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# GROWTH OF *PRUNUS* TREE STEMS UNDER SIMULATED MICROGRAVITY CONDITIONS

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## ABSTRACT

Stem growth of *Prunus* trees under simulated microgravity conditions was examined using a three-dimensional clinostat. The stems elongated with bending under such conditions. Stem elongation and leaf expansion were both promoted, whereas the formation of xylem in the secondary thickening growth was inhibited under the simulated microgravity condition. In secondary xylem, sedimentable amyloplasts were observed in the 1g control. The present results suggest that stem elongation and leaf expansion may be inhibited at 1g, while growth direction and secondary xylem formation depend on a gravity stimulus. A space experiment is expected to advance research on thickening growth in trees. 

## INTRODUCTION

There have been several researches on growth and differentiation of herbaceous plants under simulated microgravity using a 3D (three dimensional) -clinostat (Hoson *et al.* 1992, 1995, 1997; Kasahara *et al.* 1994). However, comparable research on woody plants has not yet been reported. The present paper reports the growth of stems in *Prunus* trees under simulated microgravity condition by means of a 3D-clinostat. Stem growth was examined mainly with respect to the characteristics of secondary xylem which makes it possible for a tree to grow straight on the

earth. Moreover, sedimentable amyloplasts in secondary xylem were observed.

## MATERIAL AND METHODS

Seedlings of *Prunus jamasakura* Sieb. ex Koidz were used as the plant material, the germination rate of which is the best among those of several Japanese flowering cherries tested. Germinated seedlings (Nakamura 1992) with the root, 2 to 3 mm long, were sown, and their roots were oriented towards the bottom of pots containing a mixture of Jiffy 7 (Jiffy products Ltd., Norway) and vermiculite. The pots were attached to plastic cases which were attached to the stage of the 3D-clinostat. The running conditions of the 3D-clinostat were controlled with a personal computer; the rotation was 1 to -1 (reverse direction) rpm, the photoperiod was 12.5h light with 70 $\mu$mol $mm^{-2}s^{-1}$, and 11.5h dark. The room was conditioned at 22℃ and 70% relative humidity. The seedlings were cultured during 4 weeks on the 3D-clinostat (Yamada *et al.* 1993, Hoson *et al.* 1997, Yamashita *et al.* 1997). The control seedlings were cultured with the same environmental conditions except that no clinostating was involved. The seedlings cultured in these two conditions are referred to as the 3D-clinostated and the 1g control, respectively. The measurement of leaf length was done using the leaves outgrowing from the middle part of the stems. The comparison of the characteristics of the secondary xylem between the 1g control and 3D-clinostated were carried out by using the sections from the basal internodes in the non-elongating zone of each stem. The methods for anatomical analysis was carried out as reported previously (Baba *et al.* 1995).

## RESULTS AND DISCUSSION

The stems of the 3D-clinostated elongated with bending, while the stems of the 1g control elongated straight ( Fig 1). The mean stem length of the 3D-clinostated was greater than that of the 1g control (Fig 2,A). The mean number of internodes of the 3D-clinostated was more than that of the 1g control (Fig 2,B). The mean length of long axis of leaves in the 3D-clinostated was longer than that in the 1g control (Fig 3).

The widths of stems were hardly changed between the 1g control and the 3D-clinostated; however, the widths of bark and pith of the 3D-clinostated plants were greater than those of the 1g control, and the width of the secondary xylem of the 3D-clinostated plants was thinner than that of the 1g control (Fig 4). In order to determine whether the differences in the width of the xylem were brought about by changes in the diameter of individual fiber cells or by changes in the number of fiber cells, the diameters of cells were examined. As shown in Figure 5.A, no significant difference between the diameters of the cells in the 1g control and 3D-clinostated was found. From these results, it appears that the decrease in the width of secondary xylem of the 3D-clinostated stems may be caused mainly by the smaller number of fiber cells. At least, cambial activity to form xylem in the stems of the 3D-clinostated was lower than that in the 1g