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Modification of agricultural traits in cultivated varieties of barley and wheat

Ekaterina M. Timonova, Antonina A. Kiseleva, Alina A. Berezhnaya, Mikhail A. Nesterov, Irina G. Adonina, Aleksey V. Kochetov, Elena A. Salina

Institute of Cytology and Genetics, Siberian Branch of Russian Academy of Sciences, Novosibirsk, Russia

CRISPR/Cas technology makes it possible to induce mutations at defined positions. In breeding-oriented research, this opens up exciting opportunities for the targeted improvement of many agricultural crops. Wheat and barley are among the most important cereals in the world. However, the transformation poses a particular challenge for cereals and is strongly genotype dependent. This is because agrobacteria, which is mostly used for delivering the CRISPR/Cas system, have a limited compatibility with these non-host plants. Transformation of wheat is additionally difficult due to the large genome size and polyploidy.

Besides obtaining improved genotypes, the object of the current study was to optimize the method of genomic editing based on the CRISPR/Cas system using particle bombardment for non-model varieties of barley and wheat. In barley, we targeted the *Nud* gene that controls hulled/naked phenotype of the grain. Since the regeneration rate remains an issue for the cultivated cultivars, we used the JD633 vector that carries the *GRF4-GIF1* chimera to increase the efficiency of regeneration. We obtained five T_0 plants, carrying mutations. In wheat, targeting *Ppd-1* genes that control photoperiod-dependent floral induction results in Cas9-induced mutations in 52 of 210 T_0 plants. The developed collection of wheat plants with different new alleles of *Ppd-D1* and *Ppd-B1* genes is being studied for the expression under short day conditions and the effect on the vegetation period.

Thus, we have obtained plants of the cultivated varieties of barley and wheat with edited agronomically important genes, using the improved protocols of biolistic transformation.

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AUTHORS' INFO

Ekaterina M. Timonova, Institute of Cytology and Genetics Siberian Branch, Novosibirsk, Russia; ORCID: 0000-0002-3341-5080; eLibrary SPIN: 7227-6576; e-mail: eegorova@bionet.nsc.ru

Antonina A. Kiseleva, Institute of Cytology and Genetics Siberian Branch, Novosibirsk, Russia; ORCID: 0000-0002-3725-8596; eLibrary SPIN: 4213-0594; e-mail: antkiseleva@bionet.nsc.ru

Alina A. Berezhnaia, Institute of Cytology and Genetics Siberian Branch, Novosibirsk, Russia; ORCID: 0009-0002-6848-3291; eLibrary SPIN: 6451-3488; e-mail: al.berezhnaya1@gmail.com

Mikhail A. Nesterov, Institute of Cytology and Genetics Siberian Branch, Novosibirsk, Russia; ORCID: 0000-0001-5407-2411; eLibrary SPIN: 9901-1738; e-mail: mikkanestor@bionet.nsc.ru

Irina G. Adonina, Institute of Cytology and Genetics Siberian Branch, Novosibirsk, Russia; ORCID: 0000-0002-8460-6119; eLibrary SPIN: 6104-4933; e-mail: adonina@bionet.nsc.ru

Aleksey V. Kochetov, Institute of Cytology and Genetics Siberian Branch, Novosibirsk, Russia; ORCID: 0000-0001-7221-9886; eLibrary SPIN: 8033-5110; e-mail: ak@bionet.nsc.ru

Elena A. Salina, Institute of Cytology and Genetics Siberian Branch, Novosibirsk, Russia; ORCID: 0000-0001-8590-847X; eLibrary SPIN: 5782-4546; e-mail: salina@bionet.nsc.ru