REVIEW ON INDIA'S MINOR FRUIT CROP MICROPROPAGATION

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ABSTRACT

In vitro plant multiplication in a short period of time utilizing any plant component (nodes, leaves, flowers, seeds, etc.) under aseptic circumstances is referred to as micro-propagation. As comparison to vegetative propagation, it is better for horticultural purposes. It is a tried-and-tested strategy for producing excess quantities of superior, identical plants in a controlled environment that are uniform, stable, free of disease, true to type, and unconstrained by seasonal constraints. Indian gooseberry (Emblica officinalis Gaertn.), Karonda (Carissa carandas L.), Bael (Aegle marmelos Corr.), Jamun (Syzygium cuminii L.), and Jackfruit (Artocarpus hetrophylous L.) are just a few of the notable but minor fruit crops native to India that have high nutritional, medicinal, and therapeutic values as well as significant commercial significance (medicinal, food and cosmetics). The commercial production procedure for these crops is constrained due to a lack of acceptable planting materials. The number of novel cultivars or genotypes of these fruit crops might be greatly increased with micropropagation. This review study's goal is to synthesize the body of knowledge about the micropropagation of these neglected fruit crops.

Key words: *Indian gooseberry, Jackfruit, Jamun, Karonda, Micro-propagation, Minor fruit.*

Introduction

India, the second-largest producer of fruits in the world, is also regarded as the origin of a broad variety of fruit crops that are neglected but have great promise. It can be cultivated in even the most neglected marginal settings and have significant nutritional, pharmacological, and therapeutic properties. Aonla, bael, karonda, jamun, jackfruit, etc. are examples of underutilized fruit crops. These plants may be grown successfully with little inputs and under distressingly high temperatures. Minor fruits are rich in a variety of essential vitamins, minerals, and bioactive substances that have been linked to antioxidant properties against different free radicals.

In addition to these benefits, these minor fruit crops are not widely grown, and their consumption and commercial trade are constrained in comparison to large fruits both geographically and quantitatively. Unused fruits are a crucial component of the traditional diets of rural and tribal populations, and they have the necessary capacity to provide food security and to combat poverty. In order to combat hidden hunger, "Biodiversity International" advised using underused fruits as substitute sources. The amount of these crops that are produced commercially is limited due to a lack of sufficient planting material. The number of notable varieties of these fruit crops might be greatly increased with micropropagation.

Because of the lengthy life cycle, breeding and selection trials are a very challenging technique. Fruit tree output is significantly decreased by a variety of biotic and abiotic stress conditions.

The urgent integration of plant biotechnology technologies for fruit tree enhancement is required since conventional procedures are inadequate to address these problems.

Micro-propagation is a term used to describe a synthetic process of creating genetically identical or clonal plantlets in vitro under aseptic conditions with a predetermined nutritional media. The limitations of the season have no bearing on this method. It contributes significantly to the nursery, propagation, and orchard sectors by producing uniform, stable, disease-free, true-to-type, elite propagules and high-quality plantlets that multiply quickly. Commercial applications of plant tissue culture technology for microbial-free plants (Parmessur et al., 2002).

Applications of micropropagation in fruit crops are as follows:

a) In vitro cultivation may be used for ex situ conservation of small fruits.

b) Micro-propagation allows for the yearly production of millions of fruit crop clones from a little number of plant tissues. It would take a long time to grow a same amount of plants using conventional techniques.

c) Tissue culture, specifically "meristem tip culture," may be used to create plants free of disease.

d) It is possible to improve yield qualities.

f) Tissue culture may be used to enhance qualitative qualities.

f) Managing several plants in a small laboratory space.

g) Creating ideal growth conditions in a small laboratory space.

h) Rapid reproduction of a cell, component, or organism in vitro may be carried out at any time of the year.

I) Using the "Introduction" method, it is feasible to exchange plant material swiftly across international boundaries without running the danger of disease transmission. The duration of quarantine is shortened by this method.

j) Time management and seed rate.

