Max-Planck-Innovation

Max-Planck-Innovation GmbH
Arnulfstraße 58
80335 Munich
Germany

Phone: +49 (89) 29 09 19 - 0
Fax: +49 (89) 29 09 19 - 99
info@max-planck-innovation.de
www.max-planck-innovation.de

Contact:
Dr. Ingrid Kapser-Fischer
Tel.: 089 / 290919-19
kapser-fischer@max-planck-innovation.de

Technology Offer

Circumventing Barriers to Hybrid Crops from Genetically Distant Crosses

Enabling clonal seed production in F1 hybrids for sustainable agriculture

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Background

Hybrid crops leverage heterosis for superior yields and resilience, but require costly annual reseeding from parental lines, limiting adoption by smallholder farmers. Intersubspecific crosses, such as indica-japonica in rice, often fail due to post-zygotic barriers like endosperm defects, preventing viable hybrid seeds from genetically distant parents. A single-step method to induce synthetic apomixis in F1 hybrids would bypass these barriers, allowing clonal propagation of vigorous hybrids for multiple generations.

Technology

Researchers of the Max Planck Institute for Plant Breeding Research have developed a method using MiMe ("Mitosis instead of Meiosis") mutations combined with egg cell-specific BABYBOOM 1 (BBM1) overexpression to induce parthenogenesis and apomixis in F1 hybrids from distant crosses. In rice, a single transformation step enables indica-japonica F1 plants to produce clonal seeds with restored hybrid vigor, fertility, and yield stability across generations. For this groundbreaking work, the team received the VinFuture prize in 2025.

Advantages

- Bypasses endosperm and hybrid incompatibility barriers for wide crosses (e.g.,indica-japonica rica).
- Single-step induction yields apomictic clonal seeds in F1 hybrids, maintaining heterosis indefinitely.
- No need for parental line maintenance or repeated crossing, reducing seed costs for farmers.
- Applicable to major crops; scalable via Agrobacterium or CRISPR delivery.

Applications include the development of affordable, self-reproducing hybrid rice varieties, the expansion of hybrid vigor to elite distant germplasm for climate-resilient crops, and hybrid seed production in maize, wheat, and vegetables.

Publications

1. d'Erfurth et al 2009, PLoS Biology, doi:10.1371/journal.pbio.1000124
2. Mieulet et al 2016, Cell Research, https://doi.org/10.1038/cr.2016.117
3. Khanday et al 2018, Nature, https://doi.org/10.1038/s41586-018-0785-8

Patent Information

The patent WO2024074888A2 was filed in 2022.

Opportunity

We are seeking licensing, co-development, or collaboration partners in agricultural biotechnology and seed industry.

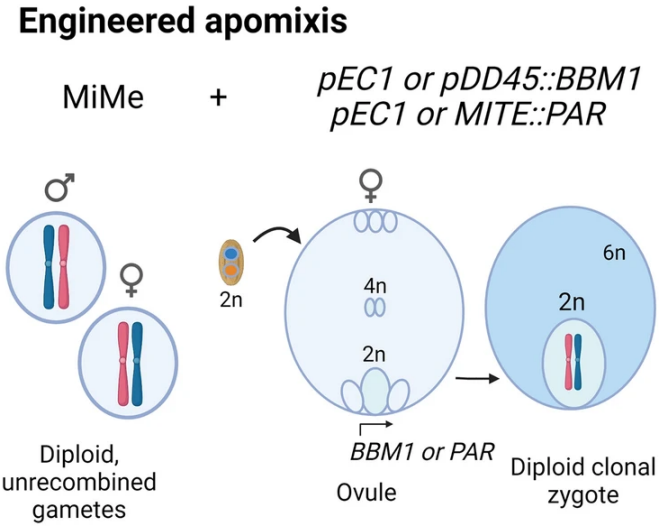

Figure 1 By pairing MiMe with BBM1/PAR expression, clonal progeny can be obtained that represent synthetic apomicts.