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ROOT INITIATION IN MUKHIKACHU (*Colocasia esculenta*)AS INFLUENCED BY IAA AND NAA

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Abstract

In vitro root initiation in Mukhikachu *(Colocasia esculenta var. globulifera)* was assessed in a factorial experiment using three levels of IAA (0.5, 1.0, and 2.0 mg/l), three levels of NAA (0.5, 1.0, and 2.0 mg/l) and control. Fifty percent intact shoots were used as usual, which was named as normal cut explant and the rest 50 % shoots were cut slantly to expose fresh surface i.e., cambium zone and named as slant cut explant. Low levels of IAA (0.5mg/l) initiated the roots earliest (≈14 DAC) and gave the highest percentage of root (49.71). This treatment also gave the maximum roots/culture (3.63). Root initiation was higher (61.33 %) with slant cut when cultured on a medium containing 0.5 mg/l IAA. The cultures with slant cut end also produced more number of roots and longest roots whereas, the highest root initiation (45.05 %) was given by the treatment 1.0 mg/l NAA, but 2.0 mg/I NAA gave lower percentage of roots (39.89).The maximum number of roots/culture was also obtained by 1.0 mg/l NAA. Slant cut explant performed better regarding root initiation (%), number of roots/culture and length of roots. In this experiment, slant cut explant performed better than that of normal cut and either IAA (0.05 mg/l) or NAA (1.0 mg/l) might be used for root initiation in Mukhikachu.

Keywords: Root initiation, *Colocasia,* IAA, NAA.

Introduction

Mukhikachu *(Colocasia esculenta* var. *g1obu1ifera* (L.) Schott), a high land taro, is an important summer vegetable in Bangladesh. It occupies about 80% of the total aroid production in the country ((Bhuiyan and Ahmed, 2001)). The only variety of this crop in Bangladesh is "Bilashi". It grows in high land covering an area of 20,000 ha of land in Bangladesh (Anon., 2006). It is rich in vitamin A, C, iron and calcium (Bhuiyan and Ahmed, 2001). Secondary corm and cornel is the edible part of this crop, which is acrid free and its yield potentiality is 30-32 tons per ha (Rashid, 1990). The corm and cormels are the propagating material of this crop, but this corm and cormels are also used as vegetable in our country. As a result, major part of this crop is used as vegetable keeping only very small part

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for seed purpose. The seed multiplication rate through conventional method is very poor approximately 1:5 (Bhuiyan, 2005). This ratio should be upgraded in many fold to get sufficient propagating materials. This can be achieved through *in vitro* technique (Yam *et al.,* 1990, 1991; Malamug *et al.,* 1992). *In vitro* multiple shoot production of different crops has been reported by many workers (Ye *et al.,* 2002; Seelye *et al.,* 1994; Chand *et al*., 1999).

Generally multiple shoot produced few adventitious roots when they were intact. After separation, all the detached shoots do not possess roots. But in *in vitro* technique, plantlet regeneration is very important. For regeneration of plantlet, presence of adventitious root is obligatory. Therefore, it is necessary to develop protocols for initiation of adventitious root in detached multiple shoot. Adventitious root initiation of different crops through *in vitro* technique has been reported by many workers (Dhar and Singh, 1984; Houndonougbo, 1989; Hossain *et al.,* 1998; Shibli *et al., 2000,* Ye *et al.,* 2002;). But, reports on regeneration of plantlet from detached multiple shoots of taro are very scanty. Therefore, to develop efficient protocols for organogenesis of taro, this investigation was undertaken.

Materials and Method

The experiment was conducted at the Tissue Culture Laboratory of the Tuber Crops Research Centre (TCRC), BARI, Joydebpur, Gazipur in July 2008. The excised individual multiple shoot of Mukhikachu cultivar "Bilashi" *(Colocasia esculenta* var, *g1obu1ifera)* was used as explant of this experiment. Fifty percent detached shoots were used as it is and the rest 50 % shoots were given slant cut to expose fresh surface i.e., cambium zone. Those were then cultured in the Murashige and Skoog culture medium.

Basic salts of Murashige and Skoog (MS 1962) culture media were used. In order to regeneration of adventitious roots, a two-factor experiment was set up. Factor a was two types of explants: slant cut and normal cut explant. Factor b was seven levels of rooting hormone: three levels of IAA (0.5, 1.0, and 2.0 mg/l), three levels of NAA (0.5, 1.0, and 2.0 mg/I) and control (at 0 level of IAA and NAA). Total number of treatments was 14 including control. The culture media were prepared as per treatments and agar @ 0.6% was used to solidify the media. The pH of media was adjusted to 5.8 prior to autoclaving. The cultures were incubated under 3.0 k lux photo-intensity for I 6h daily and at a temperature of 22 ± 2°C. The experiment was set up in a completely randomized design with three replications. Five tubes of each treatment considered as a replication. Data were analyzed statistically and mean differences were evaluated by DMRT.

