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COMMUNICATION

CONTRIBUTION TO THE MACROMYCETES OF WEST BENGAL, INDIA: 69–73

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Contribution to the Macromycetes of West Bengal, India: 69–73

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Abstract: The varied topography, soil and climate of West Bengal makes conducive conditions of macrofungal habitats nurturing magnificent diversity. During exploration of macro-fungal diversity in Terai Duars region of the state during 2017–18, basidiocarps of different kinds of the genus Lentinus (Polyporaceae) were collected, photographed along with macro-morphological and ecological notes. The specimens were identified through macro and micro-morphological characters following standard literature. Five species of the genus Lentinus (L. araucariae, L. fasciatus, L. polychrous, L. soja-caju, and L. squarrosulus) were identified which are presented in this paper along with amplified description, necessary figures and photographs. Literature survey revealed that out of five identified species, L. araucariae and L. fasciatus represent new distributional record for India. The outcome of the present study would enrich data related to the macro-fungal diversity from the state of West Bengal.

Keywords: Basidiomycota, Lentinus, Polyporaceae, polypore fungi, species, taxonomy.

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Author contribution: Specimens collected by DD, PP, AR and KA. Field Photographs by Entaj Tarafder and AR. Microscopic photographs by DD. Macro and microscopic characteristics described by DD and PP. Data compiled and analysed by KA, AR and DR.

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INTRODUCTION

West Bengal being a state with varied climate and topography includes Himalayan temperate-sub-temperate region, foothills having moist-deciduous forests, vast gangetic plains, lateritic plateau and coastal plains which create diversified habitats for mosaic of life-forms, including macro-fungi (Pradhan et al. 2012, 2013, 2016; Dutta et al. 2013).

Among the polypore fungi, the genus *Lentinus* Fr. has subtropical distribution as lignicolous fungi and is represented globally by 40 species (Kirk et al. 2008), out of which 20 species are encountered in India (Sharma & Atri 2015).

From the evolutionary stand point *Lentinus* Fr. is an interesting taxon for its transitional nature between poroid and gilled fungi by gradual reduction of tubulate hymenophore. Moreover, *Lentinus* Fr. represents agaricoid development with a lineage of polyporoid ancestry (Pegler 1983a; Hibbet & Vilgalys 1991). During the exploration of macro-fungal diversity of West Bengal, India, a good number of specimens were collected of which five species of *Lentinus* Fr. had been identified, two of which are new records for India (*L. fasciatus* and *L. araucariae*), and are represented in the present paper and it is in continuation of the series of publications on macro-fungal diversity of West Bengal (Bera et al. 2018; Saha et al. 2018).

Macro-fungal specimens were collected from June 2017 to October 2018 from Terai region of West Bengal, India. During fieldwork digital photographs of the samples were taken in their habitat and their macro-morphological and habitat features were noted.

During the tenure of work, by using standard identifying protocol, colour photographs and macro-morphological features of each specimen were taken in the field. Each collection was then wrapped with tissue paper and kept in separate boxes to avoid contamination/spore mixing. Finally, the collected specimens were carefully withered (separately) 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 basidiocarps by staining with Congo Red and Melzer’s reagent. Microscopic figures were photographed with microscope-mounted digital camera. Thirty measurements of basidiospores were taken from each sample for calculating dimensions of basidiospore. Length/breadth ratio denotes the Q value. Mean Q value ($Q_{av}$) was measured by dividing sum of Q value by total number of spores observed.

Specimens were properly identified using standard keys and published literature (Singer 1962; Pegler 1983a; Manimohan et al. 2004; Senthilarasu 2015). Kornerup & Wanscher (1978) was followed for colour terminology. The voucher specimens were preserved following Pradhan et al. (2015) and were deposited in the Calcutta University Herbarium (CUH), Kolkata, India.

   Journal de Botanique (Morot) 17: 11 (1903)
   (Image 1–2).

