New buzz about coffee genes: A more complete genome sequence of world's most popular variety

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Like its flavor profile, the genome of Arabica coffee is large and complex. This makes breeding and genetic survey work more difficult, but this diverse genetic background may have contributed to bean's popularity, practicality, and commercial success.

A new study published in *Nature Communications* has generated a more complete genome sequence of the world's most popular coffee variety, suggesting that historic hybridization with Robusta coffee is the source of disease resistance within modern Arabica cultivars.

Commercial coffee is mainly produced from Coffea canephora and Coffea arabica, known as Robusta and Arabica coffee, respectively. Arabica coffee, the species responsible for about 60% of global coffee production, is derived from the hybridization between the ancestors of present-day Robusta coffee and another closely related coffee species, Coffea eugeniodes.

This hybridization resulted in Arabica's coffee flavor and its large and complex genome, which poses challenges for breeding and genetic studies. Several partial genome assemblies of Arabica coffee are currently available, but the mechanisms generating its genetic diversity are unclear.

Michele Morgante, Gabriele Di Gaspero and colleagues employed the latest sequencing technologies to generate a more complete genome assembly for Arabica coffee, allowing for a detailed analysis of the structure of its chromosomes.

When analyzing the genome, including previously inaccessible regions, such as those around centromeres, they found differences in the structure, function and evolution of the genomes contributed by its two progenitor species, especially for genes involved in caffeine biosynthesis.

The authors also analyzed the genomes of 174 samples collected from different species within the Coffea genus and noticed a very low level of genetic diversity within Arabica coffee. Diversity was found to increase in some Arabica coffee cultivars at specific genomic regions, due to two different sources of variation: chromosomal abnormalities and genetic segments donated by a Robusta-Arabica hybrid, known as the Timor Hybrid.

This hybrid has become the parental line of many modern cultivars that combine the disease resistance trait of Robusta coffee and the unique flavor of Arabica coffee.

The authors suggest that the genetic diversity of Arabica coffee is essential for its commercial success, and the findings may help develop new coffee varieties with desirable traits, such as disease resistance or different flavor profiles.

More information: Simone Scalabrin et al, A chromosome-scale assembly reveals chromosomal aberrations and exchanges generating genetic diversity in Coffea arabica germplasm, *Nature Communications* (2024). DOI: 10.1038/s41467-023-44449-8

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