Environmental Effects on the Closure of Flowers

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Introduction:

Our group sought to address the question of whether flower closing in Spring Beauty (*Claytonia virginica*) was influenced by temperature and/or light exposure. In addition to this, the possibility that flower opening/closing was time-dependant was considered.

Based on previous observations it was assumed that all flowers capable of opening and closing were fully closed at night, and we were interested in determining what triggered the process. We hypothesized that the absence of sunlight caused a cooler environment, which in turn caused the flowers to close. Alternatively, it was hypothesized that flower opening/closing was independent of one or both of these effects, suggesting that the action was dependent on some sort of biological process, or 'internal clock' within the flower.

We are expecting the data collected to prove our first hypothesis. It stands to reason that an organism which utilizes photosynthesis would have evolved to maximize its potential for light harvesting, and to also undergo whatever necessary physical change to conserve energy in the absence of nurturing environmental stimuli.

Methods:

Experiments designed to test the effects of light exposure and temperature were conducted on the west bank of Wildwood Park, in Radford, Virginia. A sample size of approximately 75-100 flowers was utilized for statistical accuracy. The number of 'open' vs. 'closed' *C. virginica* were counted, and only flowers whose petals were touching were considered 'closed.' Time of observation was also noted.

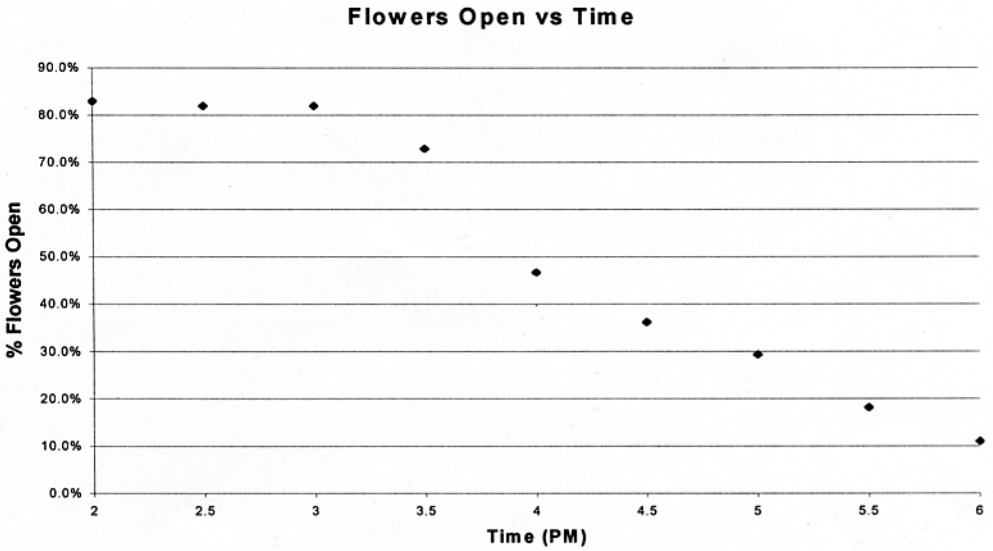
Temperature measurements were made using a thermometer placed in one of the patches of flowers chosen to study, and the measured value was assumed to be the average for that particular group. Light intensity was measured using a photometer, provided by Dr. Kugler. Data analysis was performed on a Mac using the Excel spreadsheet program.

The flowers served as their own controls; obviously it was possible to observe the flowers that 'would' close by checking their status at light and temperature extremes (ie, night). Independent variables in our experiment were temperature and light exposure, both of which were varied to test our first hypothesis.

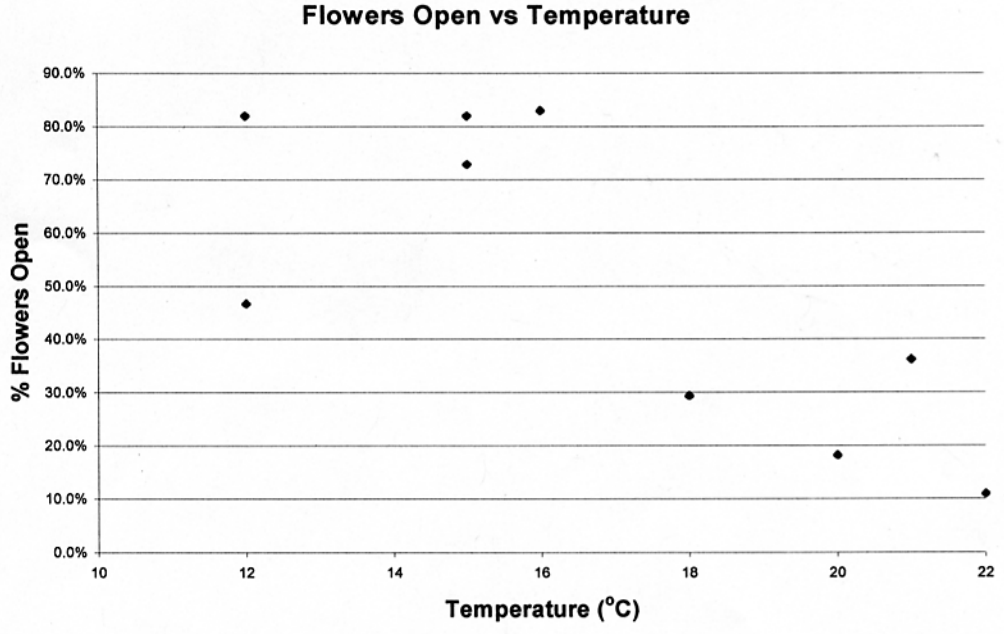
We assumed that there was no unnatural interference with the flowers between observations (ie, human stomping). It was also assumed that both the photometer and thermometer were accurate.

