WITHIN-A-TREE VARIATION OF WOOD ELEMENT SIZE IN TILIA JAPONICA

by

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Summary

The wood elements of *Tilia japonica* Simk. were identified in macerations and their size and frequency was studied in relation to distance from the pith and height level in the tree. Elements were classified into a 'vessel group' composed of vessel members, tracheid-shaped vessel members and vascular tracheids; and a 'fibre group' composed of libriform fibres and normal and abnormal fibre-tracheids. The abnormal fibre-tracheids are wide and short cells with blunt ends, mostly in contact with ray or axial parenchyma or vessel members. They are of frequent occurrence near the pith and rapidly decrease in frequency during the juvenile wood stage in *Tilia japonica* — they are considered to be derived from juvenile cambium. There is a gradual transition from abnormal via normal fibre-tracheids to libriform fibres. On the other hand abnormal fibre-tracheids are hard to distinguish from tracheid-shaped vessel members and vascular tracheids in transverse section because of their wide diameter. Tracheid-shaped vessel members and vascular tracheids are also a feature of the juvenile wood. Juvenile wood in the trunk is defined as the wood within a 5 cm radius. At lower height level the zone is broader, in the crown region it is narrower as judged from the radial variation of length, diameter and frequency of the wood elements.

Introduction

Basic density variations in a tree of *Tilia japonica* Simk. (Japanese basswood) were investigated and the age and growth effects on density were reported in a previous paper (Fukazawa & Ohtani, 1979), in which juvenile wood was characterised by its low density, and was defined as the region up to 7 cm from pith to bark at low height (below 1.3 m), 5 cm at medium height of the trunk and 2–3 cm near the crown. It was also indicated that the radial variation of cell percentages and wall thickness of wood elements were main factors to account for the age effects on density variation. These anatomical results were insufficient because it was difficult to distinguish the kinds of wood elements in cross section, especially in the juvenile stage.

In the present study wood elements were analysed and measured in macerated samples from pith to bark at different height levels, in order to define juvenile wood on anatomical criteria.

Material and Methods

The sample tree of *Tilia japonica* used in this study was the same as tree No. 1 in the previous paper (Fukazawa & Ohtani, 1979). The tree was 150 years old, and 22 m high, 8 m in clear length and its breast height diameter was 0.44 m. Small blocks and match-like sticks for maceration were taken at 1–5 cm intervals from pith to bark at the height of 1.3 m, 5.3 m and 11.3 m from the main stem. These were kept in the Jeffrey's solution (5% chromic acid with 5% nitric acid) at room temperature for about two weeks (Jeffrey, 1917). The macerated cells were stained with a 1% solution of methylene blue for one night and covered with glycerin-water. The size of cells was measured with a projecting microscope at a magnification of x 200.

Results and Discussion

Description of wood elements

In juvenile wood, especially near the pith, there were numerous unidentified cells with thin walls and small diameter as seen in transverse sections which we could not classify exactly in the previous study (Fukazawa & Ohtani, 1979). On the basis of their morphology as seen in macerations the wood elements could be classified into the following cell kinds:

A. Vessel members. Tubular elements with 2 simple perforations and spiral thickenings on the inner surface of secondary wall.

B. Tracheid-shaped vessel members. Cells resembling vascular tracheids except for having 1 simple perforation.

C. Vascular tracheids. Imperforate cells with spiral thickening.

D.1. Libriform fibres. Long, narrow cells with small simple pits and pointed ends.

D.2. Fibre-tracheids of the normal type. Fibre-like tracheids with bordered pits and pointed ends.
Fig. 1–3. Scatter diagrams of cell length and cell diameter. A: vessel members; B: tracheid-shaped vessel members; C: vascular tracheids; D1: libriform fibres; D2: fibre-tracheids of the normal type; D3: fibre-tracheids of the abnormal type.

Fig. 1:
Juvenile wood, 0–5 cm from the pith.

Fig. 2:
Juvenile wood, 1–2 cm from the pith.

Fig. 3:
Adult wood, 12–13 cm from the pith.