

Mycoflora of sawn timbers in Benin City

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In a fungal survey of sawn timbers in scattered localities in Benin City, fungal species isolated were mainly members of *Hyphomycetes*, with few *Ascomycetes* and *Basidiomycetes*. Cellulolytic abilities of isolates were determined and found to be highest in a basidiomycete, *Pleurotus ostreatus*. The high incidence of these isolates was traced to the poor ventilation in the shades where the timbers are sold and the high moisture content of timber before display for sale.

INTRODUCTION

Timber, a chief product of the forest, is a universally useful raw material and a foreign exchange earner for Nigeria (Panshin and Carl 1964; Kollman et al 1975; Titmus 1965; Von Wendorff and Okigbo 1963; Adeyoju 1975). Since man learnt to use timber for various purposes, it has been a target of fungal attack resulting in wood decay. However there has been an increased interest in preventing unnecessary wastage of timber by fungal attack through preservation and maintenance of wooden structures (Ramsbottom 1937; Boyce and Hepting 1943; Cartwright and Findlay 1958; Line and Cruickshank 1979).

In Benin City, timber shades exist in different parts of the city without proper precautionary measure to prevent fungal attack on them. This has the potential of making these timbers vulnerable to fungal deterioration. This study was therefore carried out to survey the different fungi associated with timber in these shades.

MATERIALS AND METHOD

Timber Sampling

Microfungi

Timber located in five stations at Uselu, Ugbowo, Okhoro, Ogida and New Benin were sampled. Samples of the infected wood from each location were taken at weekly intervals from November 1983 to January 1984, kept in sterile polythene bags and taken to the laboratory for examination. The temperature and relative humidity of each location was recorded during each sampling period. The method of Line and Cruickshank (1979) was modified and used to isolate the fungi. Thin wood sawings were cut with a sterilised scalpel, and placed on sterile potato dextrose agar (PDA) which were incubated at room temperature ($28 \pm 2^\circ\text{C}$). At the end of incubation, 5-8 days, isolates were examined under the microscope and identified at least to the generic level.

Macrofungi

The fruiting bodies of the macrofungi found on timber in the different localities were carefully excised, put in a sterile polythene bag and sent to the laboratory for identification.

Assessment of cellulase activity:

The methods of Rautela and Lowling (1966) as later modified by Tansey (1971) was used. Vertical columns (3-4 cm) of the medium were prepared in sterile test tubes. These columns were inoculated with discs of fungal mycelium, from a 7-day old culture, and were then incubated at room temperature. Depths of the medium cleared in the tubes were measured at weekly intervals. The average depths for three replicates were taken as a measure of cellulase activity.

Weight loss determination:

Three samples of timber ($10 \times 5 \times 5$ mm) were made from each sampling site, and sterilised in the autoclave at 103.4 KN/M^2 for 15 minutes. They were then oven dried at 100°C in sterile containers for 18 hrs. and their weights determined. The test timber pieces were then placed on PDA plates (3 per plate, in triplicates), previously inoculated with each of the fungal isolates which have been found to be positive in cellulose test.

The cultures were then incubated at room temperature for two months. Sterile distilled water was occasionally added to the medium to prevent drying. At the end of the incubation the blocks were removed from the petri dishes and the superficial fungus mycelium was scraped off the block carefully, avoiding to the blocks.

The blocks were then oven dried and reweighed. The losses in dry weight of the blocks were estimated by the difference between the initial dry weight and the final dry weight after inoculation.

RESULTS

Both micro- and macrofungi were isolated from the different sites of timber sampling (Tables 1 and 2). Out of the frequently occurring fungi isolated from the localities, *Mucor racemosus*, *M. mucedo*, *Rhizopus stolonifer* did not clear cellulose within a three week period (Table 3). The macrofungal isolates had higher records of cellulose clearing and weight loss than the microfungi. *P. ostreatus* had the highest weight loss (14.9%).

The temperature and relative humidity in all the locations were relatively constant 28-30°C and 65-70% respectively.

DISCUSSION

From the results of this study it appears that fungal deterioration of timber in Benin City is caused mainly by members of the *Hyphomycetes* and *Hymenomycetes*, with few *Ascomycetes*. *P. ostreatus* and *S. lacrymans* were the most active wood degraders with 14.9% and 14.0 % weight losses respectively. Similar observation has been made by Line and Cruickshank (1979) who found *P. ostreatus* to have the greatest cellulose activity. *S. lacrymans* was found to be more widespread in the city (15/15) than *P. ostreatus* (14/15).

Although most *Hyphomycetes* were not as active apart from *Trichoderma* (9.0% loss), they were very common in all the location sampled, e.g. *Aspergillus niger* (15/15), *Penicillia* 15/15, *Trichoderma* 15/15. The few *Ascomycetes* isolated (*Chaetomium* 12/15, *Daldinia* 14/15, *Xylaria* 13/15), were effective wood degraders with percentage weight loss 13.0, 13.8, 6.3 respectively.

