

## 6 Physiological and Biochemical Responses of Cucumber and Figleaf Gourd to Low Root Zone Temperature

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Chilling-sensitive cucumber (*Cucumis sativus* L. cv. Chung-Jang) and -tolerant figleaf gourd (*Cucurbita ficifolia* Bouché) were used to investigate the root acclimation process. Various physiological parameters such as leaf temperature, photochemical efficiency of photosystem II, photosynthetic activity, stomatal resistance and gene expression confirmed that the two species differ response to low root zone temperature. The plasma membrane vesicles of figleaf gourd could safely be obtained by the two-phase partitioning method devised by Larsson (1983) for cucumber plants. The inhibitor effect, pH dependence, stimulation by Triton X-100, the H<sup>+</sup>-pumping, and reconstitution of membranes with asolectin confirmed that the plasma membrane H<sup>+</sup>-ATPase obtained was of high purity. Low root zone temperature activated the H<sup>+</sup>-ATPase and H<sup>+</sup>-pumping activity in the root plasma membrane of both species, in a time-dependent manner. In cucumber plants, the high activity lasted to about day 1 at 10°C of root zone temperature, followed by a decrease. However, figleaf gourd root systems maintained the high activity at 6°C until at least day 6. The H<sup>+</sup>-ATPase gene expression pattern in the root of cucumber and figleaf gourd during the cold acclimation was examined by northern and western analyses. Using the anti-*Arabidopsis* plasma membrane H<sup>+</sup>-ATPase, the corresponding gene product at the position of approximately 100 kDa in both species was detected. In cucumber, the plasma membrane H<sup>+</sup>-ATPase gene expression was repressed as the time of exposure to low temperature prolonged up to day 6, while the same gene expression in figleaf gourd continuously increased up to day 6. This result suggests that the plasma membrane H<sup>+</sup>-ATPase gene expression in the root of both species seems to be transcriptionally and/or post-transcriptionally regulated by low root zone temperature but the pattern is different between the two species, indicating different genetic backgrounds for cold acclimation. In conclusion, normal water absorption was required for adaptation process that is achieved by H<sup>+</sup>-ATPase of root plasma membrane, which may be an important mechanism at least for figleaf gourd plants.

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