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PHYSIOLOGICAL STUDIES IN THE REGENERATING ROOT CUTTINGS OF *CLERODENDRUM VISCOSUM* VENT.

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ABSTRACT

The data on the regeneration of root cuttings of *Clerodendrum viscosum* revealed that old and lengthy roots have yielded higher percentage regeneration than the young and short cuttings. The cuttings with ring-cut brought about physical separation of the cutting into two portions on either side of the cut, resulting in the establishment of physiologically apical and basal regions at the cut faces and as a consequence shoots developed at the apical region of the lower half and roots at the basal region of the upper half of the root cutting.

THE regenerative potentiality of root cuttings depends on the factors such as season, age, length and volume of cuttings[1,2] as well as hormonal balance[3,4]. Though the polarity in the regenerating roots is reported by many workers, the physiological separation of a single cutting into two halves by ring-cut is not reported for root cuttings. The development of adventitious buds is well studied[5-8]. The present paper deals with the variables such as length and age in the regeneration of stem and root cuttings which are made with ring-cuts and half-cuts.

The tap root cuttings of 2, 4, 8 and 12 cm length from 3, 6 and 9 months old plants of *Clerodendrum viscosum* were made with ring-cuts (Fig. 1A) at their middle parts in such a way that only xylem remained interconnected between two parts of the cutting. The cuttings of 12 cm were made with half-cuts at two parts of the cutting (Fig. 1B) in such a way that half of the root tissue is removed from the half-cut. The stem cuttings of 10, 15 and 25 cm length from 6th and 9th months old plants were also made ring-cuts as well as half-cuts as it was done for root cuttings. All the root and stem cuttings were planted horizontally in the pots containing garden soil. Twenty cuttings for each group were taken for each experiment. The data has been collected after 20 days of plantation.

TABLE I

Percentage of regeneration of root cuttings made with ring-cut

Age of root (months)	Length of root (in cm)	Percentage of regeneration
3	2	..
	4	25
	8	60
	12	60
6	2	30
	4	30
	8	55
	12	60
9	2	40
	4	60
	8	75
	12	75

The increase in length of cutting is followed with increase in the percentage regeneration in all the three selected groups of roots (Table I). The percentage regeneration is improved with the advancement of age of roots. The data indicates that the regenerative potentiality of the root depends on length and age. The volume of root increases with the increasing age of the root where the root accumulates carbohydrate reserves[7] which is an important factor for the regeneration of roots[2]. In a group of 2 cm long cuttings, roots did not develop above the ring-cut but shoots developed below the ring-cut. It is noteworthy that the ability of cuttings to regenerate the shoots and roots is a feature of polar auxin transport which is diminished in short tissue sections, approaching an equal movement in acropetal and basipetal directions when very short sections are used[8].

The cuttings with ring-cut brought about physical separation of the cutting into two portions on either side of the cut, resulting in the establishment of physiologically apical and basal regions at the cut faces and as a consequence shoots developed at the apical region of the lower half and roots at the basal region of the upper half of the root cutting (Fig. 1A). Booth and Satchuthananthavale[1] confirmed that the polarity in the root cuttings is a result of accumulation of cytokinins at the proximal end developing shoots and the accumulation of auxins at the distal end developing roots. The accumulation of auxin is a result of polar auxin transport from proximal end to distal end[9]. It can be explained from the present observations that the auxin which is supposed to be transported from proximal (P_1) to distal end (D_2) of the cuttings, is bound to be remained above the ring-cut (D_1) and this accumulated auxin helps in the initiation of roots. The auxin at the proximal end (P_2) of the lower half of the cutting must have transported to its distal end (D_2) and as a result shoots developed at P_2 and roots at D_2. Working with IAA^{14}C, Wangermann[10] reported the interruption of auxin transport by ring-cut in the internode segments.

In case of root cuttings with half-cuts, the shoots have developed at the proximal end and roots at the distal end in 70% of the cuttings planted (Fig. 1B). There is no root initiation above the half-cut but there is shoot initiation below the half-cut (Fig. 1B, dart). However this shoot is not growing further. These observations indicate that the auxin transport does not stop above the half-cut but continues with the length of the cutting as the root tissues are not interrupted in one half diameter of the root. Even if there is little accumulation of auxin above the half-cut that auxin might not be sufficient to enhance the root initiation at that site.

