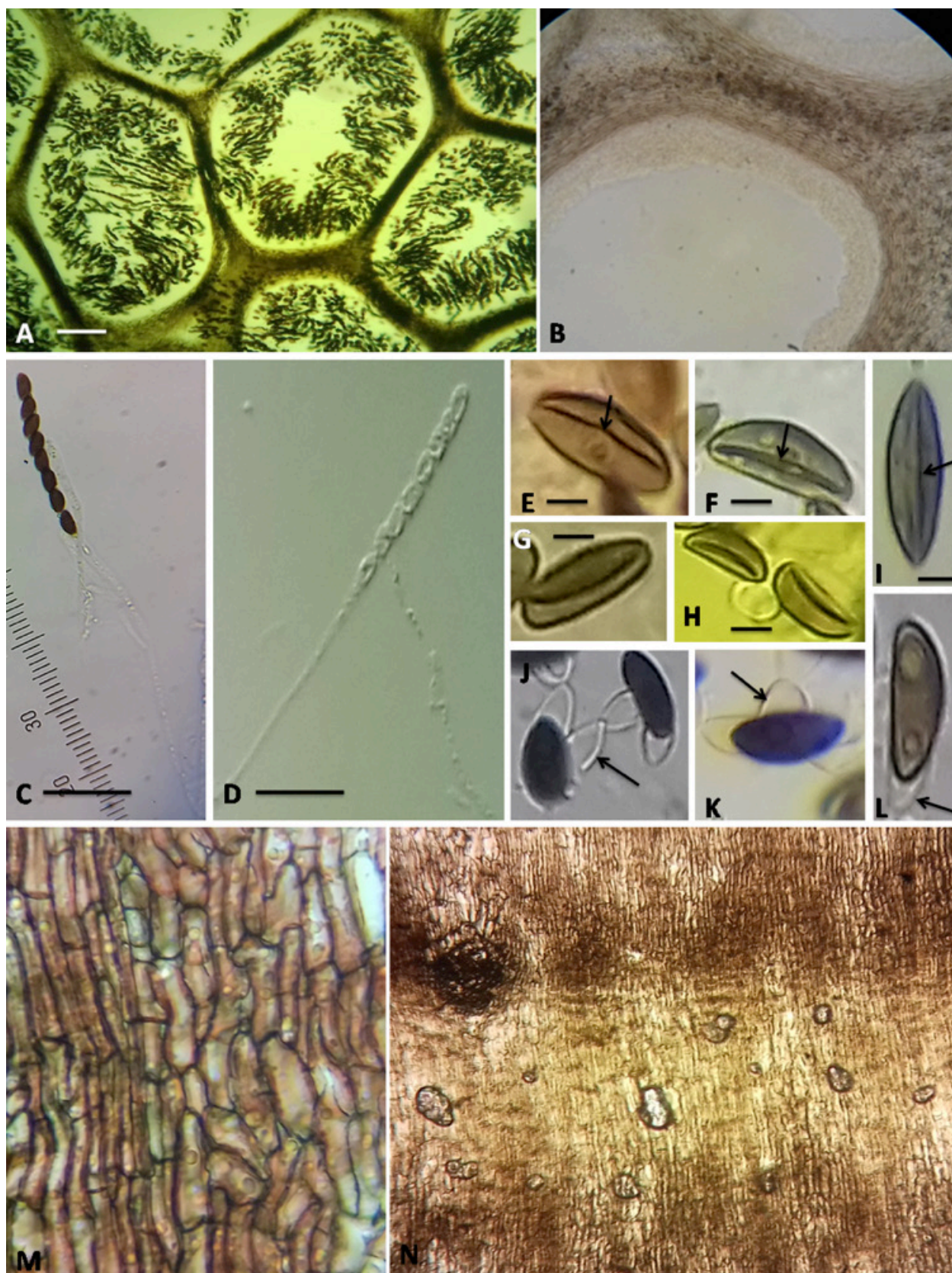


Image 4b. *Daldinia childiae* J.D. Rogers & Y.M. Ju: A—perithecia in transverse section, scale 300µm | B—Outer entostroma | C—D—Asci containing eight ascospores, scale 50µm | E—I—Ascospores (black arrows point the germ slits), scale 5µm | J—L—Perispore dehiscence in 10% KOH | M—Inner entostroma | N—Dark and lighter zones of inner entostroma.