Indian gooseberry (Emblica officinalis Gaertn)

Aonla is a significant native hardy small fruit of economic value that was first domesticated in tropical south-eastern Asia, mainly in Central and Southern India. It is also cultivated in peninsular India and near the foothills of the Himalayas. In addition to powerful antioxidants, many active tannins composition constituents (Emlicannin A, Emblicannin B, Puniglucon, and Pedunculagin) have been found, which contribute to a number of health advantages. Rao et al. (1985); Rastogi (1993).

The richest supply of for in vitro is found in the fruits of aonla; the shoots were trimmed to a length of 1-2 cm, and the determinate shoots linked to nodes were removed, leaving 0.5 cm from the base.

Explant waxing is the process of sealing the cut end of the explant with melted paraffin wax to avoid oxidative browning and contamination in vitro. According to reports, this approach has an 80% success rate in developing cultures. For the inoculation of the shoot, MS medium (Murashige and Skoog, 1962) that was supplemented with 0.8% agar, 3% sucrose, 0.4 mg/l kinetin, and 1.0 mg/l GA3 was utilized.

Cultures were kept at 25°C temperature, 50–55% relative humidity, and 2000 lux of

fluorescent tube light illumination with a 16/8 hour cycle of light and dark. The pH of the medium was preserved at 5.7. Aonla shoots gathered between August and November showed greater culture establishment, bud induction, and microshoot development than shoots obtained between April and July, according to the experiment's observations. Aonla shoots that were either soft (1–10 nodes) or highly hard, brown (20–30) nodal segments proliferated substantially less than those that were moderately hard (10–15 nodes) and somewhat green.

Barbados cherries are a source of beneficial minerals like riboflavin, calcium, iron, phosphorus, nicotinic acid, tryptophane, lysine, and methionine as well as having herbicidal properties because of the presence of high anti-ascorbic value. Treatment of the explant with Bavistin (1.0%) and Chloramphenicol (0.1%) for 240–260 minutes, followed by treatment with HCl for 8 minutes under vitamin (Anonymous, 1960). Due to its hardiness, versatility for growth in a range of agroclimatic settings, and extensive application in the pharmaceutical, nutraceuticals, cosmetics, and post-harvest processing sectors, aonla is growing in popularity in India.

Lack of homogeneous planting material is the main obstacle to the creation of Indian gooseberry orchards. Depending on the genotype, the success rate of vegetative propagation ranges from 25 to 80 percent (Ram, 1982). Aonla may be cultivated using seed products, "Inarching," or both (grafting). Cross-pollination prevents seeds from growing plants that are true to type. The traditional technique of aonla vegetative proliferation is sluggish and season-dependent. Those plants also take longer to produce fruit. Also, because to the tall branching habit, there aren't many branches near to the ground surface for approach grafting purposes.

Lack of the appropriate number of shoots for vegetative propagation methods like grafting or budding is another barrier to field multiplication and field survival (Mishra and srivastava 1999). Yet, true to type plantlets may be repeatedly replicated using standardized micropropagation technology. In vitro bud induction and shoot proliferation are the two most important factors that have a significant impact on the effectiveness of any micro propagation system.

By using axillary shoots with one node as explants, Mishra and Pathak (2001) performed an investigation on in vitro shoot growth in Narendra aonla-7 (Emblica officinalis Gaertn. To prevent in vitro contamination, aseptic conditions were employed before producing the explants (Mishra, 1997). Soon after in vitro bud induction, a stem with leaves that only bears flowers emerges. On the other side, future multiplication requires indeterminate branches.

Hence it's important that GA3 is involved in the elongation of indeterminate shoots. High multiplication of shoots (13.33 shoots/culture) were achieved in the presence of 4.33 M GA3 + 13.9 M Kinetin + 342.11 M Glutamine (Mishra et al., 2006). There are several further studies on aonla micropropagation that includes a callus phase and seedling explant. The examination of genetic transformation may be aided by this technique, but it cannot be used for true-to-type plant reproduction. Using E. officinalis callus cultures, high frequency plantlet regeneration was achieved (Verma and Kant, 1999).

