INTRODUCTION

The production of adventitious roots on stem cuttings is basically a problem of organogenesis. As each meristematic cell is totipotent in nature, it may be assumed that a detached organ possesses an inherent capacity of restorative regeneration. However, root regeneration capacity of stem cuttings many a time, does not adequately express itself because of the lack of some of the internal and/or external conditions necessary for the expression of this potentiality.

From an extensive study of the subject, it has been realized that amongst the various factors that affect rooting, plant hormones and nutrition are of paramount importance.

Went and Thimann (1937) were the first to establish the identification of endogenous root forming hormone, the auxin. Indole-3-acetic acid (IAA) and other synthetic auxins have since been extensively used in the vegetative propagation of
Skoog and Tsui (1948) and Skoog and Miller (1957) showed that the direction in which cambial cells regenerate is determined by the auxin/kinetin ratio; a high ratio favouring the formation of roots but a low one the formation of buds and the suppression of roots. The importance of a proper balance between different endogenous factors in the process of regeneration was, thus, established.

Apart from hormones, the nutritional condition of the cuttings was also known to be of prime importance. Thus Kraus and Kraybill even as early as 1918 reported that the number of roots on tomato cuttings was affected by the ratio of carbohydrates to nitrogen and Winkler (1927) reported that starch was associated with the rooting ability of cuttings.

On the basis of extensive work carried out in this laboratory for the last about 15 years, Nanda et al. (1968, 1969, 1970, 1971) consider that auxin plays multifarious roles. It might directly affect the division of meristematic cells and differentiation of cambial derivatives into root primordia, or increase the quantities of soluble carbohydrates by enhancing the activity of hydrolytic enzymes and further mobilize these sugars to the site of root initiation.

The mechanism of auxin action at the cellular and molecular levels is still far from understood, although, some reports are available in literature of the work carried out
to elucidate it. Thus, the role of RNA and protein synthesis in auxin-induced cell elongation has been stressed by Nooden and Thimann (1963, 1965); Key (1964); Penny and Galston (1966) and Courtney et al. (1967). Key (1969) considers that some of the plant responses to hormones which require the involvement of DNA-dependent-RNA synthesis, may be due to a direct effect of the hormone at transcriptional level, others at translational level while still others are probably not mediated through any of these. However, Fellenberg (1969 a,b; 1970) supports the hypothesis that auxin causes enhanced root formation by derepression of DNA and thereby resulting in the synthesis of RNA probably by promoting the uncoupling of repressing histones from DNA (Jain and Nanda, 1972). Sarkissian and Spelsberg (1967) showed that the treatment of bean hypocotyls with IAA resulted in the formation of new nuclear proteins.

A more fruitful method for the elucidation of the mechanism of hormone action is the use of inhibitors of macromolecules. Literature on the subject is scanty. Nanda et al. (1973a) reported that auxin effects on root initiation involve the synthesis of nucleic acids and proteins, as cycloheximide, actinomycin-D as well as FUdR inhibited the production of roots on etiolated stem segments. The formation of roots on hypocotyl cuttings of Phaseolus was however, promoted by 2-thioracil, 5-fluorouracil, 5-BUdR and ribonuclease (Shibaoka, Anzai, Mitsuhashi and Shimokoriyama, 1967 and Anzai et al.,
Actinomycin-D completely inhibited the IAA-effect on rooting while FU was ineffective, suggesting that the inhibition of biosynthesis of proteins that are necessary for root initiation was mediated either through the inhibition of DNA or DNA-dependent-RNA synthesis (Nanda and Dhallwal, 1974).

This investigation on "Physiological and biochemical studies on the mechanism of auxin action in rooting hypocotyls of Impatiens balsamina" was carried out with a view to study

(i) the role of cotyledons and apex in the initiation and development of roots;
(ii) the interaction effect of IAA and nutrition on the production of adventitious roots;
(iii) the period during the process of root initiation and root development when auxin is most effective;
(iv) the effect of metabolic inhibitors of nucleic acids and proteins on the time response of auxin effect on cuttings to cause root initiation;
(v) the drifts in the levels of auxin, carbohydrates, nucleic acids and proteins during rooting; and
(vi) the changes in the activities and isoenzyme patterns of some enzymes like peroxidase, IAA-oxidase and amylase during the process of initiation and development of roots.