

LICENSING OPPORTUNITY

ETH transfer – Linking Science and Business

Accelerated plant breeding by unreduced microspores and pollen

Keywords

Unreduced pollen, Triploid seeds, Polyploidy, Endosperm balance, Seedless fruits, Homozygous diploids

Background

In plants, sexual polyploidization by the formation of unreduced ($2n$) gametes is an important feature in both nature and breeding programs. Many of the world's leading crops are polyploid, indicating that human breeding activities have unwittingly selected for plants with increased ploidy. Although there is now much interest in the formation of unreduced gametes or polyploid plants for plant breeding, as yet there is no technology available that allows the generation of unreduced gametes by targeted deletion of a defined locus. The formation of unreduced gametes has a wide range of applications and can be used to overcome incompatibility barriers in interspecific or interploidy crosses, the production of seedless fruits and the generation of homozygous diploids. However, mutants producing unreduced pollen are only available in few crop species or varieties and the affected loci have not yet been identified. Thus far, production of polyploid plants is mainly achieved by colchicine treatment, a laborious, time-consuming and inefficient technique. Therefore, the targeted generation of unreduced plant gametes can open a wide field of possible applications facilitating plant breeding.

Invention

The invention describes: Generation of unreduced pollen ($2n$) by mutations in the conserved plant gene *JASON*. Lack of *JASON* causes a failure in chromatid separation during meiosis II, leading to the formation of unreduced microspores and pollen at high frequency. Unreduced *jason* pollen ($2n$) are viable and fertilization of reduced egg cells ($1n$) leads to the formation of triploid seeds ($3n$). A proof of principle is provided employing the model plant *Arabidopsis thaliana* (Figs. 1 and 2). Based on the observed production of unreduced male gametes, the invention holds great promise for facilitating interploidy crosses, production of seedless fruits and the generation of homozygous diploids.

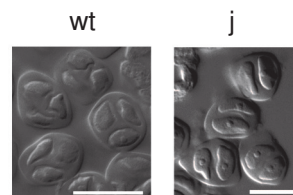


Fig. 1: The *jason* mutant forms dyads ($2n$) at high frequency. Wild type tetrads ($4n$) are shown in left panel (wt) and *jason* dyads in right panel (j).

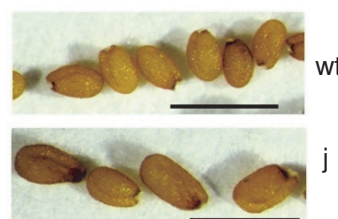


Fig. 2: The *jason* mutant forms triploid enlarged seeds ($3n$) at high frequency. Enlarged triploid *jason* seeds in the lower panel (j) compared to wild type seeds ($4n$) in the upper panel (wt).

Patent Status

- Patent pending

Features & Benefits

- Production of polyploid plants with a very efficient new method
- Avoids the time-consuming colchicine treatment
- Transgene-free technology by a targeted deletion of a single locus
- Efficient generation of unreduced microspores ($2n$) and pollen ($2n$)
- Faster mapping

Field of Application

Plant breeding industry:

- Overcoming crossing barriers that exist when crossing original varieties with crops
- Generation of seedless fruits
- Generation of homozygous diploids ($2n$)

Ref. No. T-09-039

ETH Zurich
ETH transfer
Zurich, Switzerland

+41 44 632 23 82
transfer@sl.ethz.ch
www.transfer.ethz.ch

ETH

Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich