The genetics behind being Not Like Daddy

February 22 2017

A common strategy to create high-yielding plants is hybrid breeding - crossing two different inbred lines to obtain characteristics superior to each parent. However, getting the inbred lines in the first place can be a hassle. Inbred lines consist of genetically uniform individuals and are created through numerous generations of self-crossing. In maize, the use of so-called "haploid inducers" provides a short cut to this cumbersome procedure, allowing to produce inbred lines in just one generation. A study by Laurine Gilles and colleagues, published today in *The EMBO Journal*, sheds light on the genetics behind haploid induction. "Knowing the molecular identity of haploid induction represents an important breakthrough to fully understand the fertilization process in plants, and hopefully will allow to translate this breeding tool to other species," said the study's senior author Dr. Thomas Widiez, an INRA (Institut National de la Recherche Agronomique) researcher at the École Normale Supérieure in Lyon, France.

Haploid inducers were first discovered in the 1950s. Pollination of female flower with pollen of a haploid inducer strain will yield offspring that are haploid, meaning that they will only contain one single copy of each gene as opposed to the usual two copies. All their genetic material comes from the mother. Treating these haploid plants with a chemical that causes chromosome doubling will lead to plants with two identical copies of all genes in just one generation. With classical inbreeding, this condition takes seven to ten years to achieve.

Haploid offspring in maize are not unusual; they emerge naturally, albeit at a very low rate. Haploid inducers can bring this rate up to about 10%

of the progeny being haploid - enough to make it a useful tool for breeders. More than 50 years after the discovery of haploid inducers, Widiez and his team, in collaboration with Limagrain, have now identified the gene that mainly causes the phenomenon and termed it Not Like Dad to highlight the fact that its dysfunction induces embryos without genetic contribution from the father. The gene product is necessary for successful fertilization so that its failure promotes the formation of haploid embryos. Two other research groups have in parallel identified the same gene and come to similar conclusions.

Haploid inducers are nowadays powerful breeding tools, but as yet the technology is restricted to maize, while in-vitro haploid induction in certain crops is labor-intense. Understanding the genes and molecular mechanism behind the process will help translate this technology to other crops. The identification of Not Like Dad is an important step to this end. While Not Like Dad is the most important contributor to haploid induction in inducer lines, there are at least seven more genes that play a role in increasing the rate of haploid offspring. Revealing their molecular identity, as well as understanding their mode of action, will be important to fully understand the process.

More information: Loss of pollen-specific phospholipase Not Like Dad (NLD) triggers gynogenesis in maize, DOI: 10.15252/embj.201694969

Provided by European Molecular Biology Organization