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New records of wood decay fungi from mangrove forest of Gilakaladindi, Krishna district, Andhra Pradesh, India

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ABSTRACT

Mangrove ecosystems play an important role in preventing cyclones and tsunamis at estuaries from entering into interior land and in the economic development of local inhabitants. A survey was undeetaken from 2013 to 2019 to detect the various wood deteriorating fungi in mangrove forest of Gilakaladindi, Krishna district, Andhra Pradesh, India. Three species of the poroid wood decaying fungi i.e. *Antrodiella zonata* (Berk.) Ryvarden, *Flavodon flavus* (Klotzsch) Ryvarden, *Hexagonia apiaria* (Pers.) Fr. are described for the first time from mangrove forest of Gilakaladindi, Krishna district, Andhra Pradesh, India.

Key words: *Rhizophora*, *Avicennia*, wood decay fungi, Gilakaladindi, Andhra Pradesh.

INTRODUCTION

Wood deteriorating fungi (*Agaricomycetes*, *Basidiomycota*) play an important role in the recycling of ligno-cellulosic waste. some of these fungi are pathogens of forest trees and cause serious damage to timber (Natarajan and Kolandavelu 1998). Very little attention was given on wood decay fungi of mangrove forest in Andhra Pradesh and described few micro fungi available in the mangroves of Andhra Pradesh India. Only Indian hyphomycetes have been extensively studied particularly by Subramanian (1971). Southern India with higher rate of precipitation and humidity provides an ideal set of conditions for the growth of these fungi. Some of the significant contributions to the wood decaying fungi from southern India include Rangaswami et al. (1970), Roy and De (1996) and Natarjan and Kolandavelu (1998).Very little attention had been given to the on fungal diversity of these fungi occurring in association of various mangrove species. Nagadesi et al. (2014) described 8 species of poroid wood decaying fungi from Andhra Pradesh. Keeping in view the lesser number of wood decaying fungi reported in association with the mangrove species the present studies were taken up and 3 poroid wood decaying species are described based on the collections made from Gilakaladindi, Machilipatnam, Krishna, Andhra Pradesh, India. Colour determination based on Methuen Handbook of Colour (Kornerup and Wanscher 1978). These fungi are kept in fungal collection of Botany Department Museum, Andhra Loyola College, Vijayawada, Andhra Pradesh, India.

MATERIALS AND METHODS

Study area

The Krishna mangroves are between 15° 42' - 15° 55' N and 80° 42' - 81° 01'E spread across Krishna and Guntur Districts. Machilipatnam of Krishna

district is present in between 16°10'N to 16.17°N latitudes and 81°09'E to 81.13°E longitudes on the southeast coast of India and in the east corner of Andhra Pradesh. Mangroves in this area lie between latitude 16° 0' - 16° 15'N latitude and 81° 10' - 81° 15' E longitude. Machilipatnam gets annual rainfall due to the southwest monsoon. The average normal rainfall in the district is 110 cm, as obtained from the data collected from June 2008 to June 2011. Gilakaladindi village is about 5 km east to Machilipatnam. The village boundaries are Bay of Bengal on east side, Kara agraharam on south side, Machilipatnam on west side and mangrove patches on north side. The lignicolous fungal species were collected from the mangrove vegetation patches of "Gilakaladindi" on September 25, 2015 which extends from 25- 27 ' N and 55-65' E.

Identification of fungi

Fruiting bodies of the wood decay fungi were collected from Gilakaladindi mangrove forest of Krishna district, Andhra Pradesh, India. It growing in the natural habitat of marshy, muddy areas and on wooden logs of mangrove plants like Rhizophora sp, Avicinnea sp (Plate I Fig. A). Standard methods were followed for collection, preservation, macroscopic and microscopic studies (Kumar et al 1990 Atri et al 2003, Arya et al., 2008). The morphological features of the fungi were recorded from fresh specimen. Materials were collected in clean polythene bags from different locations and brought to the laboratory. Basidiomes were studied using macroscopic (eg. size, colour, number of pores/mm, length of tubes) and microscopic (presence or absence of structures, dimensions, vegetative and reproductive characters (Ryvarden 1991). To observe basidia and setae, free hand sections were taken. For the clear observation of setae, trammel setae and setal hyphae, lacto phenol cotton blue was used as staining and mounting medium. Xanthochoric reaction was also tested using potassium hydroxide solution. The various details of specimens were compared with Hymenochaetaceae of India (Sharma 1995), Indian Polyporaceae (Bakshi 1971), CBS Aphyllophorales database, New Zealand Fungi database, and Species Fungorum. Certain specimens were sent to the Royal Botanical Garden, Kew for final confirmation. These fungi are kept in fungal collection of Botany Department, Andhra Loyola College, Vijayawada, Andhra Pradesh, India.

