Short Communication

Xanthium Leaf Movements in Light and Dark¹

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Bunning suggested that circadian rhythms provide the basis for time measurement in the photoperiodic responses of plants (2). A classic example is found in Glycine max. L. Merr. (Biloxi soybean), whose flowering response occurs in a rhythmic form having peaks of flowering that were approximately 24 hr apart (6). Recently Moore et al. (5) reported that Xanthium pensylvanicum did not exhibit a rhythmic flowering response when the plants were subjected to red light breaks and dark periods of various lengths. Likewise Reid et al. (7) found that red and far-red light perturbations did not result in a rhythmic type of flowering response. The results of Moore et al. (5) and Reid et al. (7) neither contradicted nor supported Bunning’s hypothesis (2). However, in this respect Moore et al. (5) have hypothesized that although no clear evidence for a flowering rhythm was found, the results were compatible with a rhythm that damped rapidly within 1 cycle. It was felt that an investigation of leaf movements might provide information as to the nature of the rhythmic process in Xanthium. From such information a clarification of the photoperiodic response of Xanthium might be possible.

Plants of Xanthium pensylvanicum (Wallr.)² used in these experiments were grown from seeds obtained in the Chicago area. The cultural conditions and methods were similar to those used by previous investigators in this laboratory (7). In preliminary experiments it was found that the young leaves which are in the rapid expansion stage had the greatest amplitude of movement in both continuous darkness (DD) and continuous light (LL). For this reason young leaves in the rapid expansion stage were selected for data collection. The leaf movements were measured with kymographs. On the graphs obtained in this manner an upward movement of the leaf is indicated by a downward movement of the curve and vice-versa.

Sets of 4 plants each were given 4 days of continuous light preceded by 4 days of various light-dark treatments (DD, 8L:16D, 10L:14D, 12L:12D, 14L:10D, 16L:8D). Light controlled rooms were used whose temperature was maintained at 28° ± 1° during the light period (750 ft-c) and 22° ± 1° during the dark period. Regardless of pretreatments of either light-dark cycles or continuous dark, the phase of the leaf movements was determined by the beginning of the continuous light period (fig 1). The leaf movements during the continuous light period were characterized by epinastic curvature occurring rhythmically with a period of approximately 24 hr.

Subsequent sets of 4 plants each were given 4 days of continuous darkness preceded by 4, 8, 25, or 30 days of continuous light. A growth chamber was used whose temperature was maintained at 25° + 0.5° during the light (750 ft-c) and dark periods. The phase of the leaf movements was determined by the beginning of the continuous dark period (fig 2). The movements during continuous darkness were characterized by a rhythmic upward movement of the leaf from the horizontal position and back. As in the continuous light experiment the period of the rhythm was approximately 24 hr. The movements were also observed in experiments conducted at other temperatures.

These 2 distinct leaf movement rhythms, one occurring in light and the other in darkness, are indicative of the existence of a “light-on” (fig 1) and a “light-off” rhythm (fig 2) in the leaf movements of Xanthium pensylvanicum. Similar responses involving “light-on” and “light-off” rhythms have been reported in the flowering response of Pharbis nil (8) and the petal movement of Kalanchoe (4).

Since the amplitude of the “light-off” leaf movement rhythm is rapidly damped (fig 2) it might be hypothesized that a similar rapidly damping rhythm is present in the flowering response. Support for this hypothesis may be seen in the similarity between the petal movement rhythm in Kalanchoe and its flowering rhythm (3); and the leaf movement

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² The latest accepted name is Xanthium strumarium L.
rhythm in soybean and its flowering rhythm (1). The low amplitude rhythmic flowering response in *Xanthium*, if it is present, may be completely masked by the deviations found when measuring the flowering response. This is possibly the reason that Moore et al. (5) were unable to demonstrate a clear rhythmic response and gives support to their hypothesis that a rapidly damping flowering rhythm may exist in *Xanthium*.

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**Literature Cited**


