

The Effect of Auxin on the Polarity of Tracheid Arrangement in *Pinus Thunbergii**¹

Mariko KIYOSHIGE*², Moritoshi IINO*³ and Takao ITOH*²

(Received June 1, 1998)

Keywords: auxin, tracheid, *Pinus thunbergii*

Introduction

It is generally known that tracheids, fibers, vessels and axial parenchyma cells are all arranged in vertical direction, while ray parenchyma cells and ray tracheids in transverse direction in almost all forest trees growing vertically. What is the major agent that controls such arrangement of xylem cells? The agent is not a gravity because it is known that the arrangement of fusiform initial cells gradually change from longitudinal to transverse direction after specific girdling of bark^{1,2)}. It is also known that auxin in the stem is transported through cambial zone³⁻⁵⁾. We hypothesized that auxin may effect on the polarity of tracheid arrangement after girdling of bark, and tried to prove the relation between auxin polar transport and tracheid arrangement.

Materials and Methods

Two hundred seedlings of 4 years old *Pinus thunbergii* were purchased and planted on February 1997 in a nursery of Wood Research Institute, Kyoto University, Uji, Kyoto, Japan. The girdling was done at 10 cm above the ground in 130 stems on April 23, 1997 (Fig. 1). Then, 3 wood blocks (3×5×6 mm) were cut with handy saw to collect transverse part of bridges every week, until August 27. For auxin-transport studies the wood blocks were placed between 1.2% agar blocks (6×6×3 mm), which were kept in vertical position and in contact with the newly cut surface. The donor blocks were always on top and the receiver on the bottom. The donor blocks were loaded with (5-³H) Indole-3-acetic acid. During auxin-transport experiments the blocks were kept in closed plastic boxes over wet

*¹ A part of this work was presented at the 48th annual meeting of Japan Wood Research Society in Shizuoka, April, 1998.

*² Laboratory of Cell Structure and Function.

*³ Botanical Gardens, Faculty of Science, Osaka City University, Kisaichi, Katano-shi, Osaka, 576, Japan.

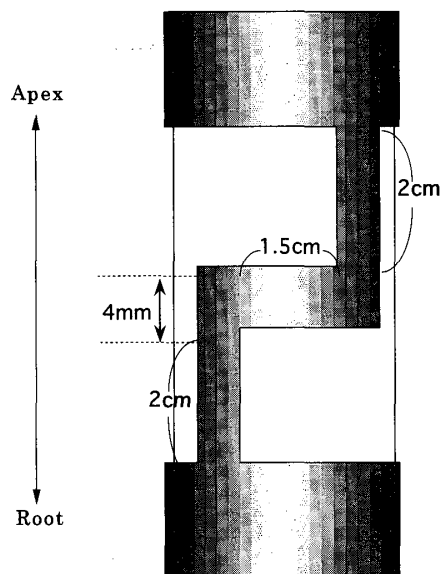


Fig. 1. Form of girdling.

filter paper. The old receiver blocks were renewed every one hour and the radioactivity of old one was counted in scintillation solution. After the termination of individual auxin-transport experiment, the transverse and tangential sections were cut from wood blocks by a microtome, followed by the observation of the change of tracheid arrangement using a light microscope.

Results and Discussion

After the initiation of girdling, the increase of radioactivity which suggest the actual flow of auxin from right to left was first observed on 56th day. Then, the radioactivity gradually increased (Fig. 2). On 70th day after girdling, the level of radioactivity was the same with or higher than control radioactivity which was counted as longitudinal flow of auxin in intact trees. No increase of radioactivity from left to right was counted throughout the experimental period, which suggests no auxin flow from left to right was detected during the experimental period. This result shows that the transverse auxin polar transport was established at 70th day on transverse bridge.

The change of the arrangement of fusiform initials was estimated from measuring their transverse cell length measured on transverse section. The length gradually increased from 56th to 84th day, and abruptly increased from 84th to 126th day. These results were in good contrast with stable auxin transport that appeared after 70th day. The evidences suggest that the establishment of transverse auxin transport is preceded to the change of cambial initials arrangement to the transverse direction. It was presumed that the directional flow of auxin may be involved in the arrangement of tracheids.

