Researchers uncover tomato's genetic history

October 14 2014, by Marcia Malory

Two years after the sequencing of the genome of one variety of tomato, scientists have sequenced the genomes of 360 tomato varieties. By analyzing the relationships among these genomes, Sanwen Huang of the Institute of Vegetables and Flowers at the Chinese Academy of Agricultural Sciences and his colleagues have reconstructed the genetic history of the tomato, from its origins as a pea-sized wild plant growing in South America's Andes region to the many varieties found worldwide today. The research appears in *Nature*.

The tomato is the world's leading vegetable crop. In 2012, global harvests yielded more than 162 million tons of tomatoes, worth more than 55 billion dollars. Understanding how the tomato's genetic profile affects its taste, size and hardiness could increase consumer satisfaction while making the tomato industry even more profitable.

That same year, Huang was part of a team of researchers who sequenced the genome of the Heinz 1706 variety of tomato, a processing tomato used to make ketchup. Huang and his current team knew that to improve breeding processes, scientists must understand the genetic profiles of the many different tomato varieties that exist today and the relationships between them.

The researchers wanted to learn how the tomato genome has changed since the fruit was first domesticated, and then transported around the globe and bred for commercial purposes. They sequenced the genomes of 333 varieties of red tomato, 10 varieties of wild tomato and 17 modern commercial hybrids. They studied the change in the tomato's size over time and found that the increase in tomato size since its domestication had involved a two-step process. At first, selection for size, the primary purpose of tomato breeding, resulted in the creation of cherry tomatoes. Big-fruited tomatoes appeared later.

Huang's team was able to identify the genetic differences between processing tomatoes and big-fruited tomatoes, which consumers eat fresh. Processing tomatoes are hardier, with more soluble fruit content and lycopene content, than big-fruited tomatoes. The researchers found the genetic signature for the processing tomato, with the genes responsible for its phenotype located on chromosome 5.

They also located the gene that makes some tomatoes pink on chromosome 1. While globally, red-fruited tomatoes are most popular, pink-fruited tomatoes are very popular in China and Japan.

Despite the wide variation in tomato phenotypes that exist today, Huang and his colleagues found that there is, in fact, very little genetic variation among the modern tomato varieties. Human selection has fixed a large proportion of the tomato genome.

More information: *Nature Genetics* (2014) DOI: 10.1038/ng.3117