DECAY OF WOOD BY ALTERNARIA AND PENICILLIUM AND CHIEF METHODS OF CONTROL

by

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INTRODUCTION

Fallen trees, timber and wood work of houses can be quite commonly seen to be the prey of several saprophytes mostly Ascomycetes: *Ustulina* and *Xylaria*, and Basidiomycetes like: *Armilaria, Collybia, Lentinus, Hydnum, Daedalia, Fistulina, Fomes, Ganoderma, Lenzites, Merulius, Polyporus, Polystictus, Poria, Trametes*, and *Stereum* etc. For years it has been thought that the only fungi responsible for the decay of wood tissues i.e. lignified and cellulose, were Basidiomycetes and species of Xylariaceae (Ascomycetes). Although many species of moulding and staining fungi (Ascomycetes and Fungi Imperfecti) have been shown to be cellulolytic and able to hydrolyze cotton cellulose, these fungi were thought to lack the enzyme or enzymes necessary to attack lignified cellulose (2,5). In the past decade, however, some of these fungi have been found capable of causing a decay of wood known as soft rot (3,4).

It has been proved experimentally that the decay of wood takes place principally by two types. In the first place there is destruction of lignin, sometimes cellulose, lignin becoming white when the rotted wood becomes white and sponge-like e.g. red ring rot of Conifers by *Trametes pini* and white mottled rot of hardwoods by *Ganoderma applanatum*. In the second type there is destruction of cellulose when the rotted wood becomes brown, soft and easily powdered e.g. red-brown butt rot of conifers by *Polyporus* sp. and brown cubical rot of conifers, especially Pines by *Lentinus lepideus* and the dry rot of building wood by *Merulius lacrimans* and *Poria incrassata*. Thus the timber and wood work often suffer immensely resulting in great economic losses.

Certain fungi are a cause of staining in wood. Stored wood may be stained by the growth of surface moulds like *Alternaria, Asper-*

gillus, Mucor, Penicillium, Rhizopus etc., or by fungi in the wood e.g. *Ophiostoma*, a cause of blue stain. Brown oak wood stained by *Fistulina hepatica* is valued and the wood coloured green by *Chlorociboria aeruginosa* is used for making "Tunbridge ware"; wood having "Zone-lines" is sometimes used for ornaments. A number of fungi which stain wood, like *Alternaria* and *Penicillium* also damage the wood pulp.

Experimental Data

Studies of the effects of moulds on wood fiberboards manufactured from aspen (*Populus tremuloides* Mich. and *grandidentata* Mich.) showed that species of Imperfect Fungi could cause substantial weight-and strenght losses by the consumption of large amounts of the hemicelluloses and alpha cellulose (Merrill, 1963). The rate of decay by these fungi was observed by the author and was found to be very slow, about 8 months to cause the same amount of decay that Basidiomycetous wood rotting fungi cause within 8 weeks. No differences in susceptibility were apparent between boards manufactured from groundwood or semichemical pulp. Thus it was assumed that either mechanical defibration or heating of the wood during manufacturing rendered the fibers more susceptible to be attacked by these supposedly non-wood-decaying fungi or these fungi were able to attack lignified wood cellulose, but at such a slow rate that it had been overlooked.

Material and Method

Matchsticks, approximately $3 \times 3 \times 65$ mm cut from nonseasoned venner, were placed in glass jars, oven-dried at 80° C and weighed. The jars were then filled with water, placed in a desiccator and vacuum drawn on the desiccator and released, partially infiltrating the sticks with water. The excess water was poured off. The jars were tightly capped stored at 80° C for 24 hr. for sterilization and the sticks inoculated with spore suspensions of the test fungi. The fungi used were isolates of *Alternaria* from decayed woodfiber and an isolate of *Penicillium* from decayed rotting bread. The tightly capped jars were incubated at room temperature and on intervals a jar was selected, opened oven-dried (both match sticks and jar) at 80° C, weighed and the percentage weight loss of the wood was calculated.

Results and Discussion

Both *Alternaria* and *Penicillium* caused significant reductions in holocellulose content with about 1% loss in weight and *Penicillium* sp. caused substantial reduction in holocellulose and alpha cellulose content with about 13% weight loss in 6 months. These fungi,

especially *Penicillium* sp. can thus be considered "wood-rotting fungi".

Species of *Penicillium* and *Alternaria* and probably other species of the Fungi Imperfecti apparently have an enzyme system capable of digesting cellulose when combined with lignin. This suggests that these fungi possess the hypothesized "X" enzyme; that they have an enzyme that functions the same as the "X" enzyme or no "X" enzyme is involved in wood decay. However, since the rate of decay by these species is so slow compared to that of the Basidiomycetes and those species of Ascomycetes and Fungi Imperfecti stated above which cause soft rot, the cellulolytic enzymes of these 3 groups must differ in some manner. This area warrants more study since most of our knowledge of fungal cellulases is based on the studies of enzymes secreted by fungi.

Control Measures

Forest hygiene and good forestry practice are the chief methods by which decay in living trees is controlled. Cut trees, stored wood and wood in buildings may be provided with such conditions as to avoid the growth of fungi. The water contents of the wood and the air should be kept low and the wood be treated with $CuSO_4$ solution or with fungicides.

Among the most important wood preservatives are creosote, coal tar, zinc chloride, mercuric chloride, sodium fluoride, potassium dichromate and arsenic compounds.

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