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DISSERTATION SUMMARY

Isolation and characterization of redlip, a novel circadian clock mutant in *Arabidopsis*

Balázs Fehér

Institute of Plant Biology, Biological Research Center, Hungarian Academy of Sciences, Szeged, Hungary

Many physiological and biochemical processes in plants exhibit endogenous rhythms with a period of about 24 hours. These rhythms are generated and maintained by an internal timing mechanism, the circadian clock, which enables plants to anticipate the forthcoming rhythmic changes in the environment and to temporally coordinate their internal processes. In model organisms, such as *Neurospora*, *Drosophila*, mice and cyanobacteria, several key components of the circadian clock have been identified and their functions in the clock mechanism have been well described. In plants, however, only few elements of the central oscillator have been characterized and little is known about their functional interactions.

In order to learn more about the molecular structure and function of the circadian clock in *Arabidopsis*, a luciferase imaging-based mutant screen (Millar et al. 1992) has been carried out and several mutants showing aberrant rhythmic expression of the CAB gene (coding for the chlorophyll a/b-binding protein) have been identified. As a result of this screen we have identified several previously described clock genes: 11 allels of zeitlupe (ZTL), an early flowering 3 (ELF3), a timing of CAB (TOC) and a completely new mutation, red light insensitive period (redlip), that shortens the period length of CAB expression under constant darkness (DD) and constant light (LL). All other clock-controlled processes examined, including the expression of the cold-circadian rhythm-RNA-binding 2 (CCR2) gene (Carpenter et al. 1994) and the rhythm of leaf movement, showed similar period shortening under free-running conditions. To investigate which part of the circadian system is affected by the mutation, fluence rate curves (FRCs; Covington et al. 2001) have been created by determining the effect of different light intensities on period length. In contrast to wild type, the free running period length in the mutant does not change significantly under varying red light intensities, suggesting a role for REDLIP in the regulation of the light sensitivity of the central oscillator. To determine whether REDLIP's action is phase dependent, we examined clock resetting by using light pulses and constructed phase response curves (PRCs; Covington et al. 2001). Mutation causes a significant alteration of the phase response curve end of the subjective day and early phase of the subjective night, suggesting that REDLIP has important role in light input to the clock during this time. The mutation is mapped to a region of chromosome 5 where already known clock genes are localized. However, comparative sequencing of the already known clock genes revealed that they are unchanged in the mutant, which means that REDLIP is a novel component of the *Arabidopsis* circadian clock.

References

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Supervisor: Ferenc Nagy
E-mail: feherb@nucleus.szbk.u-szeged.hu