

WOOD ANATOMY OF NEW ZEALAND DACRYDIUM SPECIES

By H. R. ORMAN and J. S. REID.

Introduction.

Silver pine (*Dacrydium colensoi*) and the other timbers in the silver pine group have been valued highly on account of their high natural durability. Evidence of the lasting properties of the several species has been very conflicting due partly to substitution of other timbers of superficially similar appearance but with poor natural durability. However, it is recognized that not all of the sister species are equally as durable as *D. colensoi*. The site in which the timbers are used also has a bearing upon their reputation. Physical characteristics of the woods—colour, density, burning characteristics of match-size sticks, smell, and nature of crystalline resin deposits—all play a useful part in identification. These features are discussed in a manuscript (unpublished) on the "Properties and Uses of the Silver Pines." It is often necessary, however, to establish identity by microscopic means and a key is contained in this note.

Prior to the commencement in 1933 of an anatomical study of this group by one of the writers, a very considerable amount of work had been carried out by Professor H. B. Kirk; finalized results are, however, not available although a large amount of the material has recently been donated to the Forest Service. Several specimens had been set down as "unknowns" and there is obvious scope for an extended investigation. A key to the microscopic structure of *D. colensoi*, *D. biforme* and *D. intermedium* was prepared for the Forest Service by B. E. V. Parham in 1930.

Scope of Study.

Confirmation of Parham's key with an extended range of material was the primary requirement. It was also necessary to introduce the additional species, *D. kirkii*, *D. bidwillii* and *D. laxifolium*. Apart from the last-mentioned, the secondary wood of tree size specimens were the basis of the study. Incidentally twig and root wood has been examined on several occasions, as will be referred to later.

Results of Study.

It is difficult to assign to the genus *Dacrydium* any prominent anatomical characteristic, distinguishing its woods from those of the related genera *Podocarpus* and *Phyllocladus*, with which it is often associated in the forest. Parenchymatous tissue is wholly confined to the wood rays in *Phyllocladus*, six of the seven *Dacrydium* spp., and apparently in only one the seven species of *Podocarpus*. Wood rays throughout are homogeneous, uniseriate and more or less linear,

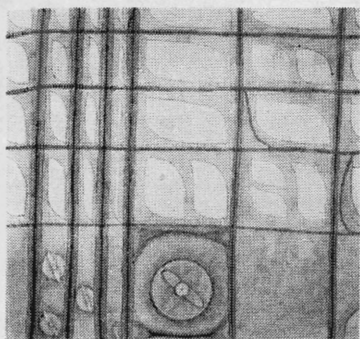


FIG 1 *D. COLENSOI*

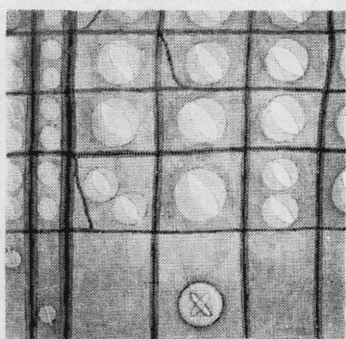


FIG. 2 *D. KIRKII*

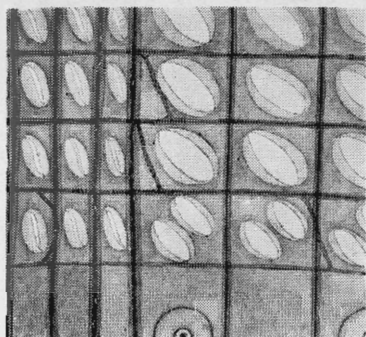


FIG. 3 *D. BIFORME*

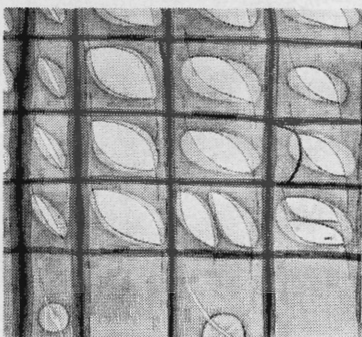


FIG. 4 *D. BIDWILLII*

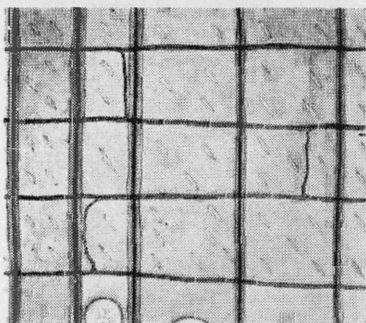


FIG. 5 *D. INTERMEDIUM*

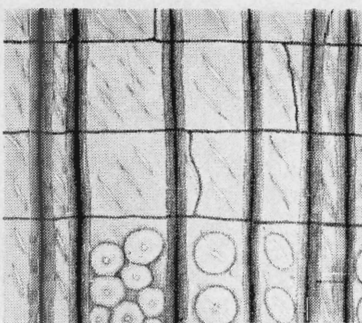


FIG. 6 *D. LAXIFOLIUM*

SCALE 0 5 10 20 30 40 50

100 MICRONS.
01 MM.

X 685

DEL. H.R.O.

