Journal of Pharmacognosy and Phytochemistry
Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2018; SP3: 418-421

Alam Khan Samim
M. Sc. (Horticulure) Dept. of Fruit Science, College of Horticulture, Mudigere, Chikmagalur District, Karnataka, India

BS Shivakumar
Department of fruit science, College of Horticulture Mudigere, Karnataka, India

Yallesh Kumar HS
Department of fruit science, College of Horticulture Mudigere, Karnataka, India

Ganapathi M
Department of Crop Physiology, College of Horticulture Mudigere, Karnataka, India

Correspondence
Alam Khan Samim
M. Sc. (Horticulure) Dept. of Fruit Science, College of Horticulture, Mudigere, Chikmagalur District, Karnataka, India

National conference on "Conservation, Cultivation and Utilization of medicinal and Aromatic plants"
(College of Horticulture, Mudigere Karnataka, 2018)

Study on rooting of stem cutting in Barbados cherry (*Malpighia glabra* L.) under hill zone of Karnataka

Alam Khan Samim, BS Shivakumar, Yallesh Kumar HS and Ganapathi M

Abstract
An investigation was to assess the influence of growth regulators IBA, NAA and their combination on rooting of stem cuttings in Barbados cherry (*Malpighia glabra* L.) under hill zone of Karnataka. It was observed that, the least number of days (21.33) taken for root initiation, maximum percentage of rooting (80.00), number of root (26.67), average length of root (17.85 cm), length of longest root (23.00 cm), maximum number of primary (8.83) and secondary root (20.83), maximum fresh (2.91g) and dry weight of root (1.15 g) and root volume (4.5 cc) was recorded in cutting treated with IBA 5000 ppm. The less number of days taken for first sprouting (11.70), number of sprouted cuttings (18.33), sprouting percentage (91.67), number of shoots (5.13), length of shoot (10.40 cm), number of leaves per cutting (21.93), diameter of shoot (2.30 mm) and maximum fresh and dry weight of shoot (3.01 g and 1.30 g respectively) was recorded in cutting treated with IBA 5000 ppm.

Keywords: Barbados cherry, rooting, stem cutting, IBA, NAA and their combination

Introduction
The Barbados cherry is member of the Malpighiaceae is a tropical fruit native of South Mexico, Central and South America, but now it is also grown in the regions in tropical and sub-tropical areas of Asia. It is naturally adapted to both medium and low rainfall regions. The vegetative propagation in Barbados cherry is utmost desirable in order to propagate true-to-type plants. Hence, vegetative methods of propagation *viz.*, air layering, cleft or modified crown grafting, budding and cuttings were followed. Among different methods of vegetative propagation, stem cutting is preferred which is inexpensive, rapid, simple and does not require the particular techniques as in case of other methods. The reports on an investigation on the propagation of Barbados cherry from cuttings and use of growth regulators for better root growth are scanty. Therefore, the study was undertaken on the propagation of Barbados cherry using different growth regulators for rapid multiplication.

Material & Method
The experiment was carried out in a low- cost polyhouse of the department of Fruit Science, College of Horticulture, Mudigere, during 2017-18. The experiment was laid out in a complete randomized design with 12 treatments consisting of growth regulators IBA, NAA and their different combinations (T_1- control, T_2- IBA 2000 ppm, T_3-IBA 2500 ppm, T_4- NAA 3000 ppm, T_5- NAA 3500 ppm, T_6- NAA 400 ppm, T_7- IBA 4500 ppm, T_8- IBA5000 ppm, T_9- IBA 2000 ppm + NAA 2000, T_{10}- IBA 2000 ppm + NAA 2500 ppm, T_{11}- IBA 2000 ppm + NAA 3000 ppm and T_{12}- IBA 2000 ppm + NAA 3500 ppm). The cuttings were taken from mature one-year-old shoots made into small pieces having 4-6 nodes, uniform (15 cm length and 0.8 to 0.9 cm diameter). The cuttings was treated with growth regulators by quick dip method and for this a required amount of growth regulator was weighed and dissolved in 0.5 N NaOH and then the volume was made up to 1 liter using distilled water and the cutting was dipped in solution for 30 seconds and planted in polybags. After planting cuttings were examined and the following observation were recorded on days taken for root initiation, per cent of cuttings rooted, average number of roots per cutting, average length of root, length of longest root per cutting, number of primary and secondary root per cutting, fresh and dry weight of root, root

volume, days taken for first sprouting, per cent sprouting, number of shoot, number of leaves, length of shoot, diameter of shoot, fresh and dry weigh of shoot.

