SOMATIC EMBRYOGENESIS IN PLANTS: AN OVERVIEW WITH REFERENCE TO *HEVEA BRASILIENSIS*

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Somatic embryogenesis (SE) is an illustration of cellular totipotency, given that a single plant cell can regenerate into a complete and functional plant. Unlike organogenesis, SE is the most important *in vitro* pathway, having wide applications both in basic and applied research. Among various stages, the developmental transition from somatic cell to embryogenic cell is the key step in SE. This transitional reprogramming is influenced by various external and internal factors. Although substantial progress has been made in understanding these factors for many plant species, the molecular mechanisms behind SE remain largely unknown. This review provides information on various factors influencing SE. Moreover, a few embryogenesis specific genes, gene encoded proteins and enzymes and other stress factors recently identified have been discussed briefly. An overview of current progress made in woody plants SE mainly on potential genes is also highlighted. Research developments on SE in rubber with a focus on molecular innovations are also summarized.

Keywords: Embryogenic competence, *Hevea brasiliensis*, Somatic embryogenesis, Totipotency

INTRODUCTION

The basic concept of totipotency is inherent in the cell theory of Schleiden (1838) and Schwann (1839), who proposed the capability of individual plant cells to divide independently and the cells as the prime structural and fundamental units of all living organisms. Later on, the theoretical basis of plant tissue culture was laid out by Haberlandt (1902) who suggested that a single cell should eventually be capable of developing into a whole plant. Recent advances in plant biotechnology and genomics are highly dependent upon the use of *in vitro* culture protocols and hence, development of efficient *in vitro* regeneration pathways is of much interest to biotechnologists. Under *in vitro* conditions, three types of embryogenesis *viz. in vitro* fertilization, microspore embryogenesis and SE were observed (Feher *et al.*, 2003). Among these, SE is considered of special value, since it has diverse applications both in fundamental and applied research. As a result, an increasing number of efficient protocols on SE have been published for many plant species since the first report on carrot (Steward *et al*., 1958).

Somatic embryogenesis relies on plant cell totipotency, where somatic cells are

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