Researchers identify the cells that trigger flowering

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Arabidopsis flower used in research. Credit: Aarhus University

How do plants "know" it is time to flower? A new study uncovers exactly where a key protein forms before it triggers the flowering process in plants.

Until now, no one has pinpointed which cells produce the small protein, called Flowering Locus T (FT). The study also points to an extensive intercellular signaling system that regulates FT production.

The findings, published in the *Proceedings of the National Academy of Sciences*, may help breeders, since controlling flowering times is critical for crop development.

"Understanding where FT is located and how it coordinates with other flowering factors is important to breeders; it's useful for breeders for the fine manipulation of flowering times," said Qingguo Chen, the paper's first author and a research associate in the lab of Robert Turgeon, the paper's senior author and professor of plant biology at Cornell University.

Flowering in many plants begins with the perception of day-length, which occurs in the leaves. Some plants flower in short days and others in long days.

It was previously known that in Arabidopsis plants, long day-length starts a process where leaves synthesize and transmit FT in the plant's vascular tissue, called the phloem, which carries sugars and nutrients from leaves to the rest of the plant. FT travels to the shoot apex, the highest point of new leaves and stems, where it promotes the formation of flowers.

Flowering regulation is complex, with the release of FT controlled by more than 30 proteins in interacting cascades. "There's a complicated network and you can't unravel it until you realize what is going on with these particular cells, so the geography is very important," said Turgeon.

Because leaf veins are very small and covered by photosynthetic cells rich in green chlorophyll, identifying the FT-producing cells was difficult. In the study, Turgeon and colleagues used fluorescent proteins

to identify the cells in the phloem (veins) where FT was produced.

The researchers discovered that FT was also produced in the same type of companion cells in the phloem of Maryland Mammoth tobacco. Furthermore, when they killed these companion cells, it delayed flowering in both Arabidopisis and the tobacco plants. When they looked more closely at the pathways that lead to flowering, they found that killing these companion cells stopped the process downstream of FT, but not upstream, confirming that FT originates in these cells and that the synthesis of FT is regulated by an extensive intercellular signaling system.

More information: Qingguo Chen et al, FLOWERING LOCUS TmRNA is synthesized in specialized companion cells inArabidopsisand Maryland Mammoth tobacco leaf veins, *Proceedings of the National Academy of Sciences* (2018). DOI: 10.1073/pnas.1719455115

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