MAD- Mechanisms of Apomictic Developments

Apomixis, or asexual seed formation, is an alternative way to sexual reproduction that some plants use to produce viable seeds containing genetic clones of the female parent. Although it is regarded as a promising tool for breeders and farmers, apomixis does not occur in most food crops. Redirecting sexually reproducing species toward apomixis is awaited through the manipulation of key biological pathways involved in developmental programmes controlling sexuality. However, to do so, scientists must first elucidate the detailed mechanisms by which it occurs. The EU-funded MAD project is creating an international research and training network to build on the wealth of knowledge and resources accumulated in numerous related multidisciplinary fields. Harnessing the important potential of apomixis could help meet the food security challenge of a growing population facing pressures due to climate change and strong societal demands on health and biodiversity preservation.

Apomixis in plants allows the formation of seeds carrying maternal embryos. While absent in major food crops, it occurs in many plants, including wild relatives of cereals and species of economical interest such as forage grasses and fruit trees. This unique reproductive mode can be achieved through many paths, all involving alterations in the orchestration of the developmental programs underlying sexual reproduction. Since it allows the use of a natural carrier, the seed, for propagating the best genotypes regardless of their constitution, apomixis represents a revolutionary tool for plant breeding programs and for reducing the costs of improved variety seeds. Despite wide-cross breeding programs to introduce the trait in cereals and decades of research using both sexual plant models and apomictic species, apomixis remains an enigma for plant biologists and a long-awaited tool by breeders and farmers. Functional analyses in Arabidopsis and maize have provided valuable molecular information to understand sexual reproduction and, occasionally, to explore alterations yielding phenotypes reminiscent of apomixis. On the other hand, the recent advances in « omics » tools and biotechnologies have opened the route for investigating apomictic species at unprecedented, cellular and molecular levels. The MAD (Mechanisms of Apomictic Developments) project will establish an international, research and training network aiming at contributing significantly to our understanding of key mechanisms involved in redirecting sexuality in plants towards apomixis. It bridges critical knowledge and biological resources recently generated by collaborative efforts in the field of apomixis biology, and novel expertise in plant reproductive biology, biotechnology and breeding by aggregating new partners. Through research, training and dissemination actions, the project will clarify the genetic architecture of apomixis and support the deployment of innovative strategies in crop improvement.

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