Journal of Experimental Botany, Vol. 64, No. 18, pp. 5817–5818, 2013
doi:10.1093/jxb/ert083 Advance Access publication 30 April, 2013

Journal of Experimental Botany
www.jxb.oxfordjournals.org

FLOWERING NEWSLETTER

My favourite flowering image: Maryland Mammoth tobacco

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Abstract

Almost 100 years ago, the study of Maryland Mammoth tobacco by Garner and Allard was one in a long series of studies that have led to a better understanding of how plants "decide" when to flower. deciphering how plants "decide" when to flower. The extreme phenotype of Maryland Mammoth tobacco, in which a single recessive mutation changes a day-neutral to a strictly photoperiod-requiring plant, impressively illustrates the action of the photoperiodic pathway of flowering.

The Maryland Mammoth mutant was instrumental in the discovery by W.W. Garner and H.A. Allard of photoperiodism in plants [which was independently discovered by Julien Tournois working with hops (*Humulus japonicas*) and hemp (*Cannabis sativa*)]. The mammoth mutant did not flower in the field during the growing season in Maryland where Garner and Allard worked as USDA scientists. It did, however, flower in the winter in the greenhouse. Garner and Allard tested many hypotheses as to why the mutant flowered in the winter, such as lower light, poor nutrition, or the shock of transplanting. Of course, changing daylength proved to be the correct hypothesis; covering field-grown mutant tobacco plants in the late afternoon during the summer with a light-tight structure which created short days caused the plants to flower and confirmed this hypothesis (Garner and Allard, 1920).

It is intriguing that in tobacco a single-gene mutation can convert a day-neutral variety into the photoperiod-requiring Maryland Mammoth variety (Allard, 1919). Although since the time of Garner and Allard great progress has been made in understanding the molecular basis of photoperiodism in *Arabidopsis*, rice, and some other species (e.g. Andrés and Coupland, 2012), the gene affected by the Maryland Mammoth mutation is not known. Given that the mutation is partially recessive (Allard. 1919), one simple model is that in the cultivated parental day-neutral tobacco the photoperiod response is suppressed by a dominant Maryland Mammoth gene, and that loss of this gene 'unmasks' an existing photoperiod pathway. Given the progress in the use of whole-genome sequencing to reveal the molecular basis of genetic changes (e.g. Worthey, 2011), the nature of the Maryland Mammoth gene may soon be revealed.

Figure 1. The huge plant is the 'Maryland Mammoth' mutant of tobacco (*Nicotiana tabacum*) grown in long days. Also shown is a typical cultivar of tobacco that flowers in long days after reaching a certain state of development, Fritz Schomburg (on the floor), and Scott Michaels (on Fritz's shoulders). Photograph taken in 1997.

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