Results & Discussion

Significant variation was observed between different treatments of growth regulators for root and shoot parameters of Barbados cherry hard wood cuttings. Earliest rooting initiation (21.33 days) was observed in cutting treated with IBA 5000 ppm while, the untreated cutting recorded maximum days (36.00) for root initiation. This might be due to efficient utilization of stored food nutrients in cuttings treated with plant growth regulators may initiate early rooting. Similar results are reported by Shivaji *et al*. (2014) [1] in fig. The percentage (80.00) of rooted cuttings was significantly highest when the stem cuttings were treated with IBA 5000 ppm and lowest rooting percentage (30.00) was recorded in control. This might also be due to the fact that optimum concentration of IBA leads to mobilization and utilization stored of carbohydrates and nitrogen fraction with the presence of co-factor at the wound site, which may have helped in better root initiation. Maximum number of roots (26.67) was observed in IBA 5000 ppm and the minimum number of roots (3.67) was observed in control this may be due to increase in carbohydrate and metabolic activities. This result is accordance with the findings of Ghosh *et al.* (1988) [2] in pomegranate and Patel *et al*. (2017) [3] in fig. Average length of root and length of the longest root (17.85 cm and 23.00 cm respectively) was observed in cutting treated with IBA 5000 ppm respectively. While, the minimum average length and minimum length of the longest root (1.95 cm and 2.17cm respectively) was recorded in control. It might be due to an auxin application has been found to enhance the histological features like the formation of callus, tissue and differentiation of vascular tissue. Jadav (2007) [4] reported that early initiation of roots at higher concentrations of IBA may be due to more utilization of the nutrients. Similar result was reported by Abdulqader *et al.* (2017) [5] in olive and Akram *et al*. (2017) [6] in Guava. The maximum (8.83) number of primary roots per cutting was recorded in IBA 5000 ppm and minimum number primary roots per cutting (1.83) were observed in control. The cuttings treated with IBA 5000 ppm recorded maximum (20.83) number of secondary roots per cutting and minimum (1.70) secondary roots per cutting was observed in control. Increasing in number of primary and secondary roots per cutting might be due to auxins produced in sprouts, which translocate downwards to increase the endogenous auxin levels in a lower portion of the stem cuttings. Pearse (1943) [7] early mobilization and metabolization of auxin leads to increased rooting. Similar reported by Ali *et al*. (2017) [8] in Kiwifruit. Maximum fresh weight of root (2.91 g) was recorded in IBA 5000 ppm and the minimum fresh weight of roots (0.09 g) was observed in control. Also maximum dry weight of roots (1.15 g) was recorded in IBA 5000 ppm and minimum dry weight of root (0.04 g) were observed in control. This might be due to the cuttings treated with plant growth regulators help in the better mobilization and translocation downward of primary metabolites for better root formation and nutrient uptake. Similar results were reported by Kaur and Kaur (2017) [9] in fig and Galavi *et al.* (2013) [10] in grape. Maximum root volume (4.50 cc) was recorded in IBA 5000 ppm and the minimum (0.07 cc) root volume was observed in control. This might be due to the greater portion of available photosynthates used in root growth and development resulted in higher root volume. Similar results are in accordance with Shashidhar (2014) [11] in litchi and Muttaleb *et al.* (2017) [12] in *Piper betle* L.

The date on shoot parameters showed significant differences among different treatments the cuttings treated with IBA 5000 ppm taken minimum number of days for sprouting (11.17) and maximum number of days taken was observed in control (16.00). While maximum per cent of sprout was recorded in IBA 5000 ppm (91.67) and minimum was observed in control (51.67). This might be due to the presence of endogenous auxins in cuttings might have brought early breakage of bud dormancy and caused in early bud sprouting. Chandramouli (2001) [13] found that the increase in the concentration of IBA significantly decreased the number of days to first sprouting of cuttings and earliness in sprouting might be due to better utilization of stored carbohydrates, nitrogen and other factors with the help of growth regulators. Similar investigation was noticed by Singh (2017) [14] in pomegranate. The maximum number of shoot per cutting (5.13) was observed in IBA 5000 ppm and the minimum number of shoots per cutting (1.67) was observed in control. This might be due to the enhancement of physiological activities in the cuttings. Similar result was reported by Baghel *et al.* (2016) [15] in Guava. Maximum shoot length (18.80 cm) and diameter of shoot (2.30 mm) was observed in 5000 ppm of IBA while, minimum shoot length (1.97 cm) and minimum diameter (0.77 mm) was observed in control. This may be due to maximum number of roots with helps in nutrition and water absorption. Chandramouli in (2001) [13] stated that earliness in sprouting, increase in number of sprouts, shoots and sprout length might be due to better utilization of stored carbohydrates, nitrogen and other factors with the aid of growth regulators. Similar result was reported by Singh (2013) [16] in *Citrus limon.* Maximum number of leaves per cutting (21.93) was observed in IBA 5000 ppm and minimum number of leaves (5.67) was observed in control, IBA at 5000 ppm produced healthier, lengthy roots as evident from the results on root parameters in the present study which might have helped in the absorption of water and nutrients that have great influence on the production of more number of leaves by the cuttings. The increase in a number of leaves per cutting might be due to the leaves are one of the major production sites of natural auxin in the plants and the production of leaf buds could be induced by external application of auxins (Wahab *et al.,* 2001) [17]. Maximum fresh weight of shoot (3.01 g) and dry weight of shoot (1.30 g) was recorded in (IBA 5000 ppm and minimum fresh weight of shoot (0.21 g) and dry weight of shoot (0.06 g) was observed in control. Data clearly indicated that maximum fresh and dry weight of shoots was associated with IBA 5000 ppm which might have increased the number of shoots resulting in increased higher accumulation of fresh and dry weight in shoots. A similar finding was noticed by Kaur and Kaur (2017) [9] in fig.

