

Extra DNA creates cucumber with all female flowers

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Ask a plant researcher how the sex of a cucumber plant is determined and the person will tell you, "It's complicated." Depending on a complex mix of genetic and environmental factors, cucumbers can be seven different sexes. Some high-yield cucumber varieties produce only female flowers, and a new study identifies the gene duplication that causes this unusual trait.

The study, led by Zhangjun Fei of the Boyce Thompson Institute at Cornell University, and Sanwen Huang of the Chinese Academy of Agricultural Sciences, in Beijing, appeared recently in *The Plant Cell*.

Dutch breeders take advantage of "gyneocious" varieties that produce only female flowers. When grown in nutrient-rich, soil-free greenhouses they produce a [cucumber](#) from each flower, greatly increasing the yield

over "monoecious" varieties that produce both types of flowers. The female flowers must be fertilized by pollen from a male flower, but by controlling the sex ratio, growers can greatly increase their harvest.

"If you compare the greenhouse production in the Netherlands, which uses plants with female flowers, to China, where they use monoecious plants and normal agricultural practices, the production in the Netherlands is about 15 times greater than in China," said Fei. He explained that farmers in China do not plant gynoecious cucumbers because the nutrition in the soil is not sufficient for fruits to develop at each flower.

Though researchers have known since the 1960s that there was a genetic cause for all-female flower-bearing plants, the exact location and sequence of the responsible segment of DNA was previously unknown.

The researchers discovered the extra DNA by screening genome sequences from a core collection of 115 different cucumber lines. They looked for changes called structural variations—large regions of the genome that are missing, added, reversed or duplicated. They generated a map of the 26,778 different structural variations that they found, some of which are associated with cucumber domestication. The analyses show that collectively, these structural variations affect more than 1,600 genes in the cucumber genome.

"It turns out that we found this one specific structural variation that is a duplication of about 30,000 bases. The duplication was highly correlated with gynoecy," said Fei. "For female flowered-plants, there's a lot of potential for agricultural production."

The study builds off of previous work by Fei, Huang and colleagues, who collaborated in sequencing the initial cucumber genome and later published a paper that identified single base differences called SNPs,

between multiple cucumber lines.

Provided by Cornell University

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