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Research Article

In Vitro Technique hasten the Secondary Metabolite Production in *Azadirachta Indica*

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Abstract

Secondary metabolites are economically important as drugs, flavour and fragrances, dye and pigments, pesticides, and food additives. The evolving commercial importance of secondary metabolites has in recent years resulted in a great interest in secondary metabolism, particularly in the possibility of altering the production of bioactive plant metabolites by means of tissue culture technology. Plant cell and tissue culture technologies can be established routinely under sterile conditions from explants, such as plant leaves, stems, roots, and meristems for both the ways for multiplication and extraction of secondary metabolites. *Azadirachtin*, a limonoid group of secondary metabolite has gain more importance on account of its broad spectrum activity, ecofreindly and non-toxic actions towards beneficial organisms. Extraction of *Azadirachtin* from seeds of naturally grown whole plants is labour intensive process and again the commercial yield relies on geographical and climatic factors. Plant tissue culture technology can be a potential process and offering consistent and stable production of this bioactive compound in a specific controlled condition abide of climatic factors and hasten the commercial yield o f *Azadirachtin*. The present review stated that plant tissue culture (*in vitro*) could be developed as promising alternative for *Azadirachtin* production.

Outline

In vitro culture is one of the key tools of plant biotechnology that exploits the totipotency nature of plant cells, a concept proposed by Haberlandt (1902) [5] and unequivocally demonstrated, for the first time, by [11]. Tissue culture is alternatively called cell, tissue and organ culture through in vitro condition [3]. It can be employed for large-scale propagation of disease free clones and gene pool conservation. Ornamental industry has applied immensely in vitro propagation approach for large-scale plant multiplication of elite superior varieties.

Metabolites are of two types, viz; primary and secondary metabolites. Primary metabolism in a plant comprises all metabolic pathways that are essential to the plant's survival. Primary metabolites are compounds that are directly involved in the growth and development of a plant whereas secondary metabolites are compounds produced in other metabolic pathways that, although important, are not essential to the functioning of the plant. However, secondary plant metabolites are useful in the long term, often for defense purposes, and give plants characteristics such as color. Secondary plant metabolites are also used in signalling and regulation of primary metabolic pathways. Plant hormones, which are secondary metabolites, are often used to regulate the metabolic activity within cells and oversee the overall development of the plant. As mentioned above in the History tab, secondary plant metabolites help the plant maintain an intricate balance with the environment, often adapting to match the environmental needs. Plant metabolites that color the plant are a good example of this, as the coloring of a plant can attract pollinators and also defend against attack by animals. Based on their biosynthetic origins, plant secondary metabolites can be divided into three major groups [2].

1. Flavonoids and allied phenolic and polyphenolic compounds,
2. Terpenoids and Nitrogen-containing alkaloids and sulphur-containing compounds.

Azadirachtin has a complex molecular structure which belongs to tetra triterpenoid class and exist in many forms of which *Azadirachtin A* and *Azadirachtin B* are well documented (Ley et al., 1993) [8] obtained from neem tree (*Azadirachta indica*. A. Juss. (family: Meliaceae) is one of the most important biopesticide currently in use. The broad spectrum activity of *Azadirachtin* at very low concentration coupled with the unique mode of action and non-toxicity to mammals make *Azadirachtin* an ideal candidate

for insecticidal use. *Azadirachtin* produced from neem effects insects in a variety of different ways: as an antifeedent, insect growth regulator and sterilant. As anti feedant sensitivity varies greatly between insects the overriding efficacy of neem insecticide use lies in its physiological toxic effects [9]. It is now accepted that neem insecticides have a wide margin of safety for both user and consumer. Since the advent of DDT chemical pesticides have been controlling the pest problem in some of the crop system very efficiently but due to their extreme persistent, bioaccumulation, toxicity towards non-target beneficial organism, tendency to cause malignancy and increasing development of insecticidal resistance has created the serious threat to crop protection program all over the world, hence in recent years instead of the use of neurotoxic, broad spectrum, synthetic pesticides much attention is being paid towards more specific, bioactive, biodegradable environmental friendly plant or microbial based biopesticide [10].

The Neem databases will serve as an open excess repository of 250 secondary metabolites collected from available scientific report [6].

In vitro production of secondary metabolite in plant cell suspension cultures has been reported from various medicinal plants, and bioreactors are the key step for their commercial production [7]. Plant cell and tissue culture techniques appear as environmentally friendly alternatives for the production of secondary metabolites when natural supply is limited or chemical synthesis is unviable. Main advantages of using plant cell and tissue culture techniques for the production of plant secondary metabolites are presented as well as the different biotechnological approaches available to improve their production [4]. Plant *in vitro* regeneration is a biotechnological tool that offers a tremendous potential solution for the propagation of endangered and superior genotypes of medicinal plants which could be released to their natural habitat or cultivated on a large scale for the pharmaceutical product of interest. Tissue culture protocols have been developed for a wide range of medicinal plants, which includes endangered, rare and threatened plant species [1]. Callus culture, suspension culture and hairy root culture is the potential method for the production of *Azadirachtin* secondary metabolite. Thus, the present reviews cataloguing the ideal method (*In vitro*) for commercial production of secondary metabolites that hasten the yield produce.

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