Teleomorph stromata erect, acute apex, 50–75 mm total height, stipitate; stipe moderately long, 20–30 mm long $\times$ 1–3 mm broad, unbranched, dark grey (1F1). Fertile part 30–55 mm high $\times$ 3–6 mm width, cylindrico-clavate, with papillate ostioles, surface roughened, greyish yellow (3D3). Outer ectostroma tough, carbonaceous, interior solid. Perithecia narrow ellipsoid 300–680 $\times$ 114–243 μ m.

Ascospores (5.4–)5.7–6.3–7.1(–7.8) $\times$ (2.6–)2.8–2.9–3.1(–3.4) μ m, ($n=30$ spores), $Q_m=2.1$, uniseriate ellipsoid-inequilateral, without hyaline cellular appendage, dark brown, smooth, with a centre guttule, inconspicuous germ slit. Asci 63–78 $\times$ 3.4–3.7 μ m, narrow cylindrical, 8-spored. Outer entostroma textura angularis and inner entostroma inconspicuous.

Habit and habitat: Terrestrial in habitat and were associated with termite nest.

Notes: *Xylaria nigripes* (Klotzsch) Cooke is well characterized morphologically by 50–75 mm long ascomata having greyish-yellow (3D3) coloured fertile portion surrounded by distinctly papillate ostioles causing a spiny stromatal surface and anatomically by its (5.4–)5.7–6.3–7.1(–7.8) $\times$ (2.6–)2.8–2.9–3.1(–3.4) μ m sized ascospores. The present taxon has been reported several times from different corners of tropical regions. The present taxon is very well harmonized with the previously reported species from Karnataka (India) in its spore size [(5.4–)5.7–6.3–7.1(–7.8) $\times$ (2.6–)2.8–2.9–3.1(–3.4) μ m vs 5.3–7.9 $\times$ 2.6–3.3 μ m] (Karun et al, 2015). The present taxon differs from closely related species *X. escharoidea* in having cylindric to fusoid, black

ascomata with obtuse apex and smaller sized ascospores (3.7–5.2 $\times$ 2.5–3 μ m).

***Daldinia childiae* J.D. Rogers & Y.M. Ju**, in Rogers, Ju, Watling & Whalley, Mycotaxon 72: 512 (1999) (Image 4a,b)

Specimen examined: CUH AM615, 14.vii.2017, 58.047°N & 133.240°E, 46m, Tufanganj-II, Rashik Bill, Cooch Behar District, West Bengal, India, coll. K. Acharya, D. Das, E. Tarafder & A. Roy; CUH AM613, 14.vii.2017, 58.047°N & 133.240°E, 46m, Check Post, Cooch Behar District, West Bengal, India, coll. K. Acharya, D. Das, E. Tarafder & A. Roy; CUH AM614, 14.vii.2017, 58.047°N & 133.240°E, 46m, Check Post, Cooch Behar District, West Bengal, India, coll. K. Acharya, D. Das, E. Tarafder & A. Roy; CUH AM616, 15.vii.2017, 77.856°N & 144.291°E, 50m, Damanpur, Alipurduar District, West Bengal, India, coll. K. Acharya, D. Das, E. Tarafder & A. Roy; CUH AM617, 16.vii.2017, 73.674°N & 141.510°E, 49m, Buxa Tiger Reserve Forest, Alipurduar District, West Bengal, India, coll. K. Acharya, D. Das, E. Tarafder & A. Roy.

