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An Overview of the Effect of BAP (6-Benzylaminopurine) Growth Regulator on Regeneration in Tomato Tissue Culture after Gene Transfer

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Abstract

Gene transfer is the process by which a piece of foreign DNA containing a new gene or a new combination of genes is artificially inserted into a creature's genome using laboratory techniques. An important part of plant biotechnology is the cultivation of tissues and organs in the environment in vitro, and it has various applications, including the cultivation and regeneration of transgenic plants in the laboratory environment. Tomatoes have been important in various food, economic and scientific aspects. Due to the sensitivity of tomatoes to biological stresses, different genes have been transferred to improve its resistance. Numerous growth regulators, including BAP (artificial cytokine hormones), are used in tissue culture, and several studies have shown that after gene transfer, its use in tomato tissue culture has improved the percentage of micro-regeneration.

Keywords: Regeneration Percentage; BAP (6-Benzylaminopurine); Gene Transfer; Tissue Culture

Abbreviations: IAA: Indole-3-Acetic Acid; BAP: 6-Benzylaminopurine; NAA: Naphthyl Acetic Acid

Introduction

Human life has been largely affected by three factors: food shortages, health problems, and environmental issues. Various biological and non-biological stresses in field conditions reduce plant yields by up to 50% [1]. Among non-existent tensions, salinity stress has the most severe impact on the environment, covering more than 800 million hectares of the world's land [2] and about 15 million hectares of Iranian land, or 10% of the country's land area [3] is affected. The rapid growth of the world's population and the urgent need for food have made the improvement of salinity-resistant plants an important global priority [2]. The most appropriate way to deal with these problems is to use new technologies [4]. Contrary to traditional approaches to agricultural and health issues, the use of genetic engineering methods today has made it possible to shorten the long-term period of plant breeding to make these programs more targeted. In conventional modification, which transmits a large number of specific and non-specific genes to the recipient, genetic engineering transfers only a small block of the desired genes to the target through various methods, including agrobacterium [5]. Recombinant DNA technology plays a key role in improving health by producing new vaccines and medications. This technology creates new opportunities for innovation to generate a wide range of therapeutic products with immediate impact on medical genetics and biologic drugs with modification of microorganisms, animals and plants [6].

Biological stress is one of the leading causes of declining crop yields worldwide, leading to reduced yields and most important crop plants by more than 50 percent [7,8].

Tomatoes serve as a model for the introduction of important crop genes in bipedal crops, the production of oral vaccines, and the production of affordable drugs [9]. It is the second most important potato crop in the world [10]. According to FAOSTAT, global production of this product in 2009 was about 152 million tons of fresh fruit [11]. Due to the sensitivity of this crop to biological stresses, including salinity, it is sensitive. Due to the high extent of saline soils in Iran, cloning, identification, introduction of genes and production of salinity-resistant transgenic plants are essential. Ionic pumps play an important role in the salt tolerance inside vacuoles. In fact, the difference in the relative ability of plants to transport and move ions from cell membranes, especially vacuole membranes, is the basis of plant differences in salt tolerance [12]. One of these ion pumps in the tonoplast is the pyro phosphatase pump, which is encoded by the vacuole pyrophosphate gene (AVP1). This gene encodes a single-unit vacuole protein pump that generates an electrochemical slope by transferring and collecting H+ inside the vacuole [13] and can be used as a candidate gene for tomato transfer. Studies have shown that the Hv TIP2, 3 genes in the resistant cultivar of barley shows an increase in salinity stress and this gene can be studied to create resistance in susceptible plants [14].

In vitro culture is commercially important because it allows for rapid growth and high quality in plants, and is a good tool for achieving goals that are difficult to achieve in natural growing conditions [15]. So far, many studies have been conducted on the regeneration of tomato plants through tissue culture techniques [16,17]. Studies have shown that the use of growth regulators usually plays an important role in plant regeneration. IAA and BAP have been the most common regulators of growth in tomato tissue culture, and the combination of the two has improved the regeneration of tomato micronutrients [18,19]. BAP plays an important role in the regeneration of the mint family of plants, and has been reported to be suitable in the MS culture medium with 1 mg / l BAP for propagation of Mentha piperita L (Miranha piperita L) [20]. Studies have shown that BAP has been more effective in microbial growth in bean glass (Phaseolus vulgaris) than other cytokines [21]. The 4-micromolecular growth factor BAP was reported in combination with 1 micromolar IAA [22]. BAP has been shown to play an important role in tomato regeneration [23], with a higher regeneration rate in cotyledon specimens than in hypoxyl [5]. The superior reaction of the cotyledon micronutrient to the hypoxyl ratio can be attributed to the high concentrations of endogenous auxin hormone in the cotyledon and its interaction on the micronutrient [24] or the greater organogenic potential of this micronutrient. He attributed the surface level to cotyledons [25]. A study by Bin, et al. [26] showed that a certain concentration of BAP and NAA can maximize branching and rooting in Japanese cucumber hybrids. Another study showed that all tomato specimens showed a significant response to the presence of BAP. The best leaf regeneration (100%) in MS was obtained with BAP (2 mg / L) + IAA (0.1 mg / L), the best medium for maximum branch length in the presence of BAP (3 and 2 mg / L) + IAA (0.1). mg / L) were for hypocotyl (45 mm) and leaf (40.40 mm), respectively [9,27,28].

Conclusion

The transfer of genes that cause resistance to biological stress in tomatoes can be a way to overcome the plant's susceptibility to stress. One of the effective engineering strategies of ion pumps located in the vacuole membrane is through genetic engineering and gene transfer. The use of growth regulators such as BAP will be very effective in increasing the regeneration of tomatoes in tissue culture.

