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Effect Of Gravity Components On The Basipetal Flow Of Endogenous Content Of IBA During Culture Of Coleus Blumei L Stem Cuttings

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Abstract

In an earlier contribution the role of gravity components on the initiation of adventitious roots and their subsequent growth on Coleus blumei L stem cuttings has been established (Boissya and Das, 1993). An attempt has been made to find, if any, the role of gravity components on accumulation of endogenous IBA at the base of Coleus blumei L stem cuttings during culture in water for four days kept at various inclinations viz. 22.5^0,45^0,67.5^0 90^0 and 180^0 respectively.

IBA contents at the base of the cuttings were measured at the initial start and after four days of culture at various inclinations by TLC method using 'Iatroscan TH-10' scanner.

After four days of culture amount of IBA present at the base of the cuttings showed variation at different inclinations. The highest (50µg/g F.W.) amount of IBA was found to be accumulated at 22.5^0 inclination, which was followed by 45^0 inclination (43µg/g F.W.), where early root initiation took place. This had probably suggested that at different inclinations of the cuttings, each of the gravity components pgsinθand pg cosθ had exerted differential effects on the rate of flow of endogenous to the basipetal end of the cultured cuttings depending on their inclination. Of the two components the relatively more effective one decide the net accumulation of IBA at the base of the cuttings. The effectiveness of any of the components was decided by θ, the inclination of cultured cutting. Further examined whether IBA(60ppm), IAA(70ppm) and Kinetin (30ppm) through the bases of the cuttings could influence the relative effectiveness of either pg sinθ orpgcosθ. Results clearly suggested that rate of flow of indigenous IBA from the apex to the base of the cuttings was governed by relative effectiveness of gravity components which was in turn decided by the inclination of Coleus blumei L stem cuttings. Externally supplied growth regulators, however, failed to exhibit any effect on the relative effectiveness of any of the g components viz. pgsinθand pgcos θ.Thus distinctive effect of each g components on the flow of endogenous hormone had been established.

Key words: Gravity, IBA, IAA, Inclination, cuttings and pg sinθand pg cosθ

INTRODUCTION:

The effectiveness of gravity components which is less than or equal on initiation and growth of adventitious roots on stem cuttings of Coleus blumei L has been proved(Boissya &Das,1993).The basipetal transport of auxins is caused by the effect of gravity which results in the initiation of adventitious roots(Lyon,1962,1965). According to Dedolph et.el. (1965) for gravitational stimulation, geosensitive plants are dependent on magnitude and direction of gravity force. The longitudinal transport of a substance in Coleus stem is controlled by gravity (Vendrig,1960). The hormones responsible for initiation and growth of roots are produced at the apical bud and gravity plays an important role on the basipetal transport of these hormones (Lyon,1965, Tory et. el.2003). But when cuttings taken from stem are cultured at various inclinations in relation to the horizontal position, the gravity components affect differently resulting in the differential flow rates of hormone from the apical bud to the basal end of the stem cuttings (Boissya & Das,1993).

In the present experiment therefore, an attempt had been made to study the role of individual gravity components on the accumulation of endogenous Indole Butyric Acid (IBA) at the basal end of the Coleus blumei L stem cuttings. A correlation, if existed between accumulation of IBA due to gravity components and their effect on initiation of adventitious roots on cultured stem cuttings, placed at different inclinations to the soil surface, was also examined. Further initial treatment of the cuttings with each of IBA, IAA (quick dip method) prior to their culture at different inclinations was also studied to ascertain whether any of the externally supplied growth regulators could liberate the cultured cutting of the effect of gravity components on the contents of endogenous IBA and thereby changed the rooting behavior of the cultured cuttings.

MATERIALS AND METHODS:

Healthy stem cuttings from branches of similar age and size were collected from a single Coleus blumei L plant. Cuttings having 4cm length, with intact apical bud and having five numbers of leaves were used as described earlier (Das & Boissya, 1994). An arrangement was made to culture the cuttings in water contained in opaque bottles maintained at 22.5^0, 45^0, 67.5^0, 90^0 and 180^0 to the soil surface (Boissya &Das, 1993).The experimental setup was kept in diffused sunlight for a period of 4 days to investigate the amount of IBA present at the basal end of the cuttings at the initial start of the experiment (0 day) and after their culture for 4 days respectively.

