Leibniz Institute of Plant Genetics and Crop Plant Research (IPK)
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Ancient Plant, new insights:
IPK research team reveals the mosaic origin of barley

Press Release

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Gatersleben, 24.09.2025 **Barley is one of the world's oldest cultivated plants, farmed for more than 10,000 years. Scientists have long believed it was domesticated in just one location. An international research team led by the IPK Leibniz Institute has revealed that modern barley has a "mosaic origin", meaning it stems from several wild populations across the Fertile Crescent. The findings were published today in the prestigious journal Nature.**

The research team conducted an in-depth study of the evolution and domestication of barley (*Hordeum vulgare*). They focused on so-called haplotypes - sections of DNA that are inherited together and act like genetic "building blocks." To trace barley's history, the scientists analysed the genetic material of 682 barley accessions from the IPK genebank and 23 archaeological barley finds, including ancient charred grains up to 6,000 years old.

The team specifically studied 380 wild barley samples from regions across western and central Asia, and compared them with 302 samples of domesticated barley. Their goal: to determine where and when key haplotypes were introduced into barley's genome.

"Barley does not come from a single origin, as long time assumed," says Yu Guo, first author of the study. "Instead, its genome is a fascinating mosaic composed of contributions from five wild barley populations we studied in the Fertile Crescent and neighbouring areas." The Fertile Crescent is considered the birthplace of agriculture, stretching from modern-day Iraq through Turkey to Israel.

The cultivation of barley in this region began well before humans settled permanently - around 10,000 years ago, during the Neolithic Revolution - and continued for thousands of years. "Some of the haplotypes essential for domestication, like the one for the non-brittle ear (so the grain doesn't fall off the plant), appeared as early as 27,000 years ago, long time before we see archaeological evidence of domesticated barley," Yu Guo adds.

Barley's spread beyond the Fertile Crescent was not straightforward. "This expansion was shaped by repeated gene flow between local wild populations and already domesticated barley varieties - as well as by human migration and trade. This greatly influenced today's genetic diversity," says Dr. Martin Mascher, Head of the Domestication Genomics research group at the IPK. All five wild barley populations examined contributed, though to different extents, to the gene pool of cultivated barley.

As agriculture spread from the Fertile Crescent about 8,500 years ago, domesticated barley split into three main lineages: A western lineage (Middle East and Europe), an eastern lineage (Central and East Asia) and an Ethiopian lineage. Important genes associated with domestication traits - such as the non-brittle ear, six-row barley, or naked barley (grain without a hull) - originated at different times and in different regions. For instance, the mutation for naked barley arose approximately 16,000 years ago.

Analysis of ancient DNA, especially from archaeological sites in Israel, added further insight. Barley grains from the Yoram Cave (6,000 years old), the Abi'or Cave (2,000 years old) and a copper mine near Timna (3,000 years old) showed that genetic diversity increased over time, likely due to gene flow from other regions - driven by trade and human movement.

“These discoveries strengthen and add a genomic dimension to our findings of the 23,000-year-old cereal agriculture at the Ohalo site, on the shores of the Sea of Galilee. Together they show that this region was central to plants’ domestication and underscore that our exceptionally well-preserved dry archaeological record is a rare botanical and genetic treasure trove that now opens the way to fresh lines of research and to questions that until recently were considered unsolvable,” says Prof. Ehud Weiss, Head of the Archaeobotanical Lab. at Bar Ilan University.

This new view of barley’s past helps researchers understand how crops adapt to different environments. Traits such as grain retention or ear shape evolved multiple times independently. “Our study shows how closely human history is linked with the history of cultivated plants,” says Dr. Martin Mascher. “Reading the DNA of barley is like reading several thousand years of human civilisation.”

Original publication:

Guo *et al.* (2025): A haplotype-based evolutionary history of barley domestication. Nature. DOI: 10.1038/s41586-025-09533-7

Photo:

An international research team led by the IPK Leibniz Institute has revealed that modern barley has a “mosaic origin”, meaning it stems from several wild populations found across the Fertile Crescent. Photo: IPK Leibniz Institute/ D. Hirsz