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Modern biotechnologies for the targeted modification of wheat genome

Miroshnichenko D.N.[1, 2]*, Klementjeva A.A.[1], Timerbaev V.R.[1, 2], Pushin A.S.[1], Dolgov S.V.[1, 2]

[1] *Branch of Shemyakin-Ovchinnikov Institute of Bioorganic Chemistry, RAS, Pushchino, Russia*

[2] *All-Russia Research Institute of Agricultural Biotechnology, Moscow, Russia*

* *e-mail: miroshnichenko@bibch.ru*

The application of innovative research tools for the targeted genome modification open new opportunities for understanding wheat genomics and developing improved cultivars. At the same time, the application of various modern technologies such as tissue and time-specific gene expression, RNAi-based gene silencing, chloroplast transformation, T-DNA insertion mutagenesis, and genome editing is available only for the restricted number of wheat genotypes. Most of the actual procedures involve the introduction of foreign DNA/RNA/RNP complexes into plant tissue and then regenerating the plants containing the modified genome. The focus of the present work is genetic sequences transfer methods for efficient production of fertile genetically modified plants of di-, tetra- and hexaploid wheat germplasm. We present a routine procedure for a transfer of heterologous sequences by biolistic delivery method. Hundreds of independent transgenic plants, including einkorn, emmer wheat, timopheevii wheat, and bread wheat have been already producing using the optimized parameters. Various details concerning the in vitro tissue culture productivity, DNA delivery in the target tissue, an appropriate method to select the transformed plants, genetic transformation efficiency, and stability of transgene expression will be discussed. We also will speculate future trends in genetic engineering as a tool for targeted genome editing to manipulate of wheat genome in order to increase yield and enhance stress tolerance.