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REPORT

ON

THE LABORATORY EXAMINATION OF THE EFFECT OF FUNGAL  
INVASION ON THE DURABILITY OF UNTREATED MINE SUPPORT TIMBERS

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## S Y N O P S I S

The technique developed in the Laboratory for assessing the progress of decay in individual test poles 3 ft. in length and 5 ins. in diameter by the periodic measurement of their resistance to bending, has been further applied to an examination of the durability of untreated mine support timbers subjected to the invasive action of fungi under warm humid conditions.

The relative effect on the rate of timber decay by invasive fungi and those already present in the timber prior to exposure, was examined.

While untreated wattle (Acacia mollissima) exposed to fungal invasion was found to be more durable than gum (Eucalyptus saligna), the overall rate of decay was much slower in the case of both timbers than that recorded for similar untreated wattle and gum poles affected by the development of the fungi already present in the timber.

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THE LABORATORY EXAMINATION OF THE EFFECT OF FUNGAL

INVASION ON THE DURABILITY OF UNTREATED MINE SUPPORT TIMBERS

INTRODUCTION

A laboratory investigation into the durability of mine support timbers when affected by the growth of fungi present inside them prior to exposure has shown that such fungi can cause rapid decay of untreated timber when placed in warm humid conditions.<sup>(1)</sup>

This report is concerned with the second aspect of timber decay in service, namely, the effect of fungal invasion by means of wood-destroying organisms already established underground.

The object of the investigation was to ascertain:

- (i) the rate of decay of untreated wattle (Acacia mollissima) and gum (Eucalyptus saligna) subjected only to fungal invasion by wood-destroying fungi; and
- (ii) the relative significance of this type of attack in an assessment of the natural durability of these timbers in service.

The possibility of extending the service life of these timbers may exist should it be found that treatment procedures aimed at destroying fungi already present in the timber would be more effective than preservative treatments for the purpose of resisting fungal invasion while the timber is in service.

EXPERIMENTAL

Untreated wattle and gum poles 3 ft. long and 5 ins. in diameter, of the type generally used underground as timber supports were used in this experiment.

/Test ...

Test poles were soaked and then autoclaved for one hour at a pressure of 20 lb. on three successive occasions in order to eliminate the fungi already present inside the wood. Each pole was then placed standing in a plastic bucket half full of water, and enclosed in a sealed polythene bag. Incubation was at 84<sup>o</sup>F., and the relative humidity inside the sealed bags was between 95 per cent and 97 per cent.

Five wattle and five gum poles were inoculated with cultures of four wood-destroying fungi, while another five poles of each timber remained uninoculated.

Test organisms inoculated onto both wattle and gum poles were Hydnum henningsii, Polyporus rugulosus, and an unidentified basidiomycete, TRL 2338, all of which occur commonly underground. In addition, the gum poles were inoculated with Ptychogaster sp., and the wattle with an unidentified basidiomycete, these fungi having frequently developed in earlier large pole experiments from gum and wattle poles respectively.

The test fungi were inoculated at intervals using a specially devised inoculating technique in which small blocks of wood covered with fungal growth were rested on damp sponge in small sealed polythene bags. After the fungi had been incubated for a short period at 84<sup>o</sup>F, the bags were nailed into position on the poles by means of non-rusting galvanized iron nails, and slit up both sides, thus allowing growth of uninjured fungal hyphae from the feeder block onto the pole.

Each pole was inoculated in three areas - on the top cut surface, approximately half way along the length of the pole, and in the wet area just above the level of the water in which the pole was standing.

Visual observations of the development and spread of the fungi on the poles were made throughout the 18-month period of the experiment.

Measurements of the bending strength of each of the poles were made after seven months and at roughly three monthly intervals thereafter, the moisture content of the wood being at all times above the critical fibre saturation point.

The poles were tested by means of a standard bending strength testing machine, and the results expressed in terms of the applied load per unit cross-sectional area required to deflect the pole through 3 mms.

/ that is ...

(that is from 2 mms. to 5 mms.) with the load applied and the deflection measured at the midpoint of 75 cm. span.

#### OBSERVATIONS ON CHANGES IN THE MECHANICAL STRENGTH OF POLES

Results obtained for the periodic measurements of the bending strengths of the wattle and gum poles, inoculated and uninoculated, are shown in Figure 1, the mean values for each set being used.

The loss in strength of these 5 in. diameter poles, three feet in length, exposed to fungal invasion under warm humid conditions, was expressed as a percentage of the initial (sterilized) strength, and was recorded as follows:

Mean loss in strength of inoculated gum poles - 17 per cent after 1 year.

Mean loss in strength of inoculated wattle poles - 18 per cent after  
1 year.

No loss in strength was recorded for the uninoculated wattle and gum poles.