Results and Discussion

Initiation of rooting in detached shoot of *C. esculenta* as influenced by type of shoot cutting (explant) and IAA levels are presented in Fig. 1-3. Root initiation *(%)* as well as number of roots per culture increased with the increase of IAA levels up to 0.5 mg/l IAA and then declined. Low level of IAA (0.5 mg/l) initiated the highest percentage of root (49.71) compared to blanket IAA (34.98). The maximum number (3.63) of roots were produced at 0.5 mg/I IAA (Fig.1). Auxin up to a certain level (0.5 mg/l) helps to develop roots more, which dehanced by higher auxin level. Debnath *et al.* (2000) found similar results. They also found the highest number of roots/culture with *0.5* mg/I IAA in pointed gourd. IAA at 0.5 and 1.0 mg/l induced roots earlier {14 DAC (Days after culture) } against control and the highest level of IAA (21.08 DAC) (Fig.2). Auxin up to a certain level (0.5 mg/I) enhanced root initiation but dehanced by higher auxin level (Debnath *et al.,* 2000). They also found the earlier roots/culture with 0.5 mg/I IAA in pointed gourd. Rooting was enhanced when the base of cultures were cut and fresh tissues were exposed than intact cultures. Culture root initiation (%) was higher in slant cut explant compared to normal cut irrespective of different doses of IAA. Root initiation (%) was the higher (61.33) with slant cut when cultured on a medium containing 0.5 mg/I IAA compared to same level of IAA with normal cut (38.08). In both the explants, 0.5mg/l IAA gave the highest percentage of root initiation. The lowest root initiation (%) was obtained by blanked IAA with normal cut explant (Fig 3). Root initiated significantly earlier in slant cut cultures compared to normal cut ones. The cultures with slant cut end also produced more number and the longest roots compared to normal cut culture. Slant cut cultures rooted at the earliest (12.92 and 12.67 DAC, respectively) at 0.5 and 1.0 mg/I IAA compared to normal cut cultures with same level of IAA (15.58 DAC). The normal cut explant irrespective of IAA levels produced significantly lower number of roots/culture. The highest number of roots per culture with the same explant was 2.08. The slant cut explant also produced the longest roots (l.02 cm) with 2.0 mg/I IAA (Table 1). Slant cut explant showed better performance, which might be due to expose of more fresh cambium region to facilitate rooting.

Root initiation in detached shoot of *C. esculenta* var. *g1obulifera* as influenced by type of shoot cutting (explant) and NAA levels are presented in Fig. 4-6. Like IAA, NAA also enhanced rooting in cultures. Fig.4 showed that root initiation (%) was increased with the increase of NAA level up to 1.0 mg/l, then it was declined. The highest root initiation (45.05%) was given by the treatment 1.0 mg/l NAA, whereas, 2.0 mg/l NAA gave lower percentage of roots (39.89). It is well known that auxin is responsible for root initiation. Auxin up to a certain level enhanced rooting but excess auxin might worked as antiauxin and reduced root initiation percentage. Similarly, number of roots/culture increased

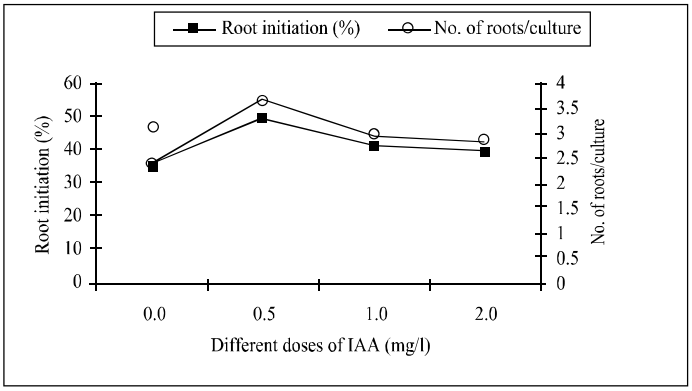

Fig. 1. Root initiation (%) and no. of roots/culture as influenced by different doses of IAA.

