

DNA MARKERS IN CROP PRODUCTION

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At the stage of genetics, the use of classical genetic markers did not find widespread use in breeding practice. As a consequence, the use of protein markers in the genetic analysis of plants comes to naught, due to low occurrence and a large number of disadvantages. Protein markers are replaced by molecular or DNA markers, such traits (qualities) as reliability, information content, reliability, reproducibility and determine the significant superiority of molecular markers over other research methods. Thus, the use of molecular markers is becoming one of the main standards for plant breeding, due to the ubiquitous distribution across the genome and the practical universality of application in modern science.

The article reveals the essence and expediency of applying current analysis methods using DNA markers in crop production.

Keywords: molecular markers, genetic map, DNA markers, genetic certification, RAPD, RFLP, CAPS, AFLP, ISSR, SSR, SNPs, DArT, MAS.

REFERENCES

1. Chesnokov Yu.V. *Geneticheskiye markery: sravnitel'naya klassifikatsiya molekulyarnykh markerov* [Genetic Markers: comparative classification of molecular markers] // Scientific and Practical Journal of Vegetables of Russia. 2018. № 3 (41). P. 11-15.
2. Chekalin N.M. *Genetika ustoychivosti rasteniy i virulentnosti patogenov: Molekulyarno-geneticheskiye osnovy ustoychivosti rasteniy i virulentnosti patogenov* [Genetics of plant resistance and virulence of pathogens: Molecular genetic basis of plant resistance and virulence of pathogens] // Genetic basis of legumes breeding for resistance to pathogens. 2003. Pp. 128-136.
3. Omasheva M.E., Aubakirova K.P., Rjabushkina N.A. *Molekuljarnye markery. Prichiny i posledstviya oshibok* [Molecular markers. Causes and consequences of errors] // *Biotekhnologiya. Teoriya i praktika* [Biotechnology. Theory and practice]. 2013. No. 4. P. 20-28.
4. Konarev V.G. *Belki rasteniy kak geneticheskiye markery* [Plant proteins as genetic markers] // V.G. Konarev-Moscow: Kolos. 1983, 320 p.
5. Khlestkina E.K. *Molekulyarnyye metody analiza strukturno-funktsional'noy organizatsii genov i genomov vysshikh rasteniy* [Molecular methods for analysis of structural and functional organization of high plants genes and genomes] // *Vavilov Journal of Genetics and Selection*, 2011. Volume 15. № 4. Pp. 577-768.
6. Khlestkina E.K. *Molekulyarnyye markery v geneticheskikh issledovaniyakh i v selektsii* [Molecular markers in genetic studies and breeding] // *Russian Journal of Genetics: Applied Research*. 2014. T. 4. № 3. P. 236-244.
7. Botstein D., White R.L., Scolnick M., Davis R.W. Construction of a genetic linkage map in man using restriction fragment length polymorphisms // *Am. J. Hum. Genet.* 1980. V. 32. P. 314-331.
8. Moore G., Devos K.M., Wang Z., Gale M.D. Grasses, line up and form a circle // *Curr. Biol.* 1995. V. 5. P. 737-739.
9. Beckmann J.S., Soller M. Restriction fragment length polymorphisms in genetic improvement: methodologies, mapping and costs // *Theor. Appl. Genet.* 1983. V. 67. P. 35-43.