RESULTS AND DISCUSSION

Wood decay fungi associated with wooden logs of mangrove plants like *Rhizophora, Avicinnea* (Plate I Fig. B.) was identified as *Antrodiella zonata* (Berk.) Ryvarden, *Flavodon flavus* (Klotzsch) Ryvarden, and *Hexagonia apiaria* (Pers.) Fr., from Gilakaladindi mangrove forest of Krishna district, Andhra Pradesh, India (Plate I Fig. A). The description of the wood decay fungi is given below as:

Antrodiella zonata (Berk.) Ryvarden, Boletín de la Sociedad Argentina de Botánica 28: 228 (1992) = *Irpex zonatus* Berk., Hooker's Journal of Botany and Kew Garden Miscellany 6: 168 (1854)

Plate I Fig. B, C

Sporophore: annual, sessile, pileate, effused to reflexed, dimidiate, corky, imbricate,1.5 x 2 x 1cm in size; abhymenial surface smooth, convex, zonate, white when young soon becoming light brownish yellow in older specimen; hymenial surface poroid, becomes irpicoid due to splitting of pores, creamy in fresh soon becoming light yellow in older specimen, irregularly poroid at margin, soon becoming spiny, spines narrow, conical, pores circular, 2-4 per mm; context light yellowish coloured, fibrous, up to 2 mm thick; pore tube light yellow to creamish white up to 6 mm deep; margin thin, wavy, brittle; Hyphal system dimitic; skeletal hyphae creamish yellow, thick-walled, branched, narrow lumen, up to 5.0 µm wide; generative hyphae hyaline, thin-walled, clamped, up to 5.2 µm wide; cystidia absent or difficult to observe, basidia clacvate, 9 – 12.5 X 3.3 µm, with four sterigmata, 3.25 x 1.8 µm in wide; basidiospores hyaline, thin-walled, circular, 5.25 – 7.9 X 3.3 - 5.5 µm; causes white fibrous rot on woods.

substrate: Branches of *Avicennia* sp

Specimen examined: India, Andhra Pradesh, Krishna district, Gillakaladindi, on branches of *Avicennia* sp., ALCM 2, September 25, 2015 (N. Praveen Kumar).

Remarks: Bakshi (1971), Dhanda, (1977) description of *Irpex zonatus* shows coriaceous, finely tomentose, becomes smooth, margin lobed, dentate teeth up to 4 mm long; but spiny, narrow, conical shaped teeth up to 6 mm deep, margin thin, wavy, brittle. Berkeley (1854), Thind *et al.* (1957) reported cystidia absent; but Sharma (1985, 2000) reported cystidia absent to very rarely present only as apical parts of Skeletal hyphae; Ryvarden and Guzmán, (2001) reported the presence of thin-walled, tubular to bladder like or ventricose cystidia with a swollen base and elongated neck; Núñez and Ryvarden (2001) reported the imbricate, ochraceous basidiocarps with irpicoid pores, and the bladder-like cystidia make the species easy to identify. In present study Indian collection cystidia is absent to rarely present, imbricate ochraceous sporophore with irpicoid pores present so it belong to *Antrodiella zonata* (Berk.) Ryvarden.

Plate I A. Fallen wood and branches of mangrove plants like *Rhizophora*; **B.** Resupinate sporophore of *Antrodiella zonata* (Berk.) Ryvarden; **C.** a. Skeletal hyphae, b. Basidia, c. Generative hyphae, d. Basidiospores of *Antrodiella zonata* (Berk.) Ryvarden; **D.** Upper surface of *Hexagonia apiaria* (Pers.) Fr. showing zonation; **E.** Lower surface of *H. apiaria* (Pers.) Fr. showing hexagonal pores.