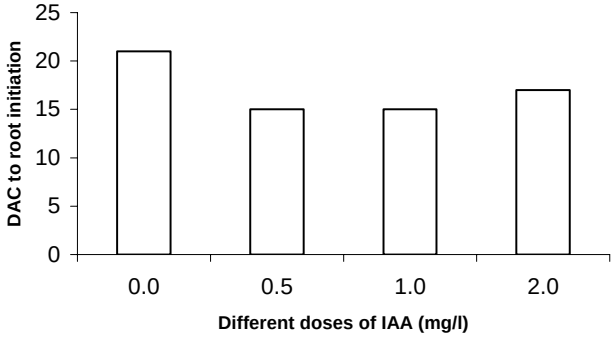

Fig. 2. Days required for root initiation as influenced by different doses of IAA.

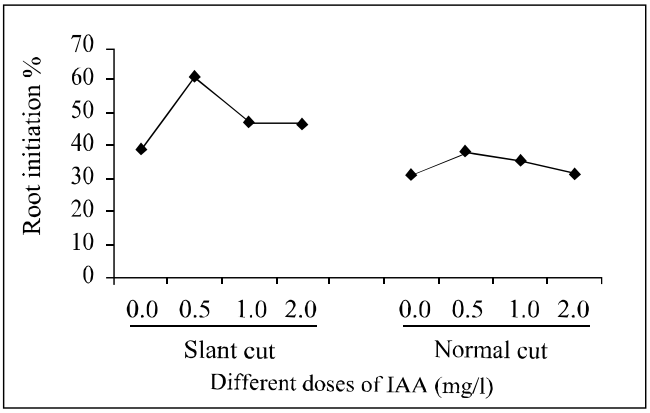

Fig. 3. Root initiation in C. esculenta as influenced by type of explant and IAA levels.

with the increase of NAA level up to 1.0 mg/l. The highest level of NAA (2.0 mg/l) reduced the number of roots/culture. This might be due to antiauxin effect of excess auxin. But, Debnath *et al.* (2000) found the highest number of roots/ culture in pointed gourd with NAA at 0.5 mg/I. Regarding NAA at 0.5 and 1.0 mg/l induced roots earlier (14.58 and 14.67 DAC, respectively) against control and 2.0 mg/l NAA which took longer time (20.96 and 18.83 DAC, respectively) (Fig.5). Slant cut explant performed better regarding root initiation (%) irrespective of the NAA levels (Fig. 6). In both the explants, root initiation (%) increased with the increase of NAA levels up to 1.0 mg/l. NAA at 1.0mg/I gave the highest root initiation percentage (54.10) with slant cut explant compared to same level of NAA with normal cut explant (36.02). NAA at 2.0 mg/l with both the explant gave the lower percentage of root initiation, which might be due to anti-auxin activity of the excess auxin. The same treatment induced roots most early in slant cut cultures, which is statistically similar with 0.5 mg/I NAA. The blanked dose took longest time to initiate root irrespective of the explants. While 1.0 mg/I NAA gave the maximum roots (4.58 with slant cut explant and 2.42 with normal cut explant). The longest roots (0.96 cm) were obtained by 1.0 mg/I NAA with slant cut explant (Table 1). But this finding is in disagreement with the findings of Debnath *et al.* (2000). They found the highest number/ culture and the longest roots in pointed gourd with NAA at 0.5 mg/l. This difference might be due to the crop specificity. From the above results, it can be concluded that either IAA (0.5 mg/I) or NAA (1.0 mg/l) with slant cut explant might be used for root initiation in detached multiple shoot of Mukhikachu *(C. esculenta* var. *g1obulifera).*

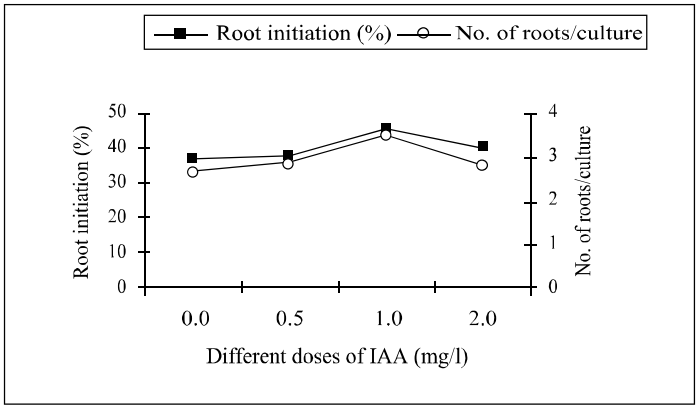

Fig. 4. Root initiation (%) and no. of roots/culture as influenced by different doses of NAA

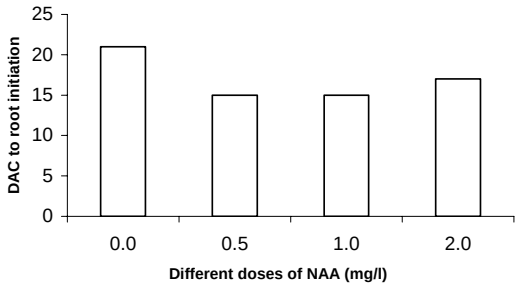

Fig. 5. Days required for root initiation as influenced by different doses of NAA.

