Leibniz Institute of Plant Genetics and Crop Plant Research (IPK)
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IPK research team develops new method to study female meiosis in *Arabidopsis*

Press Release

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Gatersleben, 19.02.2026 **A research team at the IPK Leibniz Institute has developed a method that enables the detailed observation of female meiosis - the process by which germ cells are formed - in the model plant *Arabidopsis thaliana*. The FeM-ID (Female Meiotic cell IDentification) method overcomes a significant hurdle in plant biology. Until now, female meiotic cells were difficult to access, forcing most studies to focus on male cells. The results of the study have now been published in the journal The Plant Cell.**

Chromosomes carry genetic information. Meiosis is a cell division process that produces germ cells - sperm and egg in animals, pollen and egg in plants - with half the usual chromosome number. During the formation of these germ cells, segments of parental chromosomes are reciprocally exchanged. This process, known as recombination, generates genetic diversity.

However, in many plants, there are differences between male and female meiosis. In Arabidopsis, for example, recombination events (crossovers) are more frequent in male meiosis and are often found at chromosome ends. In female meiosis, they are less frequent and are distributed more evenly along the chromosomes.

Until now, identifying female meiotic cells has been extremely difficult. These cells occur in very small numbers, are hidden deep within the flower, and are almost indistinguishable from the surrounding cells. However, the research team has now developed a ‘marking system’ that allows meiotic cells, known as meiocytes, to be specifically identified within surrounding tissues.

To achieve this, the scientists inserted a gene into the plant to produce the TurboID enzyme. In meiocytes, this enzyme binds to a protein called ASY1 and attaches biotin to chromosomes and other cellular components. The biotin label can then be made visible using fluorescent dyes. As a result, female meiocytes glow under the microscope, while other cells remain dark. One advantage of this method is that the plants produce the required biotin themselves, making the approach simple and cost-effective.

“With FeM-ID, we finally have a tool for observing female meiosis. It's like a microscope with a searchlight - we can now find the hidden cells we've been searching for over decades,” explains Dr. Chao Feng, the study’s first author. The method confirmed that female Arabidopsis germ cells undergo significantly fewer recombination events than male germ cells. This means that female germ cells are genetically less diverse than male ones.

“Our study closes a major gap in plant biology. Our new FeM-ID method enables us to compare male and female meiocytes systematically, which is a significant step towards understanding meiosis in its entirety,” affirms Dr. Stefan Heckmann, head of the independent ‘Meiosis’ research group at the IPK. “If we understand how the division of female germ cells works, we can manipulate recombination and make breeding more

efficient and precise.” This is an important step in developing new varieties with higher yields, better disease resistance, and the ability to adapt to climate change.

Original publication:

Feng, Wang *et al.* (2026): FeM-ID: A biotin labeling-based approach for the dissection of female meiotic chromosome behavior in Arabidopsis thaliana. The Plant Cell.
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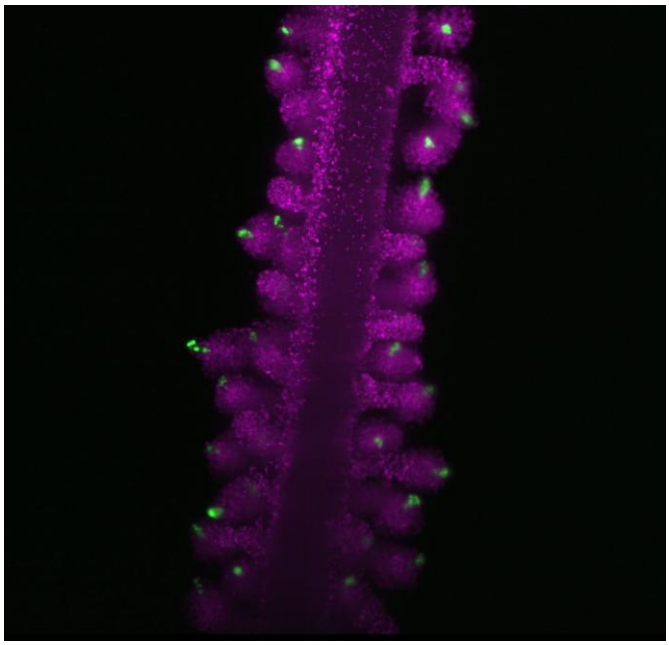
Photo:



The picture shows female meiotic cells (marked by ASY1-eYFP, green) embedded in somatic cells (marked by H2B-mRuby2, magenta) in the female reproductive organs of Arabidopsis.