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DIVERSITY OF FOREST TREE ROTTING FUNGI: A POSITIVE IMPACT FOR INCREASING CAVITY LOVING BIRDS AT KULIK RAIGANJ WILDLIFE SANCTUARY, WEST BENGAL

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ABSTRACT :

Kulik Raiganj Wildlife Sanctuary is one of the major bird's sanctuaries of West Bengal, inhabited by nearly about 164 species of birds of national and international importance. Many of which are tree cavity loving for their nesting. The frequency of cavity nester depends on limited source of tree cavities/holes in forest. These cavities/holes are produced through the processes of wood decay by tree rotting fungi, and sometimes followed by avian excavators. Conservation of cavity-nesting birds requires a solid understanding of how cavities are produced and used. We studied the role of tree rotting fungi in producing tree cavities for cavity loving birds at the community level from 2015 to 2018, and determined tree rotting fungi that produced the cavities.

KEYWORDS : *Tree cavity, Tree rotting fungi, Cavity-nesting birds, Bird's sanctuaries.*

INTRODUCTION

The Kulik Raiganj Wildlife Sanctuary (KRWS), a major wildlife sanctuary of West Bengal, India situated at the close vicinity of Raiganj (25º 37´N to 25º 62´N and 88º 07´E to 88º 12´E). It is an artificial planted forest of West Bengal forest department which was declared as a Kulik Raiganj Wildlife Sanctuary in the year 1985. The sanctuary has a network of artificial canals connected with the river Kulik (Sharma 2007). Annual rain fall varies from 1,200-1,550mm; mean winter temperature varies from 9-23°C, summer temperature from 21-25°C and humidity around 75% (Pramanik *et al.,* 2011). The KRWS is mainly popular for the present of 164 species of birds of national and international importance which includes migratory Asian Open Bill Stork (*Anastomus oscitans*) arrived in the end of June and disappeared at the end of January (Sharma 2007). This bird was coming every year mainly for nesting and breeding purpose. A large number of birds prefer cavities or holes for their nesting on trees produced by wood decay process by tree rotting fungi.

Wood decay fungi or tree rotting fungi are those fungi which have the ability to decompose wood using enzymatic and mechanical process. A good number of wood decay fungi produce large and prominent fruit bodies on dead plant parts in the sanctuary. Polypore and agarics are some of the most common and important tree-rotting fungi in forests ecosystem which produce the majority of the fruit bodies. Wood rotting fungi are categorised into three types viz. white rot, brown rot and white rot.

Brown rot fungi are those which attack and rapidly depolymerise structural carbohydrates such as celluloses and hemicelluloses in the cell wall via both non-enzymatic and enzymatic systems leaving the lignin component intact. A series of cellulolytic enzymes are involved in the degradation process of brown rot fungi, but no lignin degrading enzymes are involved which leave as brown framework. Many of the brown-rot fungi produce bracket or shelf-shaped fruiting bodies on dead tree trunk with characteristic fragile, powdery, brown brick-like cracking along lines of weakness.

White rot fungi are those which possess both cellulolytic and lignin degrading enzymes to decay all major wood components (such as cellulose, hemicelluloses and lignin). The white rot fungi are typically associated with the decay of lignin component of hard wood and require a multitude of enzymes (lignin peroxidase, manganese peroxidase, H_2O_2- generating enzymes, and laccase) to degrade lignin. As it decays, the most of the wood becomes white and fragile (Jasalavich *et al.,* 2000).

Soft rot fungi are typically attack wood of higher moisture content and lower lignin content wood. They secrete cellulase enzymes on wood and create a characteristic pattern of decay with rhomboidal cavities within the cell wall. Soft rot fungi remain persistent with its characteristic signature of rot when the fungi have died. The fungi have little or no effect on lignin component which remains more or less intact in wood.

Hence, wood decay fungi play an important role for producing cavities/holes on dead trees parts which have positive impact for increasing diversity and conservation of cavity loving birds at forest. Despite this, wood decay fungi have immense potential sources of ethno botanical, pharmaceuticals and industrial compounds for mankind.

MATERIALS AND METHODS

Collection and identification of the wood rotting fungi

The fruit bodies of the wood rotting fungi were collected at regular intervals during the period 2015 to 2018. The wood rotting fungi associated with wood decaying process were photographed and all its important morphological features were recorded. The fruit bodies were then brought to the laboratory for details examination. The specimens were preserved in liquid preservative (25:5:70ml of alcohol, formalin and distilled water) following the method of Hawksworth *et al*., (1995). A portion of collected fungal fruiting bodies were air dried. Identification of the macro fungal specimens was done by using standard keys (Arora, 1986; Singer, 1986; Hawksworth, 1974; Jorden, 2000; Pegler and Spooner, 1997; Kuo, 2003; Upadhyay *et al*., 2008). Voucher numbers were stored in the museum, Department of Botany, Raiganj University, West Bengal.

