Toxic effect of aluminium in soil water on water uptake and growth of beech, cedar and tea plant seedlings under different light intensity

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Introduction
The preliminary experiment of herbaceous plant showed that aluminium (Al) toxic on growth of grasses grown under the same Al concentration in soil water was different by light intensity. We got a hypothesis that the objective would be induced by different water uptake. Therefore, the objective research is to determine how the light intensity and water uptake affect on the toxicity of Al concentration for beech, cedar and tea plants.

Materials and methods
Seedlings of beech (Fagus crenata Bl.), Japanese cedar (Cryptomeria japonica D.Don) and tea plant (Camellia sinensis L.) were grown by water culture in greenhouse during April to October 2001 under three different levels of light intensities of 100%, 80% and 60%, respectively. Light intensity of 100% means full light intensity in the greenhouse, while 80% and 60% mean shaded with mesh net by 80% and 60%, respectively. The water culture solution were prepared according to Hoagland solution and Tanaka et al. (1981). These solution were dissolved in deionized water. As for Al treatment, the concentrations of Al were 0, 25, 50, 100 and 200 ppm. During the growth experiments, the water culture solution was drained and replaced every 3 weeks. The pH of the water culture solution was adjusted every 3 days to pH 4.0 with solution of HCl (0.1N) or NaOH (0.1 N).

Results and discussion
Comparison among three light intensity treatments as a whole for three tree seedlings, shading to 80% and 60% decreased dry matter weight than 100% (fig.1). The result showed that root, stem and leaf dry weight of cedar decreased with increasing Al concentration under 100% light intensity (fig.1). But in 60% light intensity treatment the dry weight of root, stem and leaf did not show decreasing tendency with increasing Al concentration. As for beech, although root and stem dry weight showed slightly decreasing tendency under 100% light intensity, root and stem dry weight of 60% light intensity treatment showed slightly increasing tendency. In case of tea plants of 100% light intensity, root and stem dry weight showed decreasing tendency with increasing Al concentration, however leaf dry weight of tea plants showed increasing tendency. In 60% light intensity treatment, the dry weight of root and stem showed increasing tendency except 0 ppm treatment (fig.1). As for 80% light intensity treatment showed intermediate between those of 100% and 60%. As a whole, the present experiment implies that the toxicity of Al on plant growth for three tree seedlings decreases or disappears even grown under very high Al concentration if these tree plants are grown under shading condition.

Fig.1 Effect of Al on root, stem and leaf dry matters of cedar, beech and tea plants under different light intensity treatment. The values followed by different letters are significantly different according to Duncan’s multiple range tests (p<0.05)