Stromata shows spherical to turbinate geometry in structure, pulvinate, 15–46 $\times$ 11–36 $\times$ 9–35 mm, attached with a small stipe, coalescent, surface smooth with inconspicuous perithecial moulds, smooth but slightly undulating, dull red to reddish-brown (9C4–9D4). KOH extractable pigments Cinnamon brown (6D6–6E6). Outer entostroma textura prismatica type, dark brown (6F6), pithy to woody; inner entostroma consists of alternately placed darker and lighter zones, the ratio of darker with lighter zone is 1: 1.5–2, pithy to woody; dark



Image 5a. *Ascobolus scatigenus* (Berk. & M.A. Curtis) Brumm.: A—Habitat | B—Apothecia, scale 5mm.

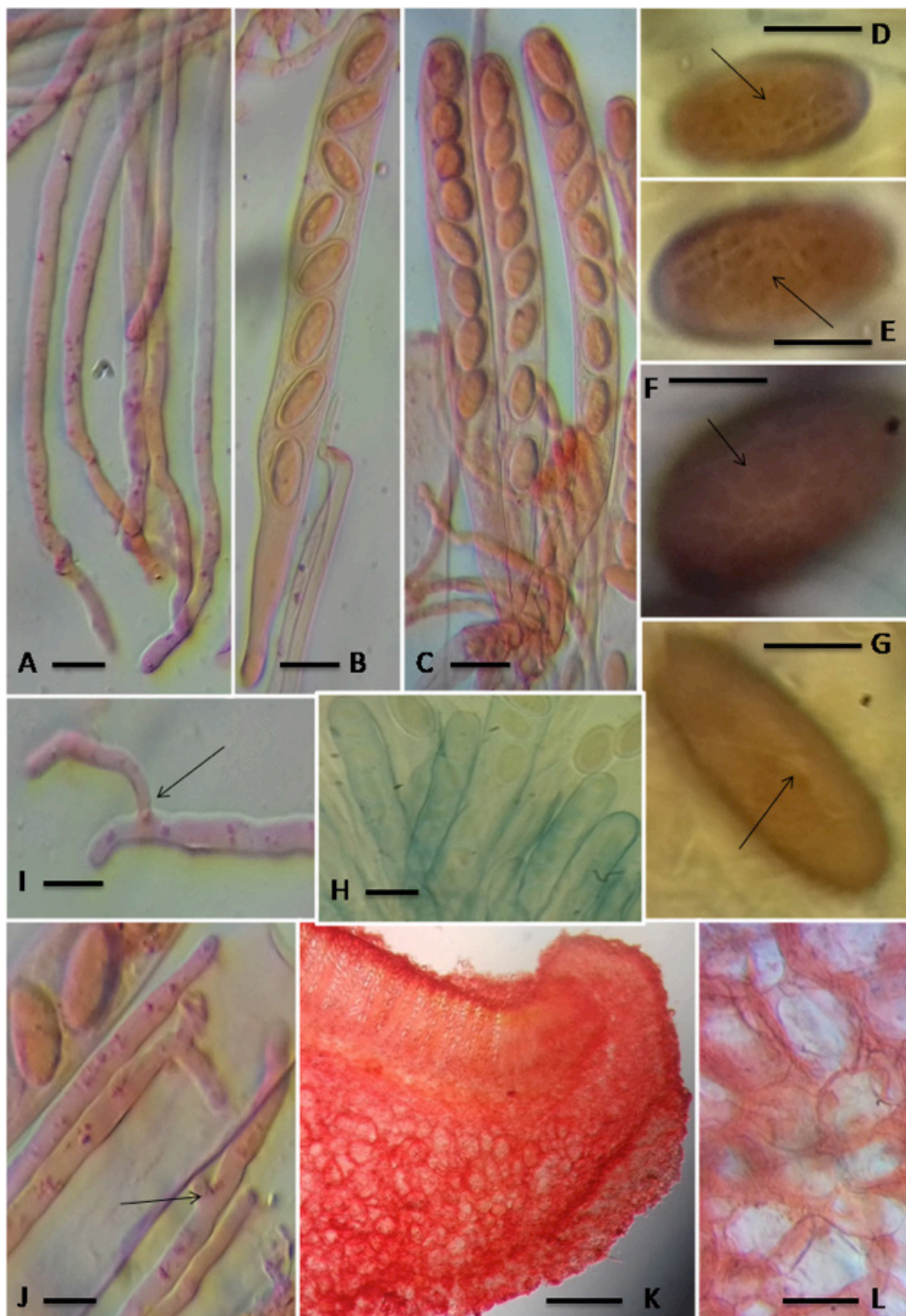


Image 5b. *Ascobolus scatigenus* (Berk. & M.A. Curtis) Brumm.: A—Paraphyses with narrow cylindric tips, scale 10 μ m | B–C—Asci with eight ascospores, scale 20 μ m | D–G—Ascospores with reticulate fissures (black arrows show the fissures), scale 10 μ m | H—Asci wall blueing in Melzer's reagent, scale 15 μ m | I–J—branched paraphyses (Black arrow points the branched portion), scale 10 μ m | K—a cross section of an ascoma shows hymenium and excipulum, scale 250 μ m | L—Excipulum with textura globulosa, scale 5 μ m.

zone textura porrecta to textura angularis with hyphae or cells, dark brown (6F6) pigmented, thick walled; lighter zone textura porrecta with broad thick walled hyphae, less pigmented to hyaline, agglutinated. Perithecial layer loculate on drying. Perithecia obovoid to lanceolate, $2-3.2 \times 1-2.3$ mm. Ostioles slightly papillate.

Ascospores $(11.6-11.9-14-16.6(-16.9) \times (5.3-5.6-6.4-6.9(-7.3) \mu\text{m}$, ($n=30$ spores), $Q_m=2.2$, ellipsoid-inequilateral, germ slit equal to spore length in convex side, brown (6E8) to dark brown (6F6), episporium smooth. Asci $183-216 \times 7.3-11.6 \mu\text{m}$, with amyloid, discoid apical apparatus. Perispore dehiscent in 10% KOH. Perithecial diameter $600-1,500 \mu\text{m}$.