RESULTS AND DISCUSSION

Eighteen different wood rotting macro fungi (*Antrodia malicola, Trametes hirsute, Auricularia auricula-judae, Pleurotus ostreatus, Marasmius luteolus,* ***Phloeomana alba, Oxyporus populinus,*** *Marasmius calvus, Marasmius armeniacus, Inonotus glomeratus, Hericium coralloides*, *Ganoderma lucidum, Coprinellus micaceus*, *Coprinopsis lagopus, Cyathus striatus, Daldinia concentric, Armillaria mellea* and *Schizophyllum commune*) were found to produce cavities or holes through degradation process of wood in Kulik Raiganj Wildlife Sanctuary (**Figure-1&2**). Majority of wood rotting fungi associated with cavity formation were found as white rot fungi which typically decay lignin component of hard wood with multitude action of enzymes such as lignin peroxidase, manganese peroxidase, H_2O_2-generating enzymes and laccase (Jasalavich *et al.,* 2000) and wood becomes white and fragile **(Table-1).** Moreover, presence of fruiting bodies of various tree rotting fungi is considered a reliable indicator of more cavity formation on trees which may potentially increase the diversity of cavity loving birds in forest communities. But more work is necessary to understand the structure and function of forest ecosystem to conserve diversity of birds at community level.

Table-1: Tree rotting fungi found at Kulik Wildlife Sanctuary, Uttar Dinajpur, West Bengal.

Name of Wood decay fungi	Family	Decay types	Spore deposit
Antrodia malicola (Berk. & M. A. Curtis) Donk	Fomitopsidaceae	Brown rot	White
Trametes hirsuta (Wulfen) Lloyd	Polyporaceae	*White rot*	White
Trametes versicolor (L.) Pilat	Polyporaceae	*White rot*	White
Auricularia auricula-judae (Bull.) Wettst.	Auriculariaceae	*White rot*	White
Pleurotus ostreatus (Jacq. ex Fr.) P.Kumm.	Pleurotaceae	*White rot*	*White*
Marasmius luteolus Berk. & M.A. Curtis	Marasmiaceae	Brown rot	White
***Phloeomana alba* (Bres.) Redhead**	Porotheleaceae	*White rot*	White
***Oxyporus populinus* (Schumach.) Donk**	Schizoporaceae	*White rot*	White
Marasmius calvus Berk. & Broome	Marasmiaceae	Brown rot	*White*
Marasmius armeniacus Gilliam	Marasmiaceae	Brown rot	*White*
Hydnellum caeruleum (Hornem.) P. Karst	Bankeraceae	White rot	Brown
Inonotus glomeratus (Peck) Murrill	Hymenochaetacea e	*White rot*	White
Hericium coralloides (Scop.) Pers	Hericiaceae	*White rot*	White
Ganoderma lucidum (Curtis) Kummer	Ganodermataceae	White rot	Brown
Coprinellus micaceus (Bull.) Vilgalys, Hopple & Jacq. Johnson	Psathyrellaceae	Brown rot	*Black*
*Coprinopsis lagopus (*Fr.) Redhead, Vilgalys & Moncalvo	Psathyrellaceae	Brown rot	Black
Cyathus striatus (Huds.) Willd.	**Nidulariaceae**	White rot.	White
Daldinia concentrica (Botton) Cesati & de Notaris	Xylariaceae	White rot	Black
Armillaria mellea (Vahl) P.Kumm.	Physalacriaceae	White rot.	White
Fomes fomentarius (L.) Fr.	Polyporaceae	White rot	Brown
Schizophyllum commune Fries	Schizophyllaceae	White rot	*White*

Figure-1 softening of wood by tree rotting fungi and avian excavator: **A-** softening of tree wood by ***Oxyporus populinus***; **B-** tree cavities/holes produced by white rot fungi; **C-** tree cavities produced by *Inonotus glomeratus*; **D-** softening of tree wood by *Pleurotus ostreatus*; **E-** softening of tree wood by *Auricularia auricula-judae*; **F-** holes produced by avian excavator.

Figure-2. Wood decay macrofungi found at Kulik Raiganj Wildlife Santuary, West Bengal: A- *Antrodia malicola;* **B-** *Trametes hirsute;* **C-** *Auricularia auricula-judae;* **D-** *Pleurotus ostreatus;* **E-** *Marasmius luteolus;* **F-*Phloeomana alba;* G- *Oxyporus populinus;* H-** *Marasmius calvus;* ***I-*** *Marasmius armeniacus;* ***J-*** *Inonotus glomeratus;* ***K-*** *Hericium coralloides* ; **L-** *Ganoderma lucidum;* **M-** *Coprinellus micaceus* ; **N-** *Coprinopsis lagopus;* ***O-*** *Cyathus striatus;* ***P-*** *Daldinia concentric;* **Q-** *Armillaria mellea;* **R-** *Schizophyllum commune*

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