Karonda (*Carissa carandas* L.)

The apocynaceae family of hardy, evergreen, spreading, semi-vine-like shrubs includes karonda (Carissa carandas L.). In both tropical and subtropical climes, it does well. It is vulnerable to flooding during periods of severe rain. It produces berry-sized fruits that are too sour and astringent to consume fresh, making them suitable for processing into a variety of high-quality products like nakal cherries, jam, jelly, jam, syrup, squash, sauce (from ripe fruits), and chutneys and pickles (from unripe fruits), which are in high demand both domestically and abroad. The fruits include a lot of nutrients including iron (39.1 mg/100 g), calcium (21 mg/100 g), and phosphorus (38 mg/100 g), as well as vitamin C (1.6–17.9 mg/100 g), protein, and (1.1–2.25%). Dried fruits are one of the highest sources of iron content (39.1 mg/100 g) (Anonymous, 1950; Anonymous, 1979; Kumar and Singh, 1993), as well.

The roots are used as an anthelmintic, stomachic, and antiscorbutic as well as a treatment for intestinal worms, scabies, and itching (Warrier et al., 1993). Combs and spoons may be made from the white, sturdy, and smooth wood of the karonda shrub. Around apple orchards, the plants may be utilized as live fence and taught to develop into a sturdy hedge. The widespread use of karonda needed several plants per square foot. A different method for rapid and extensive multiplication is urgently required in order to enhance the area of this crucial underutilized crop that is being cultivated. Throughout several seasons, shoot tips from mature Carissa carandas cv. Pant Sudarshan plants were cultivated on Murashige and Skoog's (MS) basal medium supplemented with benzyl adenine (BA) and indole butyric acid, according to Rai and Misra's (2005) study (IBA).

The greatest rate of sprouting was seen in the 1.5 cm length explants harvested in the spring season (February–March), followed by those harvested in the summer (April-June). MS-basal media that has been supplemente. Shoot proliferation was greatest at 3.0 mg/l BA. The mixture of 1/2 MS with 0.8 mg/l IBA and 0.2 mg/l naphthalene acetic acid resulted in the best micro-shoot rooting (NAA). Successful acclimatization of the rooted seedlings in a potting combination of vermiculite, sand, and soil (1:1:1). Dey et al., (2017) also conducted an experiment on various cuttings of Carissa carandas which were treated with different concentrations of sucrose (2%, 4% and 6%) as well as with IBA (7500 ppm, 8000 ppm and 8500 ppm) and observed that in a short period of time, different levels of sucrose and IBA had a significant impact on the success, survival, and rooting of Karonda (Carissa carandas L.) cuttings. IBA @ 8000 ppm followed by 4% sucrose application is the best course of action for commercial vegetative propagation of Karonda by stem cuttings.

Bael (*Aegle marmelos* Corr.)

The bael (Aegle marmelos Corr.), an old medicinal fruit tree native to India with chromosomal number (2n=36, is a deciduous member of the rutaceae family. Bael fruit that is ripe is full of fiber, vitamins, minerals, and tonic properties that are also healthy for the heart and brain. Fruit pulp is high in "psoralen" and "marmelosin." Bael fruit may be processed into a variety of value-added goods, including bael sweets, preserves, sherbet, and powder, due to its hard shell, mucilaginous texture, and abundant seeds that make it difficult to eat out of hand. Traditionally, bael is multiplied via seed, which is planted in June and develops into

seedlings after a year but is not true to type.

