after which the solutions were analysed and found to contain 15 and 20 p.p.m. respectively. (All the silica was in ionic state.)

Finally the amount of soluble silicic acid in various top soils in Israel was determined by extracting 40 gm. soil with 200 c.c. water and was found to be 10–100 p.p.m., all in ionic state.

The present work can neither support Reifenberg's theory nor refute it. Though no colloidal silicic acid was found in the extracts, it may be argued that it was present in the soil samples and was depolymerized on extraction.

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FOREST PRODUCTS

Chemistry of Decay of Heartwood on Ageing in Incense Cedar (*Librocedrus decurrens* Torrey)

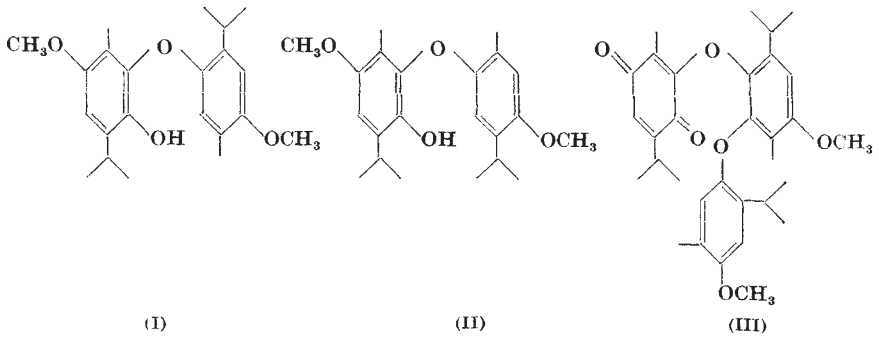
It is now generally recognized that the type of extractives present in certain woods accounts for practically all the decay resistance, and physical factors are of little significance. It has been repeatedly observed in tests of resistance to natural decay that the inner heartwood of many woods is less resistant to decay than the outer heartwood. This is particularly true in the lower trunk of larger and older trees. Moreover, it is a common observation that a hollow tree or log has sustained most loss of wood in the central portion of the trunk. The phenomenon of decreasing resistance to decay with ageing of the wood in the tree occurs in many species, so necessarily there will be a variety of chemical changes involved.

The fungitoxic properties of a number of compounds isolated from incense cedar heartwood were previously reported[1]. The observation was made that, while one of the extractive components, namely, *p*-methoxythymol, exhibited fungicidal properties against a number of wood-destroying fungi, its dimer, libocedrol (I), exhibited very little fungitoxic action.

It was suggested that this may be one type of chemical change that conceivably could account for the decrease in resistance to decay in heartwood on ageing.

Recently, two new extractive components have been isolated from incense cedar heartwood—hyderiol (0·14 per cent dry wood basis) (II) and 3-libocedroxy-thymoquinone (0·02 per cent) (III)[2]. The former is a dimeric cryptophenol ether consisting of *p*-methoxythymol and *p*-methoxycarvacrol, while the latter is a trimeric ether consisting of two molecules of *p*-methoxythymol (libocedrol) and thymoquinone.

The decay-retarding characteristics of each of these compounds were determined, together with that



(I) (II) (III)

of their monomeric counterparts, *p*-methoxythymol, *p*-methoxycarvacrol and thymoquinone. The method used, except for minor deviations, was the standard soil-block bioassay procedure ("Tentative Method of Testing Wood Preservatives by Laboratory Soil-Block Cultures", A.S.T.M. Designation *D* 1413-56 *T*, 1956). Test blocks of ponderosa pine sapwood were impregnated with each of the aforementioned compounds and subjected to decay by a pure culture of a wood-destroying fungus. Loss in block weight during the test constituted the measure of decay. The wood-destroying fungus used was *Lentinus lepideus* (Madison, 534). The results are summarized in Table 1.

Table 1. Decay Retardent Bioassay using *Lentinus lepideus**

Chemical	Weight-loss (per cent)
p-Methoxythymol	15
p-Methoxycarvacrol	16
Thymoquinone	26
Heyderiol	22
Libocedrol	27
3-Libocedroxythymoquinone	33
Control	32

* Test blocks containing 1·2 per cent, by weight of chemical. Test duration, six weeks.

It will be noted that heyderiol, while exhibiting faint fungitoxic properties, was not so potent as its monomeric counterparts. Libocedrol, as previously indicated, again showed, at best, weak fungicidal action. Similarly, but even more apparent, 3-libocedroxythymoquinone had virtually no decay-inhibiting capacity against *Lentinus lepideus*. It is even less fungitoxic than the dimers heyderiol and libocedrol and apparently retains little or none of the fungitoxic qualities inherent in the parent compounds.

The present finding of the denaturing of *p*-methoxythymol, *p*-methoxycarvacrol and thymoquinone via their several polymeric phenol ethers represents a type of chemical change that conceivably could account for relatively lower decay resistance, hence greater susceptibility to heart-rot, in the central lower trunk of mature incense cedar trees. As the tree or wood ages it may be reasonable to assume that, in the biogenesis of extractives, certain enzymatic systems and/or time convert certain phenols to polymeric phenol ethers which can reduce the resistance of heartwood to decay.

Further investigations are in progress.

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