Flavodon flavus (Klotzsch) Ryvarden, Norwegian Journal of Botany 20 (1): 3 (1973) = *Polyporus flavus* Jungh., Praemissa in floram cryptogamicam Javae insulae: 46 (1838)

II Fig. B, C

Sporophore; annual, effuse-reflexed to pileate, imbricate, leathery, pilei up to 10 x 3 x 1cm; abhymenial surface light yellow in fresh and brownish in older sporocarps, matted tomentose, concentrically zonate; context yellowish, fibrous, up to 3 mm thick, hymenial surface poroid to irpicoid yellowish when fresh, changed to cream white with age, pores round to cylinrical 2 per mm, marigin entire to wavy; hyphal system dimitic; skeletal hyphae pale yellow with narrow lumen, unbranched, aseptate, thick-walled, up to 6.6 µm in diameter, generative hyphae hyaline, thin-walled, simple septate up to 4.8 µm in diameter; cystidia cylindrical, subclavatee, capitates, thick-walled, 2.5 x 3.5 - 5.9 µm at apex; basidia clavate 3.5 x 4.25 - 5.8 µm in wide, sterigmata four; basidio-spores hyaline, ellipsoid, thin-walled 4.2 - 5.25 x 2.0 - 2.5 µm in wide; cause white rot on wood

Substrate: Branches of *Rhizophora* sp wood

Specimen examined: India, Andhra Pradesh, Krishna district, Gillakaladindi, on branches of *Rhizophora* sp. ALCM 3, September 25, 2015 (N. Praveen Kumar).

Remarks: Bakshi (1971) description of *Irpex flavus* shows slightly narrow cystidia and spores where as Roy (1981) reports thinner skeletal hyphae, wider badidia and longer spores than those of the present collection. Except for their bigger spores of east African (Ryvardeen and Johansen 1980) collections of this polypore agrees with the present collection

Hexagonia apiaria (Pers.) Fr., Epicrisis Systematis Mycologici: 497 (1838) = *Polyporus apiarius* Pers., Botanique (Nagpur) 5: 169 (1827)

