Domestication of the banana

The domestication of the banana is the process that transformed fruits full of seeds into parthenocarpic seedless fruits that develop in the absence of pollination[1] [2]. The founding events took place in the humid tropical belt that extends from India to the Solomon Islands, the natural range of the wild species of bananas, which belong to the genus *Musa*. The earliest archaeological evidence of domesticated bananas is from Papua New Guinea and has been dated to at least 7,000 years before present[3].

Africa is a secondary centre of diversification for at least two large groups of bananas, the Plantains and the East African highland bananas[4].

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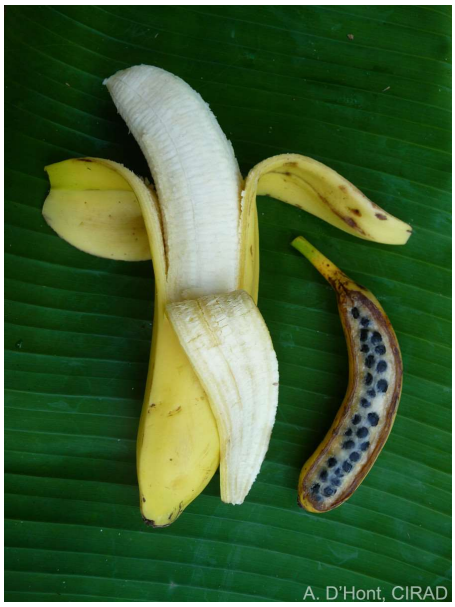

Contents

The ancestors

Cultivated bananas were domesticated from a small subset of wild species of bananas. The best known ones are *Musa acuminata* and *Musa balbisiana*. Their genetic signature, especially *Musa acuminata*'s, is found in the vast majority of cultivars known today. The ancestor of a group of bananas domesticated independently in the Pacific region, the Fei bananas, has not been identified.

Like human beings, wild bananas are diploid, that is they have two copies of each gene-bearing chromosome, one from each parent. Those with a genetic predisposition to parthenocarpy (the ability to produce a fruit in the absence of pollination) set the stage for the domestication of seedless edible bananas.

Sexual phase

From wild bananas to edible diploids

The potential to produce parthenocarpic fruits has been traced to genes present in *Musa acuminata*[5] . Domestication for edibility most likely started with farmers transplanting the offshoots (suckers) of plants that were edible by virtue of having less seeds and more pulp. But since these plants were still fertile, they continued mating with other fertile banana plants. The latter could belong to the same or different subspecies of *Musa acuminata*, or to another species, *Musa balbisiana*.

While still fertile diploid bananas continued mating and produced triploid bananas (see From diploids to triploids) some diploid bananas became too sterile to engage in sexual reproduction. These bananas belong to the AA and AB genome groups, in the nomenclature system developed by Norman Simmonds and Kenneth Shepherd. The letter A standing in for acuminata and B for balbisiana.

From diploids to triploids

Fertile diploid bananas went on to produce triploid plants when one of the diploid parents normally passed on one copy of its genome, while the other contributed both copies (a phenomenon called meiotic restitution). These triploid bananas belong to three genome groups : AAA, AAB and ABB.

Asexual phase

Sterility is most likely due to a combination of structural and genetic factors[6] . The structural factors are linked to matings between distant relatives (between different subspecies of *Musa acuminata* or between different species, mainly *Musa acuminata* and *Musa balbisiana*), as inheriting mismatched chromosomes made it difficult for the progeny to produce fertile ovules and pollen. But scientists also believe that farmers preferentially propagating the plants that produced fruits with the least seeds might have selected for genes that contribute to sterility[6] . Triploidy made further sexual reproduction extremely unlikely.

From that point on, further diversity has been produced by somatic mutations in the rhizome's lateral buds, which develop into suckers, and ill-defined epigenetic processes. New cultivars are created by growers propagating somatic variants that exhibit desirable traits. But because these are nearly genetically identical to the cultivar they are derived from, they do not contribute to genetic diversity. This is why, in banana, cultivar diversity is not a good proxy for genetic diversity.

A better measure of the crop's genetic diversity is the subgroup, a cultivar and its somatic variants. Intensely selected cultivars can give rise to large subgroups. Two examples of large subgroups are the Plantains and the East African highland bananas, which have upwards of 100 cultivars each.[7]

References

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4. The hidden side of banana diversity, published 24 October 2017 in InfoMus@'s News & analysis.
5. Simmonds, N.W. 1953. Segregations in some diploid bananas. Journal of Genetics 51(3):458-469.
6. • InfoMus@ news on GWAS and the parthenocarpic banana.
7. The hidden side of banana diversity, published 24 October 2017 in InfoMus@'s News and analysis blog.

Also on this website

Musapedia page on the nomenclature system for classifying cultivated bananas

Linnaeus's banana legacy: *How Linnaeus inadvertently muddled the taxonomy of bananas when he gave Latin binomials to two edible bananas*, published 22 May 2019 in InfoMus@'s News and analysis section.