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Short Note

Decomposition of Cell-wall Components of Wood of *Diospyros embryopteris* Pers. by *Hexagonia polygramma* Mont.

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Summary

Hexagonia polygramma caused considerable amount of decomposition of *Diospyros embryopteris* wood. During four months of experimental period, the fungus was able to utilize about 17.8 and 32.5 percent of holocellulose and lignin of host wood respectively. The moisture content and alkali solubility of the decayed wood increased by 52.8 and 86.8 percent respectively. The fungus proved to be a white-rot one.

Schlüsselwörter (Sachgebiete)
Holzbefall
Alkalilöslichkeit
Cellulosegehalt
Ligningehalt
Ebenholz
Weißfäule

Abbau von Zellwand-Komponenten von Ebenholz (*Diospyros embryopteris*) durch den Weißfäulepilz *Hexagonia polygramma*

Zusammenfassung

Durch *Hexagonia polygramma* wird Ebenholz in beträchtlichem Ausmaß abgebaut. Bei 4 Monate dauerndem Kolleschalen-Versuch verwertet der Pilz etwa 17,8% der Holocellulose und etwa 32,5% des Lignins des Holzes. Feuchtigkeitsgehalt und Alkalilöslichkeit des befallenen Holzes steigen um 52,8% bzw. 86,8%. Der Pilz kann zu den Weißfäulen gerechnet werden.

Introduction

It has been reported that wood-rotting basidiomycetes fungi differ widely in their abilities of decomposing the cell-wall substances of the host wood during decay (Harris 1945; Lindeberg 1946; Seifert 1968; Kirk 1971; Santra and Nandi 1975). The complex cell-wall substances of wood contains holocellulose, comprising of true cellulose and hemicellulose, and also lignin. The white-rot types of wood-rotting fungi are able to decompose all the components of cell walls though lignin more severely while the brown rot ones can utilize only the holocellulose components leaving lignin component almost unattacked. But there are some species which can utilize simultaneously the holocellulose and lignin components of wood. Though Siu (1951) Scheffer et al. (1966), Pelczar et al. (1950) and Van Vliet (1950) have reviewed the literature on the utilization of cellulose and lignin by wood-rotting fungi yet reports on the chemical characterization of decayed Indian economic timbers caused by wood-rotting fungi are scanty. The present investigation reports on the chemical changes of an economic timber of *Diospyros embryopteris* due to decay caused by *Hexagonia polygramma* Mont. under controlled laboratory conditions.

Materials and Methods

Tissue cultures of the test-fungus was made from a fresh fructification growing on host tree in Dum Dum area near Calcutta, West Bengal, India. Following the method of Banerjee (1955), host wood blocks (5 cm × 25 cm × 1 cm) were exposed to decay by the mycelium of test-fungus in Kolle flasks for a period of four months under controlled laboratory conditions (30° C temperature, 80—90 percent relative humidity and diffused light). Host wood blocks treated similarly in Kolle flasks but without any mycelium of the test-fungus served as controls or normal sound host-wood. At regular intervals of one months, wood blocks were taken out and completely freed from superficial mycelium. These were then dried at 60° C, ground into a powder of 40 mesh and kept in a closed vial in desicator for quantitative estimation purposes. Before each aliquot was taken for chemical analysis, the vial was shaked properly to randomize the size of wood particles.

During quantitative estimation of cell-wall substances different standard methods were used. Moisture content and alkali solubility were estimated following the methods of Cowling (1961). Lignin was estimated following the method proposed by Saeman et al (1954) and modified by Cowling (1961). Holocellulose, Alpha-, Beta-, and Gamma-cellulose contents were determined following the methods of TAPPI standard T 9m-54, and Cowling (1961). All data presented here are average of three replicates on the basis of percentage of moisture free weight of original wood samples.

Results

From Table 1, it is evident that moisture content of the decayed wood is gradually increased due to decay. The moisture content of the decayed wood increase by 11.4, 27.1, 40.3 and 52.8 percent during the period of one, two, three and four month respectively. Similarly the alkali solubility of the decayed wood also increase by 11.7, 28.1, 52.8 and 86.8 percent during the period of one, two, three and four months respectively. These data indicate that the test-fungus is capable of depleting

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Table 1

Percentage of cell wall substances in sound and decayed wood of *Diospyros embryopteris* caused by *Hexagonia polygramma* after four months of decay

Cell wall substances (%)*	Sound wood	Decayed wood			
		1 month	2 months	3 months	4 months
Moisture content	12.11	13.50	15.30	16.00	18.50
1% alkali soluble matters	10.12	11.31	12.97	15.47	18.90
Holocellulose	59.00	54.10	52.27	50.20	48.47
Alpha-cellulose	42.50	41.00	36.10	33.00	29.00
Beta-cellulose	3.70	3.50	3.25	3.00	2.50
Gamma-cellulose	12.80	10.40	12.82	14.20	16.97
Lignin	34.25	30.70	29.10	25.36	23.10

* Average of three replicates

the complex cell wall substances into simpler form and ultimately increasing the alkali solubility of the wood and also makes the wood more porous than the sound wood. It is also evident that host wood contains about 59 percent cellulose. The loss of cellulose in decayed wood is 8.3, 11.4, 14.5 and 17.8 percent during the period of one, two, three and four months respectively. The lignin content of the host wood is more than 34 percent. The loss of lignin in decayed wood is 10.3, 15.0, 25.9 and 32.5 percent during the period of one, two, three and four months respectively. It is experimentally found that the test-fungus can utilize more lignin compared to that of cellulose of the host wood though the cellulose content of the wood is quite high.

Discussion

From the experimental data it is quite evident that *H. polygramma* is one of white-rot type fungi. Chattopadhyay (1977) has already reported the positive oxidase reaction of the test-fungus which possibly supports the present findings. It suggests that the test fungus produces extra-cellular polyphenoloxidase enzymes which help in the lignin utilization. The fungus is also able to produce extra-cellular cellulolytic enzymes which is indicative from the loss in cellulose content in decayed wood. The inability of the fungus to utilize the cellulose of host wood in large amount is might be due to high molecular weight of the enzyme or due to the complex crystalline core of the microfibrilar cellulose and lignin polymer system of wood (Pew and Wayna 1962; Wardrop 1957).

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