RESEARCH ARTICLE

Impact of plant growth regulator on shooting of stem cuttings in Jamun (*Syzigium cumini* L. Skeels)

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Asexual propagation of Jamun (*Syzigium cumini* L. skeels) through cutting is the easiest, convenient and the cheapest method to obtain true to type plants in considerably lesser time. In the present study, effect of different growing media on the shooting ability of different types of stem cuttings of Jamun was assessed at School of Agriculture, Lovely Professional University, Phagwara, and Punjab. The experiment was laid out in randomized block design. The hardwood cuttings were significantly best with respect to most of the shoot parameters. In the interaction of treatments, number of days taken for sprout initiation was found early in T3 (soil+vermi-compost+sand +IBA (5000 ppm), 12.13 days), the highest number of sprouts (11.36, 9.8 and 7.33) and number of leaves per cutting (5.7, 7.00 and 8.93) at 30, 60 and 90 DAP, the highest diameter of shoot was found in T5 (1.56, 1.8, 2.66) at 30, 60 and 90 DAP, the highest survival percentage was found in T5 (IBA 3000 ppm+NAA 1000 ppm) (60.8), the highest leaf area was found in T5 (68.8) and highest plant height observed in T5 (85.33 cm) at 90 DAP. Overall, T5 (IBA 3000 ppm+NAA 1000 ppm) having interaction of hard wood cutting was shown superior results as compared to other treatments.

Key Words: *Jamun; Shooting; Stem cutting; Growing media; Vegetative propagation; Growth regulator (IBA and NAA)*

INTRODUCTION

Jamun (*Syzygium cumini*), an indigenous and significant minor crop in India, is a member of the Myrtaceae family [1]. Jamun has recently gained significant commercial importance in dry regions. It is widely grown throughout most of India, from the Indo Gangetic Plains in the North to Tamil Nadu in the South. An important evergreen tree native to India goes by the names Indian blackberry, Java plum, Jambu, Black plum, and Jambul [2]. A new fruit crop for the twenty-first century is S. cumini. Alkaloids, fatty acids, steroids, and tannins are only a few of the many phytochemicals the fruit contains. The fruit's hypoglycemic qualities have earned it the nickname "diabetes warrior." The multipurpose tree known as Jamun has many pharmacological and phytotherapeutic applications [3]. Iron, sugars, minerals, proteins, carbs, and sugars are all present in good amounts in the fruit. In addition to being consumed fresh, fully ripe fruits can be made into beverages like jelly, jam, squash, wine, and vinegar. The fruit creates a very reviving squash and has a sub acidic spicy flavour. Fruit syrup, in small doses, can be used to treat diarrhea. A slightly under ripe fruit's juice is used to make vinegar, which has digestive, stomachic, carminative, and diuretic properties. Beverages can be made from little fruits that are unsuited for consumption but are high in acids, tannins, and anthocyanins [4]. According to Singh, fruits are an effective cure for diabetes, heart disease, and liver issues [5]. Several properties of the jamun, including those that are anti-diabetic, anti-hyperglycemic, anti-leishmanial, antifungal, anti-inflammatory, radio-protective, antibacterial, gastro-protective, antifertility, anorexigenic, antidiarrheal, ulcerogenic, and anti-HIV, have been demonstrated [6-12]. The main sugars in ripe fruits are glucose and fructose; sucrose is utterly lacking the main acid is malic acid (0.59%), with a trace amount of oxalic acid. The tannins and gallic acid in the fruits make them astringent. The blooms in North India constitute a substantial source of honey produced by *Apis dorsata*. Acetyl oleanolic acid, eugenia-triterpenoid A, and eugenia-tritetrapeniod B are the three triterpenoids said to be present in the flowers. Together with the flavonoids isoquercitrin, quercetin, kaempferol, and myricetin, jamun flowers also contain ellagic acid [11,13]. Jamun fruits provide a decent quantity of calcium, potassium, vitamin C, and B-complex (alanine, arginine, aspergine). Delphinine and petunidin are the two main anthocyanins; malvidine, peonidin, and cyanidin are only found in trace amounts [4]. Dihydrocarvylacetate, geranyl butyrate, and terpinyl valerate are three esters that are most likely in charge of the fruit's distinctive flavour. Vitamins, tannin, and anthocyanins are said to have an antioxidant effect [14]. 8.5 percent crude protein, 16.9% crude fibre, 21.72% ash, 0.41% calcium, and 0.17% phosphorus are all present in seeds. Using ground seeds to treat diabetes is a great idea [4,13]. Seeds contain the glycosides jambolin and antimellin, as well as the alkaloid jambosin, which inhibit the diastatic conversion of starch to sugars. The Jamun seed's dried alcoholic extract may be able to lower blood sugar and glycosuria [15,16]. Plants grown from seeds require a lot of time to bloom and develop fruit, and the fruits they do produce will vary in size and quality. Three weeks and 8%, respectively, are the average germination rates for Jamun seeds [17]. Thus, vegetative propagation is the most ideal method for producing plants that are true to type. The most practical and affordable way to grow a fully formed, more robust tree in a lot less time is by cuttings. There is virtually little research on the rooting of Jamun cuttings. During conducting the current study, which investigated the impact of plant growth regulators on the ability of several types of Jamun stem cuttings to successfully root, these parameters were taken into account. The greatest number of roots per cutting at IBA concentrations of (1000, 2000, 3000, 4000, and 5000 ppm) was also reported. There is virtually little research on the rooting of Jamun cuttings. These factors were taken into consideration when conducting the current study, which examined the effect of PGRs on the success of different types of Jamun stem cuttings ability to take root.