References

1. Vij S, Tyagi AK (2007) Emerging trends in the functional genomics of the abiotic stress response in crop plants. Plant Biotechnol J 5(3): 361-380.

2. Witzel K, Weidner A, Surabhi GK, Born A, Mock HP (2009) Salt stress-induced alterations in the root proteome of barley genotypes with contrasting response towards salinity. J Exp Bot 60: 3545-3557.

3. (2007) FAOSTAT. Food and Agriculture Organization of the United Nations (FAO).

4. Khan S, Ullah MW, Siddique R, Nabi G, Manan S, et al. (2016) Role of Recombinant DNA Technology to Improve Life. INT J Genomics 2405954.

5. Kumar S, Kumar A (2015) Role of genetic engineering in agriculture. Plant Archives 15(1): 1-6.

6. Shinde S, Chavhan S, Sapkal S, Shrikhande V (2018) Recombinant DNA Technology and its Applications. IJOMR 4: 79-88.

7. Boyer JS (1982) Plant productivity and environment. Science 218(4571): 443-448.

8. Bray EA, Bailey Serres J, Weretilnyk E (2000) Responses to abiotic stresses: Biochemistry and Molecular Biology of Plants. American Society of Plant Physiologists 4(108): 1158-1249.

9. Otroshya M, Khalilia Z, Ebrahimib MA, Nekouic M, Moradia K (2013) Effect of Growth Regulators and Explant on Plant Regeneration of *Solanum lycopersicum* L. var. *cerasiforme*. Russ Agr Sci 39(3): 226-235.

10. (2011) Tomato: Land and Water. Food and Agriculture

Organization of the United Nations (FAO).

11. (2011) Crop Statistics. Food and Agriculture Organization of the United Nations (FAO), FAOSTAT.

12. Shannon MC (1985) Principles and strategies in breeding for higher salt tolerance. Plant and Soil 89: 227-241.

13. Zhang J, Li J, Wang X, Chen J (2011) OVP1, a vacuolar H+-Translocating inorganic pyrophosphatase (V-PPase) overexpression improved rice cold tolerance. Plant Physiol Biochem 49(1): 33-38.

14. Salami R, Mohammadi SA, Ghaffariyan S, Moghaddam M (2017) Evaluating the expression of HvTIP2;3 and HvTIP4;1 in barley genotypes under different levels of salinity stress. Indian J Genet 77(4): 524-530.

15. Lambardi M, Rugini E (2003) Micropropagation of Olive (*Olea Europaea* L.). Micropropagation of Woody Trees and Fruits 75: 621-646.

16. Afroz A, Chaudhry Z, Rashid U, Khan MR, Ali GM (2010) Enhanced regeneration in explants of tomato (*Lycopersicon esculentum L.*) with the treatment of coconut water. Afr J Biotechnol 9(24): 3634-3644.

17. Chaudhary Z, Abbas S, Yasmin A, Rashid H, Ahmed H, et al. (2010) Tissue culture studies in tomato (*Lycopersicon Esculentum*) Var. Moneymaker. Pak J Bot 42(1): 155-163.

18. Sherkar HD, Chavan AM (2014) Studies on callus induction and shoot regeneration in tomato. Sci Res Rep 4(1): 89-93.

19. Rashid R, Bhat JA, Bhat ZA, Dar WA, Shafi W (2012) Calluse formation and organogenesis of tomato (*Solanum lycopersicum L.*). VEGETOS: An International Journal of Plant Research 25: 243-248.

20. Kiran G, Kaviraj CP, Venugopal RB, Jabeen FTZ, Rao S (2004) Rapid regeneration of *Mentha piperita* L. from shoots tip and nodal explants. Indian J Biotechnol 3: 594-598.

21. Malik KA, Saxena PK (1991) Regeneration in *Phaseolus vulgaris* L.: Highfrequency induction of direct shoot formation in intact seedlings by N6-benzylaminopurine and thidiazuron. Planta 186(3): 384-389.

22. Sivanesan I, Jeong BR (2007) Micropropagation and in vitro flowering in pentanema indicum ling. Plant Biotechnol 24(5): 527-532.

23. Ugandhar T, Venkateshwarrlu M, Begum G, Srilatha T, Jaganmohanreddy K (2011) In vitro plant regeneration of cucumber (*Cucumis sativum* L.) from cotyledon and hypocotyls explants. JSRR 1(3): 164-169.

24. Gambley RL, Dodd WA (1990) An in vitro technique for the production of de novo multiple shoots in cotyledon explants of cucumber (*Cucumis sativus* L.). Plant Cell Tissue Organ Cult 20: 177-183.

25. Motamedi J, Zebarjadi AR, Kahrizi D, Hatef Salmanian A, Soheilikhah ZH (2010) Study of Callus Induction and Shoot Regeneration of Safflower (*Carthamus tinctorius* L.) Using Hypocotyl and Cotyledon Explants Culture. J Agric Biotechnol 2(1): 99-111.

26. Bin Azizan MNA, RISDA (2015) The Effect of BAP and NAA Treatment on Micropropagation of *Cucumis sativus.L*. International Journal of Science and Research 6(11): 170-176.

27. Bao A, Wang S, Wu G, Xi J, Zhang J, et al. (2009) Over-expression of the Arabidopsis H+-PPase enhanced resistance to salt and drought stress in transgenic alfalfa (*Medicago sativa L.*). Plant Sci 176(2): 232-240.

28. Mittler R, Vanderauwera S, Gollery M, Van Breusegem F (2004) Reactive oxygen gene network of plants. Trends Plant Sci 9(10): 490-498.