

A MULTILAYERED SECONDARY WALL IN FIBRES OF *EUCALYPTUS OBLIQUA* L'HÉRIT.*

By D. S. SKENE†

The secondary cell wall structure most commonly found in fibres and tracheids consists of three layers, as first proposed by Bailey and Kerr (1935) and recently reviewed by Wardrop (1964). The thin outermost and innermost layers, the S_1 and S_3 layers respectively, are characterized by the microfibrils being aligned at a large angle to the fibre axis. Between these two layers there is another, the S_2 layer, in which the microfibrils are aligned at a small angle to the fibre axis. These layers can be readily distinguished using a polarizing microscope, the S_1 and S_3 layers appearing bright and the S_2 layer dark in transverse sections.

The fibres of *Eucalyptus obliqua* normally have this three-layered secondary wall. In some recently collected samples, however, fibres were found in which the normally more or less uniform S_2 layer was interrupted by a variable number of thin layers of microfibrils aligned at a large angle to the fibre axis (Plate 1). These layers were distinguishable by both polarized light (Plate 1, Fig. 1) and electron microscopy (Plate 1, Figs. 2 and 3) — such fibres will be referred to as multilayered fibres and the more normal ones as three-layered. The structure of the multilayered fibres appears similar to that described in *Myodocarpus simplicifolius* Brong. & Gris. (Bailey and Kerr 1935). Under ultraviolet light there was no evidence of concentric layers of lignin, as described for the fibres of *Pandanus odoratissimus* L. (Bailey and Kerr 1935) and the sclerosed vertical parenchyma of *Dialium laurium* Baker (Wardrop and Dadswell 1952).

Of 31 trees collected from near Belgrave, Vic., only sections cut from two trees were free of multilayered fibres. All the trees sampled were suppressed and, though tall, were overtopped by the dominants. No multilayered fibres were found in similar trees of the same species growing near Mount Macedon and Toolangi, Vic.

The numbers of multilayered fibres were very varied, some sections having only one or two. In all cases, however, the more normal three-layered fibres were predominant. In the phloem, and in much of the xylem, the multilayered fibres were either isolated or in small groups but whenever there were many multilayered fibres in the xylem they occurred in definite tangential bands. In one band they formed 30% of the total number of fibres.

The occurrence of these fibres in tangential bands suggests that their formation might be subject to an environmental stimulus but, on comparing different trees, there was no evidence of any similarity in the time of their formation. If there is an environmental influence, therefore, it must be closely dependent on the condition or the reaction of the individual tree. This is paralleled by another aspect of wood

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† Division of Forest Products, CSIRO, Melbourne.

structure. For instance, there are no distinct growth rings in *E. obliqua*, but there are ill-defined bands of thick- and thin-walled fibres; with these too, there was little correlation in the time of their formation.

The formation of reaction wood is a proven case in which the tree reacts to the environment, changing the pattern of secondary wall development. The formation of multilayered fibres is clearly another problem in morphogenesis whose solution must ultimately be found in the same basic cell processes, presently believed to be under the direct control of the cytoplasm (Preston 1964; Wardrop 1964). Whether or not the formation of multilayered fibres is, in part, due to changes in the environment must await further investigation.

References

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EXPLANATION OF PLATE I

Transverse sections through multilayered fibres of *E. obliqua*. All material was embedded in methacrylate for sectioning. *p*, primary wall; *a*, S₁ layer of the secondary wall; *b*, *d*, layers similar to the S₂ and S₃ layers of the secondary wall, respectively; *e*, other layers typical of multilayered fibres, in which the microfibrils are oriented at a large angle to the fibre axis

Fig. 1.—Photographed between crossed polarizers, matrix materials still present.

Fig. 2.—Shadowed after removal of the embedding medium with chloroform. Matrix materials still present.

Fig. 3.—This material was treated to remove the matrix substances and then embedded in partially polymerized methacrylate for sectioning. This treatment caused the cell wall to expand enormously and reveals, more clearly, its microfibrillar structure.

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