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Determining the effect of bioregulators on *in-vitro* rooting of *Carica papaya* L. through shoot tip and inflorescences

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Abstract

Papaya is a highly heterozygous fruit crop, therefore there is a need for multiplication of plant through Tissue Culture for bearing fruits in almost all the plants. Keeping these facts in view the multiplication of Papaya *Carica papaya* L. cv. Pusa Delicious through Tissue Culture were studied in the Tissue Culture Lab of the Department of Horticulture, Sardar Vallabhbhai University of Agriculture & Technology, Meerut, (U.P.) during the year 2016-2017. The experiment was conducted in two way factorial design with 10 treatments comprising 5 levels of NAA (0.01, 0.1, 0.5, 1, 2 and 3 ppm) and 5 levels of IBA (0.1, 0.5, 1, 2 and 3 ppm) replicated thrice. The different concentrations of Auxins alone are applied. The effect of these treatment was observed among the different concentration of the bio-regulators, In case of rooting of explants, the effect of IBA and NAA was studied with the half dose of CHU (N6) media, NAA 3 ppm was most effective in terms of root induction in explant which induced the root just in 11.66 days. IBA 1 ppm was best in inducing maximum number of roots. Hence based on the result obtained from the investigation it can be concluded that the NAA 3 ppm is the best for early rooting and IBA 1 ppm is ideal for obtaining maximum numbers of root in CHU (N6) media for Papaya (*Carica papaya* L.) tissue culture.

Keywords: bioregulators, inflorescences, heterozygous fruit crop

Introduction

Papaya (*Carica papaya* L.), the fifth important fruit of India, is valued for the nutritional qualities of its fruit as a source of provitamin A and calcium as well as for the pharmaceutical industry as a rich source of commercial papain. Almost all the plant parts including leaves, fruits, seeds, latex, bark and roots are used in several ways (Anibijuwon and Udeze 2009) [3]. The usefulness of papaya extends beyond as a raw material in the food and pharmaceutical industry; its potential applications and uses are yet to be fully explored, derived and understood (Boshra and Tajul, 2013) [6].

A big disadvantage regarding its commercial cultivation is its dioecious character and heterozygosity coupled with cross pollination. Thus, the conventional method of its propagation through seeds results in great variability in fruit quality. Since colour and flavour of its fruit are controlled by pollen grains, cloning through tissue culture of female and male elite plants is warranted to ensure uniform quality and yield of fruit. There are several reports on tissue culture multiplication of this plant, including genetic transformation. It has been micro propagated mostly by using seedling explants, but also through shoot tips taken from mature plants. There are quite a few reports on efficient micro propagation of papaya, they are in alien varieties. As expected, such protocols are not equally applicable in case of indigenous varieties in view of the wide variation existing in the *in-vitro* responses of different varieties and clones in general. The poor transplant success of the *in-vitro* raised plantlets, which in turn depends on difficulty in obtaining desirable rooting of micro shoots is a big hindrance in its commercial propagation. Furthermore, establishment of aseptic cultures through shoot apices of mature plants is intractable because of high incidence of endogenous infection. This paper reports cloning of mature plants of *Carica papaya* L. var. Pusa Delicious of known sexuality employing tips of their shoots and young inflorescences. There appears to be no earlier report on the latter aspect.

The western Uttar Pradesh may be well suited for disease free commercial cultivation of papaya. Since papaya is highly heterozygous fruit crop. There is need of multiplication of plants through tissue culture for bearing fruits in almost all the plants. Viewing the above fact the multiplication of papaya through tissue culture is needed for the production of numerous plants within a short period of time that is why the present experiment is proposed.

