ENDOSPERM METABOLISM

Nutritious corn

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Credit: Lorant Csakany/EyeEm/Getty

Different plant species and tissues contain considerably various amounts of oxalate, which plays a role in plant metal tolerance and other stress resistance. However, consuming plant-derived food with high oxalate accumulation could reduce metal nutrient availability and raise the risk of calcium oxalate kidney stone formation, thus undermining human health. Recently, Yongrui Wu and colleagues at the Shanghai Institutes for Biological Sciences, Chinese Academy of Sciences, China, revealed a mechanism of oxalate degradation that affects seed metabolism and quality in maize.

The researchers aimed to understand maize endosperm development and started the project by investigating an opaque endosperm mutant. Despite the colour changes, the mutant kernels have reduced weight and nutrient (starch and proteins) levels. There are also pleiotropic phenotypes, such as impaired seed germination and dwarf seedlings, caused by the mutation. The authors mapped the responsive mutation in a gene (*GRMZM2G175171*) that encodes a putative oxalyl-CoA decarboxylase, so the mutant was designated *ocd1-1*. Two additional *ocd1* mutant alleles (*ord1-2* and *ord1-3*) showed similar phenotypes to *ocd1-1*, confirming the function of Zm*OCD1* in maize endosperm development. Zm*OCD1* is ubiquitously expressed in different tissues, including the embryo and endosperm. It is also highly induced by oxalate treatment. Using a heterogeneous recombinant protein and a synthesized substrate oxalyl-CoA, they demonstrated the decarboxylase activity of ZmOCD1 in vitro. The implications in vivo were also indicated by comparing the oxalyl-CoA decarboxylase activity of homogenates from the wild type versus *ocd1-1* endosperms. The oxalate content is two-fold higher in the *ocd1-1* mutant compared to that in the wild type, therefore ZmOCD1 is important for oxalate-degradation. At the end, the researchers conducted a targeted endosperm metabolomics analysis of the wild type and *ocd1-1* mutant to provide a landscape of metabolic changes induced by loss of ZmOCD1.

Endosperm is the storage organ of nutrients in corn kernels. The discovery of genes involved in endosperm development and the composition of nutrients in crop plants is no doubt essential in paving the way for future engineering.

Lei Lei

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