It was noted that -

- (1) the bending strength of the wattle poles was affected markedly by the sterilization processes used at the commencement of the experiment, though that of gum was not greatly altered.
- (2) exceptionally low values were obtained in all cases at 10½ months, probably due to experimental error during measurement.
- (3) results for uninoculated wattle poles were based on four replicates only, the fifth pole having proved to be unstable during measurement processes.

#### Mycological observations

Basidiomycete growth was established successfully on all the inoculated poles. Of the test organisms inoculated, one, Hydnum henningsii, grew so rapidly and luxuriantly that in most cases any growth of the other test organisms became swamped, though fairly extensive growth of TRL 2338 was observed in the very wet areas of two wattle and two gum poles.

No basidiomycete growth developed on any of the uninoculated poles, and the surface mould growth visible on them was considered to be due to  
/air ...

air contaminants.

Relation of fungal growth to strength

A loss in strength was evident in the case of almost all the inoculated poles on which had developed substantial growths of wood-destroying fungi. Two of the inoculated wattle poles, however, which exhibited little change in strength, were only partly overgrown.

The mould fungi present on the uninoculated poles had no apparent effect on the bending strength of these poles during the eighteen month test period.

Role of fungal invasion in the decay of timber in service

The loss of strength observed for wattle and gum poles subjected solely to fungal invasion is surprisingly small even after eighteen months under test in warm humid conditions. This is particularly notable when certain experimental factors which would tend to predispose these test poles to attack of greater severity than that experienced in service are taken into consideration. Sterilization processes such as those used at the start of this experiment not only affect the strength of the timber, but are also known to render it more susceptible to fungal attack. Further, the laboratory inoculation technique based on the contact of a mass of healthy mycelial growth with the poles, provides a most vigorous and powerful inoculum.

Despite these favourable test conditions, the loss in strength of untreated wattle and gum poles subjected to a fungal invasion was very much less, particularly in the case of wattle, than that recorded for similar poles affected only by the development of the fungi already present inside them<sup>(1)</sup>. At a comparable stage, that is after one year under warm humid test conditions, the respective mean losses in bending strength of poles, expressed as a percentage of initial strength, were as follows:

| Description                                   | Gum | Wattle |
|---|-----|--------|
| Loss in strength due to fungi already present | 40% | 27%    |
| Loss in strength due to invasive fungi        | 17% | 8%     |

/Conclusions ...

Conclusions

- (1) Fungal invasion does not appear to cause rapid decay of untreated mine support timber, losses in strength after one year being recorded as 17 per cent in the case of gum and 8 per cent in the case of wattle.
- (2) Untreated wattle poles subjected to fungal invasion for a period of up to eighteen months are approximately 50 per cent more resistant than gum poles.
- (3) As assessed in the Laboratory, fungal invasion does not appear to be a major factor in the short term decay of untreated mine support timber in service, the natural durability of such timbers being in all probability largely dependent upon the activity of fungi already present inside the wood prior to exposure.
- (4) Indications are that treatments intended to preserve timber for a limited period should preferably be aimed at eliminating fungi already present in the timber rather than at protecting it from infection subsequent to sterilization.

REFERENCE

- (1) HALL, PHYLLIS J.

The laboratory examination of the durability of treated and untreated mine support timbers. Part I : Round poles.  
C.O.M. Research Report No. 41/65.

# BENDING STRENGTHS OF STERILIZED POLES

- x MEAN VALUES FOR UNINOCULATED POLES
- MEAN VALUES FOR INOCULATED POLES

FIG. 1.a

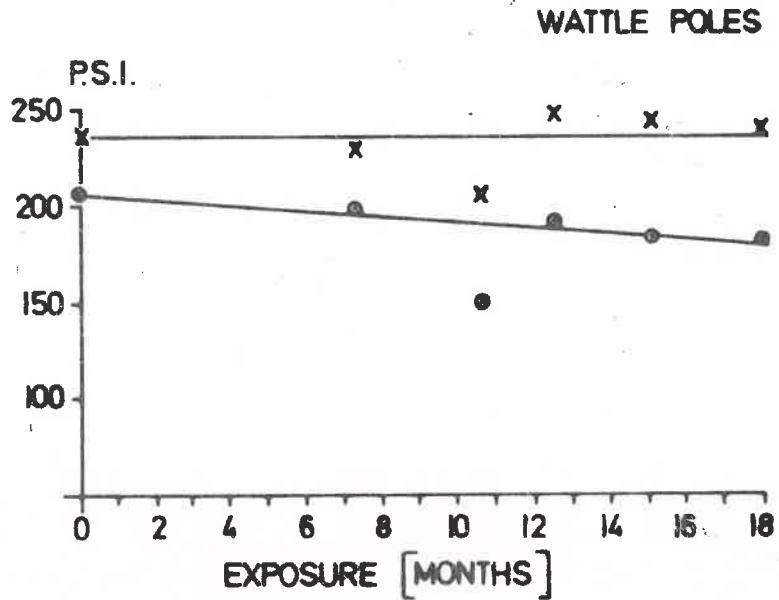


FIG 1.b