10. Burr B., Evola S.V., Burr F.A., Beckmann J.S. The application of restriction fragment length polymorphism to plant breeding // Genetic Engineering. N.Y.: Plenum Press. 1983. P. 45-59.
11. Tanksley S.D. Molecular markers in plant breeding // Plant Mol. Biol. Rep. 1983. V. 1. P. 3-8.
12. Rubel I.E., Panteleev S.V., Golovchenko L.A., Dishuk N.G., Konstantinov A.V. *Molekulyarno-geneticheskaya identifikatsiya fitopatogenov nekotorykh tsvetochnykh rasteniy v nasazhdeniyakh Belarus. Rol' botanicheskikh sadov i dendrariyev v sokhranenii, izuchenii i ustoychivom ispol'zovanii raznoobraziya rastitel'nogo mira* [Molecular genetic identification of phytopathogens of some flowering plants in Belarus, The role of botanical gardens and arboreta in the conservation, study and sustainable use of plant diversity] // *Materialy Mezhdunarodnoy nauchnoy konferentsii, posvyashchennoy 85-letiyu Tsentral'nogo botanicheskogo sada NAN Belarusi* [Materials of the International scientific conference dedicated to the 85th anniversary of the Central Botanical Garden of the NAS of Belarus]. Minsk: Medisont, 2017. P. 414-418.
13. Song Y.C., Gustafson J.P. The physical location of 14 RFLP markers in rice (*Oryza sativa* L.) // *Theor. Appl. Genet.* 1995. V. 90. P. 113-119.
14. Lewin B. *Geny* [Genes]. M.: Mir? 1987. 544 p.
15. Chan V.-T.V. *Gibridizatsiya nukleinovykh kislot* [Hybridization of nucleic acids] // *Molekulyarnaya klinicheskaya diagnostika* [Molecular clinical diagnostics]. M.: Mir, 1999. P. 375-394.
16. Matveeva T.V., Pavlova O.A., Bogomaz D.I., Demkovich A.E., Lutova L.A. *Molekulyarnyye markery dlya vidoidentifikatsii i filogenetiki rasteniy* [Molecular markers for species identification and plant phylogenetics] // *Ecological genetics*. 2011. Volume IX. No. 1. Pp. 32-43.
17. Karmen de Visente M., Fulton T. *Ispol'zovanie tehnologii molekulyarnykh markerov v izuchenii geneticheskogo raznoobraziya rasteniy: training module* [Use of molecular marker technology in the study of plant genetic diversity: a training module] // *Mezhdunarodnyy institut geneticheskikh resursov rasteniy (IPGRI) i Institut raznoobraziya genomov (IGD) Kornel'skogo Universiteta* [International Plant Genetic Resources Institute (IPGRI) and Institute for Diversity of Genomes (IGD) Cornell University]. 2003. 372 p.
18. Kalendar' R. N., Glazko V.I. *Tipy molekulyarno-geneticheskikh markerov i ih primeneniye* [Types of molecular genetic markers and their application] // *Physiology and Biochemistry Plants*. 2002. V. 34. № 4. 19 p.
19. Kobozeva E.V. *Vidovaya spetsifichnost' i taksonomicheskiye vzaimootnosheniya vidov StY-genomnoy gruppy roda Elymus L. aziatskoy Rossii: diss. ... kand. biol. nauk* [Thesis for the degree of candidate of biological sciences, Species specificity and taxonomic relationships of species of the StY-genomic group of the genus *Elymus* L. of Asian Russia]. Novosibirsk, 2014.
20. Shavrukov Yu.N. *CAPS-markery v biologii rasteniy* [CAPS markers in plant biology] // *Vavilovsky journal genetics and selection*/ 2015. 19 (2). P. 205-213.
21. Zabeau M., Vos P. Selective restriction fragment amplification: a general method for DNA fingerprinting // European Patent Office. publication 0 534 858 A1, 1993. bulletin 93/13.
22. Jo K.-R., Arens M., Kim T.-Y., Jongsma M.A., Visser R.G.F., Jacobsen E., Vossen H.J., Mapping of the *S. demissum* late blight resistance gene R8 to a new locus on chromosome IX // *Theor Appl Genet.* 2011. Vol. 123. P. 1331-1340.
23. Gupta M., Chyi Y.S., Romero-Severson J., Owen J. L. Amplification of DNA markers from evolutionarily diverse genomes using single primers of simple sequence repeats // *Theoret. Appl. Genet.* 1994. Vol. 89. P. 998-1006.
24. Boronnikova S.V. *Molekulyarnoye markirovaniye i geneticheskaya passportizatsiya resursnykh i redkikh vidov rasteniy s tsel'yu optimizatsii sokhraneniya ikh genofondov* [Molecular labeling and genetic certification of resource and rare plant species in order to optimize the conservation of their gene pools] // *Agrarnyy vestnik Urala*. 2009. V. 2. P. 57-59.
25. Sukhareva A.S., Kuluyev B.R. *DNK-markery dlya geneticheskogo analiza sortov kul'turnykh rasteniy* [DNA markers for genetic analysis of cultural plant varieties] // *Biomika*. 2018. Vol. 10. № 1. 69-84.
26. Vdovichenko L.D., Glazko V.I. *Geneticheskaya passportizatsiya sortov pshenicy s ispol'zovaniem ISSR-PCR markerov* [Genetic certification of wheat varieties using ISSR-PCR markers] // *Agricultural Biology*. 2007. № 3. P. 33-37.
27. Eckert A.J. High-throughput genotyping and mapping of single nucleotide polymorphisms in loblolly pine (*Pinus taeda* L.) // *Tree Genetics & Genomes*, 2009, Vol. 5(1). P. 225-234.

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