   Basidiocarps pileate, lamellate and stipitate. 
Pileus 34–89 mm in diam., white (1A1) to yellowish-white (1A2), deeply indented to infundibuliform, surface velutinate, with uplifted white (1A1) squamules, margin sulcate striate to rimose, white to yellowish-white (3A1 to 3A2) when young becoming pale yellow (3A3) on drying, concolorous. Context up to 3 mm thick, yellowish-white (3A2). Lamellae decurrent with two–three tiers of lamellulae, lamellae width up to 3 mm, margin serrate, moderately crowded, furcate with at least two dichotomies, light yellow (4A4) when young becoming (4B4) on drying, concolorous. Stipe 15–22 × 3–7 mm, slight eccentric, surface appressed white (1A1) squamulose, solid, fibrous, insitusibute base, yellowish–white to pale yellow (3A2 to 3A3) when young turning light yellow (4A4) on drying.

   Basidiospores (5.1)–5.7–6.7–7.4–(8.1) µm, $Q_{av}=2$, cylindric, hilar appendix bilaterally symmetric, thin walled. Basidia 20.4–27.8 × 5.8–6.8 µm, cylindrico-clavate, basally clamped, two to four spored, sterigma 2–3.7 µm in length, thin walled. Basidioles 21–30.2 × 5.8–7.1 µm, cylindrico-clavate, thin walled. Pileocystidia none. Cheilocystidia none. Hyphal system dimitic with skeleto-ligative hyphae. Generative hyphae 3–6.4 µm wide, clamped, clamp 2.7–3.7 µm wide, thin- to thick-walled, branched, interlocking projections present, content hyaline in 10% KOH. Skelete-ligative hyphae 7.4–11.9 µm wide, with tapered branches, content not too narrow, thick walled, pale yellowish in 10% KOH. Hyphal pegs 40.8–57.8 µm wide, abundant, composed of 30 to 40 generative hyphae with rounded apical portion. Hymenophoral trama irregular, interwoven. Pileipellis trichodermal palisade, elements 8.5–13.6 µm wide.

   Habit and habitat: Basidiocarps lignicolous, saprotrophic, growing gregarious, and caespitously upon fallen and decaying *Shorea robusta* Roth.

   Specimen examined: CUH AM667, 04.x.2018, 26.5873N & 89.5327E, elevation 62 m, Panijhora bit, Dooars, Alipurduar District, West Bengal, India, coll. K.
Acharya & A. Roy.

Remarks: Presence of rigid, coriaceous basidiocarps with dichotomously furcated lamellae, pale yellowish pileus ranging from 34 to 89 mm, abundant hyphal pegs, devoid of cheilocystidia; central to excentric stipe; dimitic hyphal system with skeleton-ligative hyphae and 3–6.4 µm wide generative hyphae, and spore size of 5.1–5.7–6.7–7.4–8.1 × 2.7–3.2–3.7 µm places the studied specimen under *Lentinus araucariae* (section *Dicholamellatae* of subgenus *Lentinus*). The studied specimen matches with the previously reported Australian specimen (Pegler 1983b) in terms of spore size [5.4–6.1–6.9–8.1–8.5 × 2.7–3–3.4 µm vs 6–10 × 3–5], width of generative hyphae [3.4–6.4 µm vs 2–5 µm] and width of skeleto-ligative hyphae [7.4–11.9 µm vs 2–12.5 µm], making it a new record for India. Morphologically, *Lentinus badius* (Berk.) Berk. is also closely related to the present taxon. Presence of sub-distant to moderately close lamellae, pale yellowish basidiocarp, trichodermal palisade pileipellis in *L. araucariae* distinguishes it from *L. badius*. *Lentinus araucariae* differs from *L. dicholamellatus* Manim. by its spore size [5.4–6.1–6.9–8.1–8.5 × 2.7–3–3.4 µm vs 6–10 × 3–5], and absence of pseudo sclerotium.

2. *Lentinus fasciatus* Berk.


Basidiocarps pileate, lamellate and stipitate. Pileus 20–74 mm in diam., umbilicate to infundibuliform, surface white (1A1) to orange brown (5B2) to pale yellow (2A3), tomentose with numerous whitish (1A1) erect hairs, 1–3 mm long, becoming longer towards pileal margin, greyish-orange (6B4), appressed squamules present towards centre, Lamellae 2–4 mm wide, deeply decurrent with lamellulae of 1–3 tier, lamellae margin entire, smooth, distant to close, sometimes lamellae bifurcated in the region just above the stipe, yellowish grey (4B2). Stipe 10–55 mm × 2.5–7 mm, short and stocky, central, cylindric, solid, tomentose, amount of hairs more in the base, without pseudo sclerotium, concolorous with the pileus. Context up to 2.5mm thick.
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It differs from L. hookerianus Berk. by its spore size [(6−)6.4−6.9−7.8−(8.2) × (2.1−)2.8−3.3−3.9−(−4.2)] μm vs. 5.6−6.5 × 2.7−3.5 μm] and Q∞ value [2.07±0.24 vs. 1.87].