Some Diagnostic Features in the Anatomy of N.Z. Dacrydiums.
Details of the ray/tracheid pitting in radial section (excluding *D. cupressinum*).

but over a range of specimens the maximum and mean heights are of diagnostic value; the average for the silver pine group is consistently low and the maximum is likewise fairly low. The tracheids have no distinctive features constant in this group but absent elsewhere; bordered pits are in single rows generally, with round to slit-like mouths of which pairs may or may not be opposed. Pits between tracheids and ray cells are also of little use for group differentiation.

Hence, any key for identification by purely microscopic characters would need to include most of the other New Zealand softwoods of the three related genera mentioned above, and also *Libocedrus*. Eliminating *D. cupressinum*, whose anatomical features resemble those of *Podocarpus*, the remaining six *Dacrydium* spp., the silver pines, are a more homogeneous group. Thus the growth rings are well defined with 3-4 (occasionally up to 8) layers of latewood tracheids contrasting with the earlywood of adjacent rings; resin cells (so characteristic of *D. cupressinum*) are absent; and reference has already been made to the low wood rays. In addition, certain microscopic characters may be used for distinguishing the group, e.g. the resinous odour, narrow growth rings (except in *D. kirkii*) and high specific gravity. For the identification of the six species, it is convenient to use as a basis the nature and appearance of the pits between the ray cells and tracheids, the ray heights and the tracheid dimensions. Using these features, it has been possible to prepare the following key based on authenticated material collected from a reasonably wide range of sites:—

1. Pits between ray cells and tracheids apparently simple, large (often over 0.02 mm. in length of mouth), each one occupying most of the cross-field (occasionally more than one pit per cross-field occurs, as many as four having been observed). See Fig. 1. Tracheids of medium length (over 3 mm. in earlywood) and of medium tangential diameter (about 0.030 mm. in earlywood). Ray height seldom exceeds 0.33 mm. and averages about 0.15 mm. *D. colensoi*.
2. Pits between ray cells and tracheids semi-bordered, one or two (rarely three or four) per cross-field, mouths narrow-lenticular, oval or orbicular-elliptical in shape and of medium size (0.01—0.015 mm. in length). Ray height frequently exceeds 0.50 mm. but averages 0.15—0.20 mm. 4.
3. Pits between ray cells and tracheids semi-bordered or simple, numerous (often 5 or more pits per cross-field), mouths narrow-elliptical in shape and of small size (about 0.004 mm. in length). 5.
4. (a) Tracheids of medium length (earlywood 3 mm., latewood 2.2 mm.) and of medium tangential diameter (0.034 mm. in early-

wood. Often 2 pits side by side in ray/tracheid cross-field, but may also be one above the other or diagonally placed; the pit mouths are frequently 0.015 mm. in length and oval to orbicular in shape. See Fig. 2.

The number of rays per mm. in tangential section averages about 9. *D. kirkii*.

(b) Tracheids short (earlywood 2.4 mm., latewood 1.7 mm.) and of small tangential diameter (0.027 mm. in earlywood). Ray/tracheid pits generally with distinct border, one per cross-field, but where two are present they are usually one above the other; the pit mouths are usually about 0.01 mm. in length obliquely placed and oval to narrow-lenticular in shape. See Fig. 3.

The number of rays per mm. in tangential section averages about 12. *D. biforme*.

(c) Tracheids very short (earlywood 1.6 mm., latewood 1.0 mm.) and of small tangential diameter (0.024 mm.). Ray/tracheid pits large, occasionally very obscurely bordered, one to two per cross-field; where two are present one is usually above the other; the pit mouths occasionally exceed 0.016 mm. in length, are diagonally placed (sometimes extending almost from one corner to the other) and narrow-lenticular in shape. See Fig. 4.

The number of rays per mm. in tangential section averages about 13. *D. bidwillii*.

5. (a) Tracheids of short average length (earlywood about 2.4 mm., latewood 1.6 mm.) but sometimes attaining as much as 3.8 mm., of medium to large diameter (0.03 mm.—0.043 mm. in earlywood). Ray/tracheid pits range from 1 to 6, and average about 4 per cross-field. See Fig 5.

