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Plant Tissue Culture: A Promising Approach for Production of Clean Planting Material of Blueberry

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Introduction

Taxonomic Classification of Blueberry

Blueberry belongs to the heath family and is classified as follows:

Taxonomic Rank	Classification	Images
Kingdom	Plantae	 
Subkingdom	Tracheobionta (Vascular Plants)	
Division	Magnoliophyta (Flowering Plants)	
Class	Magnoliopsida (Dicotyledons)	
Order	Ericales	
Family	Ericaceae	
Subfamily	Vaccinioideae	
Tribe	Vaccinieae	
Genus	Vaccinium	
Species	Several species including <i>Vaccinium corymbosum</i> , <i>Vaccinium angustifolium</i> , <i>Vaccinium virgatum</i>	

Berry crops gain popularity in India and abroad as they offer numerous health benefits. Blueberry (*Vaccinium* L. sp.) is a tetraploid perennial rhizomatous cross-pollinated shrub which is worldwide consumed fruit with high health benefits due to anti-inflammatory and antioxidant properties. The genus *Vaccinium* L. is quite large with about 400 species which are utilized globally for their health-promoting factors. It is consumed fresh as well as in the form of blueberry products, but only 1% have been used as fresh. Blueberries are a type of small, sweet and juicy berry that is native to North America.

Major Cultivated Blueberry Types are:

Type	Scientific Name	Characteristics
Northern Highbush Blueberry	<i>Vaccinium corymbosum</i>	Most widely cultivated; requires higher chilling hours.
Southern Highbush Blueberry	Hybrid of <i>Vaccinium corymbosum</i> and southern species	Adapted to warmer climates and lower chilling requirements.
Rabbiteye Blueberry	<i>Vaccinium virgatum</i>	Vigorous, drought-tolerant, suitable for subtropical regions.
Lowbush Blueberry	<i>Vaccinium angustifolium</i>	Short-growing plants, often managed in wild stands.
Half-high Blueberry	Hybrid of highbush and lowbush blueberries	Cold-hardy and suitable for northern regions.

Nutritional status

Blueberries are known as antioxidant rich fruit and have abundant health profit such as anticancer activity, eye straining problem, macular degeneration prevention, and reduced risk of heart disease (Kalt et al., 2007). These are nutritional powerhouse rich in vitamins, minerals, antioxidants and fibers which are relayed with specific health benefits in respect of heart health, brain health, blood sugar control, cancer prevention and many other benefits. There has been increased market requirement on consumption of blueberries due to their numerous recognized health promoting properties.

Nutritional Status of Blueberry (Per 100 g Fresh Fruit)

Nutrient	Amount
Energy	57 kcal
Water	84.2 g
Carbohydrates	14.5 g
Total Sugars	9.9 g
Dietary Fiber	2.4 g
Protein	0.7 g
Total Fat	0.3 g
Vitamin C	9.7 mg
Vitamin K	19.3 µg
Vitamin E	0.57 mg
Vitamin A	3 µg
Folate (Vitamin B9)	6 µg
Calcium	6 mg
Phosphorus	12 mg
Magnesium	6 mg
Potassium	77 mg
Sodium	1 mg
Iron	0.28 mg
Zinc	0.16 mg
Manganese	0.34 mg
Anthocyanins*	100–500 mg
Total Antioxidant Capacity	High

*Anthocyanin content varies with cultivar, maturity stage, growing conditions, and storage.

Need for Clean Planting Material in Blueberry

Production of blueberry for fresh and processed consumption is increasing globally. In recent years blueberry cultivation in India has become popular due to increase in demand of fruits in International and National market. Blueberry market is estimated to grow at a CAGR of 6.5% by 2027 and market is anticipated to increase in size by 2463.41 million USD. In India, blueberry farming is mainly concentrated in Himachal Pradesh, Uttarakhand and Jammu & Kashmir state, as the climate conditions of these states are suitable for blueberry farming. Himachal Pradesh showed promising soil conditions and environmental conditions for blueberry cultivation. But major challenges in blueberry farming at commercial level are availability of planting material of blueberry, cost of blueberry plant and limited expertise in blueberry cultivation. Typically blueberries are propagated by asexual method like stem cutting but that method is time consuming and laborious. Plant biotechnology has the potential to meet the market demand for a significant number of clean planting materials. There is an excellent result of micropropagation with notable achievements which are observed in case of number of plant species particularly berries.

***In vitro* Micropropagation of Blueberry**

Micropropagation method has been used to produce large number of uniform planting material of blueberry. Through micropropagation genetic uniformity can be achieved and other problems like variations in fruit characteristic and precocity of flowering can also be overcome (Arencibia et al 2013). Modern plant improvement programs use plant tissue culture techniques as new tools. *In vitro* micropropagation has been achieved in highbush, lowbush, and rabbiteye blueberries through axillary shoot production (Litwinczuk, 2023, Ruzic et al., 2012, Tetsumura et al., 2008). It has been observed that tissue culture raised blueberry plants produced more fruits as compared to conventional blueberry plants when compared and have good rooting ability. *In vitro* propagation of blueberry is a promising approach as it is one of the most suitable means of propagation where acidic conditions can be maintained and large number of planting material can be developed in the lab conditions. Micropropagation is a valuable technique for the large-scale propagation of economically important fruit crops, offering a viable solution to meet the growing market demand for high-quality planting material. In the case of blueberry, tissue culture methods have demonstrated superior outcomes compared to traditional propagation through cuttings.

Conclusion

There is high rise in the demand of clean and quality planting material of fruit crops across the nation. Plant tissue culture has emerged as a promising and sustainable approach for the production of clean planting material of blueberry. The technology offers rapid multiplication, disease-free plants, genetic uniformity, and year-round propagation, making it highly suitable for commercial cultivation. By supply of clean planting material and right practices, blueberry farming can be game changer for progressive farmers.

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