

1.1 INTRODUCTION

Catharanthus roseus (L.) G. Don (the Madagascar periwinkle) has attracted the attention of the natural product chemists and pharma industries for nearly five decades. The dimeric indole alkaloids vincristine (VCR) and vinblastine (VLB) and the monomeric alkaloid ajmalicine have proven usefulness in the treatment of cancer and hypertension respectively. The very low yield of VCR in field grown plant and the presence of nearly 200 less important indole alkaloids posed a serious isolation and purification problem. The VCR is, therefore among the costliest known alkaloids.

The advent of plant cell suspension culture had enthused the scientists all over the world in using *C. roseus* suspension culture for producing medically important indole alkaloids under *in vitro* conditions. So far, the economic viability of the processes has not been realized. These studies however deciphered many information related to secondary metabolism for alkaloid biosynthesis and their regulation. In recent years the hairy root system has been projected to be an interesting model system for investigation on the production of secondary metabolites, particularly for root specific metabolites. The genetic/ biochemical stability, amenability to scale up, release of some metabolites into the media, higher growth rates etc. offers unique advantages of hairy root culture systems. As of now, the level of achievements in hairy root culture systems, including the indole alkaloid production in *C. roseus* is far from commercial exploitation. The selection of desirable superior root clones and the optimization of their culture conditions for better yield/ productivity deserve serious attention. A number of reports indicate their potential as a model system for studying bioremediation.

In view of the more expensive nature of product formation (in comparison to the cost of production for a particular metabolite from field-grown plant) and yet unsuccessful commercial utilization of indole alkaloid from *C. roseus in vitro* culture systems, value addition from alternate products/ by-products is necessary. Similar attempts are being made for many other plants as well. In fact, commercial success has been achieved/ projected for only a handful of metabolites, in comparison to a great majority those are detected from cultures. Some of the suggested alternate products are

enzymes, cell wall polysaccharides/ proteoglycans, food flavoring/ coloring compounds etc.

One more attractive possibility is the heterologous expression of diagnostic/ therapeutic molecules in plant cells/ tissues *in vitro*. By virtue of the very high value nature of these products their commercial application is more promising. Plantibodies are expected to be important recombinant bio-product in the market.

1.2 OBJECTIVES

Considering the overall scenario on commercial prospects of indole alkaloid production by *in vitro* culture systems of *C. roseus* the following objectives were set for the present investigation:

1. Induction of hairy root culture and screening of a few hairy root lines with higher biomass production efficiency
2. Isolation and characterisation of indole alkaloids from hairy root clones
3. Expression of human fibroblast growth factor-8b
4. Isolation of arabinogalactan proteins (AGPs) and peroxidases as by-products
5. Study of cadmium uptake and dye removal by hairy roots of *C. roseus*