Diversity of Genus Hypoxylon (Hypoxylaceae,Xylariales) from Chikkamagaluru District,Karnataka, India

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Abstract: The present paper deals with a partial survey of Hypoxylon species collected from forest regions of Balehonnur, Chikkamagaluru District, Karnataka, India. Exploration of Hypoxylon species was done in 2020. Six species, *Hypoxylon cinnabarinum, Hypoxylon fendleri, Hypoxylon haematostroma Hypoxylon lenormandii, Hypoxylon rickii,* and *Hypoxylon subgilvum* have been recorded. Amomg them *Hypoxylon lenormandii* and *Hypoxylon subgilvum* are new records in India. This paper presents detailed descriptions of all six species with illustrations

Keywords: Chikkamagaluru, Diversity, Hypoxylon, Karnataka, Taxonomy, Xylariales.

Introduction:

The genus Hypoxylon belongs to the family Hypoxylaceae order Xylariales (Sordariomycetes). Genus Hypoxylon is having 232 morphological species and 95 species with sequence data(Hyde et.al 2020). Species of Hypoxylon are widespread in the tropical and sub-tropical regions as saprobes, endophytes, and also as eventual parasites. They are characterized by ascomata immersed unipartite, effused-pulvinate stromata containing secondary metabolites. Stromata possess different pigments in contact with KOH solution. (Cruz et al.2015, Fournier et al.2015, Diaz et al.2018, Wendt et al. 2018, Reyes et al.2020 and Sanchez et al. 2020).

A mycological exploration is done in the forest region of Balehonnur, Narasimharajpura (N.R. Pura) taluk, Chikkamagaluru District, Karnataka, India resulted in six different species of Hypoxylon based on macro and micromorphology. Previous studies show 36 species of Hypoxylon have been reported from India among them 26 species from Punjab (Dargan 2016), 19 species from Maharastra (Patil et al.2018), 10 from Karnataka (Nejakar et al.2018), and 1 from Gujarat (Nagadesi et al.2017). This paper presents detailed descriptions with illustrations. This is the first report of the partial survey of genus Hypoxylon from Chikkamagaluru District, Karnataka, India.

Materials and Methods:

Specimens were collected in forest regions of Balehonnur, Chikkamagaluru District, Karnataka, India during July-September 2020. Balehonnur is a study site in Narasimharajpura taluk and is dominated by semi-evergreen forests. The study area lies between 13.35° N and 75.46° E with an elevation of 714 m. The area has an average rainfall of 80 inches per year. Specimens were collected in a paper bag and dried at room temperature at 15–25°C. Stromata and associated structures were studied using a stereo microscope (MagnUs), microscopical analysis such as color, shape, and size of ascospores were noticed using a compound microscope (Olympus CH20i). Melzer's reagent was used to test the staining of apical apparatus and 10% KOH was used to test Perispore dehiscence and stromatal pigments. Photographs of stromata and associated structures were taken by Sony cyber-shot digital camera. The voucher specimens were deposited in Department of Botany, Kuvempu University, Shankaraghatta, Shivamogga, Karnataka, India.

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Taxonomy:

Six species of Hypoxylon were identified. All the species are described as follows.

***Hypoxylon cinnabarinum*:** (Henn.) Y.-M. Ju & J.D. Rogers, Mycologia Memoirs, 20: 99 (1996)
MycoBank number: 414954 **Fig:** 1.a, b

Morphology: Stromata effused-pulvinate 10–70 mm long × 12–35 mm broad.Surface orange a- red with KOH- extractable pigment orange. Perithecia tubular 0.5– 0.7 mm high × 0.2–0.4 mm diam. Ostioles umbilicate Asci cylindrical, uniseriate, octosporate, 130–160 µm long × 7–10 µm wide apical apparatus bluing in Melzer's reagent. Ascospores brown to dark brown, ellipsoid, equilateral with narrow rounded to acute 10–13 µm × 5–7 µm with a straight germ slit along it. Perispore indehiscent in 10% KOH, epispore smooth.

Material examined – Found on bark of dead dicot stem in forest regions of Balehonnur. Collection Date: 10 July 2020, Collected by Himani S, Acccession no: KUABHS33.

