Bulletin of Biological and Allied Sciences Research
***ISSN:* 2521-0092**
www.bbasr.org
DOI: https://doi.org/10.54112/bbasr.v2021i1.35
*Bull. Biol. All. Sci. Res., Volume, **6**: 35*

BBASR

Review Article

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EXPLORING THE LATEST DEVELOPMENTS IN TOMATO TISSUE CULTURE

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(Received, 12th February 2021, Revised 14th October 2021, Published 15th October 2021)

***Abstract**: The tomato is an important vegetable crop that has grown widely over the past 100 years. The development of in vitro selection techniques could lead to new ways of making plants that can deal with stress. Techniques have been improved to make it possible to develop haploids and somatic hybrids. Also, work has been done to make it possible for tomato cultivars to grow back faster than wild varieties. It's important to consider how stable the genes are in tissue-cultured tomato plants. Many traditional and molecular breeding methods can be used to make cultivars that are resistant to both biotic and abiotic stressors. This essay looks at how tomato tissue culture has changed in several ways. It also talks about the problems that need to be fixed before plant tissue culture techniques can be fully used to make tomatoes grow more quickly and improve their genes. The ways to grow tomato tissue are changing quickly. There is still much work to be done before tissue culture can be used to make hybrid cultivars that can be sold*.

*[Citation: Abbas, A., Rehman, A.U. (2021). Exploring the latest developments in tomato tissue culture. Bull. Biol. All. Sci. Res. **6**: 35. doi: https://doi.org/10.54112/bbasr.v2021i1.35]*

Keywords: In vitro Techniques, Haploids, Somatic Hybrids, Tissue Culture, Tomato Cultivars

Introduction

Lycopersicon esculentum is the scientific name for a tomato. Tomato is a diploid plant because it has 24 chromosomes in 2n. Tomatoes (Lycopersicon esculentum), a popular vegetable crop, have become much more popular in recent years. Almost every country grows it in fields, greenhouses, and net houses. But tomatoes are grown as an annual crop even though they are perennial. At the moment, tomatoes are grown on more than 3.9 billion hectares of land around the world. In 2002, this land produced 108 million metric tons of tomatoes (Database of Statistics from the FAO, 2003). The tomato is high in vitamins A, C, and fiber and has no cholesterol (Hobson, 1971). A normal-sized tomato (148 g) has only 35 calories. The tomato is in the family Solanaceae. Most tomatoes grown in greenhouses are indeterminate and must be helped to grow. Specified cultivars are usually smaller than indeterminate varieties, and are used in field settings for commercial fresh market production. Determined varieties ripen their fruit more quickly and are easier to pick (Rhodes, 2002).

Food security is a recurring and serious global threat, and increasing food production is needed for population growth (Pradhan, 2015; Yu, 2021) climate change and new global events like the COVID-19 pandemic (Devereux, 2020). Because traditional breeding takes a long time and often leads to the loss of fitness and genetic diversity, new technologies are needed to meet the growing demand for crop improvement (Araki et al., 2015). Genome editing may be the most important advance in plant breeding because it allows for precise breeding and quickly creates unique, transgene-free plants similar to or the same as plants made by traditional breeding methods (Araki, 2015; Zhang, 2018). One of the most commonly grown and eaten vegetables, the tomato (Solanum Lycopersicum), gives people a lot of lycopene, vitamins, and minerals (Zhu, 2018). If you want to study the biology of fruits, the tomato is the best plant to use as a model. Since 2014, tomatoes have changed their genes (Brooks, 2014). Using targeted mutagenesis driven by genome editing to reevaluate tomato genes that are important for fruit ripening (Gao, 2020; Ito, 2017; Wang, 2019) shows that several things about how tomato fruits ripen need to be looked at again. Plant tissue culture had come a long way since the 1930s when scientists used it for the first time to grow cells in a lab. Currently, it is used for many things, such as making calluses, growing protoplasts, and re and somatic embryogenesis. Plant tissue/cell culture is a key part of helping Agrobacterium tumefaciens, electroporation, and particle bombardment change the genes of plants (Zhang, 2018). Due to the crop's high economic value and potential for genetic improvement, research on in vitro regeneration of cultivated tomatoes (Lycopersicon esculentum Mill (Evans, 1989). Because of this, a lot of research has been done on plant regeneration using different parts and tissues from both wild and grown tomato germplasm (Padmanabhan et., 1974; CASSELLS, 1979; Novak, 1979; Ancora, 1981; Zapata, 1981). Several in vitro tests for biotic and abiotic stress on tomato cell cultures have been done (Stavarek, 1984; TOYODA, 1984; Bhatia, 2004; Toyoda, 1989). along with the growth of haploids (Gresshoff, 1972; Zagorska, 1982; Zagorska, 1998; Chlyah, 1984; Toyoda, 1989). A process is used to make somatic hybrids (Sink, 2019; Wijbrandi et al., 1988). One more essential is mass communication (Fari et al., 1992).