Results:

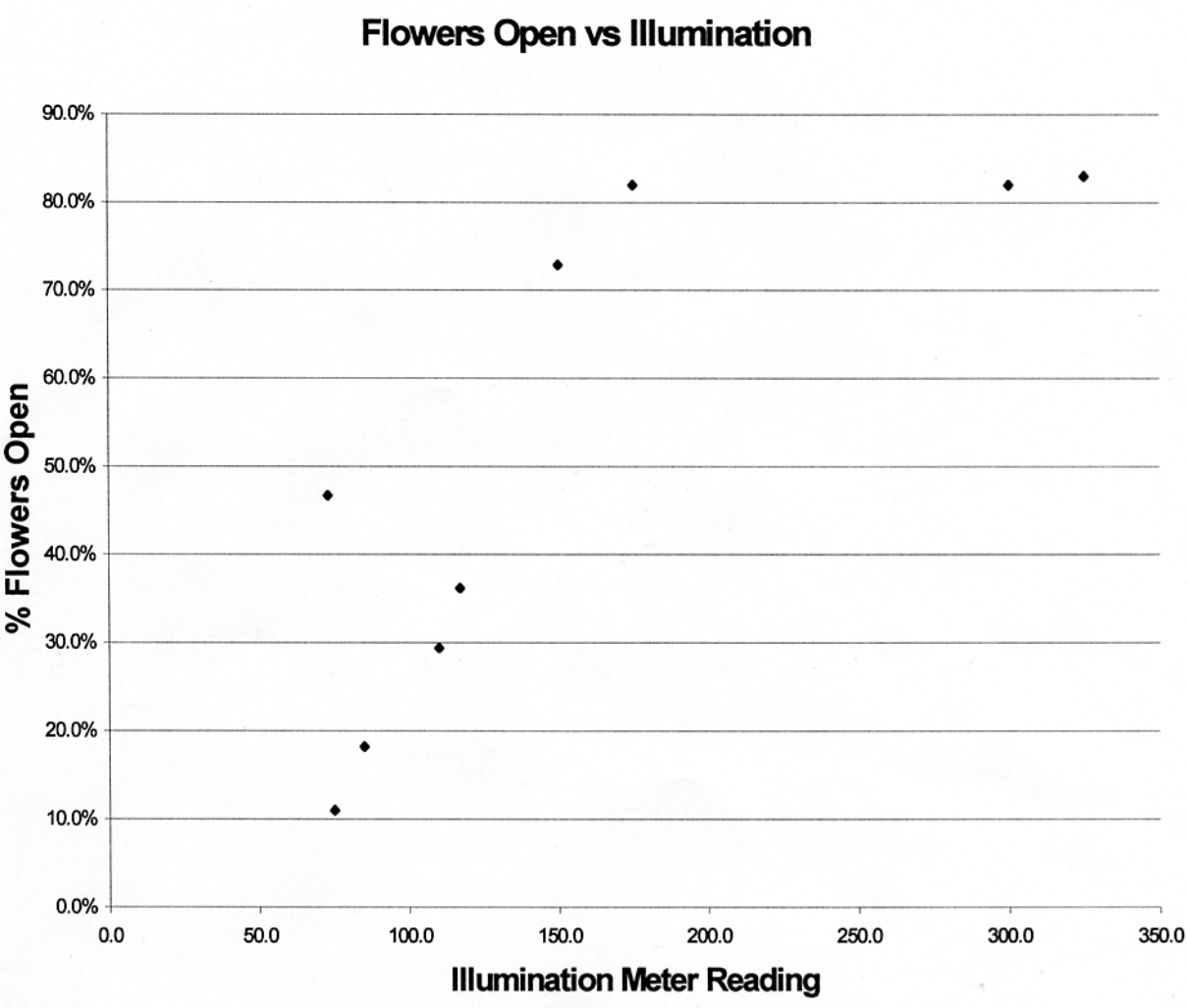
The time-dependence of flower opening is shown below for various hours of the afternoon, showing a gradual decrease of the number of open flowers in relation to the time of day.



Similarly, the temperature-dependence of the same flowers is shown below. This draws us to the conclusion that there is no corrleation between



And the photo-dependence of flower opening can be seen below, which points to flowers opening when greater illumination is present.



Discussion:

Based upon these data it can be concluded that there is no correlation between flower opening and temperature. A direct relationship with time of the afternoon, however, is seen, suggesting that the flower's state is somehow dependent on time or the conditions of the environment at that time, or perhaps some type of biological 'internal clock'/functioning circadian rhythm. The third graph indicates that more flowers open with increased light until a certain maximal level is achieved and all the flowers are open, although it is unclear whether the second graph is merely the result of this effect as light intensity decreases throughout the afternoon. Clearly more studies are required to differentiate the effects of light exposure and time-of-day.

In conclusion, temperature does not play a significant role in flower opening/closing. Flower-state does seem to be dependent on illumination and/or time-of-day, although which of the two is the more significant factor remains unproven.

(It should be noted that when the experiment was originally planned in late March, there was a veritable blanket of *C. virginica* all along the west bank of the park. However, our sample sized seemed to gradually decrease as the overhead canopy of the deciduous trees regained their leaves - possibly proving our hypothesis of the importance of sunlight in the opening, but leaving us with a sample group which was smaller than we would have liked.)

Acknowledgements:

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