It was also tried to see whether it was possible to minimize the effect on the flow of hormonal transport of each of pgsinθ and pgcosθacting on the cultured cuttings by externally supplied

hormones. A separate set of experiments was performed where the cut ends of the stem cuttings were quickly dipped (quick dip method) for a minute immediately after their excisionfrom the stock plant separately in each of IBA (60ppm), IAA (70ppm) and Kinetin (30 ppm) and subsequently cultured in water and maintained at different inclinations as reported earlier The amount of endogenous IBA present was investigated as before. The suitability of the applied concentrations of the used substances on root initiation was determined from a preliminary experiment (Boissya &Das, 1993).

The amount of IBA present in 2cm length from the basal end of the cultured Coleus blumei L cuttings wasanalyzed. 2 cm length from the basal end of the cutting was selected for estimation of IBA contents in view of the fact that in all used inclination initiated roots were found to be restricted to a maximum length of 2cm only from the base of the cuttings, IBA contents of the basal ends of the cuttings were extracted by the method followed by Gmelin and Virtanen(1961) and finally estimated quantitatively through TLC method using Methanol: water: formic acid as solvent system and finally scanned in a 'IATROSCAN TH-10'scanner.

The experiments were repeated 3 times and in each experiment 5 replications were taken. The content of IBA was estimated as µg/g of the fresh weight (F.W.).

The average results of the experiments are presented in tables I and II.

RESULTS AND DISCUSSION:

From the results presented in Table I, it is seen that in cultured Coleus blumei L stem cuttings inclination plays a great role on flow and accumulation of endogenous IBA, as it changes appreciably with inclination.

Table I: Showing effect of gravity components on the amount of endogenous IBA(µg/g FW) content at the base of Coleus blumei L stem cuttings.

Degree of inclination with soil surface	Amount of IBA (µg/g F.D.)present	
	0 Day	4 Day
22.5^0	37	52
45^0	37	43
67.5^0	37	41
90^0	37	38
180^0	37	36

It is interesting to note that amongst all the used inclinations 22.5^0 inclination shows the maximum increase in the amount of IBA (52µg/g F.W.) over the initial content(37 µg/g F.W.), whereas 180^0 inclination does not show any increase in the content of IBA, rather this inclination shows the maximum amount of IBA(36µg/g F.W.)Which is even slightly less thanthe initial amount (37µg/g F.W.). The cuttings oriented at 45^0 inclination, which shows earliest rooting, highest number of roots and maximum root length (Boissya and Das, 1993) fails to exhibit the maximum amount of IBA content. On the other hand the content of IBA in the cuttings maintained at higher degree of inclinations gradually decreases.

This variation in the IBA contents at different inclinations may perhaps be attributed to gravitational pull which is resolved into two components pg sinθand pg cosθ(Boissya and Das,1993). The former acting along the axis of the cutting directed toward the base of the cutting and latter working in the transverse direction i.e. at right angle to the axis of the cutting and their effectiveness particularlyon the flow and accumulation of IBA are solely dependent on inclination (θ)of the cultured cuttings, where θis the only variable factor. Therefore with every change in θthe values of each of pgsinθand pg cosθ will vary. Accumulation of IBA at the base will be decided more by effectiveness of pgsinθ

With a view to understand whether substances like IBA, IAA or Kinetin , supplemented to the cuttings quickly(1 min.) through the cut end prior to their culture at different orientations could liberate the effect of g components in respect of endogenous IBA accumulation, a series of experiments were performed.

The results of the experiments are presented in Table II.

Table II: Showing effect of pretreatment of the cuttings with each of IBA(60ppm), IAA(70ppm) , Kinetin(30ppm) and gravity components on IBA accumulation at the base of Coleus blumei L stem cuttings(µg/g F.W.) at 0day and 4day.

Degree of inclination with soil surface	Amount of IBA contents (µg/g F.W.)			
	0 Day	Treatment of 4Day		
		IBA	IAA	KINETIN
22.5^0	37	145	132	101
45^0	37	125	122	92
67.5^0	37	116	109	77
90^0	37	113	93.7	58
180^0	37	100	82.5	53

From the results it is seen that amongst all the used growth regulators as pretreatment, IBA is the most effective as after four days of culture, its accumulation is exhibited as the maximum in the cuttings. In this respect each of the used growth regulators exhibits the highest accumulation of IBA at 22.5^0 inclination and the lowest at 180^0 inclination. However, their amounts are different. Although 22.5^0 inclination shows the accumulation maximum amount of IBA at the base of the cuttings, early root initiation, highest number of roots and lowest root length have been found in the cuttings maintained at 45^0, irrespective of their pretreatments (Boissya and Das, 1993, Das,2016-17).But so far as liberation of the cuttings from the effect of fractionated g(pgsinθnd pg cos θ) is concerned , none of the used growth regulators has any effect but for their enhancing accumulation of IBA in cuttings of Coleus blumei L stem.

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