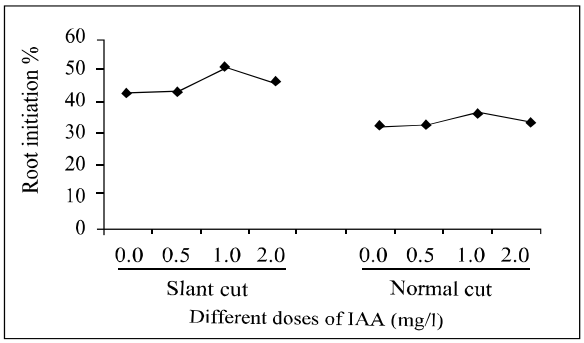

Fig. 6. Root initiation in C. esculenta as influenced by type of explant and NAA levels.

Table 1. Effect of type of cutting, IAA and NAA on rooting.

Treatment			DAC to root initiation	No. of roots/culture	Length of root (cm)
Explants	Auxin levels				
Slant cut		0	18.67c	3.00c	0.73c
	IAA mg/l	0.5	12.92d	5.17a	0.34e
		1	12.67d	4.08ab	0.74c
		2	16.75bcd	3.83bc	l.02a
	NAA mg/I	0.5	13.58d	4.00a-c	0.57d
		1	16.58cd	4.58ab	0.96a
		2	13.17d	4.25ab	0.80b
Normal cut		0	23.50a	l.75de	0.29e
	IAA mg/I	0.5	15.58cd	2.08de	0.23e
		1	15.58cd	l.83de	0.22e
		2	22.42a	1.83de	0.34e
	NAA mg/iL	0.5	16.l7cd	1.67de	0.23e
		1	21.08b	2.42d	0.35e
		2	15.58cd	1.33de	0.24e

In a column, means followed by common letters are not significantly different from each other at I % of level of probability by DMRT. * DAC- Days after culture

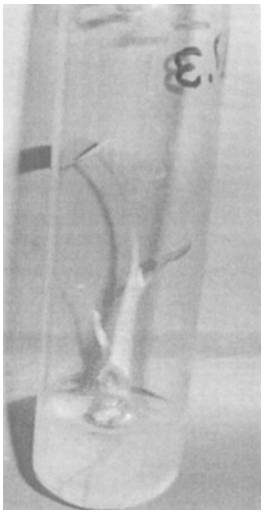

Fig. 7. Roots produced in slant cut shoot with 0.5 mg/l IAA

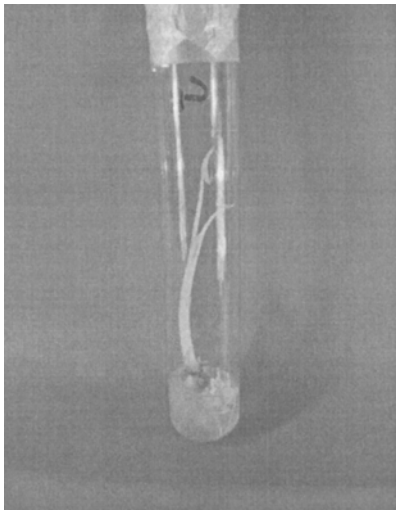

Fig. 8. Roots produced in slant cut shoot with 1.0 mg/l NAA

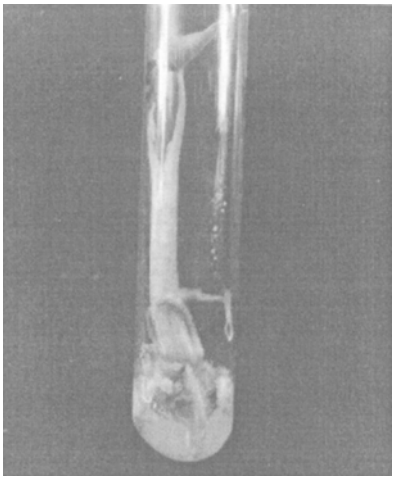

Fig. 9. No root produced in control

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