INTRODUCTION

The propagation of plants by rooting stem cuttings has engaged the attention of foresters, horticulturists and all others interested in obtaining plants of desired genetic make-up within a short time to improve growth, yield, wood quality, resistance of plants to pests and diseases and also to maintain the purity of types so evolved for commercial exploitation.

This method of propagation has been known from time immemorial. The first scientific paper on rooting stem cuttings was, however, published by Duhamel du Monceau in the year 1758. A considerable amount of literature that
has accumulated since then, reveals that the rooting potential of plant species varies considerably. While some root easily, others root with difficulty and still others do not root at all (Stoutemyer, 1937, 1938; Shapiro, 1957; Fadl, 1966; Fadl and Hartmann, 1967; Hyun, 1967 and Nanda, 1971). Excellent reviews on the factors influencing rooting of stem cuttings have appeared from time to time (Haissig, 1965; Dore, 1965; Fernqvist, 1966; Hyun, 1967 and Nanda, 1971).

Thimann and Behnke-Rogers (1950) showed that synthetic growth substances stimulate the rooting of stem cuttings of many tree species. Nevertheless, the cuttings of many species are obstinate and do not root even with the application of synthetic growth substances which, therefore, are not able to overcome the limitation(s) imposed by some of the external or internal factors.

Bouillenne and Went (1933) reported the occurrence of an acidic heat-stable factor responsible for rooting and named it as 'rhizocaline'. Torrey (1950) and Libbert (1956a, b) demonstrated that substances other than 'rhizocaline', were also necessary for root formation. Bouillenne, Bouillenne and Wallrand (1955) postulated that the initiation and development of roots is dependent upon 3 factors, one of which is phenolic in nature, the other an auxin and the third a specific enzyme of phenol-oxidase type. More recently
Hess et al. (1962, 1963, 1965, 1968) put forth the concept of rooting co-factors and demonstrated that while cofactors 1 and 2 were basic in nature cofactor 3 was an acid and cofactor 4 a neutral substance. All these were thermosable and their activity in root initiation could not be replaced by any of the known nutrients or growth substances.

Hess (1968) and Dasu et al. (1969) showed the synergistic effect of phenolic compounds with IAA on rooting. Phenolic compounds are known to occur widely in plants. Although their physiological behaviour in general, is not known with certainty (Hanson et al., 1967), one hypothesis regarding their mode of action is that they inhibit an enzyme that oxidatively destroys IAA and thereby affects growth (Gantzer, 1960; Finkle, 1967). Their effect, therefore, appears to be similar to that of TIBA which at low concentrations acts synergistically with the supra-optimal concentrations of endogenous auxin. It would, thus, appear that rooting of stem cuttings may involve the interaction of auxins, anti-auxins and phenolic compounds, the magnitude and relative concentration of each of which is determined by the environmental conditions that prevail during the annual cycle of plant growth. An understanding of the interaction effects of auxins, anti-auxins and phenolic compounds with seasonal changes in the temperature and light conditions, therefore, is likely to provide
leads to a better understanding of the physiology of production of adventitious roots and help in proper planning in the use of growth substances in the vegetative propagation of plants. This investigation was, therefore, undertaken keeping the following objectives in view:-

(1) Study of seasonal changes in the rooting response of a number of plant species by conducting trials at 3-month intervals and classify them into different response types.

(2) Investigate the extent to which the nature and distribution of sclerenchymatous tissue is related to the rooting of stem cuttings.

(3) Seasonal changes in the effectiveness of auxins in rooting.

(4) Study the effect of environmental conditions to which the stock plants are subjected on rooting stem cuttings.

(5) Study the extent to which seasonal changes in the effects of auxins and anti-auxin could be ascribed to the prevailing temperature and photoperiodic conditions.

(6) Study of the interaction effects of auxins, anti-auxin and phenol on the ability of callus produced on cuttings to regenerate.

The results of this investigation constitute the subject matter of this thesis.