***Hypoxylon fendleri* :** Berk. ex Cooke, Grevillea 11: 132. (1883)
MycoBank number: 206066 **Fig:** 2.a, b

Morphology: Stromata effused-pulvinate 5−35 mm long × 3.5−20 mm broad. Surface brown vinaceous with KOH- extractable pigment orange. Perithecia obovoid, 0.5−0.8 mm high × 0.3−0.8 mm diam. Ostioles umbilicate. Asci cylindrical, uniseriate, octosporate, 86–160 µm length x 5.5–7.5 µm broad, apical apparatus bluing in Melzer's reagent, discoid. Ascospores brown to dark brown, ellipsoid, equilateral with narrow rounded 8–12 × 4.5–6.5 µm with sigmoid germ slit spore-length. Perispore dehiscent in 10% KOH, epispore smooth.

Material examined – Found on bark of *Grevillea robusta* in forest regions of Balehonnur. Collection Date: 10 July 2020, Collected by Himani S, Acccession no: KUABHS34.

***Hypoxylon haematostroma*:** Mont, Ann. Sci. nat. Bot, se´r. II, 17:124 (1842)
MycoBank number: 156076 **Fig:** 3.a, b

Morphology: Stromata hemispherical to effused-pulvinate, 10–70 mm long × 10–30 mm broad. Surface bright orange with KOH-extractable pigment orange. Perithecia long tubular. Ostioles umbilicate. Asci broad cylindrical, uniseriate, octosporate, 1.5–2 mm high × 0.4–0.7 mm diam. apical apparatus bluing in Melzer's reagent, discoid. Ascospores brown to dark brown, uniseriate, ellipsoid-inequilateral with narrow rounded ends, 15.5–18.5 µm × 6–8 µm with straight germ slit spore–length . Perispore dehiscent in 10% KOH, epispore smooth.

Material examined –Found on bark of dead dicot stem in forest regions of Balehonnur. Collection Date: 18 August 2020, Collected by Himani S, Acccession no: KUABHS35.

***Hypoxylon lenormandii*:** Berk. & M.A. Curtis, Berkeley, J. Linn. Soc.Bot, 10(46):385(1868)
MycoBank number: 152747 **Fig:** 4.a, b

Morphology: Stromata glomerate to effused-pulvinate. 10 – 80 mm long × 5 – 25 mm broad. Surface Grayish Sepia with KOH- extractable pigment blood colour. Perithecia spherical 4 – 8 mm high×3 – 6 mm diam. Ostioles slightly umbilicate. Asci cylindrical uniseriate, octosporate, 120 – 170 µm long × 6–10 µm wide, apical apparatus bluing in Melzer's reagent. Ascospores brown to dark brown, ellipsoid inequilateral with narrow rounded ends, 10 –15 µm × 4.5– 6.5 µm with slightly sigmoid germ slit . Perispore dehiscent in KOH, epispore smooth.

Material examined –Found on dead bark of *Gliricidia sepium* in forest regions of Balehonnur. Collection Date: 18 August 2020, Collected by Himani S, Acccession no: KUABHS36.

***Hypoxylon rickii*:** Y.M. Ju & J.D. Rogers, Mycol. Mem. 20: 174(1996)
MycoBank number: 434557 **Fig:** 5.a, b

Morphology: Stromata hemispherical to effused-pulvinate, length 15–60 mm long × 10–30 mm broad. Surface orange to reddish-orange with KOH- extractable pigment orange. Perithecia tubular 0.5– 0.8 mm high × 0.3– 0.4 mm diam. Ostioles umbilicate. Asci cylindrical, uniseriate, octosporate, the spore-bearing parts 100–125 µm long × 4–7 µm wide. Apical apparatus bluing in Melzer's reagent, discoid. Ascospores brown, ellipsoid, inequilateral with narrow rounded ends 6.5–7.5 × 3–4 µm with a straight to slightly sigmoid germ slit spore-length. Perispore dehiscent in 10% KOH, epispore smooth.

Material examined –Found on bark of *Tectona grandis* in forest regions of Balehonnur. Collection Date: 21 September 2020, Collected by Himani S, Acccession no: KUABHS37.

***Hypoxylon subgilvum*:** Berk. & Broome, J. Linn. Soc, Bot, 14: 120 (1873)
MycoBank number: 215553 **Fig:** 6.a, b

Morphology: Stromata effused-pulvinate, 8–35 mm long × 0.4–0.8 mm thick, surface dark brick to reddish brown with KOH-extractable pigment reddish-orange. Perithecia spherical to obovoid, 0.2-0.6 mm in dia. Ostioles umbilicate. Asci cylindrical, uniseriate, octosporate, 100–130 µm long × 5–10 µm wide, with apical apparatus bluing in Melzer's reagent discoid. Ascospores brown to dark brown ellipsoid, inequilateral with narrow rounded ends, 8–10 µm × 4–5 µm with straight germ slit slightly spore-length, perispore dehiscent in 10% KOH, epispore smooth.