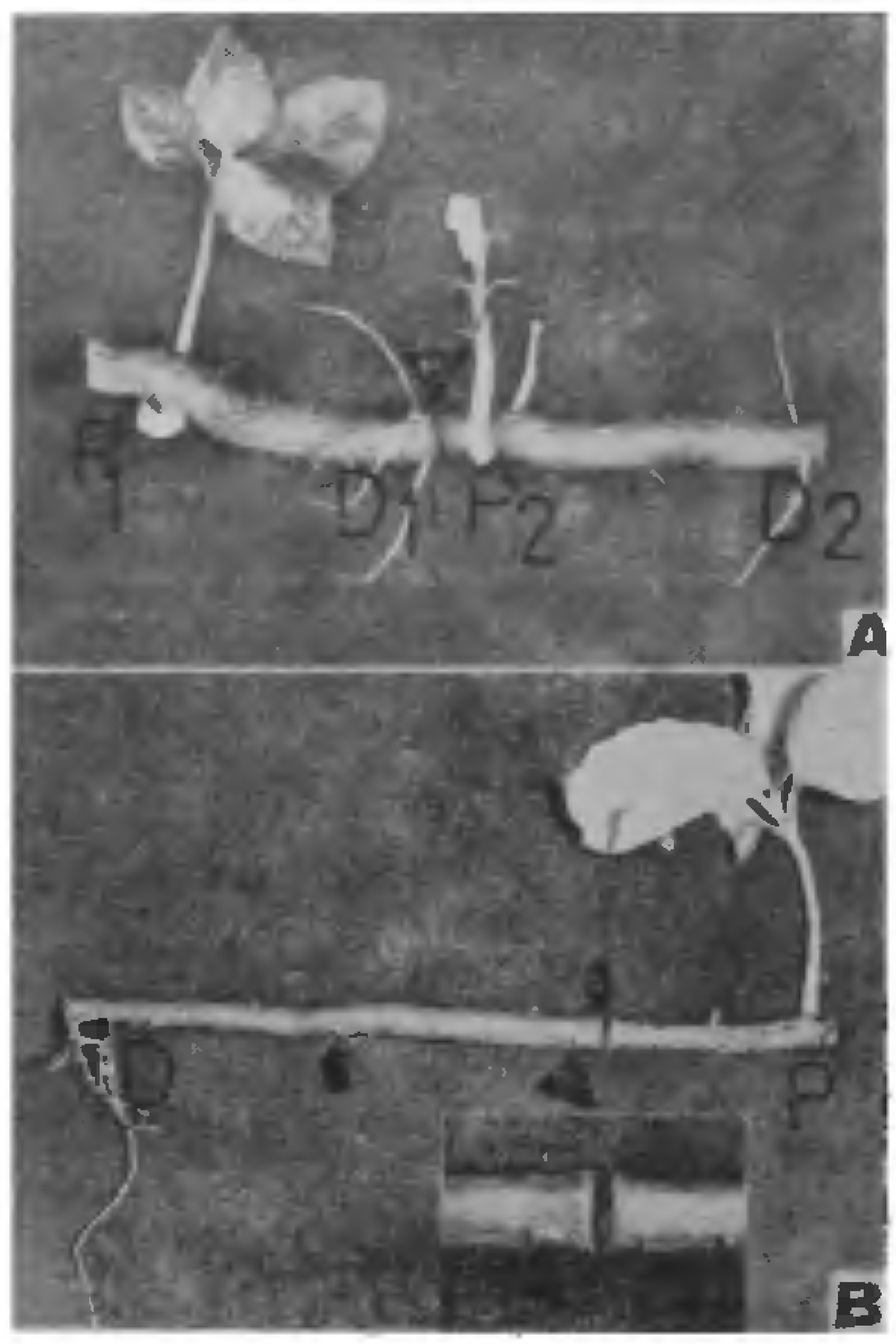

FIG. 1A. Root cutting of *C. viscosum* showing the development of shoots and roots on either side of the ring-cut (at dart), × 0·71. B. Root cutting showing stunted bud growth (at dart) below the half-cut part (at arrows) × 0·7.

P, proximal end; D, distal end; P_1P_2, proximal ends of two parts of a single root cutting; D_1D_2, distal ends of two parts of a single root cutting.

Matured tissues of root are the possible source of growth substances as reported by Thurman and Street[11]. Strictly enough, the buds and roots are developing only in association with lateral root scars. The lenticels are formed in association with lateral roots after the plantation of root cuttings from the same region where the buds and roots develop. The developing primordia pierce out through these lenticels.

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STUDIES ON THE RETROCEREBRAL ENDOCRINE AND NEUROHAEMAL ORGANS OF THE ADULT *SERINETHA AUGUR* (FABR.) (HETEROPTERA : COREIDAE)

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ABSTRACT

The retrocerebral endocrine system of the adult *Serinetha augur* consists of a pair of corpora cardiaca (CC) and a single corpus allatum (CA) situated below the brain and dorsal to the gut. The posterior parts of the corpora cardiaca appear to have fused with the anterior part of the corpus allatum forming a complex organ. The brain of this insect has two groups of median neurosecretory cells (MNC) in its pars intercerebralis and one group of lateral neurosecretory cells (LNC) in its lateral side of the protocerebrum. The cephalic aorta (AO) in sections seems to have the axons of the median neurosecretory cells of the brain, the former being connected with the latter by NCC–I through the median neurosecretory pathways. The axons of the lateral neurosecretory cells appear to terminate in corpora cardiaca which are linked with the LNC by NCC II through the lateral neurosecretory pathways. The corpus cardiacum, consisting of some smaller chromophobic and some larger chromophilic cells, reveals the presence of neurosecretory materials synthesized in LNC as evidenced by its intense reaction with AF. Similarly the neurosecretory materials produced by MNC are identified in the wall of the cephalic aorta indicating its role as neurohaemal organ. It is inferred from these observations that the corpus cardiacum and the cephalic aorta function as neurohaemal organs in the adult *S. augur*.

INTRODUCTION

STUDIES on the neurosecretory system and retrocerebral endocrine glands of insects have revealed that corpus cardiaum acts as a neurohaemal organ in several insects[1–5]. This gland is a neurohaemal organ has not been established for many insects including those of Hemiptera.

Further, Johansson[6] has reported for *Oncopeltus fasciatus* that the aorta acts as neurohaemal organ as evidenced by the deposition of neurosecretory material (NSM) in this structure. Subsequently this conception of accepting aorta as the neurohaemal organ in hemipteran insects was supported by various authors[7–14]. This structure has also been shown to be the neurohaemal organ in the dipteran insect *Calliphora erythrocephala*[15,16] and *Sarcophaga ruficornis*[14]. These observations are further supported by the presence of axons of the neurosecretory cells of the brain in the aorta of *Periplaneta americana*[17] and the lygaeid bug, *Metochus uniguttatus*[13] and *Leptocorisa acuta*[18],