3. Lentinus polychrous Lév.


Basidiocarps pileate, lamellate, stipitate. Pileus 70–150 mm in diam., sub-infundibuliform, texture tough leathery flexible when young become rigid on drying, surface orange grey to greyish-orange (5B2–5B3) when young turn into yellowish-grey (2D2) on drying, covered with chestnut brown (6F7) coloured uplifted squamules, concolorous, margin entire. Context up to 6mm thick, white (1A1). Lamellae deeply decurrent with 1–3 tiers of lamellulae, width up to 5mm, spacing less than 1mm, crowded, tough and thick, honey yellow to golden brown (5D6 to 5D7) when young becoming brown to dark brown (7F4 to 7F5) on drying. Stipe 10–25 × 4–12 mm, slightly eccentric to central, solid, rigid, covered with minute appressed squamules, base tapered, white (1A1) at apex and slightly darker towards base.

Basidiocarpes (6.1−)6.4–8.1–9.5–(−10.2) × 3–3.4–3.4–3.7–4 μm, Q∞=2.3 (n=30), cylindrical, hiliar appendix bilaterally symmetric or asymmetric, thin-walled, hyaline, negative in Melzer’s reagent. Basidia 17–27.2 × 4.7–7.1 μm, cylindrico-clavate, basal clamp not found. Pleurocystidia none. Cheilocystidia none. Hyphal system dimitic with skeletal-ligative hyphae. Generative hyphae 2.7–6.8 μm wide, thin to thick-walled, branched, clamped, clamp connection 2.3–3.4 μm wide, hyaline in 10% KOH, 4-spored; sterigma four, 2–3.4 μm high. Basidioloele 17–27.2 × 4.7–7.1 μm, cylindrico-clavate, basal clamp not found. Pleurocystidia none. Cheilocystidia none. Hyphal system dimitic with skeletal-ligative hyphae. Generative hyphae 2.7–6.8 μm wide, thin to thick-walled, branched, clamped, clamp connection 2.3–3.4 μm wide, hyaline in 10% KOH. Cheilocystidia none. Hyphal system dimitic with skeletal-ligative hyphae. Generative hyphae 2.7–6.8 μm wide, thin to thick-walled, branched, clamped, clamp connection 2.3–3.4 μm wide, hyaline in 10% KOH.

Remarks: Presence of rigid, coriaceous basidiocarps with hispid stipigale pileus with short erect hairs, moderately crowded lamellae, presence of abundant sclerocystidia; central to eccentric stipe; dimitic hyphal system with skeletal hyphae and 2.1−3.5 μm wide, thick-walled, hyaline in 10% KOH.

Habit and habitat: Basidiocarps lignicolous and saprotrophic, growing caespitosely upon fallen and decaying trunk of Schima wallichii (DC.) Korth. The present taxon was limited to this species by forming a strongly agglutinated thick-walled generative hyphae. Plepippellis a trichodermal palisade.

Basidiocarps lignicolous and saprotrophic, growing solitary to slightly gregarious upon fallen and decaying logs of Shorea robusta Roth.