Materials and methods

Plant materials and *in vitro* culture

The healthy shoot tips of 1 to 1.5-month-old papaya seedlings and immature female flower were taken from papaya experimental block of Horticultural Research Centre (HRC), Sardar Vallabhbhai Patel University of Agriculture and Technology Meerut (U.P). Cloning of female papaya plants

through *in-vitro* shoot bud culture is an ideal approach (Ali 1976) [1]. Plants were grown from fresh seed obtained from mature fruit. Apical shoot tips 2 cm in length were removed and the leaves were excised leaving the petioles intact (Arora and Singh, 1978) [4]. The excised shoot tips were then treated for 15 min in a 1% sodium hypochlorite solution containing a few drops of 7X detergent. After three rinses in sterile water, apical bud explants of 0.25-0.5cm were excised and placed on nutrient media. The basal medium for papaya was medium concentrations of minerals and growth factors, riboflavin and containing 2% sucrose and 0.8% Agar. The pH of all media was adjusted to 5.8 with 0.1 M KOH before autoclaving at 121 °C for 15 min. Shoots were cultured in polycarbonate screw cap containers and incubated at 25 ° ± 1 °C, with cool white fluorescent tubes providing a photoperiod of 16 h day and 8 h darkness.

Table 1: Days taken for root initiation and root development percentage

Treatment	Combination of Hormones	Days taken for root initiation	Root development (%)
T ₁	IBA 0.1 ppm	18.00	(70.66)
T ₂	IBA 0.5 ppm	16.66	(74.33)
T ₃	IBA 1 ppm	16.00	(85.00)
T ₄	IBA 2 ppm	15.66	(60.33)
T ₅	IBA 3 ppm	12.66	(70.66)
T ₆	NAA 0.1 ppm	15.00	(51.66)
T ₇	NAA 0.5 ppm	13.66	(65.00)
T ₈	NAA 1 ppm	14.33	(70.33)
T ₉	NAA 2 ppm	13.00	(75.00)
T ₁₀	NAA 3 ppm	11.66	(55.33)
SE(m)		0.488	1.564
C.D. at 5%		1.449	4.683
C.V.		5.761	4.863

Days taken for root development

It is clear from the data presented in Table-1 that among treatments the days taken for root development varied significantly from 11.66 days to 18 days. The minimum number of days taken for the development of root (11.66 days) was recorded with NAA 3 ppm followed by IBA 3 ppm (12.66 days), NAA 2 ppm (13.00), NAA 0.5 ppm. Maximum number of days taken for root development was recorded in IBA 0.1 ppm (18 days) which was observed to be 7 days late from earliest treatment.

Root development percentage

In-vitro grown multiple shoots were taken for root induction in CHU (N6) media enriched with various concentrations of

IBA and NAA. These cultures were placed in growth room at 25°C ± 2°C and 16/8 hr light/dark regime under fluorescent light with 55 - 60% RH. The root initiation percentage were varied between 51 to 85%. It is clear from the data presented in Table-1 that among treatments the percentage of root development varied significantly from 51.66% to 85%. The maximum percent of root development was recorded with IBA 1.0 ppm (85%) followed by NAA 2 ppm (75%), IBA 0.5 ppm (74.33%) and IBA 0.1 ppm (70.66%). The least percent of root development (51.66%) was recorded with NAA 0.1 ppm which was observed to be the 34% less than the highest one treatment.

Table 2: Number of roots and root length per plantlet

Treatment	Combination of hormones	Number of Roots	Root Length (cm)
T ₁	IBA 0.1 ppm	5.33	2.9
T ₂	IBA 0.5 ppm	9.00	3.5
T ₃	IBA 1 ppm	11.66	4.0
T ₄	IBA 2 ppm	5.33	3.0
T ₅	IBA 3 ppm	7.00	2.5
T ₆	NAA 0.1 ppm	4.00	2.8
T ₇	NAA 0.5 ppm	7.66	3.7
T ₈	NAA 1 ppm	9.66	3.0
T ₉	NAA 2 ppm	4.33	2.2
T ₁₀	NAA 3 ppm	4.33	1.8
SE(m)		0.234	0.091
C.D. at 5%		0.694	0.271
C.V.		5.920	5.378

