ABNORMAL RAYS IN THE WOOD OF EUCALYPTS

by

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Summary

Two types of abnormal ray tissue are described from the secondary xylem of two species of *Eucalyptus*. In *E. deglupta* Bl. (Kamarere), abnormal rays are similar to normal rays except for their size and a distinct reduction in the size of the ray parenchyma cells in the interior of the ray. In *Eucalyptus* sp. (red ironbark) abnormal rays consist of large areas of distorted tissue containing ray parenchyma often intermingled with obliquely oriented fibres and associated with severe grain distortion and prominent dimpling on the outer tangential surface of the wood.

Introduction

The xylem rays of eucalypts are almost exclusively 1–3-seriate but may reach 5 cells wide in rare specimens. They are homocellular or slightly heterocellular with 1–3 marginal rows of upright cells. Some species have rays occluded with extraneous materials while others do not (Dadswell, 1972).

Large abnormal xylem rays have, for instance, been reported in the following hardwood genera: *Acer* (Borthwick, 1905; Fink, 1982), *Alnus, Fagus, Fraxinus* (Fink, 1982), *Malus* (Borthwick, 1905) and *Ulmus* (Fink, 1982). A recent report has indicated that abnormally large rays are formed as a result of disturbance in the cambial zone, caused by adventitious root primordia (Fink, 1982).

Materials and Methods

Samples of *Eucalyptus deglupta* Bl. were provided by Dr. J. Kininmonth, Forest Research Institute, New Zealand. The samples originated from an exotic plantation in Western Samoa. Samples of *Eucalyptus* sp. (red ironbark) were provided by Dr. R.K. Bamber, Forestry Commission of New South Wales, Australia. Blocks from each sample were boiled for six hours before fixation in FAA solution for three days. Sections were prepared on a sledge microtome at a thickness of 20 μm. The sections were stained with toluidine blue 0, dehydrated in ethanol and mounted in DPX. All anatomical terms used are those defined by the I.A.W.A. (1964).

Observations

Eucalyptus deglupta (Fig. 1)

Large multiseriate rays from 5 to 13 cells wide are described. These rays are homocellular or heterocellular with 1–4 marginal rows of upright cells. Uniseriate tails, much shorter than the multiseriate portion of the ray, are present, containing procumbent and or upright cells. Ray height is slightly greater in the abnormal rays – up to 0.76 mm compared with up to 0.60 mm in normal rays. Procumbent cells in the interior of the ray are considerably smaller in tangential view than the outer cells.

Eucalyptus sp. (red ironbark) (Fig. 2)

Large multiseriate rays from 5 to 25 cells wide are described. These rays are homocellular or heterocellular with occasional upright cells interspersed amongst the procumbent cells. The rays are very irregular in shape, often appearing to be conglomerates with several bi- or triseriate tails at each end. Aggregate rays, involving obliquely oriented fibres as well as irregular areas of ray parenchyma 40–50 cells wide, are also present. Such aggregate rays are up to 20 mm or more in height and up to 3 mm wide. The size of the ray parenchyma cells in the abnormal rays is more or less the same as in normal rays except for occasional larger cells. The large rays are associated with prominent dimples in the outer tangential surface of the wood.

Discussion

Fink (1982) investigated the formation of abnormally large xylem rays in both hardwoods and softwoods and found that these structures were associated with adventitious root primordia. In the two species examined in the present report, the morphology of the abnormal rays is distinctly different, even though these species are closely related and their normal wood anatomy is similar. Grain distortion similar to that described in this report, has been reported in *Alnus glutinosa* (L.) Gaertn. (see fig. 4 in Fink, 1982), in association with adventitious root primordia. Assuming that adventitious root pri-

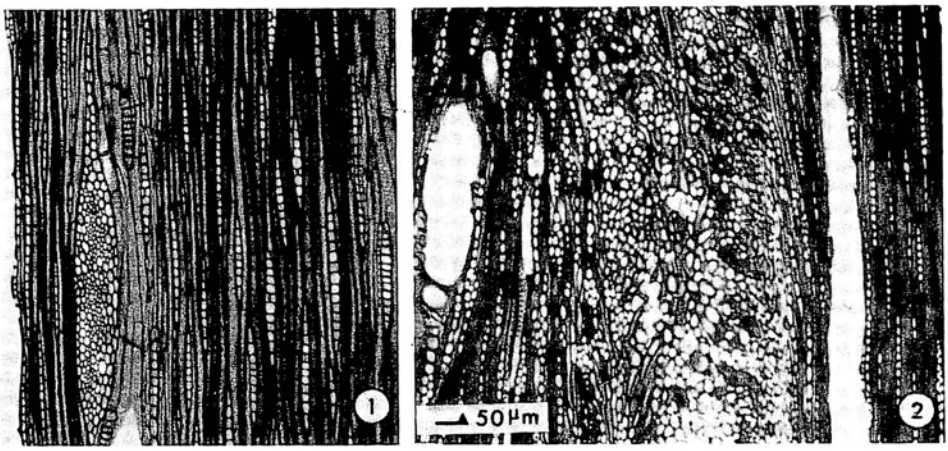

Fig. 1. *Eucalyptus deglupta*: TLS Large abnormal ray. Note the reduction in parenchyma cell diameter in the interior of the ray. — Fig. 2. *Eucalyptus* sp. (red ironbark): TLS Large abnormal ray. Note the grain distortion and the presence of fibres within the ray tissue.

mordia are responsible for the abnormal rays in the two eucalypt species, a possible explanation for the difference in the morphology of abnormal rays shown by these two species may be that in the red ironbark sample (*Eucalyptus* sp.) a much larger number of primordia were involved causing a more severe disturbance in the cambial zone. The alternative explanation is that the structures observed in this sample were formed as a result of some other traumatic disturbance. It has been suggested that this irregularity may be due to the presence of a foreign organism in the phloem causing a hormone imbalance and consequent disturbance of the cambium (Bamber, pers. comm.). In the absence of further information a definite conclusion cannot be made.

In both of the species examined, the abnormal rays are very rare and would not normally present a problem with identification of unknown samples.

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