Remarks: Presence of rigid, coriaceous basidiocarps with hispid stipigale pileus with short erect hairs, moderately crowded lamellae, presence of abundant sclerocystidia; central to eccentric stipe; dimitic hyphal system with skeletal hyphae and 2.1−3.5 μm wide, thick-walled, hyaline in 10% KOH.
with brown coloured uplifted pileal squamules, amber coloured thick rigid hymenophore, irregular lamellae trama, central to excentric dark coloured tapered base; complicated dimitic hyphal system with skeleto-ligative hyphae and 2.7−6.8 µm wide generative hyphae, hyphal pegs and spore size of (6.1−)6.4−8.1−9.5(−10.2) × 3−3.4−3.7−4 µm places the studied specimen under *Lentinus polychrous* (section Rigid of subgenus *Lentinus*). The present taxon is one of the most widely distributed species in India and it has been reported several times from several localities including Bihar, West Bengal, Andhra Pradesh, Kerala (Pegler 1983a; Sharma & Atri 2015). The present specimen matches nicely with the description illustrated by Pegler (1983a) in spore size [(6.1−)6.4−8.1−9.5(−10) × (3−)3.4−3.7(−4) µm vs. 6−9 × 2.7−3.3 µm], width of generative hyphae [2.7−6.8 µm vs. 1.4−4.5 µm], length of basidia [20−25.5 × 5.7−7.1 µm vs. 20−27 × 5−6 µm] and with the description of Corner (1981) in spore size [(6.1−)6.4−8.1−9.5(−10.2) × (3−)3.4−3.7(−4) µm vs. 6−9.5 × 3−3.7 µm], width of generative hyphae [2.7−6.8 µm vs. 2−5 µm] and length of basidia [20−25.5 × 5.7−7.1 µm vs. 15−35 × 5−6 µm]. The present taxon is distinguished from closely resembling *L. squarrosulus* Mont. by having fine tomentum, short stipe, fuliginous to umbrinous amber coloured lamellae, (6.1−)6.4−8.1−9.5(−10.2) × (3−)3.4−3.7(−4) µm sized basidiospores instead of appressed soft squamules, deeply decurrent white lamellae, 5.5−7.5 × 1.7−2.5 µm sized basidiospores in *L. squarrosulus*.

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

*Epicrisis Systematis Mycologici*: 393 (1838) *(Image 7–8).*

Basidiocarps pileate, lamellate, stipitate. Pileus 25−75 mm in diam., convex to broadly convex when young, becoming infundibuliform at maturity, disc dark brown (6F7), margin golden brown (5D7) to brown (6E7), turning brown (6E5) to dark brown (6F5) on drying, margin incurved, entire to undulating. Context up to 3mm thick, off white. Lamellae ca. 1mm broad, deeply

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decurrent, densely crowded without lamellulae, narrow, white (1A1) to pale orange (5A3) or light orange (5A4), concolorous. Stipe 15–25 × 10–15 mm, central to slightly eccentric, fleshy-fibrous, white (1A1) to pastel grey (1C1) turning yellowish-grey (3B2) on bruising. Annulus single, white (1A1), inferior, removable.

Basidiospores (4.2−)5.3−6.9−7.5(−9.6) × (2.1−)4.6−2.6−2.8(−3.5) µm places the studied specimen under Lentinus sajor-caju (section Rigidi of subgenus Lentinus). From India this species has been reported from West Bengal, Kerala, Andaman Island (Pegler 1983a; Sharma & Atri 2015). The currently studied specimen matches with the description of specimen studied by Pegler (1983a). L. sajor-caju differs from its closely related species L. umbrinus Reichardt by having pure white pileus, a distinct annulus, densely crowded lamellae and cylindric basidiospores [(4.2−)5.3−6.9−7.5 (−9.6) × (2.1−) 4.6−2.6−2.8(−3.5) µm vs. 5−8.5 × 2.3-3.5].

5. Lentinus squarrosulus Mont.
Basidiocarps pileate, lamellate, stipitate. Pileus 40–68 mm in diam., fleshy, covered with soot brown (5F5) appressed squamules forming a circular lining on the grey (14C1) coloured pileus, margin lacerate to undulated, slightly inrolled. Context up to 3mm thick, grey (14C1) in colour. Lamellae up to 4mm in width, strongly decurrent with 1–3 tires of lamellulae, moderately crowded to crowded, light orange (5A4) in colour, gill edge denticulate. Stipe 15–25 × 6–15 mm in size, eccentrically placed, covered with grey (11C1) coloured squamules, base slightly bulbous, solid. Odor pleasant mushroomy.

Basidiospores (4.2−)5.3−6.19−6.8(−7.16) × (2.1−)2.5−2.6−2.8(−3.5) µm, $X_{w} = 6.19±0.71 \times 2.63±0.36$. Q-Value= 1.33−2.85, $Q_{w} = 2.37±0.33$, n = 30

hyphae 3.9–7.8 µm wide, thick walled, well branched, tapered towards the apex. Annulus hyphae 3.2–4.6 µm broad, hyaline, thin-walled, clamp-connections present. Hyphal pegs abundant, 47.6–91.8 µm wide. Pileipellis made up with repent generative hyphae.