The degradability of these isolates appear to follow the taxonomic disposition of the fungi in the order, *Basidiomycetes*; *Ascomycetes* and *Phycomycetes*. Similar reports have been made by Thornton (1979) and Line and Cruickshank (1979). Some species, namely *M. racemosus*, *M. mucedo* and *R. stolonifer* (Table 3), showed the ability to degrade wood but failed to produce cellulase in culture on cellulose agar. This apparent anomaly has also been observed by other workers, Line and Cruickshank (1979) and Nilsson (1974) who isolated a wide variety of wood-attacking microfungi that showed this feature.

One of the possible reasons according to Wilson (1974) is that the carbon in the cellulose agar medium is in soluble form and as a result there was a tendency for production of cellulase by the fungi. In general terms, the high values for temp and low RH during the dry season months are not favourable

Table 2
Macrofungi isolated from sawn timbers

Fungi	Sample sites												Total occurrence			
	Uselu			Ugbowo			Okhoro			Ogida				New Benin		
	Nov	Dec	Jan	Nov	Dec	Jan	Nov	Dec	Jan	Nov	Dec	Jan		Nov	Dec	Jan
<i>Auricularia</i> sp.	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1/15
<i>Coprinus</i> sp.	+	-	-	-	-	-	+	-	-	-	-	-	-	-	-	2/15
<i>Daldinia concentrica</i> /Fr./ Ces. and de Not.	+	+	-	+	+	-	+	+	+	+	+	+	+	+	+	14/15
<i>Pomes</i> sp.	-	+	-	+	+	-	-	-	-	-	-	-	+	+	-	6/15
<i>Pleurotus ostratus</i> /Fries/ Kummer	+	-	-	+	-	-	+	+	-	+	+	-	-	-	-	8/15
<i>Poria</i> sp.	+	-	-	-	-	-	-	-	-	-	-	-	-	-	+	2/15
<i>Schizophyllum commune</i> Fries	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
<i>Serpula lacrymans</i> /Wild/ Sehmel	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	15/15
<i>Stereum hirsutum</i> /Wild/ Fr.	+	+	-	+	-	+	+	+	+	+	+	+	+	+	+	11/15
<i>Stereum purpureum</i> /pers./ F.	-	+	-	+	-	+	+	+	+	+	+	+	-	-	-	8/15
<i>Trametes</i> sp.	-	+	-	+	+	+	+	+	+	+	+	+	+	+	+	9/15
<i>Xylaria hypoxylon</i> /L.ex Fr./ Grev.	+	+	+	+	+	-	+	+	+	+	+	+	+	+	+	13/15

+ indicates presence; - indicates absence

NB: - Each + or - is an average of 4 samples

Table 3
Cellulose clearing and weight loss records
of selected isolates

Fungi	Depth of clearing in cellulose agar columns /mm/ in three weeks	% Weight loss of block wood attacked individually by isolate
<i>Aspergillus niger</i>	8.0	3.8
<i>A. tamarii</i>	7.0	2.5
<i>Cephalosporium</i> sp.	3.0	3.9
<i>Chaetomium globosum</i>	11.0	13.0
<i>Cladosporium herbarum</i>	7.8	4.7
<i>Daldinia concentrica</i>	17.0	13.8
<i>Fusarium</i> sp.	9.6	8.1
<i>Mucor racemosus</i>	0	3.0
<i>M. mucedo</i>	0	2.0
<i>Penicillium</i> sp.	2.0	3.8
<i>Pleurotus ostreatus</i>	24.3	14.9
<i>Rhizopus stolonifer</i>	0	1.7
<i>Schizophyllum commune</i>	8.0	6.4
<i>Serpula lacrymans</i>	21.1	14.0
<i>Stereum hirsutum</i>	16.0	13.7
<i>S. purpureum</i>	7.2	6.0
<i>Trichoderma</i> sp.	8.5	9.0
<i>Xylaria hypoxylon</i>	10.0	6.3

Positive correlation between cellulose clearing and weight loss /at $P = 0.1$ /

for the growth of many fungi. Thus the internal moisture content of the logs during this period will in part account for the high incidence of fungal occurrence on the logs. Observations in the sawmills show that the logs are not dry enough before they are sawn and displayed for sale. Proper drying of the logs before sawing will help to prevent fungal attack on the timber. Webster (1970) has shown that wood with moisture content below 20% is not liable to attack by *S. lacrymana*.

Apart from chemical control by use of fungicides, the present level of fungal attack on the sawn timber could be reduced if the timber is air dried before it is sawn. Also the shades used for storing and sale of timber should be modernised to allow sufficient cross ventilation.

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Mikoflora drewna budulcowego w Benin City (Nigeria)

Streszczenie

Autor wyizolował różne *Hyphomycetes*, kilka *Ascomycetes* i *Basidiomycetes*. Z grzybów tych najwyższą zdolnością celulołityczną odznaczał się *Pleurotus ostreatus*.

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