

DEGRADATION OF LIGNIN IN JUTE FIBRES INFECTED WITH *MACROPHOMINA PHASEOLINA*

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The lignin content in healthy and *Macrophomina*-infected jute fibres at different stages of stem-rot was studied quantitatively. The lignin content of healthy jute fibre was about 11.6% of dry weight. The percentage of lignin in jute fibre showed a decrease as a result of stem-rot. Loss of lignin was evident in fibres showing early stage of stem-rot which increased with further advancement of the disease indicating lignin degradation.

INTRODUCTION

In a large percentage of plant diseases, host tissue disintegration is the primary mode of injury and is directly responsible for loss of tissue constituents. Lignin, which is a major component of plants, is probably the second most abundant of all the continuously cycled organic materials on earth. The biological decomposition of lignin although obviously a very important problem, has not received nearly as much attention as has the degradation of pectic materials and cellulose. In addition to those wood decaying Basidiomycetes causing "white rot", there are many saprophytic Basidiomycetes which are able to decompose the lignin found in leaves, twigs etc. that comprise forest litter (Lindeberg, 1946). Besides, numerous soil fungi are also associated with the decomposition of lignin-containing plant materials. Whether or not, these organisms are capable of totally decomposing the lignin in plant residues is not clear. Research to date indicates that the capacity for complete decomposition of lignin by a single microorganism may be limited to fungi that cause the white rot type of wood decay and to the related litter decomposing Basidiomycetes.

MATERIALS AND METHODS

The present investigation has been undertaken with a view to estimate quantitatively the loss of lignin in jute fibres at different stages of stem-rot caused by *Macrophomina phaseolina*. For this purpose fibres were collected from healthy and *Macrophomina*-infected jute plants showing different degrees of rot and their lignin content was estimated by modifying the method followed by Saeman *et al.* (1954). Other organic matters of the jute fibres were removed by hydrolysis with sulphuric acid and the lignin was condensed to an insoluble residue which was determined gravimetrically. A sample (0.4 gm) of air dry fibre meal was taken in

a 30 ml shell vial. The vial and its contents were chilled in ice water and 3 ml of ice cold 72.01% (weight by volume) sulphuric acid was added. While still in ice bath, the sample was mascerated for 2 minutes with the flat-ground end of a glass rod. The vial was then fastened to a shaker in a 30°C water bath and the sample was constantly stirred. After every 15 minutes the vial was removed from the shaker (but not from the water bath) and the sample was ground against the sides of the vial with the stirrer to ensure complete penetration of the acid into all particles. After one hour, the contents of the vial were transferred to a 250 ml beaker. The vial was rinsed with 84 ml of distilled water in small aliquots to ensure a quantitative transfer and to dilute the acid concentration to 4% by weight. The beaker with its contents was covered with a watch glass and autoclaved at 121°C for one hour. After cooling the solution was filtered through a tared, Alundum crucible under reduced pressure. It was washed several times with 25 ml aliquots of distilled water to render the lignin residue free of acid as indicated by a litmus test. The crucible and its contents were oven dried to constant weight. The residue in the tared crucible was taken as lignin and its weight expressed as percentage of the original sample.

RESULTS AND DISCUSSIONS

The results in the table showed that the lignin content in healthy jute fibre was about 11.6% of the dry weight. The percentage of lignin decreased in jute fibres as a result of stem-rot. The loss of lignin was evident in fibres showing early stage of disease and gradually increased with further advancement of the disease. Gulyas (1967) reported that pure cultures of *Penicillium* and *Fusarium* spp. can destroy about 20% of lignin of wheat straw. Waksman and Hutchings (1936) also noted upto 25% decrease in phenol lignin in the medium by *Fusarium* and *Alternaria*. Weight losses amounting to 80% of lignin by pathogenic fungi was reported by Levi and Preston (1965).

Table 1. Lignin content of healthy and *Macrophomia* infected Jute fibre at different stages of stem-rot

Stages of stem-rot of jute plants	Lignin content (in mg) per gm. of jute fibre		Percentage of lignin content
	Replicates	Mean	
Advanced	98.0	98.3	9.83
	97.5		
	99.5		
	106.0		
Intermediate	106.0	105.0	10.50
	103.0		
	112.0		
	111.5		
Early	112.5	112.0	11.20
	117.5		
	115.5		
Control (Healthy)	115.5	116.1	11.61
	115.5		

Although enzymatic degradation of lignin has not yet been clearly demonstrated, its decrease probably results from its modification (Levi and Preston, 1965). Diversity of intermonomer linkages and monomer structures in lignin as well as the occurrence of several types of functional groups in its structure provide the opportunity for organisms to bring about a variety of changes (a degradation) without necessarily affecting significant decomposition. This degradation may be somewhat analogous to the activity of certain microorganisms which oxidise hydrocarbons without assimilating them (McKenna and Kallio, 1965).

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