Number of roots per plantlet

The root development under *in-vitro* cloning of Papaya were observed in CHU (N6) media supplemented with different concentrations of IBA and NAA. Induction of root was observed within 11 days to 18 days after inoculation (DAI) in CHU (N6) media supplemented with IBA and NAA. Table-2 clearly shows that the maximum (11.66) numbers of root were observed in combination of IBA 1 ppm followed by 1 ppm NAA (9.66), NAA 0.5 ppm (7.66) and IBA 3 ppm (7.00) however last two were significantly at par with each other. The minimum roots (4.00) were recorded at 0.1 ppm of NAA treatment.

Root length

It is evident from the data presented in Table-2 that the length of the root was significantly varied with the various concentration of growth hormones supplemented in the CHU (N6) media, the data was recorded after 15 to 20 days of inoculation into the rooting media, when the shoot tip and inflorescence already attains the good observable length. Maximum root length (4.00 cm) was recorded with media supplemented with IBA 1 ppm followed by NAA 0.5 ppm (3.70 cm), IBA 0.5 ppm (3.50 cm) and IBA 2 ppm (3.00 cm); while minimum root length (1.8 cm) was recorded under NAA 3 ppm treatment.

References

1. Ali AM, Hogan L. Tissue culture of *Carica papaya*. Hort. Sci. 1976; 11:27.
2. Ambasta KA, Kumari S. Efficient procedure for clonal propagation of *Carica papaya* L. via shoot tip explant. Indian Journal of Plant Sciences. 2013; 2(1):24-33.
3. Anibijuwon I, Udeze A. Antimicrobial activity of *Carica papaya* (pawpaw leaf) on some pathogenic organisms of clinical origin from South-Western Nigeria. Ethnobotanical Leaflets. 2009; (7):4.
4. Arora IK, Singh RN. *In vitro* plant regeneration in Papaya. Curr. Sci. 1978; 47:839-883.
5. Bhattacharya J, Khuspe SS, Renukdas NN, Rawal SK. Somatic embryogenesis and plant regeneration from immature embryo explant of papaya. Indian J Expt. Biol. 2002; 40:624-627.
6. Boshra V, Tajul AY. Health and the Environment Journal, 2013, 4(1).
7. Choudhary Deepika Subhash Kajla Duhan, Poonia JS, Surekha Pushpa Kharb AK. Comparative study of various growth regulators on *in vitro* multiplication of commercial cultivar of banana grand naine. Annals of Biology. 2013; 29(3):288-293.
8. Rajeevan MS, Pandey RM. Lateral bud culture (*Carica papaya* L.) for clonal propagation. Plant Tiss. Org. Cult. 1986; 6:181-188.
9. Reuveni O, Shlesinger DR, Lavi U. *In-vitro* clonal propagation of dioecious *Carica papaya* L. Plant Tiss. Org. Cult. 1990; 20:41-46.
10. Roy KP, Hakim MD. Propagation of Papaya (*Carica Papaya* L.) CV. Shahi through *in-vitro* culture. Bangladesh J Bot. 2012; 41(2):191-195.
11. Saker MM, Bekheet SA, Taha HS, Reda AA. *In-vitro* Propagation of Papaya (*Carica papaya* L.). Indian Journal of Biotechnology. 1999; (3):235-240.
12. Sentirelna Jamir Maiti CS. Effect of various levels of cytokinin and auxin for *in-vitro* regeneration of banana cultivars. International Journal of Agriculture Innovations and Research. 2014; 2(6):1160-1163.

13. Testsushi H, Sadao K, Hiroshi F. Mass-production of Papaya (*Carica papaya*. L) Saplings Using Shoot-tip Culture for Commercial use. South Pacific studies, 2008, 28.
14. Yie S, Liaw SI. Plant regeneration from shoot tips and callus of papaya. *In-vitro*. 1997; 13:564-568.