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Review on tissue Culture of Calla Lily (*Zantedeschia* spreng.) and the Current Situation

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Abstract

Native to tropical Africa, the Calla lily (*Zantedeschia* spreng.) is a herbaceous, bulbous and beatiful flower. The calla long flowering period have contributed to its considerable rise in popularity in the global market. Besides problems related to Calla lily commercial exploitation have come to light as market demand for the plant has grown. *Zantedeschia* was formerly propagated vegetatively through tuber division. Nonetheless, the propagules frequently contain viral and bacterial species that infect the plants. These organisms are particularly prevalent in *Erwinia carotovora* subsp. and *E. chrysanthemi*. The most effective method for quickly producing a large number of pathogen-free plants is micropropagation. plant tissue culture is a technique that can be used to generate entire plantlets from a cell, tissue or any other portion of the plant. In this review article, we are going to briefly review the results of research conducted on Calla lily (*Zantedeschia* spreng.) tissue culture.

Keywords: Zantedeschia, Tissue Culture, Calla Lily, Micropropagation

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Introduction

Typically, Calla lilies are propagated through tuber division and seed culture. This flower's seeds allow for sexual reproduction, which takes two to three years and results in different offspring [13]. Thus, it is imperative to employ a different, quick, and effective technique, like Calla lily in vitro culture [1]. In addition, Traditional Calla lily propagation techniques don't give enough planting material since the plants are attacked by a variety of fungi, bacteria, and viruses during the process, which results in a low output of flowers and rhizomes or occasionally kills the plant. As a result, the only method that produces healthy, uniform seedlings and permits quick clonal replication is plant tissue culture [6]. Micropropagation is an effective technique for producing uniform, healthy plants quickly. It is also devoid of pests and illnesses [3]. Organogenesis or embryogenesis are the two methods used to produce plant regeneration from in vitro culture. Tissue culture is used to produce plant materials free of recognized viruses and to introduce novel cultivars. For the generation of tubers in Calla lilies, tissue culture-derived plant material is suggested as an alternate source of planting material [6].

Large-scale plant cell production and high-yielding product extraction from cell cultures have emerged as highly sought-after technologies. The development of this technology makes it more economical to produce materials in large quantities at low cost. In tissue culture, three major types of plant growth regulators auxines, cytokinines, and gibberellins—are employed. Only when one or more of these hormone classes are added to a medium can the growth differentiations and organogenesis of tissues be accomplished [2].
Growth regulators such as BAP, IBA, and NAA have been discovered to be necessary for shoot multiplication, root formation, and growth in the majority of cases. Due to their antimicrobial, antifungal, antioxidant, antihistaminic, antialgal, antithrombotic, and anticoagulant properties, several Calla lily species are also utilized as herbal medicines. The findings so indicate that more research and development are required to enhance this crop in order to create superior varieties with yields that are commercially significant. The current review combines procedures and methods for micropropagation to collect data, which is then given to researchers for more study and the production of both quantity and quality planting material [6].