Habit and habitat: Ascoma appear in solitary or aggregated together on a dead decayed trunk of a sal tree. Saprophytic, late decomposer, having no host specificity.

Notes: *Daldinia childiae* J.D. Rogers & Y.M. Ju, is well characterized by stipitate ascomata, cinnamon brown coloured KOH extractable pigment, dehiscent perispore and $(11.6-11.9-14-16.6(-16.9) \times (5.3-5.6-6.4-6.9(-7.3) \mu\text{m}$ sized, inequilateral, dark brown ascospores. Distribution of *Daldinia childiae* J.D. Rogers & Y.M. Ju, is cosmopolitan throughout the tropical region of the world. The present taxon is satisfyingly harmonized with the Stadler's described specimen in spore size $(11.6-11.9-14-16.6(-16.9) \times$

$(5.3-5.6-6.4-6.9(-7.3) \mu\text{m}$ vs. $12-16(-17) \times 5.5-7.5 \mu\text{m}$, ascus size $183-216 \times 7.3-11.6 \mu\text{m}$ vs. $180-220 \times 8-12 \mu\text{m}$ and cinnamon brown coloured KOH extractable pigment (Stadler et al. 2014). This specimen also very nicely matches with the described species from Gujrat (Koyani et al. 2016) in spore size $[(11.6-11.9-14-16.6(-16.9) \times (5.3-5.6-6.4-6.9(-7.3) \mu\text{m}$ vs. $11-16 \times 5-8 \mu\text{m}]$ and also shows some tiny difference with the previously described species of *Vadodora*, India in spore size $[(11.6-11.9-14-16.6(-16.9) \times (5.3-5.6-6.4-6.9(-7.3) \mu\text{m}$ vs. $10-16 \times 4-8 \mu\text{m}]$ (Koyani et al. 2016; Nagadesi et al. 2017). *Daldinia childiae* J.D. Rogers & Y.M. Ju, differs from closely related species *Daldinia pyrenaica* M. Stadler & Wollw, in spore size $[(11.6-11.9-14-16.6(-16.9) \times (5.3-5.6-6.4-6.9(-7.3) \mu\text{m}$ vs. $13-17 \times 6.5-8 \mu\text{m}]$ and *Daldinia* cf. *childiae* in having germ slit length less than spore length and smooth stromal surface (Stadler et al. 2014).

