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Effect of IBA on rooting of pomegranate (*Punica granatum*) stem cuttings cv. Bhagwa

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Abstract
Effect of Indole Butyric Acid (IBA) on rooting of pomegranate semi hardwood cuttings cv. Bhagwa was carried out at College Orchard, Department of Horticulture, Agricultural College and Research Institute, Madurai during 2018 – 19 with the aim to identify the best IBA concentration suitable for pomegranate semi hardwood cutting. Six levels of IBA *viz*., 0 (control), 500, 1000, 1500, 2000 and 2500 ppm concentrations were prepared and treated with semi hardwood cuttings as quick dip method. Pomegranate var. Bhagwa used for this study. These cuttings were planted in polybags and were kept under mist chamber for sprouting. The study was laid out in a Completely Randomized Block Design (CRD) with six treatments and five replications. Observations on success per cen (%), number of sprouts, days taken for sprouting (days), number of leaves, plant height (cm), shoot length (cm), root length (cm), fresh root weight (g) and dry root weight (g) were recorded and analysed statistically. The results revealed that cuttings treated with IBA of 2500 ppm (T6) recorded the highest values of all the traits *viz*., success per cent (75.50%), least number of days for sprouting (9.79 days), number of sprouts per cuttings (4.20), number of leaves (43.52), plant height (49.25 cm), shoot length (31.6 cm), root length (3.24 cm), fresh root weight (2.1 g) and dry root weight (1.85 g) followed by T5 (2000 ppm of IBA). Control (T1) (without IBA treatment) observed the lowest values of the traits like success per cent of cuttings (20.80%), longest days for sprouting (12.50 days), number of sprouts per cuttings (1.40), number of leaves (22.20), plant height (28.25 cm), shoot length (18.80 cm), root length (0.50 cm), fresh root weight (0.79 g) and dry root weight (0.68 g). From the conclusion of the present study, IBA treated with 2500 ppm (T6) semi hard wood cuttings was the best method for mass multiplication of pomegranate.

Keywords: Pomegranate, bhagwa, propagation, IBA, semi hardwood cuttings

Introduction
Pomegranate (*Punica granatum* L.) is a well known table fruit and it is cultivated in tropical and sub-tropical parts of the world for its delicious fruits. In India, it is cultivated in Maharashtra, Karnataka, Andhra Pradesh, Gujarat and Rajasthan in large scale manner. Among the states, Maharashtra is the largest producer covering 2/3rd of the total area under pomegranate cultivation. Pomegranates are used as a salad or table fruit and in beverages. The fruit contains minerals, vitamins, antioxidants and tannins, while its juice is an excellent source of vitamins (B and C), sugars, minerals (K and Fe) and antioxidant polyphenols. Even juice works as medicines for curing of dyspepsia (Negi *et al.*, 2003) [6]. Eventhough pomegranate may be propagated through air layering, hard-wood cuttings, semi hard wood cuttings, grafting and simple layering, but the method of commercial propagation is by rooting of cuttings. Besides these method of propagation, one year old hardwood stem cuttings with fully matured wood of 8 – 10 cm long is the simplest, effective and most suitable method of propagation for multiplication of pomegranate plants (Sharma *et al.*, 2009 [10]; Hartmann *et al.*, 1997) [4].

It has been reported that exogenous application of auxins favours more success of rooting in cuttings. Multiplication of the pomegranate cuttings depends on concentrations of IBA, type of cuttings and even the media used for rooting of cuttings (Singh, 2017; Kumari 2014) [11, 5]. Thus, the present experiment on effect of IBA on rooting of pomegranate (*Punica granatum*) propagation through semi hardwood cutting was undertaken at College Orchard, Department of Horticulture, Agricultural College and Research Institute, Madurai during 2018 – 2019.