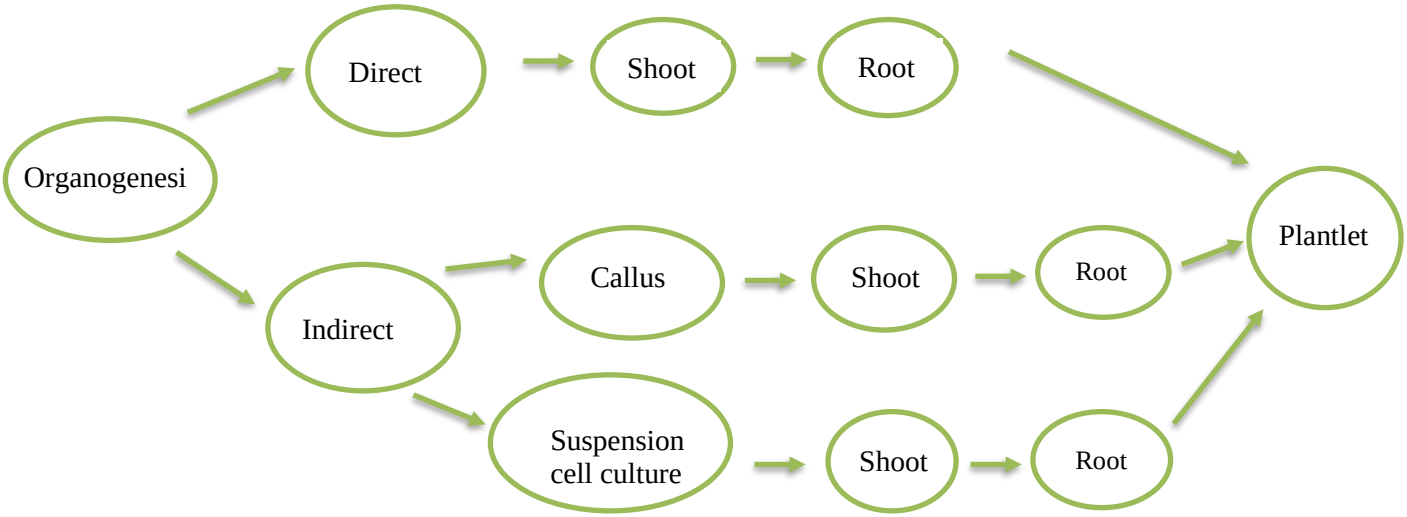

Fig 1- In vitro of plants by organogenesis

An overview of Calla lily tissue culture studies:

Wu et al. [12] carried out the first investigation on Calla lily in vitro regeneration early in the 1990s. After ten days, a callus formed on the white calla lily leaf that had been inoculated with extra auxin and cytokinin (NAA and KT) on MS media. After then, buds appeared and after around three weeks, clusters of shoots sprouted. After reaching a length of roughly 3 cm, the branches were moved to a rooting medium in order to aid in the growth of full plants. Figure 2 displays the most recent advancements in Calla lily in vitro tissue culture [9].

Many investigations for the organogenesis process have used Calla lily explants, including leaf, petiole, spathe, tuber, and anther. According to these research, while all vegetative cells have the ability to regenerate entire plants, there may be significant differences in the ease or difficulty of doing so.[9].

The direct organogenesis pathway of Calla lily induces clumps of buds primarily using 6-BA, TDZ and KT. An experiment using three different types of PGRs (6-BA, TDZ, and KT) on tuber of colored Calla lily revealed that a medium supplemented with 6-BA induced the highest adventitious bud proliferation rate [11].
In the experiment, sucrose 5.60 $mg.l^{-1}$ and 5 GA3 $mg.l^{-1}$ had the most sprouts in MS culture medium. The shoot length was observed in sucrose 3.45 $mg.l^{-1}$ and 10 GA3 $mg.l^{-1}$. The maximum length and number of roots were found in MS medium containing 13.51-56.56 $mg.l^{-1}$ sucrose [6]. According to the research results, the longest lateral branch was observed at 50 and 25 µM concentrations of BAP. Rhizome was formed in 205 µM BA treatment and rooting was observed in all treatments. Also, the longest roots were present at 10 and 5 µM BA [4]. In another experiment, the seed embryos of *Zantedeschia* cv. "Liming" and "Black Magic" in culture media containing 0.5, 1, 1.5, 2 and 2.5 mg/l 6-BA, 0.1, 0.2, 0.3, 0.4 and 0.5 mg/l NAA and 0, 0.05, 0.1, 0.2 and 0.4 CNTs were placed in all three stages of callus induction, germination and rooting. For callus induction in 6-BA and 0.1 mg/l NAA and 0.1 mg/l NAA and germination in 6-BA, 0.2 mg/l NAA and 1 mg/l CNTs and rooting in mg/l l 2 6-BA, 0.7 mg/l NAA and mg/l 2 CNTs were the best [10].