Ascobolus scatigenus (Berk. & M.A. Curtis) Brumm., Persoonia, Suppl. 1: 159 (1967) (Image 5a,b)

Specimen examined: CUH AM292, 17.vii.2017, 58.331°N & 137.670°E , 50m, Bara Debi Bari, Cooch Behar District, West Bengal, India, coll. D. Das, E. Tarafder, K. Acharya & A. Roy; CUH AM295, 18.vii.2017, 58.047°N & 133.240°E , 46m, Kaljani, Cooch Behar District, West Bengal, India, coll. D. Das, E. Tarafder, K. Acharya & A. Roy.



Image 6a. *Scutellinia jungneri* (Henn.) Clem.: A—Habitat | B—Ascomata, scale 1mm.

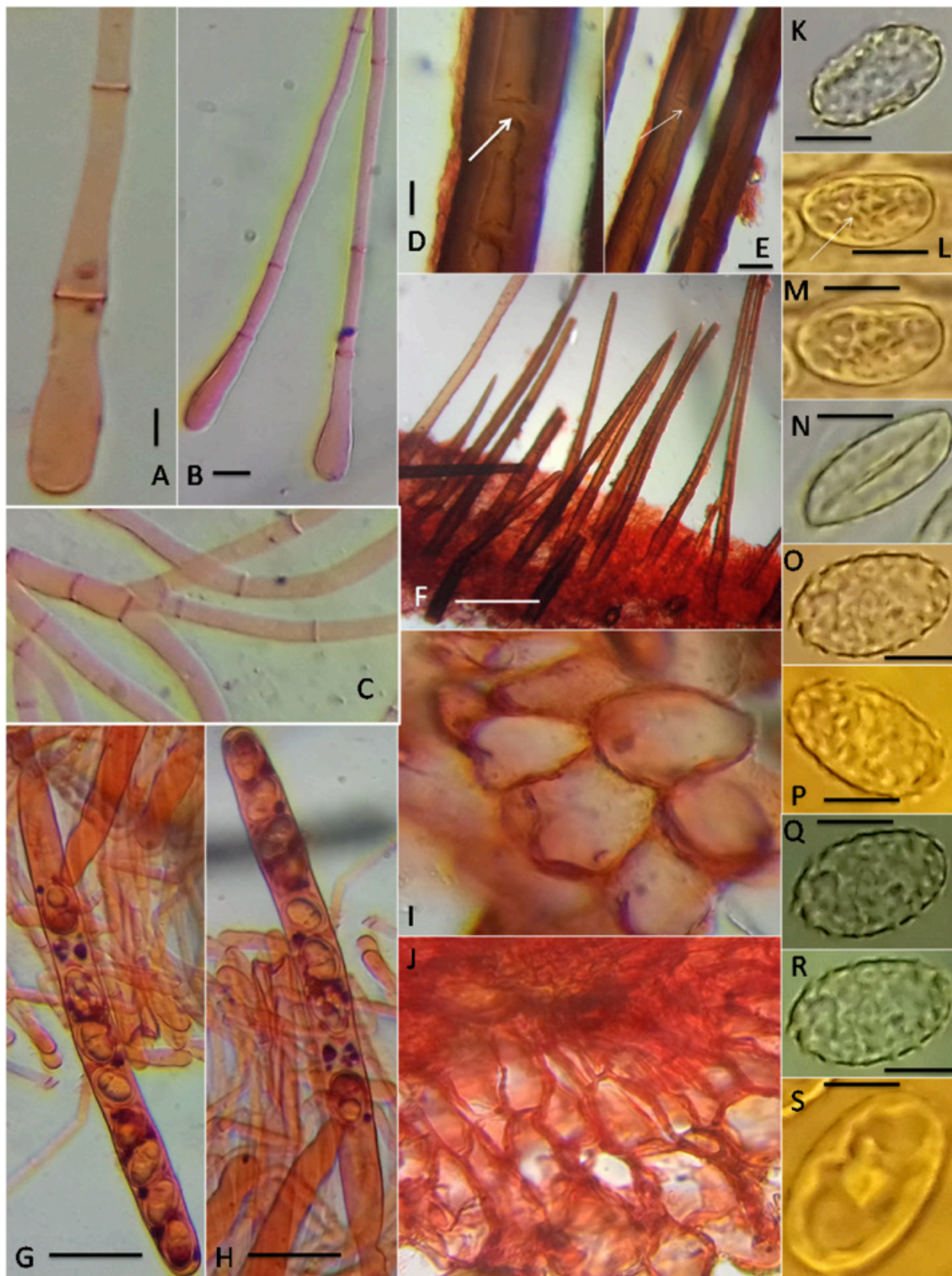


Image 6b. *Scutellinia jungneri* (Henn.) Clem.: A–B—Paraphyses, scale 5µm | C—Branched portion of paraphyses | D–E—Marginal hairs with prominent septa, scale 20µm | F—Hairs, scale 150µm | G–H—Asci containing eight ascospores, scale 25µm | I–J—Ectal excipulum cells | K–S—Ascospores (white arrows point the ornamentation), scale 10µm.

Ascomata 8–25 mm in diam., 2–4 mm high, sessile, deep concave when young becoming flat at maturity, hymenophore covered with white (1A1) granular margin, disk always darker than excipulum, greyish-green (1D5–1D6–1D7).

Ascospores (19.8–)20–22.3–24.3(–24.9) × (10–)10.3–11.6–12.6(–13.2) μm, (n=30 spores), $Q_m=1.9$, ellipsoid, uniseriate or irregular biseriate, smooth, with sigmoid or longitudinal two or more fissures, finely reticulate, pigments precipitate in uniform patches. Asci 146–253 × 16–22 μm, 8-spored, cylindrico-clavate, wall turning blue in Melzer's reagent; stalk very narrow, short 11.5–21 μm in length. Hymenium 172–204 μm, uniform; hypothecium distinct, composed of 5–11 mm diam., globose cells, textura globulosa. Paraphyses 2.8–3.4 μm, simple septate, sometimes branched; tapered towards apex, narrow cylindrical, hyaline in 5% KOH. Excipulum 45–62 μm thick, made up of globose to sub-globose cells, textura globulosa.

