Structure of Tracheid in Different Height of *Pinus Koraiensis*

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Introduction

Evolutionin conifers has produced two distinct and somewhat antagonistic modes of selective pressure on tracheid morphology. Mechanical strength of conifer wood, important in tall trees, is highly correlated with length of tracheids, with longer tracheids providing greater strength. Under conditions of water stress, however, it has been hypothesized that shorter tracheids, due to their relatively narrower diameter, may be advantageous in conifers because of their greater conductive efficiency due to their resistance to negative xylem pressure potentials (Carlquist, 1975). There is clear evidence to relate increased mechanical strength to longer tracheids (Wardrop, 1951; Wellwood, 1962). Bannan (1965) found such variations caused by a variety of ecological factors including elevation, relative habitat aridity, and wind conditions. Even in the same individual, tracheid length varies with the age and nature of woody tissue. Woody tissue in young branches is not subject to great requirements of strength, and tracheid length is relatively short in comparison to trunk wood. In this report the variation of annual ring width, tracheid diameter and wall thickness were measured in *P. koraiensis* in different height of the tree.

Materials and Methods

Wood species used

18 years old *Pinus koraiensis* Sieb. et Zucc. was used for this experiment. The tree height was 9.5m. Wood samples were collected from Kangwon National University reserve forest at breast height. Immediately after collection, discs were made and kept in air tight cellophane bag to protect the moisture loss.

Annual ring measurement

Collected sample was marked first to identify the butt end from top end. From the ground to 2.0m, 4.0m and 6.0m above, discs with 2-3cm thickness were made. From bark to pith samples were made for microscopic observation.

Tracheid diameter and wall thickness

1x1x1cm samples were made from pith to bark in considered height. After softening the, 15-30μm cross sectional samples were made by sliding microtome. Permanent slides were made after treating with safranine solution. Tracheid diameter in tangential and radial direction was measured for both in early and latewood.

Results and Discussion

Annual ring width

Annual ring width was measured to observe the variation in different plant height from pith to bark showed in figure 1. From bark to 3rd it had tendency to produce clear and wider annual rings. The frequency of annual rings was found lower with increasing plant height and this result also supported by Lim, 1985 according to the nutrition theory.

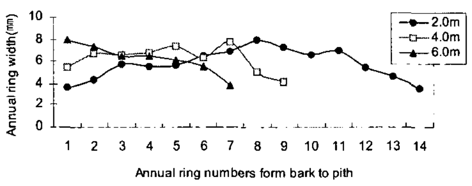

Fig.1 Variation of annual ring width from bottom to top (*P. koraiensis*).

From pith to 6 or 7 annual rings, width was found the highest and gradually decreased. Distinct region between juvenile wood and matured wood was not found clearly in this species.

Tracheid diameter

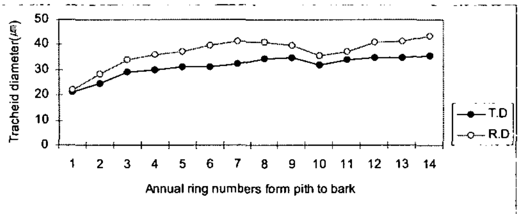

Fig.2 comparison of tangential tracheid diameter with radial tracheid diameter in early wood of *P. koraiensis*.

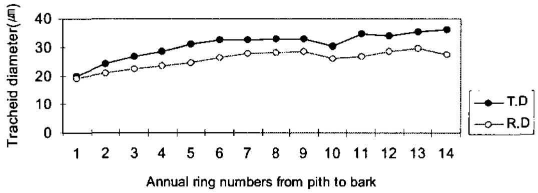

Fig.3 Comparison of tangential tracheid diameter with radial tracheid diameter in late wood of *P. koraiensis*.

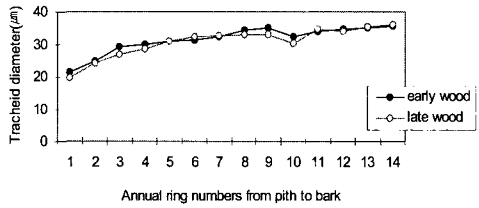

Fig.4 Comparison of early wood tangential diameter with late wood tangential diameter in *P. koraiensis*.

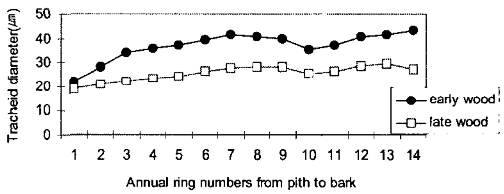

Fig.5 Comparison of early wood radial diameter with late wood radial diameter in *P. koraiensis*.