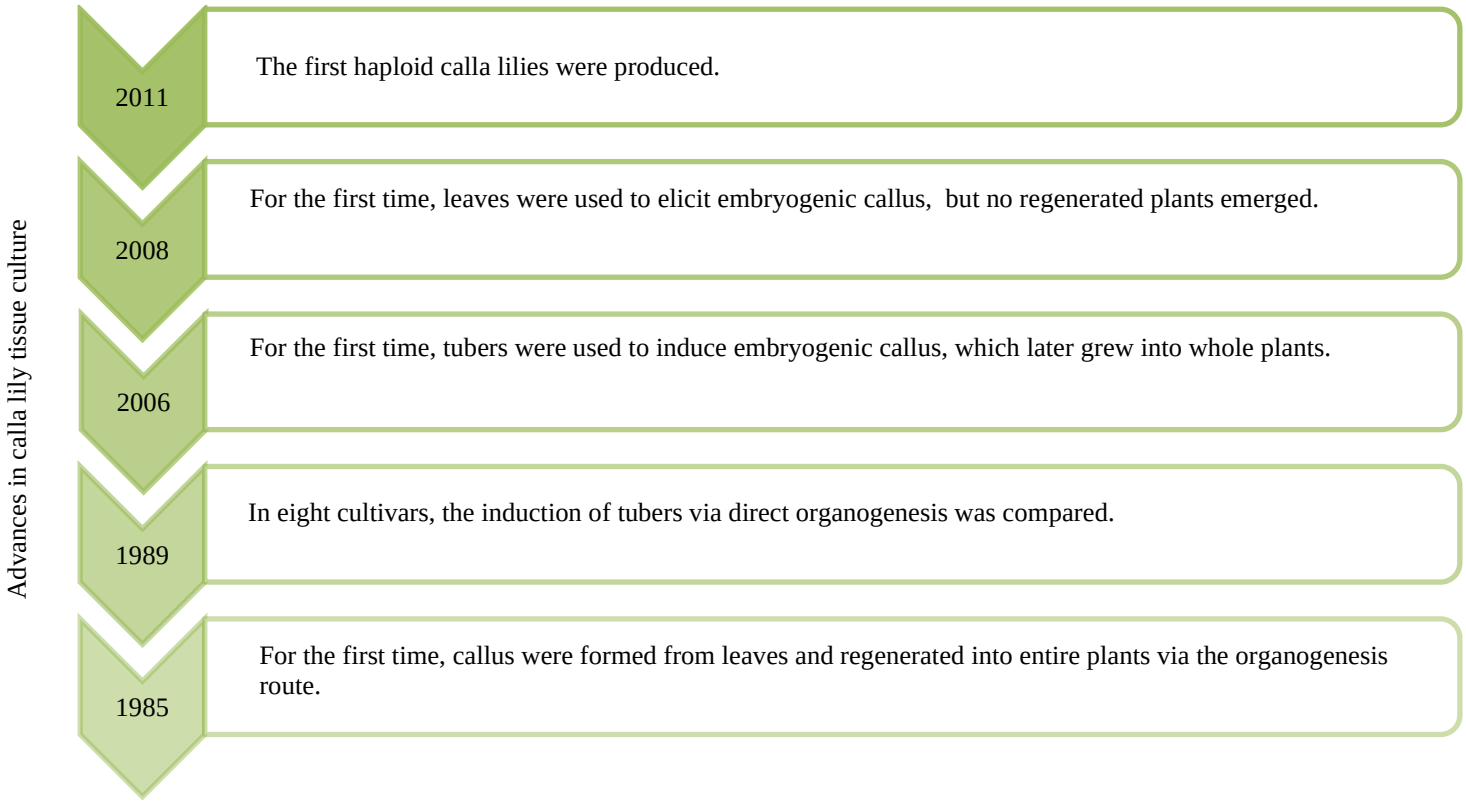

Fig 2- research on calla lily in vitro tissue culture.

As root initiation can only be stimulated by adding NAA to the rooting medium, studies have found that rooting can also be promoted without adding hormones in the culture environment of 1/2 MS medium and 200 mg/L activated carbon [5]. Numerous researchers have reported that NAA is the strongest auxin compared with others [7]. Several studies on calla lilies have demonstrated that NAA exhibits a noticeable promoting effect on the rooting stage. However, an increase in the concentration of NAA results in a lengthening of the rooting induction period [8]. For this reason, the main objective of research on the initiation of roots is to determine the appropriate concentration of NAA [9].

Conclusion

Zantedeschia species are the most popular plants in the cut flower industry due to their attractive flowers. Lack of quality planting material is a fundamental problem in large- scale growth of Calla lily. The problems related to calla lily commercial exploitation have come to light as market demand for the plant has grown. The majority of research has been done on the Calla lily's indirect somatic embryogenesis route, looking at the impact of explants, plant growth regulators (PGRs) and other relevant parameters on the efficiency of induction. Three different types of explants were employed in the investigation of the Calla lily's embryogenic callus: leaves, tubers, and anther. Propagation through tissue culture of this plant, especially regeneration through leaves and embryogenesis, needs more research.

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