Habit and habitat: Basidiocarps lignicolous and saprotrophic, growing solitary to gregariously in an imbricate fashion on a fallen and decaying log of Shorea robusta Roth. Hymenophoral surface of this species also provided shelter and food to members of the insect order Coleoptera L.


Remarks: Presence of tough, coriaceous, central to eccentrically stipitate basidiocarps with deeply infundibuliform pileus, stipe short with distinct annulus, dimitic hyphae with skeleto-ligative hyphae and 3.5−7.5 µm wide generative hyphae, presence of hyphal pegs and spore size of [(4.2−)5.3−6.9−7.5 (−9.6) × (2.1−) 4.6−2.6−2.8(−3.5) µm]
spores, narrow cylindric, hilar appendix asymmetric, thin-walled, hyaline, negative in iodine test. Basidia 14.32–24.34 × 3.9–4.6 µm, 2–4 sterigmate, cylindricoclavate; sterigmata 0.3–0.7 µm in length. Basidioles 17.5–21.4 × 5.01–7.1 µm, cylindricoclavate, basal clamp present. Cheilocystidia 11.8–21.4 × 6.4–7.8 µm, narrow clavate with emergent skeletal hyphae, content hyaline with no oil guttule. Pleurocystidia none. Lamellar edge sterile. Hyphal peg abundant, 32.2–64.4 µm wide, consisting of 25–30 generative hyphae, extruded from the lamellae trama. Hyphal system dimitic. Generative hyphae of context 3.5–5.3 µm in width, clamped, thin walled, branched, content hyaline. Skeleto-ligative hyphae of context 5.7–10.74 µm in width, become tapered towards apex, highly branched, thick-walled, wall 1–2 µm thick. Generative hyphae of stipe 3.5–7.1 µm in width, clamped, thin to thick-walled, content hyaline. Skeletal hyphae of stipe 6.8–11 µm in width, thick walled, wall 1.2–2 µm thick. Hymenophoral trama irregular interwoven, devoid of sub-hymenium layer. Pileipellis consists of inflated generative hyphae. Squamules of pileus emerging from the disrupt epikutis.

Habit and habitat: Basidiocarps lignicolous and saprotrophic, grows in troops or clusters of 1–4 caespitose basidiocarps upon fallen and decaying logs of Shorea robusta Roth.

Specimen examined: CUH AM622, 15.vii.2017, 26.64N & 89.54E, elevation 116m, near Buxa forest, Alipurduar District, West Bengal, India, coll. K. Acharya & A. Roy.

Remarks: Presence of tough, coriaceous, excentrically stipitate basidiocarps with soot brown coloured appressed squamules which forms a ring-like pattern on pileus surface; dimitic hyphae with skeleto-ligative hyphae and 3.5–5.3 µm wide generative hyphae, presence of hyphal pegs and spore size of (4.2–)5.3–6.19–6.8(–7.16) × (2.1–)2.5–2.63–2.8(–3.5) µm places the studied specimen under Lentinus squarrosulus (section Rigidi of subgenus Lentinus).

Spore dimensions of the collected specimen is similar with the previously reported taxon from Kerala (Manimohan et al. 2004) [(4.2–)5.3–6.19–6.8(–7.16) × (2.1–)2.5–2.63–2.8(–3.5) µm vs 5.5–9 × 1.8–2.7 µm], but the length of the spore of the material studied by Pegler (1983a) slightly larger [(4.2–)5.3–6.19–6.8(–7.16) × (2.1–)2.5–2.63–2.8(–3.5) µm vs 5.5–9 × 1.8–2.7 µm].
The present taxon is one of the most widely distributed species in India and it was reported previously from Chennai, Kerala, Maharashtra, West Bengal (Manimohan et al. 2004; Sharma & Atri 2015). Among other members of the section Rigidi, the studied specimen differs from L. cladopus in having absence of branched stipe, L. sajor-caju and L. umbrinus in the absence of annulus or annular ridge, L. polychrous in the absence of complex hyphal system tending towards trimitic amber coloured tough hymenophore.

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