Short Communication

THE BREAKDOWN OF COCONUT FIBERS BY *TRAMETES VERSICOLOR* AND *STEREUM RUGOSUM*

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The decomposition of coir, normally used as a wrapper of drain pipes, has been studied by the author for several years (1, 2). In that investigation it has been shown that pure cultures of fungi belonging to the ascomycetes and deuteromycetes may cause a slow decomposition of coir (unpublished data). This report deals with the rather quick decay of coir in soil by pure cultures of the basidiomycetes *Trametes versicolor* CBS 47172 and *Stereum rugosum* CBS 47472. These two organisms, obtained from the type culture collection CBS, Baarn, Holland, decompose the coir within 4 months at 25°. At 12° the decomposition occurs more slowly. The fibers show the typical white-rot decay by which cellulose as well as lignin is decomposed.

The fungi were cultivated in Erlenmeyer flasks of 500-ml capacity. A small flowerpot was placed upside down on the bottom of the flask. A circular coir mat (ϕ 9 cm) lying on the flowerpot and pierced by a hollow glass pipe, was covered with about 300 g of soil of recent marine origin (pH 7.0), which was moistened by addition of 150 ml of tap water (Fig. 1). The flasks were sterilized twice, with an interval of 24 hr, inoculated and incubated at 12° and 25°. After different periods the coir mat of one flask was photographed and the tensile strength and elasticity of ten fibers of each sample were estimated. The span of the fibers was 5 cm. The diameter of the fracture was estimated microscopically and the strength was calculated per square millimeter. The presence of the pure culture in each sample was checked by incubation of 18 fibers on malt agar plates. Growth of other microorganisms around the fibers appeared to be absent.

Figure 2 shows photographs of the coir mats after different periods of incubation at 25°. *Trametes versicolor* (T15) and *Stereum rugosum* (S55) show the color of white-rot decay after 4 weeks of incubation. At 25° the coir mats of both strains lost their solidity within 14–16 weeks. At 12° the decay process proceeded more slowly, the typical white-rot color appearing only after 8–10 weeks.

Table 1. Rate of coir decomposition by *Trametes versicolor* and *Stereum rugosum*.

Incubation time (weeks)	<i>Trametes versicolor</i>				<i>Stereum rugosum</i>			
	12°		25°		12°		25°	
	Strength (kgf/mm ²)	Elasticity (%)	Strength (kgf/mm ²)	Elasticity (%)	Strength (kgf/mm ²)	Elasticity (%)	Strength (kgf/mm ²)	Elasticity (%)
0	22.9±1.0	27±2	22.9±1.0	27±2	22.9±1.0	27±2	22.9±1.0	27±2
2	17.3	25	16.0	23	19.8	26	15.6	25
4	13.9	20	8.8	20	15.9	25	12.3	22
6	11.3	19	6.7	8	14.0	22	9.0	11
8	10.3	16	6.4	7	10.7	17	4.9	7
10	10.2	15	2.8	5	10.8	16	3.9	5
12	8.5	12	2.2	2	9.6	14	3.7	4
14	6.1	11	2.1	2	8.7	13	3.6	4
16	5.6	10	0.6	1	7.1	9	2.4	2

Averages of data from 5 samples of twice sterilized, unattacked coconut fibers.

Fig. 1.

Fig. 1. Cultivation of pure cultures of fungi on coconut fibers.

Fig. 2.

Fig. 2. Decay of coir by *Trametes versicolor* and *Stereum rugosum* after different weeks of incubation at 25°.

Table 2. Average monthly temperatures at 50 cm below the surface of fields where the drain pipes, surrounded by the coir, are located.

	1976	1977	1978	1979
January	6.2*	3.5	5.2	2.1
February	3.4	4.7	3.0	1.1
March	4.2	6.8	5.8	2.2
April	7.1	7.0	7.4	6.7
May	10.8	10.9	11.4	10.0
June	14.8	14.6	15.0	15.4
July	17.7	16.7	15.7	15.3
August	17.0	16.9	17.3	15.7
September	15.1	15.5	15.4	14.5
October	13.5	13.2	12.6	12.1
November	9.6	9.9	10.0	8.2
December	5.6	6.4	5.0	7.0

* Data obtained from the Department of Meteorology, Agricultural University, Wageningen.

The rates of coir decomposition of the two basidiomycetes are shown in Table 1. The strength and elasticity of the fibers are given after different periods of decay. During incubation at 25°, fibers attacked by *Stereum rugosum* lost about half of their strength within 4 weeks, whereas fibers partly decomposed by *Trametes versicolor* lost more than 50% of their strength. At this temperature total

strength and elasticity were lost after about 16 weeks of incubation. At 12° the rate of coir decay was lower, but this temperature is clearly below the average temperatures which were found at 50 cm below the field surface during 5 months of a number of years (Table 2). At such soil temperatures moderate growth of the white-rot basidiomycetes and coir decomposition may be expected. Sometimes white rot was observed during the decay of coconut fibres under field conditions and in laboratory jars. Some unknown fibre decomposing basidiomycetes from partly decayed coir were isolated already. During these experiments the rapid growth of ascomycetes and deuteromycetes was inhibited with benomyl as described by BOLLEN and FUCHS (3).

The nature of coir decomposition by the basidiomycetes tested was observed microscopically with thin sections of the partly decayed fibers. The decomposition of the fibers starts at the center, as described by the author for an unknown fungus in partly decomposed fibers under field conditions (2). Of the fibers partly decayed by *Trametes versicolor* and *Sterum rugosum* more than 70% of the cross sections showed a hole in the center. The remaining cross sections showed sectorial decay or unattacked fibers. In the available thin, longitudinal sections, lateral branches penetrating adjoining cells were not observed.

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