Study on the Physiological Reaction of Evergreen Broad-Leaved Trees to Light and Temperature (II)

—Effect of shading treatment on seasonal photosynthetic rates—

Fac. of Agr., Kyushu Univ. Mansur FATAWI
Tamio SUZAKI

I. Introduction

In the previous report, the effects of various constant growth temperature treatments on photosynthesis of some evergreen broad-leaved trees were discussed.

In this paper, the effects of shading treatment on seasonal photosynthetic rates of young evergreen broad-leaved trees through a year were studied.

II. Material and Method

Around two and half year-old young trees of *Cinnamomum camphora, Cyclobalanopsis glauca, Distylium racemosum* and *Machilus thunbergii* were used for the experiment. 90 pots with each two seedlings were shaded with black screen net adjusting the relative light intensities of 13, 22, 36, 60 and 100 % respectively.

The rate of photosynthesis in winter, spring and summer seasons were measured on February, May and August, 1983 after shading treatments during each 10, 13, and 16 months in a nursery under natural temperature regime. The photosynthetic rates were measured under the measuring light intensity of 5, 10, 20, 30 and darkness, by suing of Infrared Gas Analyser (Hitachi-Horiba) and the changeable illumination system with spattering shadow-less lamps. In winter and spring, the photosynthesis were measured under the temperature of 20 ℃ and in summer 25 ℃. The differences of photosynthetic activity of light intensity in each treatment were analysed by comparing with parameter a, b, b/a in the light-photosynthesis curve formula:

$$P = \frac{bI}{1 + aI}$$

P : Photosynthetic rate
I : Light intensity on leaf surface
a, b : Factors according to species and/or leaf characteristics

In these parameters, larger *a* means more quick reaching to photosynthetic saturation, while larger *b* means more effective photosynthesis in low intensity of light. *b/a* shows a photosynthetic rate under the saturation of light.

III. Results

a) The parameter *a* (Fig. 1)

In winter, the value of *a* of all species was small. In spring the *a* values of *C. glauca* and *M. thunbergii* became larger than winter at the middle range of light intensity, and other two species did not show so much change. The value of *C. camphora*, however, showed negative relation with light intensity or positive to shade intensity. In summer, the values of *D. racemosum* and *C. glauca* became larger than spring and other two species showed more or less same as in spring. However the relation to light intensity was observed as clear correlation.

b) The parameter *b* (Fig. 2)

In winter, the values of *b* of all species were smaller than other seasons, and showed negative correlation with light intensity. In spring, the values became large and showed maximum value at 36 % of relative light intensity in all species. In summer, the value of *D. racemosum* and *C. glauca* became larger than spring, but relation to light intensity did not differ with spring. The value of *M. thunbergii* did not change so much, but the relation to light intensity showed negative correlation. The value of *C. camphora* decreased in the heavy shading and showed maximum value at 60 % of light intensity.

c) The value of parameter *b/a* (Fig. 3)

In winter, the value were less than other seasons, but did not reduce to zero. The relation of it's value to light intensity of *C. glauca* and *C. camphora* showed convex curve, however *M. thunbergii* and *D. racemosum* showed negative correlation. In spring the values of *C. camphora* and *D. racemosum* increased, but the relation to light did not differ from winter. In *C. glauca* and *M. thunbergii* the value did not change so much, but relation to light intensity showed tendency to change over. In summer *C. camphora, D. racemosum* and *C. glauca* showed large value, and *M. thunbergii* showed smaller than other species. In relation to light intensity, *D. racemosum* and *C. glauca* had positive correlation with light intensity.

IV. Discussion

From the results mentioned above, the influence of shading treatment to seasonal photosynthesis can be determined as follows:

a) Photosynthesis in winter is tend to increase slightly at the shading. This seems to be due to avoiding from low temperature under shading treatment.

b) The photosynthesis in open treatment decreased in summer, owing to high temperature and strong light, while the decrease in photosynthesis was not observed under the weak shading.

c) The sensitivity to light differ from species and season. In some species the photosynthetic rate rose quickly in low range of intensity of light, while others delayed. This seems to relate to the native of species and growing temperature.

d) As natural characteristics, *M. thunbergii* and *D. racemosum* were seemed to be tolerant.

References

(1) Futawi, M. and T. Suzuki: Bull. Kyushu Br. Jap. For. Soc., No. 36, 65-66, 1983.

(2) Tamiya, H.: Bot. Mag., Tokyo, 64, 167-173, 1951.

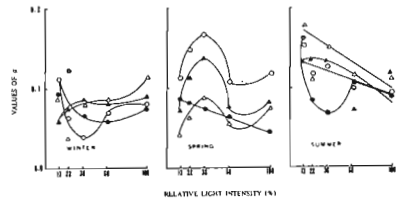

Fig. 1 Relative Light Intensity and *a* Parameter Values of *C. glauca* (○), *C. camphora* (●), *D. racemosum* (△) and *M. thunbergii* (▲).

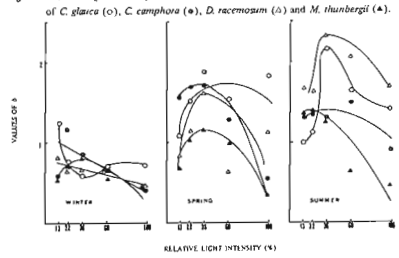

Fig. 2 Relative Light Intensity and *b* Parameter Values of *C. glauca* (○), *C. camphora* (●), *D. racemosum* (△) and *M. thunbergii* (▲).

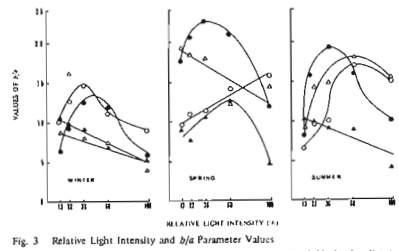

Fig. 3 Relative Light Intensity and *b/a* Parameter Values of *C. glauca* (○), *C. camphora* (●), *D. racemosum* (△) and *M. thunbergii* (▲).