A Circadian Rhythm in the Sleep Movements of the Marsileaceae

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Abstract

Plants belonging to the genus *Marsilea* exhibit "sleep movements" when placed in the dark and "waking movements" when transferred from the dark to the light. These more immediate responses which occur in less than an hour upon the changes in light conditions appear to be superimposed upon a circidan rhythm which persists for several days when plants are maintained in complete darkness or in continuous light.

Observations on sleep and helionastic movements in members of the genus *Marsilea* grown under field conditions were previously reported to the Academy (1). It was noted that sleep movements in this genus could be induced during the day by covering the plants and prevented after sundown by providing artificial light.

Since the opening of the leaves was assumed to be a light response, we were interested in determining its action spectrum. Studies in this connection revealed that individual leaves cut to include a portion of the rhizome and maintained in vials of water responded to light in much the same way as leaves of whole plants.

The isolated leaves were held in one of the following conditions: a) continuous fluorescent light; b) continuous monochromatic light; or c) continuous darkness. Monochromatic light was obtained by means of interference filters, but no attempt was made at this time to provide equal intensities at each of the wavelengths. Examination of the leaves at various times during the day and night revealed that the leaves in all three groups assumed sleep positions at night and were open during the day.

At the time these observations were being made, other studies were in progress for the purpose of determining the mean time required for the leaves to change from the fully closed to the fully opened position and for the reverse response. Whole potted plants were transferred from a lighted window sill to a dark closet or from the dark closet to the lighted window sill. The leaves of plants remaining overnight in the closet were found to be in the open position in the morning although they had received no light stimulus.

Studies of a possible circadian rhythm in plants held in continuous darkness have been limited for lack of any recording techniques or methods of observation which would avoid stimuli which might interfere with the responses under study.

A circadian rhythm has been recorded in whole plants held in continuous light. The plants in this study were illuminated by a combination of fluorescent and incandescent light with intensities of from 350 to 450 fc. at the level of the leaves. The plants were photographed at regular intervals by means of an 8 mm movie camera. Examination of the film record revealed a circadian rhythm which persisted for from three to four days.

To date, the studies have involved only *Marsilea quadrifolia, M. Drummondii,* and *M. mucronata.* All have exhibited the circadian rhythm. Further studies are planned when necessary equipment becomes available.

The authors believe this to be the first report of a circadian rhythm in a member of the Marsileaceae.

Literature Cited

1. BLOOM, WILLIAM W. and KENNETH E. NICHOLS. 1967. Some responses by members of the Marsileaceae grown under field conditions. Proc. Indiana Academy of Science. **76**:215-216.