Radial tracheid diameter of *L. kaempferi* was found higher than that of tangential tracheid diameter in earlywood. But it was found opposite in latewood (Fig. 2 and 3). With the increase of annual ring, tracheid diameter also increased. Earlywood tracheid diameter was found higher than latewood tracheid diameter. Radial tracheid diameter varied considerably from earlywood to latewood due to lignification (Fig. 4 and 5).

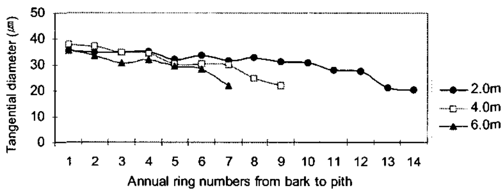

Fig.6 Variation of tangential diameters of early wood tracheid (*P. koraiensis*).

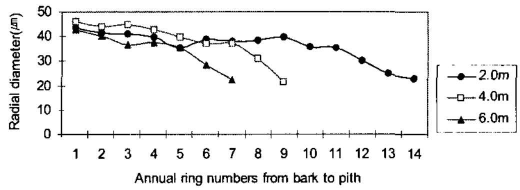

Fig.7 Variation of radial diameters of early wood tracheid (*P. koraiensis*).

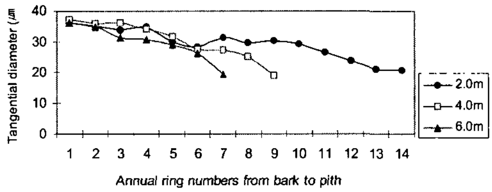

Fig.8 Variation of tangential diameters of late wood tracheid (*P. koraiensis*).

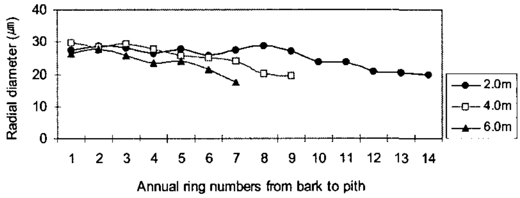

Fig.9 Variation of radial diameters of late wood tracheid (*P. koraiensis*).

Tangential and radial diameter of earlywood and latewood tracheid followed the same pattern. With the increase of tree height, tangential and radial diameter increased from pith to bark (Fig. 6, 7, 8 and 9). 2.0m above from the ground, diameter of tracheid was found the highest and it gradually decreased with increasing the plant height.

Tracheid wall thickness

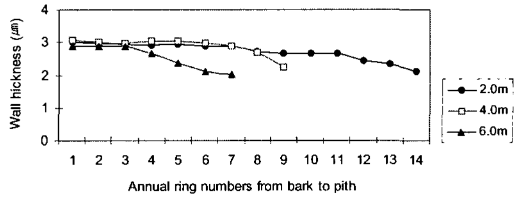

Fig.10 Variation of tracheid wall thickness in early wood (*P. koraiensis*).

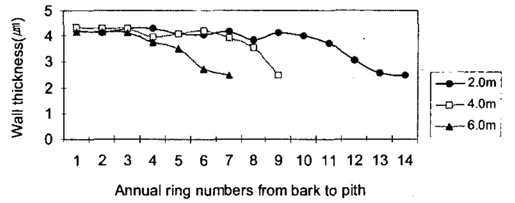

Fig.11 Variation of tracheid wall thickness in late wood (*P. koraiensis*).

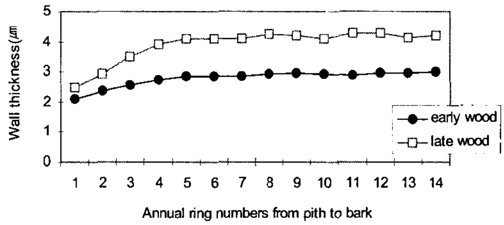

Fig.12 Comparison of tracheid wall thickness of early wood with one of late wood (*P. koraiensis*)

Tracheid wall thickness was found highest in 2.0m height from above ground samples and it increased gradually from pith to bark (Fig. 10 and 11). Latewood wall thickness was found higher than earlywood tracheid thickness. This is because of lignification in latewood growth. From pith to bark, tracheid wall thickness increased gradually. In earlywood the average range of tracheid wall thickness was found on an average of 2.1-3.0㎛㎛ where as in latewood it was found 2.4-4.2㎛㎛.

Conclusion

The investigation of the annual ring width, tracheid diameter and wall thickness measured in the level of tree height of *Pinus koraiensis*. The higher the height of the tree, the wider the tree annual ring width, tracheid diameter and tracheid wall thickness. But the tracheid diameter and the wall thickness showed a tendency to decrease at a tree height.

References

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