Materials and methods

The present experiment was carried out during 2018 to 2019 and to identify the best IBA concentration suitable for easy rooting of pomegranate. Six levels of IBA *viz*., 0 (control), 500, 1000, 1500, 2000 and 2500 ppm concentrations were prepared and treated with semi hardwood cutting as quick dip method. Pomegranate var. Bhagwa used for this study. Semi hardwood cuttings with the length of 20 – 22 cm taken from the pomegranate mother plants and were used for the experiment. A total of 25 semi hard wood cuttings for each treatment were studied. Cuttings were dipped in IBA concentration, planted in polybags and kept under mist chamber for sprouting. The study was laid out in a Completely Randomized Block Design (CRD) with six treatments and five replications. Observations on success per cent (%), number of sprouts, days taken for sprouting (days), number of leaves, plant height (cm), shoot length (cm), root length (cm), fresh root weight (g) and dry root weight (g) were recorded and analysed statistically as per the method was suggested by Panse and Sukhatme (1967) [7].

Results and discussion

The results of the shoot characters are presented in Table 1. The results revealed that semi hard wood cuttings treated with IBA concentrations of 2500 ppm (T6) recorded the highest success per cent of cuttings (75.50%) followed by T5 (IBA @ 2000 ppm) of 68.80 per cent whereas the minimum per cent of success of cuttings (20.80%) was observed in T1 (control). The reason might be that application of IBA has been found to stimulate cambial activity thereby resulted the mobilization of reserve food material to the site of root initiation as stated by Gurumurthy *et al*. (1984) [3]. The enhanced hydrolytic activity in presence of applied IBA might be responsible for the increased percentage of rooted cuttings. High carbohydrate and low nitrogen have been reported to favour root formation reported by Singh and Tomar, 2015 [12].

In the case of days taken for sprouting, T6 (IBA @ 2500 ppm) recorded the minimum days taken for sprouting (9.79 days) followed by T5 (IBA @ 2000 ppm) of 9.98 days. The longest days taken for sprouting (12.5 days) were observed in control (T1). This might be due to better utilization of stored carbohydrates; nitrogen in the semi hardwood cuttings treated with IBA application. Enhanced IBA concentration in the cell and increased the cell division which resulted on quick callus formation in the cuttings was reported by Patil *et al*. (2000) [8] in grapes. Number of sprouts per cutting recorded the highest (4.2) in T6 (IBA @ 2500 ppm) treatment followed by T5 (IBA @ 2000 ppm) of 3.0 and the lowest number of sprouts was found in control (T1) of 1.40. The number of leaves per plant (43.52) recorded the highest in cuttings treated with IBA of 2500 ppm (T6) followed by T5 (IBA @ 2000 ppm) of 39.60. The lowest number of leaves (22.20) was observed in T1 (Control). This might be due to favorable climatic conditions which play an important role to increase the number of leaves. This is in agreement with findings of Singh *et al*., 2015 [12, 13] he also stated that the application of IBA might have played some role in augmenting to increase the number of leaves per cutting in phalsa.

Shoot length was increased with increase in the concentration of growth regulators. The highest shoot length (3.24 cm) was recorded in semi hardwood cuttings treated with IBA of 2500 ppm (T6) followed by T5 (IBA @ 2000 ppm) of 2.38 cm whereas the lowest length (0.5 cm) was noticed in control (T1). This might be due to increased concentrations and activity of IBA which be caused hydrolysis and translocation of carbohydrates and nitrogenous substances in the cellular level at the base of cuttings which resulted in accelerated cell elongation and cell division under favorable environmental condition. Banker and Prasad (1992) [2] reported that IBA @ 2000 ppm recorded the highest shoot length in pomegranate cv. Jalore Seedless under Rajasthan condition. Plant height recorded the highest (49.25 cm) in T6 (IBA of 2500 ppm) followed by T5 (48.75 cm). The lowest plant height was noticed in control (T1) of 28.25 cm. Singh (2017) [11] reported that Indole Butyric Acid (IBA) is the active inhibiting axillary bud break on developing shoots and it stimulates the shoot initiation. IBA treatment enhanced rooting, plant growth and produced taller and healthy plants in pomegranate cv. Ganesh under Uttar Pradesh condition (Umrao, 1999) [14].

