Short Communication

Atsushi TAKIMOTO*: Timing Mechanism Determining the Critical Dark Period in *Pharbitis nil*

滝本 敦*: アサガオの限界暗期を決定する計時機構

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There are at least three kinds of timing mechanisms in the photoperiodic response of *Pharbitis nil*^{1,2)}. The first, which is very temperature dependent, is similar to an hourglass in that increasing the duration of the dark period results in a linear increase in the flowering response. The second, the light-on rhythm, is an endogeneous circadian rhythm which starts at the beginning of the light period. The third, the light-off rhythm, is also an endogeneous circadian rhythm which starts at the beginning of the dark period, and has a red sensitive phase with a maximum 8 hours after the onset of darkness. How is the critical dark period determined? The

Fig. 1. Flowering response to light-dark cycles of various durations. The different curves give the responses for treatments with different lengths of photoperiod. Seven cycles were given consecutively, separated from the preceding continuous illumination by 8 hours of darkness. Numbers adjacent to each curve show the length of the light period in hours.

critical dark period is little affected by temperature, unlike the first type of timing mechanism, the hourglass response. The determining factor may therefore be either one or both of these circadian rhythms.

Pharbitis seedlings (strain Violet) were subjected to seven light-dark cycles of different lengths at 20°, separated from preceding continuous illumination by an 8-hour dark period. Lighting used in the present experiment was obtained from daylight fluorescent lamps. Light intensity at the leaf surface was 4000-5000 lux. As shown in Fig. 1, it is quite clear that irrespective of the length of the light period, 10 hours of darkness, but not 8 hours, are

enough to induce flowering. If the light-on rhythm determines the critical dark period, flowering response should be controlled by the length of the light-dark cycles rather than the length of the dark period. However, the length of the dark period is an essential factor determining the flowering response of *Pharbitis nil*. This suggests that the critical dark period is determined by the light-off rhythm. Probably, when the most light sensitive phase is reached (the 8-hour point), some conditions may be

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satisfied under which the hourglass component of the timing mechanism is able to begin. This hourglass component is considered to be a process required for synthesis of the floral hormone. Because of the high sensitivity of the hourglass component to temperature, the photoperiodic response is also very sensitive to night temperature, although the critical dark period is hardly affected by temperature.

References

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- 2) ———, and ———, *ibid.* **40**: 852 (1965).