Material examined –Found on dead bark of *Gliricidia sepium* in forest regions of Balehonnur. Collection Date: 21 September 2020, Collected by Himani S, Acccession no: KUABHS38.

Conclusion:

Genus Hypoxylon is rich in secondary metabolites and produces novel compounds. Fournier et al. 2015; Sir et al. 2019; Sanchez et al. 2020). Species of Hypoxylon show different color pigments for the KOH test. Morphological similarities of the species may lead to confusion in the identification of species, to solve these advanced studies like molecular characterization and chemotaxonomic studies should be done. In the present study, six species of Hypoxylon have been collected, described and illustrated.

Among six species, *Hypoxylon lenormandii* and *Hypoxylon subgilvum* are new records in India.*Hypoxylon cinnabarinum, Hypoxylon fendleri, Hypoxylon lenormandii, Hypoxylon rickii,* and *Hypoxylon subgilvum* are new records in Karnataka. The luxuriant growth of these species due to the rich canopy of semi evergreen forest. The diversity and distribution of the genus Hypoxylon in India are lesser-known. It is very important to study the diversity of genus Hypoxylon and hence there are possibilities of the addition of new species for Indian mycobiota.

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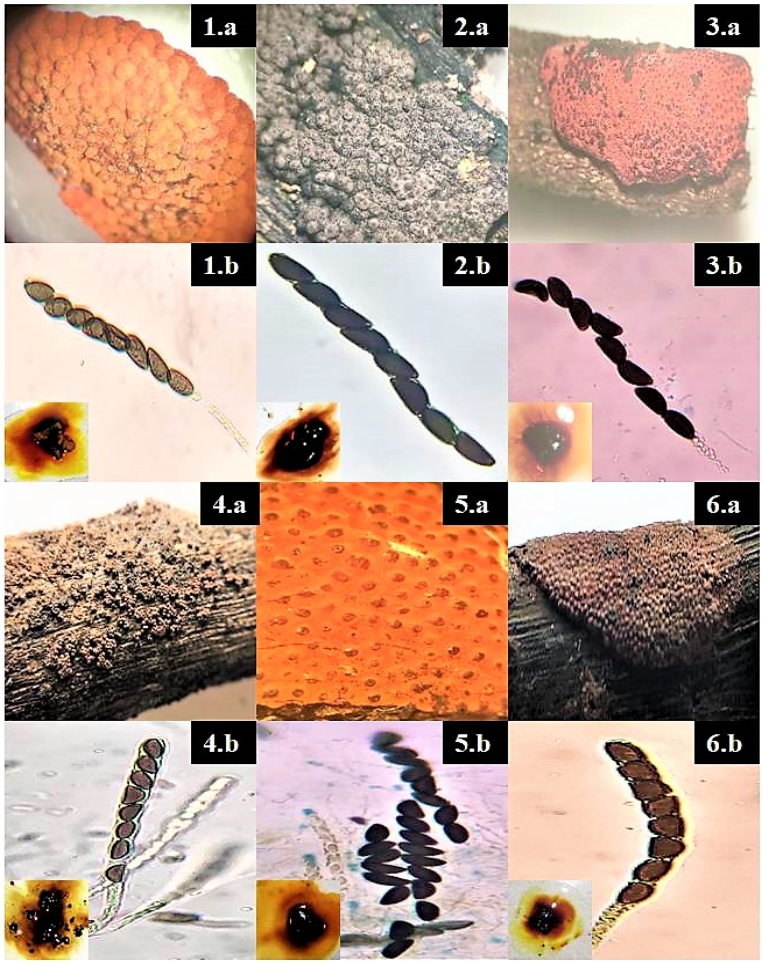

Figure: 1.a, b: Stromata of Hypoxylon cinnabarinum and ascospores with KOH pigment. 2. a,b: Stromata of Hypoxylon fendleri and ascospores with KOH pigment. 3. a,b: Stromata of Hypoxylon haematostroma and ascospores with KOH pigment. 4. a,b: Stromata of Hypoxylon lenormandii and ascospores with KOH pigment. 5. a,b: Stromata of Hypoxylon rickii and ascospores with KOH pigment. 6. a,b: Stromata of Hypoxylon subgilvum and ascospores with KOH pigment.

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