Seedling growth and photophysiology of Quercus austrocochinchinensis under two light levels

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Introduction
Protecting endangered species is an important part of conservation. Quercus austrocochinchinensis is an evergreen tree of the Quercus subgenus cyclobalanopsis Oerst. of Fagaceae. Q. austrocochinchinensis is an endangered oak species, which has only been identified at two sites in Yunnan province and Hainan province in China. Q. austrocochinchinensis is distributed in ravines in southwest China, northern Thailand, Vietnam, and Laos at elevations of 700 to 900 m. Because of tree felling, the distribution and population size of this species are both declining rapidly. At the same time, this species hybridizes with other common species, which might accelerate its extinction. The objective of this study was to compare the growth characteristics of Q. austrocochinchinensis seedlings under two light levels.
Material and Methods
Q. austrocochinchinensis seeds were collected from Pu-Er, Yunnan Province, in September 2011. Seeds were kept in a 4°C refrigerator before being sown on October 21, 2011. Seeds were sown in 32-cell plug trays with 60% peat and 40% perlite mix as a substrate. When the young seedlings reached 20 cm in height, they were transplanted into 18-cm plastic pots containing the same potting mixture. These seedlings were separated into two groups and grown under two different light levels in a greenhouse. The maximum PAR(Photosynthetically available radiation) of the high-light and low-light treatments was 530 and 150 μmol*m-2*s-1 respectively. Plant height, leaf number, and stem diameter of seedlings were measured monthly. Leaf chlorophyll content, stomatal density, chlorophyll fluorescence, and rapid light response curves were also measured at the end of experiment.
Results
Q. austrocochinchinensis had a low rate of seedling emergence (21.88%) and some seedlings died during the experiment, which may explain why Q. austrocochinchinensis is rare.
Seedlings differed considerably with respect to plant height, number of leaves, and stem diameter, especially the number of leaves under the low-light condition. The growth rate during the winter was slow, and growth started from February onwards. The higher number of lateral shoots on seedlings grown under the high-light conditions was of interest and might be explained by Q. austrocochinchinensis being shade tolerant; therefore, high light levels may have adversely affected the shoot growth of dominant seedlings.
The chlorophyll content of Q. austrocochinchinensis grown under high-light conditions was 3.17 mg/g for new leaves and was 2.88 mg/g for old leaves. At low light levels, the chlorophyll content of new leaves was 4.01 mg/g and that of old leaves was 3.39 mg/g. Leaf chlorophyll content of seedlings grown under low-light conditions was higher than that of seedlings grown under high-light conditions. In addition, the differences observed between new and old leaves under high light were greater than the differences observed between new and old leaves of seedlings grown under low light.
The stomatal density of Q. austrocochinchinensis under low light levels (318.42/mm2) was higher

than that under high light levels (286.84/mm2).
Chlorophyll fluorescence and rapid light curve, ETR raises with the increase of PAR, then reached saturation and remained stable. Q. austrocochinchinensis had higher ERT max under low light levels.
Conclusion and Discussion
Q. austrocochinchinensis had a low seedling emergence rate, and some seedlings died during the experiment. Q. austrocochinchinensis presented large differences among its seedlings, suggesting that the quantity of seedlings should be increased.
Research on Q. austrocochinchinensis in biological engineering and physiology has been lacking. This study presents valuable information on Q. austrocochinchinensis and may be helpful in the recovery of this endangered species.

キーワード：Quercus austrocochinchinensis、Seedling growth 、Photophysiology 、Light level
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