



A soil temperature control system for ecophysiological study in alpine regime

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Mountain is more sensitive to global change, and its temperature increases more than that in low elevational area in the recent decades. How responses of understory saplings in alpine regime to soil warming are poorly understood, due to a lack of suitable facility for the study. Thus, a soil temperature control system was designed for ecophysiological study in alpine regime and tested in the alpine station (approximately 3,000 m elevation) of Mt. Gongga Forest Ecology Research Station at the Institute of Mountain Hazards and Environment, Chinese Academy of Science, from April 28 to August 14, 2009. The control system consisted of a power switch, voltage regulator, microcomputer timer, safety relays, temperature control devices, temperature sensors, heating cables, fireproofing plastic pipes (PVC), 108 heavy-duty plastic containers and seedlings. The heating cables were held in six 2-layer PVC frames with 25-cm wide, 320-cm long and 25-cm high, and installed in six ditches of 30-cm wide, 330-cm long and 30-cm deep for 20°C and 25°C soil temperature treatments, respectively; and three 1-layer frames with 25-cm wide and 320-cm long for the 15°C treatment. 12 seedling containers with 20-cm top diameter, 18-cm bottom diameter and 25-cm high were homogenously placed at each of the ditches, and spaces between the containers were filled with natural soil. The system was economic, and increased soil temperatures both obviously and uniformly, the maximal and minimal standard errors of soil temperatures were ± 0.276 and $\pm 0.050^\circ\text{C}$ at 10-cm depth in the containers within each of all the ditches. In the system, aboveground environment was natural, diurnal and monthly soil temperatures changed with changing air temperature, the research results may be better to know the ecophysiological responses of the saplings to soil warming than that in greenhouse, laboratory and open top chamber.

Key words: alpine mountain, ecophysiology, seedling growth, soil temperature control system