Habit and habitat: Grows gregariously on cow or buffalo dung, coprophilous.

Notes: *Ascobolus scatigenus* (Berk. & M.A. Curtis) Brumm, is very well characterized microscopically by its ellipsoid, reticulated, (19.8–)20–22.3–24.3(–24.9) × 10–11.6–12.6(–13) μm sized ascospores and morphologically by its coprophilous habitat, greyish green (1D5–1D6–1D7) coloured hymeneal disc, granular white margin and sessile flat concave ascomata. *Ascobolus scatigenus* (Berk. & M.A. Curtis) Brumm, distributed throughout the tropic region of the world. The present taxon satisfyingly harmonized with the previously reported taxon from northern Rhodesia by J. Van Brummelen (1967) in his world monograph of *Ascobolus* and *Saccobolus* and with the Brazilian species (Melo et. al. 2014) in its spore size [19.8–24.9 × 10–13 μm vs. 20–26 × 11–14 μm], shape and reticulate fissures on the spore wall. *Ascobolus scatigenus* (Berk. & M.A. Curtis) Brumm., differs from its closely related species *A. castaneus* Teng, in having 15–19.5 × 7.5–9 μm sized ascospores and perfectly smooth episporium.

***Scutellinia jungneri* (Henn.) Clem.,** Bull. Torrey bot. Club 30: 90 (1903) (Image 6a,b)

Specimen examined: CUH AM298, 19.ix.2017, 78.163°N & 160.517°E, 84m, Targhera, Jalpaiguri District, West Bengal, India, coll. D. Das, E. Tarafder, K. Acharya & A. Roy.

Apothecia 2–6 mm in diam., 2–4 mm high, sessile, disk flat, yellowish golden yellow to orange (5B7–5B8); margin along with receptacle covered with brown erect hairs with various length, dark brown (7F7–7F8).