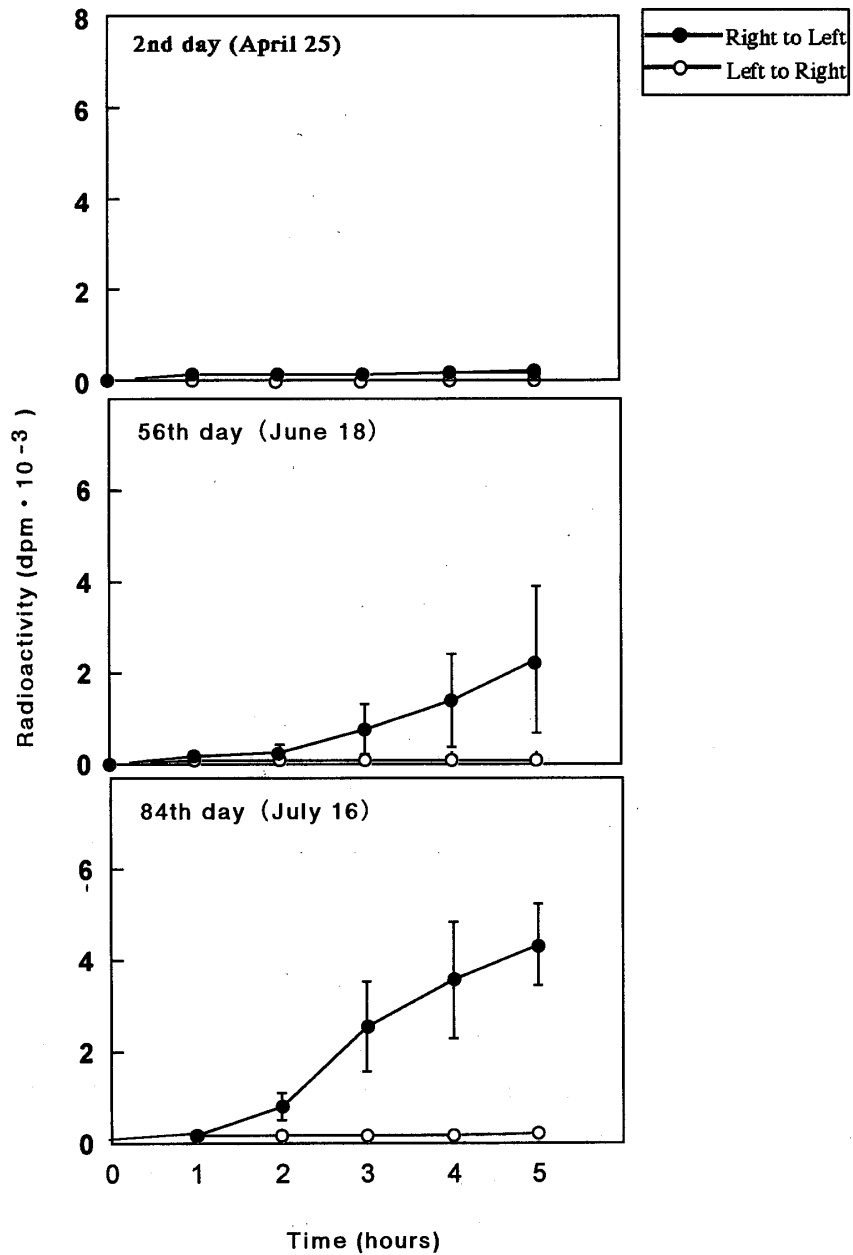


Fig. 2. Transverse transport of auxin.

References

- 1) H. KIRSCHNER, *et al.*: *Israel J. Bot.*, **20**, 184–198 (1971).
- 2) B. ZAGORSKA-MARK and C.H.A. LITTLE: *Can. J. Bot.*, **64**, 1120–1128 (1986).
- 3) M. JACOBS: *Plant Physiol.*, **14**, 17–21 (1983).
- 4) C. UGGLA, *et al.*: *Proc. Natl. Acad. Sci. USA*, **93**, 9282–9286 (1996).
- 5) T.J. WODJICKI, *et al.*: *Plant Physiol.*, **84**, 135–143 (1987).