Table 1: Effect of IBA, NAA and their combination on rooting parameters

Tr. No	Days for root initiation	Per cent rooted cutting	No. of roots/ cutting	Av. length of root (cm)	Length of longest root (cm)	No. of primary roots	No. of secondary roots	Fresh weight of roots (g)	Dry weight of roots (g)	Root volume (cc)
T_1	36.00	30.00	3.67	1.95	2.17	1.83	1.70	0.09	0.04	0.07
T_2	30.33	36.67	7.50	7.42	12.33	2.33	4.67	0.39	0.11	0.30
T_3	29.33	41.67	8.83	9.04	12.50	2.67	4.83	0.49	0.12	0.37
T_4	27.33	60.00	14.50	11.92	17.17	5.83	10.50	0.69	0.47	1.27
T_5	28.67	51.67	14.50	11.92	14.83	5.50	8.67	0.98	0.43	1.23
T_6	28.67	50.00	14.00	10.50	14.70	4.67	8.67	1.07	0.33	1.00
T_7	26.00	63.33	14.67	12.75	17.83	7.17	11.33	1.17	0.57	2.03
T_8	21.33	80.00	26.67	17.85	23.00	8.83	20.83	2.91	1.15	4.50
T_9	28.67	48.33	12.67	10.33	14.67	4.33	7.17	0.55	0.29	0.77
T_{10}	29.00	48.33	12.17	9.83	14.25	4.33	7.00	0.27	0.16	0.53
T_{11}	29.00	48.33	10.33	9.58	14.00	4.17	7.00	0.22	0.15	0.47
T_{12}	29.00	45.00	9.33	9.25	13.00	3.50	6.17	0.18	0.13	0.42
S. Em ±	1.10	4.74	2.17	1.78	2.14	1.13	1.61	0.15	0.08	0.20
C.D @ 5 %	3.20	13.83	6.34	5.19	6.23	3.31	4.70	0.46	0.25	0.57

Table 2: Effect of IBA, NAA and their combination on shoots parameters

Tr. No	Days taken for first sprouting	Per cent cuttings sprouted	Number of shoots per cutting	Shoot length (cm)	Number of leaves per cutting	Diameter of shoot (mm)	Fresh weight of shoot (g)	Dry weight of shoot (g)
T_1	16.00	51.67	1.67	1.97	5.67	0.77	0.21	0.06
T_2	12.17	73.33	2.67	4.83	9.00	1.37	0.43	0.15
T_3	12.67	76.67	2.93	3.15	9.00	1.49	0.34	0.12
T_4	13.33	78.33	3.07	4.50	10.73	1.48	0.94	0.35
T_5	12.17	80.00	3.00	3.62	8.40	1.48	1.42	0.53
T_6	12.00	83.33	3.73	5.55	13.87	1.65	0.97	0.38
T_7	12.00	86.67	3.87	10.60	14.73	1.96	2.08	0.92
T_8	11.17	91.67	5.13	18.80	21.93	2.30	3.01	1.30
T_9	13.83	73.33	3.47	2.69	10.00	1.17	0.24	0.29
T_{10}	12.50	71.67	2.80	3.27	7.20	1.25	1.42	0.11
T_{11}	13.83	75.00	2.80	4.37	8.80	1.15	0.25	0.11
T_{12}	12.50	81.67	2.33	2.62	6.40	1.14	0.24	0.10
S. Em ±	0.57	4.95	0.47	1.09	2.11	0.14	0.49	0.21
C.D @ 5 %	1.60	14.30	1.39	3.21	6.12	0.42	1.47	0.62

Conclusion

On the basis of results obtained in the present investigation, it can be concluded that among the 12 treatments, IBA 5000 ppm shown comparatively good results with respect to root and shoot parameters followed by the IBA 4500 ppm. Based on the findings of the current investigation, it is recommended that vegetative method of propagation through cuttings in Barbados cherry is reliable for nursery plants production as it is a quick and easy method of vegetative propagation.

