

# Organ specific spatio-temporal patterns of circadian clock in lettuce

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## Abstract

Plant circadian clock controls many physiological events by synchronization with environmental changes. The clock can be controlled artificially by imposing various light conditions in a closed system for plant cultivation in plant factory. The plant circadian rhythm is formed by enormous self-sustained cellular circadian oscillators, so that the synchronization of circadian oscillators is of great importance to the formation of individual circadian rhythms. Therefore, the study of synchronization phenomena is important for precise control of the circadian rhythm. This study investigated the spatio-temporal dynamics of circadian oscillators in lettuce (*Lactuca sativa* L.). Bioluminescence of transgenic lettuce carrying a *CCA1::LUC* construct, as a reporter of a circadian gene expression, was measured in the leaf and root. The phase of wave propagation in the leaf was observed: with a phase delay in the region of the primary vein, and with the primary vein region showing lower amplitude than other regions. Wave propagation occurred from the edge of the leaf inward. In addition, a striped wave travelled from the base to the tip along the roots, which were grown under continuous dark or light conditions. The features observed in the lettuce plants could be explained by phase oscillator models established in the study of *Arabidopsis thaliana*. The results of this study showed the possibility of applying circadian clock control in a model plant for plant production.