Bael seeds also have a limited vitality and are quite vulnerable to insect assault. Root sucker reproduction is laborious and sluggish (Anonymous, 2003). The strain on natural sources has increased due to excessive exploitation and indiscriminate collection of bael species' wild populations, which has led to the extinction of this plant, which is currently categorized as vulnerable in a few Indian states (Ravikumar and Ved, 2000). Axillary bud multiplication, leaf explants, and the nucellar callus approach have all been used to explain in vitro bael propagation (Arumugam and Rao, 1996; Hossain et al., 1994a; Ajithkumar and Seeni, 1998). (Hossain et al., 1994 b).

Jamun (*Syzygium cuminii* L.)

In the Indo-Malayan region, jamun is a significant hardy medicinal fruit crop that can be cultivated with ease in neglected and swampy places. The jamun has gotten a lot more attention in traditional medicine and the pharmaceutical sector than in any other field. Fruits include a variety of anti-oxidant substances that are vital for human health because they lower oxidative stress and prevent macromolecular oxidation, such as polyphenolic compounds, flavonoids, carotenoids, and vitamins (Kubola et al., 2011). It has both medicinal and nutritional benefits. It is used to treat diabetes, heart disease, and liver illness and is a high source of iron. The quantity of sugar in urine is swiftly reduced by the jamun fruit's seed powder.

Large-scale true-to-type planting material may be produced by micropropagating Jamun using juvenile tissue (Roy et al., 1996), utilizing seedling explants (Yadav et al., 1990, and Jain and Babber, 2000), and other methods. Single nodal explants from seedlings may be used to propagate jamun (Syzygium cuminii L.) in a laboratory setting. In single nodal explants cultivated on half-strength MS with 2 mg/l BAP + 3% sucrose + 3% activated charcoal, shoot proliferation was improved. The shootlets were successfully planted on 1/4 strength MS with 3% sucrose and 2.5 mg/l IBA. The rooted shootlets were placed in polybags and moved to the field after six weeks of hardening on vermiculite (32.5 percent survival) (Chaudhary et al., 2013).

Jackfruit (*Artocarpus hetrophylous* L.)

Jackfruit (Artocarpus hetrophylous L.), which has the Indian chromosome 2n=56, is a member of the moraceae family. In African nations like Uganda, it is also referred to as "poor man's food" and is recognized as a staple dish. Immature fruits are utilized as veggies, and ripe fruits are used as table fruits. Because to their high pectin content, perigones and rinse are perfect for creating jelly.

Fruits that are ripe but not quite mature may also be used to create papad and chips. A excellent source of starch, jackfruit seeds are utilized in many different types of food. The significant heterozygosis makes jackfruit reproduction a controversial practice. For jackfruit multiplication to maintain true-to-type quality fruit all year long, tissue culture technology might be used. Also, because to a lack of good cultivars and acceptable planting materials, jackfruit production is often restricted. Jackfruit has been developed utilizing a tissue culture method that uses apical bud cultures (Amin and Jaiswal, 1993), plants, or shoot tip or nodal explant (Roy et al., 1990; Azam and Rahmatullah, 2009; Miro and Acedo, 2015). Healthy (disease-free) and

juvenile shoot tips were used as explants and grown in Murashige-Skoog (MS) medium supplemented with different doses of plant growth regulators, such as BAP (0 mg/L, 1 mg/L, 2 mg/L, 3 mg/L, and 4 mg/L) (6-benzylea minopurine). Shoot regeneration considerably enhanced with the addition of 2 mg/L BAP to MS medium. As the subculture grew, the proportion of shoot proliferation rose (up to the tenth maximum). The number of roots/explants, root length, and early root induction were all highest in the medium containing 2 mg/L IBA (Indole-3-butyric acid) when these shoots were cultivated on half strength MS media supplemented with 0 mg/L, 1 mg/L, 2 mg/L, 3 mg/L, and 4 mg/L IBA (Ashrafuzzaman et al., 2012).

CONCLUSION

Taking into account everything said above, we may simply use the approaches suggested to generate millions of clones of minor fruit harvests each year that are true to type, stable, elite, uniform, and disease-free.

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