References

1. Shivaji T, Madhavi K, Sudhavani V. Effect of type of cuttings and IBA concentrations on the propagation of Fig (*Ficus carica*) cv. Poona Fig under open conditions. Trends of Biosciences. 2014; 7(11):1087-1090.
2. Ghosh D, Bandyopadhyay A, Sen SK. Effect of NAA and IBA on adventitious root formation in stem cuttings of pomegranate under intermittent mist. Indian Agriculturist. 1988; 32(4):239-243.
3. Patel HR, Patel MG, Singh S. Effect of different levels of IBA and NAA on rooting of hardwood and semi hardwood cutting in fig. Int. J Agri. Sci. Res. 2017; 7(4):519-523.
4. Jadav AS. Studies on propagation of phalsa by cuttings. M.Sc. Agri. Thesis, Univ. Agric. Sci., Dharwad, Karnataka (India), 2007.
5. Abdulqader SM, Abdulrhman AS, Ramazan ZI. Effect of wounding and different concentration of IBA on the rooting and vegetative growth of stem cutting of three olive cultivars. Kufa J Agri. 2017; 2(9):203-225.
6. Akram MT, Qadri RW, Khan I, Bashir M, Jahangir. Clonal multiplication of guava (*Psidium guajava*) through soft wood cuttings using IBA under low-plastic tunnel. Int. J Agri. Biol. 2017; 19(3):417-422.
7. Pearse HL. The effect of nutrition and phytohormone on the rooting of *Vinca* cuttings. Ann. Bot. 1943; 7:123-132.
8. Ali MT, Iqbal U, Mushtaq R, Parray EA, Ibrahim A, Wani MA. Effect of plant growth regulators on rooting of Kiwifruit (*Actinidia deliciosa*) cuttings. J Pharmacognosy and Phytochemistry. 2017; 6(6):514-516.
9. Kaur A, Kaur A. Effect of IBA concentrations on success of cuttings of fig cv. Brown turkey. Int. J Sci. Res. 2017; 8(11):1576-1579.
10. Galavi M, Karimian MA, Roholla S, Mousavi. Effects of different auxin (IBA) concentrations and planting-beds on rooting grape cuttings (*Vitis vinifera*). *Annu.* Rev. Res. Biol. 2013; 3(4):517-523.
11. Shashidhar NG. Studies on growth regulators on rooting and success of air layers in litchi (*Litchi chinensis* Sonn.) under hill zone of Karnataka. M. Sc. Thesis, Univ. Agric. Sci. Shivamogga, Karnataka (India), 2014.
12. Muttaleb QA, Abdullah TL, Rashid AA, Hassan SA. Rooting of stem cuttings with different Indole 3- butyric acid (IBA) treatments and development of

micropropagation protocol for *Piper betle* L. Node Culture. American. J Plant. Sci. 2017; 8:3084-3100.
13. Chandramouli H. Influence of growth regulators on the rooting of different types of cuttings in *Bursera penicilliatai* (DC) Engl. M.Sc. Thesis, Univ. Agric. Sci. Bangalore, 2001.
14. Singh KK. Effect of IBA concentrations on the rooting of pomegranate (*Punica granatum* L.) cv. Ganesh hardwood cuttings under mist house condition. International. J Horti. and Flori. 2017; 5(4):318-323.
15. Baghel M, Raut UA, Ramteke V. Effect of IBA concentrations and time of air layering in Guava cv. L-49. Res. J Agri Sci. 2016; 7(1):117-120.
16. Singh KK, Choudhary T, Kumar P. Effect of IBA concentrations on growth and rooting of *Citrus limon* cv. Pant lemon cuttings. Biol. sci. Agric. Adv Soc. 2013; 2(3):268-270.
17. Wahab F, Nabi G, Ali N, Shah M. Rooting response of semi-hardwood cuttings of guava (*Psidium guajava* L.) to various concentrations of different auxins. Online J Biol. Sci. 2001; 1(4):184-187.