New bean genome unveils potential to boost food security in drought-prone regions

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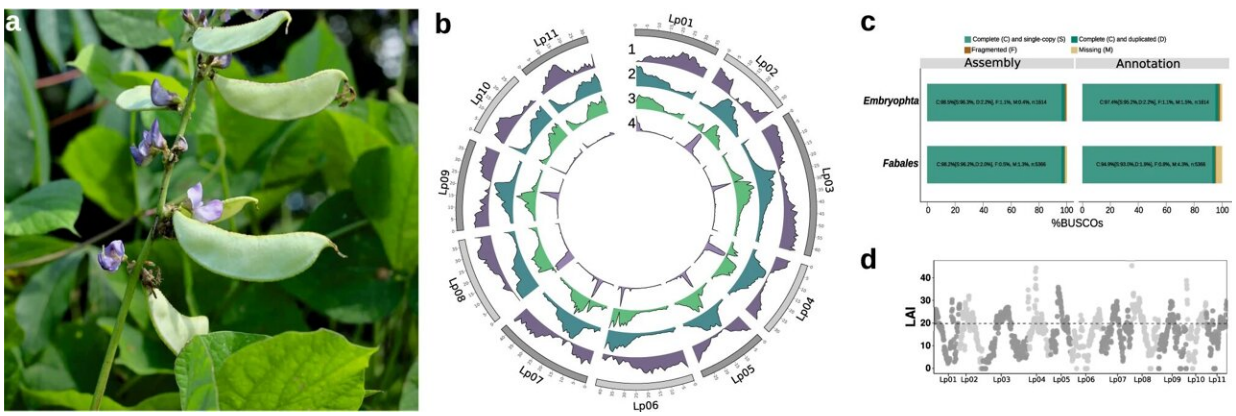

Genome assembly of lablab. **a** *Lablab purpureus* plant showing flowers, leaves and pods**. b** Gene and repeat landscape of the lablab genome. The tracks from the outer to the inner track show 1) gene density, 2) repeat density, 3) LTR-RT density, 4) tandem repeat density. **c** BUSCO scores of the lablab genome and gene annotation using the embryophyta and fabales reference lineages. **d** LAI index of the 11 lablab chromosomes. Source data are provided as a Source Data file. Credit: *Nature Communications* (2023). DOI: 10.1038/s41467-023-37489-7

An international team of researchers has fully sequenced the genome of a climate resilient bean that could bolster food security in drought-prone regions.

The sequencing of the hyacinth bean or 'lablab bean' [Lablab purpureus] paves the way for wider cultivation of the crop, bringing nutritional and economic benefits, as well as much needed diversity to the global food system.

The plant is native to Africa and is cultivated throughout the tropics producing highly nutritious beans, which are used for food and livestock feed. It's extremely drought-resilient and thrives in a range of environments and conditions, contributing to food and economic security, and improving soil fertility by fixing nitrogen. Lablab is also used medicinally in some areas and contains bioactive compounds with pharmacological potential.

The plant's adaptability suggests high genetic diversity, which means it's possible to select different adaptive genotypes for different environments and climatic challenges. But lablab's potential for genetic improvement to boost its productivity and facilitate wider cultivation—especially in drought-prone areas—has yet to be fully exploited.

"When it comes to valuing a crop, people often focus on its global market value in US dollars," said Chris Jones, Program Leader for Feed and Forage Development at the International Livestock Research Institute (ILRI) based in Kenya, and one of the lead authors of a new study in *Nature Communications* that shares the findings of the work.

"However, for farmers who struggle to produce enough food, the value of a crop like lablab is incredibly high. Although it may be cultivated on a smaller scale compared to major crops, its impact on food security can be significant, and we need to recognize that."

Important genetic traits

The researchers identified the genomic location of important agronomic traits relating to yield and seed/plant size. They documented the organization of the trypsin inhibitor genes, which inhibit a key enzyme in the digestion process in humans. This provides opportunities for targeted breeding to reduce these anti-nutritional properties.

They also tracked the history of lablab's domestication, confirming that this occurred in a parallel, in two different places. Mark Chapman, another lead author of the study and Associate Professor at the University of Southampton, said, "This is an exciting finding, and it opens the door to studying whether agronomic traits can evolve more than once using the same genes, or if different pathways can evolve to give the same outcome. Compiled, this information offers a valuable resource for genetic improvement."

Diversifying the global food system

The lablab bean is one of a long list of 'orphan crops': indigenous species that play an important role in local nutrition and livelihoods, but that receive little attention from breeders and researchers.

The three major crops that currently provide over 40 percent of global calorie intake—wheat, rice, and corn—receive the bulk of breeding and crop improvement efforts. With so little diversity in crop cultivation, the global food system is vulnerable to environmental and social instabilities. Underutilized crops like lablab hold the key to diversified and climate-resilient food systems and genome-assisted breeding is one promising strategy to improve their productivity and adoption.

Oluwaseyi Shorinola, another of the study's lead authors from the International Livestock Research Institute (ILRI)—and a visiting scientist at the John Innes Centre in the United Kingdom—said, "The first green revolution was achieved with major crops like wheat and rice. Orphan crops like lablab could pave the way for the next green revolution."

African-led research

The research process itself was also ground-breaking for its inclusivity. "Although many African indigenous crops have been sequenced in the past few years, in most of that work African scientists have been underrepresented, and when we've been involved we have been in the back seat," said Meki Shehabu, another co-author of the study and a scientist at ILRI in Ethiopia. "What makes this project special is that it is led by African scientists, in collaboration with scientists from international institutes."

To make this happen, the project had to overcome contextual constraints such as the continent's relative lack of sequencing facilities and high-performance computing infrastructure, as well as the bioinformatics capacity required. The researchers addressed these challenges by using new low-cost portable sequencing platforms, carrying out in-depth capacity building (including an Africa-based eight-month residential bioinformatics training), and working carefully to facilitate equitable international collaboration.

Looking forward, the team anticipates that the resource will inspire genetic improvement work on lablab—and other under-utilized indigenous crops—with the aim of increasing food and feed availability on the African continent and beyond.

More information: Isaac Njaci et al, Chromosome-level genome assembly and population genomic resource to accelerate orphan crop lablab breeding, *Nature Communications* (2023). DOI: 10.1038/s41467-023-37489-7

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