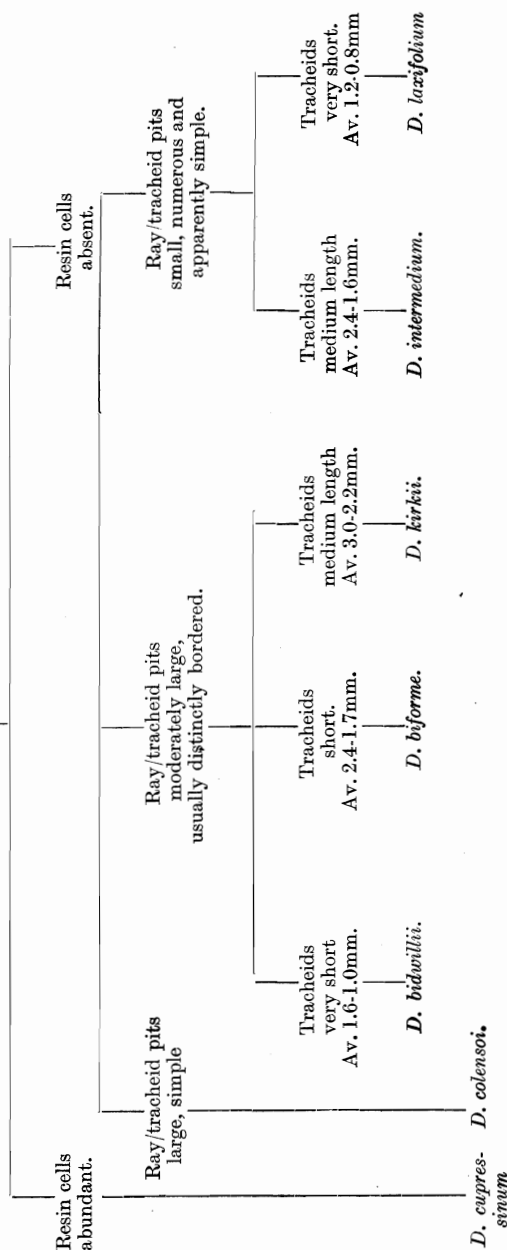
Number of rays per mm. in tangential section averages about 9; height of rays seldom exceeds 0.18 mm. with an average about 0.07 mm. *D. intermedium*.

(b) Tracheids extremely short (earlywood 1.2 mm., latewood 0.8 mm.) and with very small diameter (0.017 in earlywood). Ray/tracheid pits range from 2 to 7, occasionally up to 9, and average about 5 per cross-field. See Fig 6. *D. laxifolium*.

Key for the Identification of the N.Z. Dacrydiums by their Microstructure.

New Zealand Dacrydium spp.

Resin Cells



Conclusions.

1. The six species fall into logical groups as indicated by the key.
2. *D. bidwillii* is occasionally difficult to distinguish from *D. colensoi* on the basis of ray-tracheid pits; the latter are, in those cases, obscurely bordered. In other material supplied as *D. bidwillii* the ray-tracheid pits lack the extended borders shown in the drawing and the structure is closely related to that of *D. biforme*.

Summary.

A wide range of material of *Dacrydium* spp. indigenous to New Zealand has been examined. In this discussion of wood anatomy, rimu (*Dacrydium cupressinum*) is referred to briefly as having anatomical links with *Podocarpus* spp., rather than with its sister species in New Zealand. The latter comprise six recognized species referred to as the *silver pine group*; in general the heartwood of the five species attaining tree size is rated as durable in the ground. The feature emphasized as being of principal importance in separating the species is the shape, number and size of pits between ray cells and tracheids.

AERIAL FIRE PATROL IN THE ROTORUA DISTRICT 1945-46 FIRE SEASON

By F. J. PERHAM.

Introduction.

Although planes were first used for fire patrol duties in the Rotorua District in 1943, this article deals only briefly with the 1943-44 and 1944-45 fire seasons. It was from the experience gained then that the organisation for 1945-46 was built up.

Early in 1944 very dry conditions prevailed and a number of scrub fires raged. The haze and smoke from these made it impossible for lookouts or patrolmen to report their location accurately or to determine their potential danger. Accordingly the R.N.Z.A.F. was requested to provide a plane for general patrol duties and an Oxford was assigned for the purpose. This plane, later replaced by a Harvard was stationed at Rotorua Aerodrome. On all flights a forest officer was carried as an observer, but as the machine was not equipped with suitable radio, it was impossible to communicate with the Kaingaroa Forest radio station, ZLGA. All reports on location of fires or on action required were therefore transmitted by telephone after the plane landed. Nevertheless, the advantages of an aerial patrol were apparent, and from the experience gained during the few hours flown during this season, the foundations were laid for a similar service in the following year.

For the 1944-45 season arrangements were made with the R.N.Z.A.F. for an Oxford to be on call at any time from the Rukuhia Aerodrome. The machine was equipped with radio and communicated with ZLGA on 4750 kcs. This was the normal air force fre-