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Prevalence and Prospects of Coal Fungi in Northwestern Zone of Bangladesh

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Bangladesh is a South Asian country with very few forests. The entire 10.2% of Bangladesh's land area is covered with forest, which is about 1.3 million hectares (Chandulal et al., 2013). Bangladesh forests can be divided into four major groups based on location, type and type of management. They are mangrove forests, tropical moist deciduous forests, tropical evergreen and semi-evergreen forests, and village forests. The Rajshahi district is located in a moist tropical deciduous forest area and was investigated to screen for several basidiomycete species. The government's forest area is located in 12 districts in the eastern and southeastern parts of the country, accounting for more than 90%. Only 4.65% of the forest area is in the central and northwestern parts of the country, covering 120,000 hectares (Rahman et al., 2010). The soil texture of this forest is generally sandy loam and silty loam. The surface soils of this forest area are composed of organic matter ranging from low (less than 1.5% below the grassland) to moderate (25% below the forest cover) and are naturally acidic (PH 5.2 5.5) (Dhar & Mridha, 2006). During field surveys of various basiodiomycetes, some black hard spherical structures were found in the forest area of Chapainawabganj. Glossy black powdery masses are superficially observed on these black spheres, much like convulsive spheres. Hard spherical fruiting bodies resemble coal rods and can give some of their common names, such as coal fungi and coal balls. Within the spasmodic sphere, the individual fruiting bodies of *Daldinia concentrica* (formally called stroma), 2-8 cm in diameter, were usually fragile and grew over several seasons (hence the growth ring), but some coalesced. And has the potential for much larger complex growth (Figure 2). Initially, the fruiting bodies were brown and dense, quickly blackened, dried and less dense. There were no stems. The fruiting bodies were connected to the host wood by a wide flat area beneath the pillow-shaped fruiting bodies (Figs. 1 and 2). The surface with spores consists of a series of small chambers called perithecia embedded outside the fruiting body, and the shed spores leave a slightly dark woody area around the fungus.

Fig.1 Coal Fungus at early (Pinkish) stages (perithecia in upper surface). **Fig.2** Mature stage of coal fungus with prominent growth rings

When fully grown, the fruiting body turns black, as shown in the photo above. The pinkish-brown specimen shown above is young, still growing, and develops for a long time at this stage of asexual reproduction, releasing pale, almost colorless spores called conidia (or simply conidia).

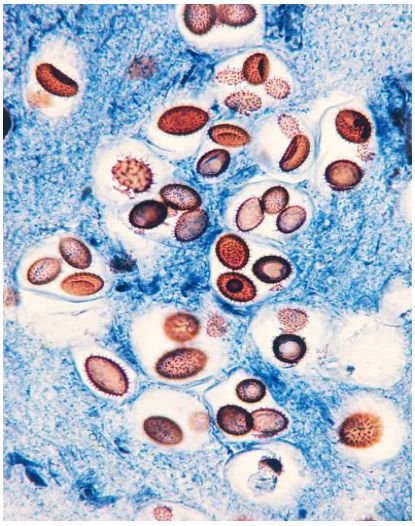

Fig.1 Coal Fungus at early (Pinkish) stages (perithecia in upper surface). **Fig.2** Mature stage of coal fungus with prominent growth rings

The image on the left is a much magnified view of the conidia, the shape of the ascus and the dark room where the spores are produced. Like other ascomycetes, there are sterile parasites that isolate the ascus. As the spore matures in the ascus, the ascus expands longitudinally, guided by the surrounding ascus, until its tip protrudes beyond the neck of the ascus. Next, the water pressure accumulated inside the ascus ruptures the tip of the ascus, forcing the ascus cyst to be expelled. At this mature stage, the surface becomes dotted with small ridges, which are the openings of perithecia, the sporulation structure just below the surface. Jet-black fruiting bodies, in contrast to pale conidia spores, are expelled in large quantities through these openings and quickly cover the surface of the fruiting bodies, darkening the substrate wood around them to some extent (actually) produces a natural spore print).

The ascus leaving an opening for draining the next set of eight spores. Each ascus contained 8 ascus cysts. Asci was usually 200 µm x 1011 µm cylindrical, and the tip of asci was amyloid. The spores were oval to spindle-shaped, 1217 x 69 µm. Perithecia were 0.5-0.8 mm in diameter and their small surface openings can only be seen at a fairly high magnification (see below). Their separation was very variable. Below each of these small surface ridges was the cob axis on which ascospores develop. Inside the fruiting body were concentric layers of silver gray and black (pictured below), from which the species name *concentrica* is derived.