Biotic and Abiotic Stress Selection

In a laboratory environment, in vitro tomato culture has been used to find cell cultures resistant to a wide range of biotic and abiotic challenges. It takes far less time and money than selecting tomato genotypes under field circumstances. In the case of the tobacco mosaic virus, virus resistance was chosen by physically injecting viruses into cells (Toyoda, 1989). Also, soma clonal variations have been used to make lines of genetic material resistant to disease (Toyoda et al, 1989).

Production of Haploids

Both anthers and microspores have been cultured to produce haploid tomatoes. Gresshoff and Doy were the first to use anthers to make haploid tomato callus cultures. They added different amounts of kinetin and NAA to the growing medium.

Mass Propagation

Tomatoes can grow new shoots directly or indirectly through a phase called "medium callus" (Dwivedi, 1990; Behki, 1980). In Callus, shoots can grow simultaneously (Geetha et al., 1998). Also, genome editing has been used to improve tomatoes, mostly to increase fruit yield and quality, increase stress tolerance, domesticate wild tomatoes, and adapt tomato cultivars for urban agriculture (Li et al., 2018). Almost all plants in their natural environment are often infected by viruses, which were studied to select new varieties of Chinese herbal medicines in Zhejiang Province in 2019. These viruses are usually found in the Ministry of Agriculture's Agricultural Major Technology Collaborative Promotion Project of China and other technological projects. These viral infections can cause diseases that are hard to treat and cost money. This makes viral diseases a big problem for agricultural production and long-term growth. But these losses can be reduced by making and using plantlets that are not infected with viruses. In vitro, culture techniques are the best way to eliminate different viruses from almost all of the most important crops for the economy. Meristem tip culture, somatic embryogenesis, chemotherapy, thermotherapy, electrotherapy, shoot tip cryotherapy, and micro grafting are all ways to make virus-free plantlets. At the moment, meristem tip culture is the one that is used the most. Here, we explain in detail how to use tissue culture techniques to make Chrysanthemum morifolium Ramat plantlets free of viruses.

Tomatoes are a major vegetable crop that has become very popular over the past 100 years. Almost every country in the world has seen it grow. Creating protocols for in vitro selection can be a step forward in making cultivars that can handle stress. The best methods have been found for making haploids and somatic hybrids. People have also tried to give cultivated tomatoes a higher ability to grow back than wild varieties. Even though there is some information about how tomatoes change shape, the techniques have not yet advanced to the point where they can be used to make many copies of commercially important cultivars. The morphogenesis response seems to depend a lot on the PGRs in the medium, which are again specific to the cultivar and genotype. Somatic embryogenesis in tomatoes is still in its early stages, and there aren't any good ways to use somatic embryogenesis on a large scale yet (Bhatia et al., 2003). The genetic stability of the tomato plants grown from tissue culture also needs to be looked at. Molecular breeding and traditional breeding methods could be used together to make cultivars resistant to both biotic and abiotic stresses. This paper looks at the progress made in different areas of tomato tissue culture. It also talks about the problems that still need to be solved before plant tissue culture techniques can be used to their full potential in improving tomato genes and making more of them.

Conclusion

Tomato plant tissue culture techniques have come a long way in the past few years and are improving. Tissue culture has made it possible to grow high-yield tomato plants in a lot less time. This is because more efficient and cost-effective ways of making tomato plants have been found. Using biotechnology has also made it possible to make genetically modified tomatoes with better traits, like being resistant to disease and having a better taste. These improvements have allowed the tomato industry to boost productivity and make more money. As new technologies continue to be made, the future of tomato tissue culture will surely be interesting. There are more and more ways to grow tomato cells all the time. Tissue culture has a long way to go before it can be used to make hybrid cultivars cheaply. It would help if you used techniques like regeneration and somatic embryogenesis to produce plants from cells that have been changed. These techniques are also required to make a wide range of better transgenic plants. While using genome editing in breeding has been good for tomatoes and other important crops. Genome editing is one of the most important ways to reach the long-term breeding goal of making crops that can quickly adapt to different climates, handle bad weather, and have high yields and quality. When these genes are taken out, most of the time mutations happen that make the organism less useful.

Conflict of interest

The authors declared absence of conflict of interest.

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