Ascospores (15.8–) 17–18–19.5 (–20) × (9.2–) 10.4–11.3–11.4 (–11.8) μm, (n=30 spores), $Q_m=1.6$, ellipsoid, with two or more guttule, ornamentation consisting of angular or rounded warts, inamyloid. Ascus 149–220 × 12–18 μm, 8-spored, cylindrico-clavate, inamyloid; stalk very short, 5.7–11.8 μm in length. Hymenium 250–400 μm, uniform; sub-hymenium distinct, composed of narrow cells. Paraphyses 3.5–8.6 μm broad, simple septate, straight, branched at the middle or basal portion, cylindrico-clavate apex, hyaline in 5% KOH. Ectal-excipulum made up with 23–71.7 μm diam., globose cell, textura globulosa. Hair 229–574 × 31–40 μm straight, multi septate, no furcation at the base, thick walled; wall 3.7–8.6 μm thick.

Habit and habitat: Ascomata grown solitary to gregariously on a rotten wood, saprotroph.

Notes: *Scutellinia jungneri* (Henn.) Clem. is very well characterized by 2–6 × 2–4 mm, yellow to orange (5B7–5B8) ascomata surrounded by 229–574 × 31–40 μm dark brown (7F7–7F8) hair, (15.8–)17.2–18.1–19.5(–20) × (9.2–)10.4–11.3–11.4(–11.8) μm, ellipsoid ascospores having angular or rounded warts, 149–220 × 11.5–17.2 μm ascus with short narrow base. The present taxon is distributed throughout the tropical region of the world. It was reported previously from India in the year of 1968 as *Scutellinia jungneri* (Henn.) Clem., by Kar & Pal (Schumacher 1990). The present taxon is satisfyingly harmonized with the Trond Schumacher's description in spore size [15.8–17.2–18.1–19.5–20 × 9.2–10.4–11.3–11.4–11.8 μm vs. 16.8–19.4 × 8.8–12.2], shape, ascus size [149–220 × 11.5–17.2 μm vs 160–250 × 11–15 μm] and the size of the dark brown coloured marginal hair [155–574 × 31–40 μm vs 150–400 μm] with no furcation at the base (Schumacher 1990). *Scutellinia jungneri* (Henn.) Clem., differs from its closely related species *Scutellinia jungneri* (Henn.) Clem, in having 17.4–22.8 × 11–13 μm sized ascospores, 360–1600 × 22–47 μm marginal hairs with multibranched base (Schumacher 1990).

DISCUSSION

The genus *Xylaria* under the family Xylariaceae can easily be identified by their cardinal anatomical features including the perithecial ascomata embedded in the dark coloured stromata, cylindrical asci with an amyloid apical ring, ascospores with dark coloured complex multi-layered walls with a germ slit and asexual morph during maturation (Rogers 2000). Most of the species grow on several substrates like fallen leaves,

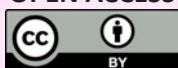
petioles, herbaceous stems, dung, grasses, seeds, fruits, wood, soil, and rotten wood (Rogers & Samuels 1986; Hashemi et al. 2014). Recent studies revealed that the family Xylariaceae is one of the largest and most diverse family among Ascomycota, which comprised 85 genera and more than 1,350 species (Daranagama et al. 2017). Both the genera *Daldinia* and *Hypoxylon*, belonging to the family Hypoxylaceae have some common characters like presence of nodulisporium-like asexual morph and geniculosporium-like asexual morph respectively (Daranagama et al. 2017). But *Daldinia* can easily be distinguished from the genus *Hypoxylon* by having distinctly zonate inner entostroma. The genera *Ascobolus* and *Scutellinia* belonging two different families Ascobolaceae and Pyrenomataceae respectively are differentiated by bright coloured apothecia with marginal septate hairs and ellipsoid ascospores with irregular ornamentation and less bright apothecia without any marginal hairs and dark purplish brown ascospores with reticulate fissure. Moreover, *Ascobolus* are coprophilous where *Scutellinia* are lignicolous.

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