The ascus shrivels leaving the opening clear for the next set of eight spores to be expelled. Each ascus contains eight ascospores. Asci were typically 200µm x 1011µm, cylindrical, and the asci tips were amyloid. Spores are ellipsoidal to fusiform, 1217 x 69µm. The perithecia were 0.5 to 0.8mm in diameter, and their tiny openings of the surface were visible only with quite strong magnification (see below). In the image above, you can see the neck of perithecia. Their separation was very variable. Below each of these small surface ridges was the cob axis on which ascospores develop. Inside the fruiting body were concentric layers of silver gray and black (pictured below), from which the species name concentrica was derived.

The inedible fungus *Daldinia concentrica* is known by several common names, such as Alfred the Great's cake, crampons, and cabbage mushrooms. It is one of the largest genera of the family Dead Man's buds (Ascomycete, Dead man's fingers genus). Like other fungi, light spores are distributed worldwide, and fungi occur wherever appropriate conditions are present. It is a common and widespread saprophytic plant that inhabits dead and rotten trees. Commonly referred to as King Alfred's cake (of course, Alfred evacuated from the busy farmer's wife with other concerns allowed him to accidentally burn her cake after he promised to see her cooked cake. As a reference to her burnt appearance, they are also called spasm balls (because they were thought to be worn to cure seizures). These hard, inedible fungi are most commonly found on ash and beech trees, but can also be found on other hardwoods. Each season, a new fertile outer layer develops, along with a new peritesia that produces the next season's ascospores. Traditionally, Daldinia species have been recognized by these inner concentric zones beneath the peripheral layer of the interstitium and the presence of KOH extractable pigments on the interstitial surface and below Ju. et al. (1997). The latest world monograph of this genus brings together over 1000 specimens and cultural morphological, hyperstructural, and chemical taxonomic data to provide preliminary phylogeny based on ITS sequence data. (Stadler et al. 2014).

Daldinian species are highly prolific producers of secondary metabolites, and their stroma and culture metabolites can be used as taxonomic markers, while other species are selective and prominent in biological systems. Be active (Helaly et al. 2018). As each ascus swells with fluid, the ascus spreads outwards around it, releasing spores. D. concentrica contains several unique compounds, including a purple polycyclic dye and a metabolite called concentricol, which is squalene oxide. This type of fungus is home to many types of insects and other small animals. From ancient civilizations to modern times, mushrooms have been used as food because of their very high nutritional value (Bhunia et al., 2010; Rathore et al., 2017). In addition, mushrooms have such remarkable medicinal properties as mushrooms (Gargano et al., 2017). Today, it is widely used in the fields of dietary supplements, pharmaceuticals and cosmeceuticals. Rathore et al. (2017). In some studies, mushrooms include antidiabetic drugs (Wu and Xu, 2015), antibacterial drugs (BeltranGarcia et al., 1997), antiviral drugs (Teplyakova and Kosogova, 2016), antioxidants (Liuetal.,). 2014), antitumor (Meng et al., 2016), immunomodulatory and hepatoprotective (Soares et al., 2013) effects. The antibacterial and antifungal activity of the above extracts was determined by a well diffusion assay. Almost both extracts have proven effective against these bacteria and fungi. The aqueous extract showed a higher inhibition zone than the methanol extract tested. The extracts show antibacterial activity with inhibition zones ranging from 14.54 mm and 5.23 mm for aqueous and methanolic extracts, while antifungal activity is 9.25 mm and 7 for aqueous and methanolic extracts, respectively. An inhibition zone in the range of .18 mm was shown. Organisms were more sensitive to aqueous extracts of fungal fruiting bodies than methanol extracts (Goswami, et al., 2020).

Therefore, it can be pointed out that the crude extract contains potential antibacterial and antifungal compounds and the results obtained may also be useful in assessing the substance of interest. Further investigation is underway to isolate and characterize potential antibacterial and antifungal compounds. Mushrooms have been used as a medicine to cure various diseases long before the advent of modern medicine. Previous studies have reported the antibacterial activity of macrofungi. Species D Concentricity has the potential to become a natural source of new antibiotics in the near future. Therefore, in-depth research, especially in this area, requires awareness of the protection of this native species before it becomes extinct due to overfishing and destruction of its natural habitat.

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