Plate I Fig. D, E, Plate II Fig. A

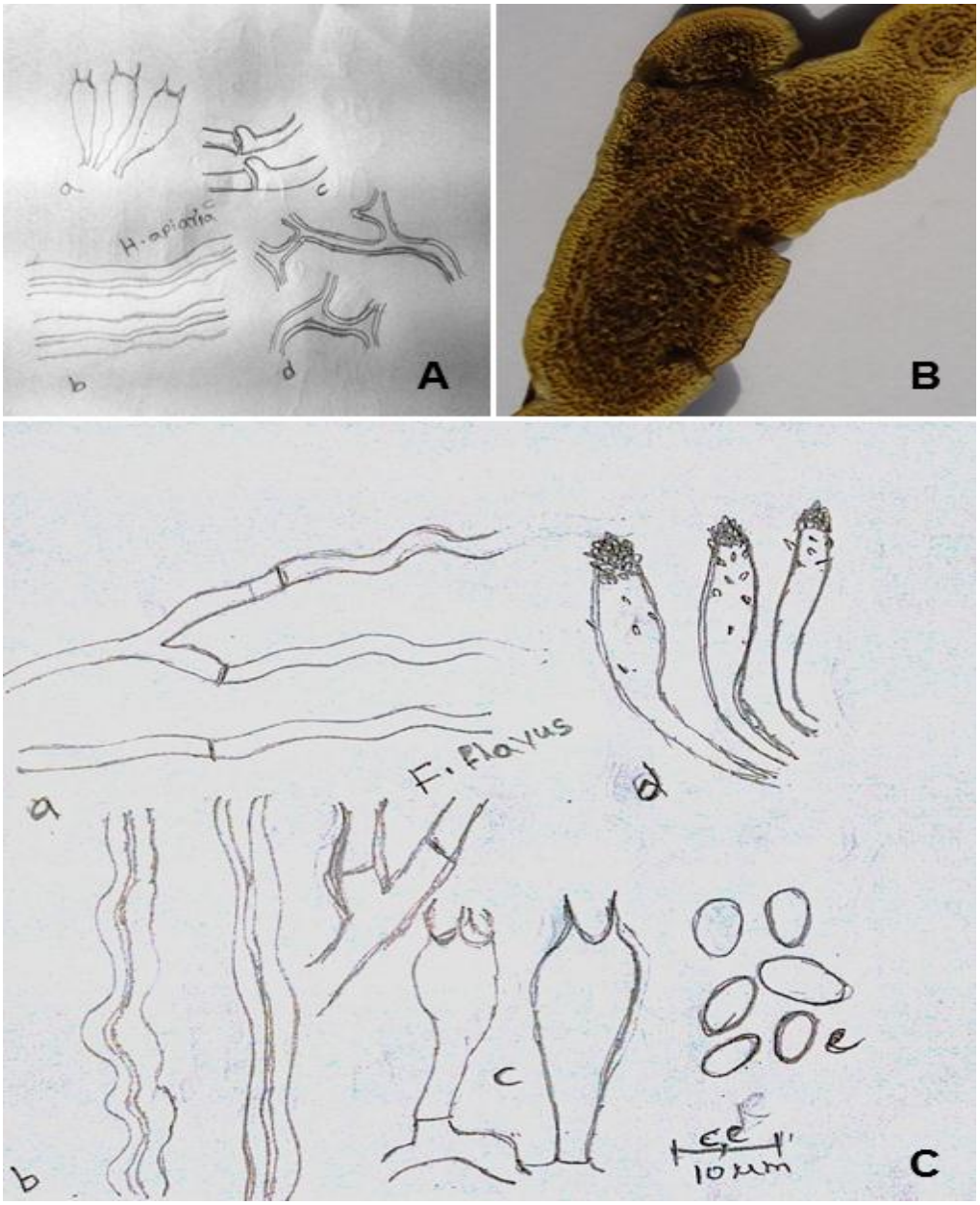

Plate II A. a. Basidia, b, skeletal hyphae, c. generative hyphae, d. binding hyphae of *H. apiaria*; **B.** Effuse - reflexed sporophore of *Flavodon flavus* (Klotzsch) Ryvarden; **C.** a. generative hyphae, b. skeletal hyphae, c. basidia, d. cystidia, e. basidiospores of *F. flavus.*

Sporophore: annual, solitary, sessile, dimidiate, rigid, corky 3.5 x 3 cm in size, pilei circular, abhymenial surface light brown, zonate, radiantly wrinkled, densely covered with brown hairs, becoming glabrous in old specimens; hymenial surface brown, pores visible to naked eye, Pores hexagonal, 3-5 per cm. context brown, fibrous, up to 8 mm thick, margins wavy; Hyphal system trimitic, generative hyphae hyaline, clamped, up to 3.2 µm in diameter. Binding hyphae thick-walled, yellowish brown, branched, aseptate, up to 3.3 µm in diameter, skeletal hyphae dominating in the

basidiocarp, yellowish to pale rusty brown, unbranched, aseptate, up to 6.5 µm in diameter. cystidia absent but cystidoid hyphae often projecting into the hymenium, arising from the skeletal hyphae; Basidia clavate, 20 x 30 µm in diameter with four sterigmata; Basidiospores not seen. Cause white rot

Substrate: branches of *Rhizophora* sp wood

Specimen examined: Specimen examined: India, Andhra Pradesh, Krishna district, Gillakaladindi, on branches of *Rhizophora* sp. ALCM 1, September 25, 2015 (N. Praveen Kumar).

Remarks: Bakshi (1971) description of *Hexagonia apiaria* does not show Basidia and Basidiospores but present collection have clavate basidia. It causing white rot as saprophyte on branches, twigs and logs of various hardwoods but in present collection is observed on branches of *Rhizophora* sp wood. The *H. apiaria* is closely related to *H. hirta*, but is separated in having larger pores and the cystioid hyphae which are absent from *H. hirta* (Ryvarden and Johansen, 1980). In the present collection also have cystioid hyphae so the sporocarp is *H. apiaria* Sharma (2000 and 2012) reported *H. hirta* from Arunachal Pradesh. It is also observed from mangrove of Andhra Pradesh.

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