CIRCADIAN CLOCK

Imaging plant rhythms

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Credit: nikamata / E+ / Getty

Circadian rhythms are the approximate 24-h activity cycles of various biological processes regulated by an innate circadian clock in almost all living organisms, such as the sleep–wake cycle of animals. Plants do not sleep, but they have rhythmic cycles in a range of physiological activities, including photosynthesis, growth, leaf movement, flower blossom, volatile emission and many others. Recently, Yuri Dakhiya and Rachel Green, at the Hebrew University, Israel, reported that the circadian clock also controls leaf temperature; therefore, they developed an effective thermal imaging approach to monitor the circadian rhythms in plants.

To measure the intrinsic temperature fluctuations of plant leaves, Dakhiya and Green equipped their FytoScope growth chamber with a thermal camera. They tested the system by transferring *Arabidopsis* plants from the long-day growth condition to constant light, under which thermal measurements were made on leaves at 5-min intervals. The soil in the pots was covered to reduce water evaporation that affects background temperature. They also set up multiple pieces of aluminium foil in the chamber to work as background standards. The measurements of wild-type (Col-0) plants displayed obvious 24-h oscillations, suggesting leaf temperature is under rhythmic regulation. And, as predicted, these oscillations are correlated with stomatal open–close cycles and the activity of non-photochemical quenching. The method was also sufficiently sensitive to distinguish the rhythmic differences between the wild type and several circadian clock mutants. In addition, they applied the system to monitor circadian rhythms of wild barley, petunia, coleus, tomato, begonia and maize. The results suggest that this fast, non-invasive method is applicable for a broad range of plant species.

Further implementations of the method might help to increase the resolution and possibly make it real-time. This study also reflects an increasing demand for robust, fast, smart and economic tools in plant research.

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