Table 1: Influence of IBA on success per cent and shoot characters of pomegranate cuttings.

Treatment Details	Success per cent (%)	Days taken for sprouting (days)	Number of Sprouts per cutting	Number of leaves	Plant height (cm)	Shoot length (cm)
T1 - Control	20.80	12.50	1.40	22.20	28.25	18.8
T2 - 500ppm	46.20	10.85	1.80	28.60	35.45	20.1
T3 - 1000ppm	55.60	10.35	2.80	35.80	47.20	24.3
T4 - 1500ppm	62.50	10.15	2.60	36.80	48.30	24.3
T5 - 2000ppm	68.80	9.98	3.00	39.60	48.78	28.1
T6 - 2500ppm	75.50	9.79	4.20	43.52	49.25	31.6
SEd	1.09	3.451	0.404	5.708	3.150	1.492
CD (P = 0.05)	2.59	7.586	0.795	11.781	7.013	3.079

Root characters

The results of the root characters are presented in Table 2. The results revealed that semi hardwood cuttings treated with IBA @ 2500 ppm (T6) recorded the highest root length of 3.24 cm followed by T5 (IBA @ 2000 ppm) of 2.78 cm whereas control (T1) observed the lowest root length of 0.80 cm. This might be due to auxin application which been found to enhance the histological features like formation of callus and tissues differentiation of vascular tissue. Indole Butyric Acid (IBA) is the synthetic plant hormone. It is active in inhibiting axillary bud break on developing shoots, and it stimulates the root initiation. It promotes cell elongation which helped to increase in root length. It is a leading plant hormone used to generate new roots in the cloning of plants through cuttings. This is in accordance with the findings of Randhawa and Nito (1980) [9] and he stated that higher percentage of rooting, increase in length of roots and average number of roots per cutting in *Malus sp.* with increasing concentration of IBA. Hartmann *et al.* (1997) [4] reported that auxin might have increased rooting and ensured root length.

Regarding fresh root weight, the highest weight (2.1 g) was noticed in T6 (IBA at 2500 ppm) followed by T5 (IBA @ 2000 ppm) of 1.6 g. The lowest fresh root weight (0.79 g) was observed in control (T1). The fresh weight of the root is

directly proportional to number of roots in each cutting. Umrao (1999) [14] reported that IBA treated hardwood cuttings recorded the highest root length in pomegranate cv. Ganesh. This is in accordance with the findings of Arumugam *et al.* (1996) in pomegranate and Singh and Tomar (2015) [12] in phalsa.

Treatment T6 (IBA @ 2500 ppm) recorded the highest dry root weight (1.85 g) followed by T5 (IBA @ 2000 ppm) of 1.3 g whereas the lowest dry root weight was observed in control (T1) of 0.68 g. The higher dry weight of the roots might be attributed to higher root length which accumulates more stored carbohydrates and more number of roots increased their volume per cutting in semi hardwood cuttings (Hartman *et al.* 1997). Similar results were also reported by Singh and Tomar (2015) [12] and Singh *et al*. (2015) [12, 13] in phalsa.

Table 2: Influence of IBA on root characters of pomegranate cuttings

Treatment Details	Root length (cm)	Fresh root weight (g)	Dry root weight (g)
T1 - Control	0.80	0.79	0.68
T2 - 500ppm	1.08	1.09	0.95
T3 - 1000ppm	1.84	1.30	1.00
T4 - 1500ppm	2.38	1.40	1.10
T5 - 2000ppm	2.78	1.60	1.30
T6 - 2500ppm	3.24	2.10	1.85
SEd	0.313	0.079	0.06
CD (P = 0.05)	0.650	0.20	0.19

Conclusion

The present study it was concluded that IBA @ 2500 ppm (T6) treated semi hard wood cuttings recorded the highest values in all the traits and the best method of propagation in pomegranate for further multiplication.

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