MATERIALS AND METHODS

Preparation of cuttings

Stem cuttings for jamun (*Syzygium cumini* L.) were taken from mother plants that were healthy and free of disease. The 15 cm long cuttings have four to five buds on them. Three different types of stem cuttings were used in the current investigation, and they are as follows:

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Preparation of growth regulator

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 0.2 N NaOH and then the volume was made up to 1 liter using distilled water and the cutting was dipped in solution for 2 minutes and planted in portrays containing coco-peat as media.

Proposed research methodology

The present investigation entitled "The effect of plant growth hormone and maturity of cuttings on the propagation in Jamun (*Syzygium cumini*)" will be conducted at post-harvest laboratory, Department of Horticulture, Lovely professional University, Punjab. The all growing media ratio is 1:1 and PGR concentration in ppm. The details of materials will be used during experimentation and methodologies are as below (Table 1).

TABLE 1
Treatments details

S. no.	Notation	Treatments
1	T1	Soil+IBA (3000 ppm)
2	T2	Soil+vermin-compost+IBA (4000 ppm)
3	T3	Soil+vermin-compost+Sand+IBA (5000 ppm)
4	T4	Soil+vermin-compost+Sand+Coco-peat+IBA (6000 ppm)
5	T5	Soil+IBA (3000 ppm)+NAA (1000 ppm)
6	T6	Soil+vermin-compost+IBA (4000 ppm)+NAA (1000 ppm)
7	T7	Soil+vermin-compost+Sand+IBA (5000 ppm)+NAA (1000 ppm)
8	T8	Soil+vermin-compost+Sand+Coco-peat+IBA (6000 ppm)+NAA (1000 ppm)
9	T9	Control

RESULTS AND DISCUSSION

Days taken to start sprouting

The information collected regarding the influence of varied planting dates, IBA and NAA application, and their interplay on the initiation of sprouting is outlined in Table 2. The findings indicate a significant impact of both planting date and IBA and NAA on the duration required for sprouting to commence. The earliest (12.13 days) sprouting was observed at T3 (Soil+Vermicompost+Sand+IBA (5000 ppm) planting, which was significantly superior to other date of planting, followed by T5 (IBA 3000 ppm+NAA 1000 ppm) (14.50). Whereas, sprouting was delayed and maximum T7 (IBA 5000 ppm+NAA 1000 ppm) (17.06) days required planting. The duration for sprout initiation in jamun stem cuttings was notably impacted by different levels of growth regulators and the type of cuttings, as well as their interplay. Shoot-tip cuttings (11.46 days) exhibited earlier sprouting compared to other types, while rootex (11.20 days) proved to be the most effective in promoting early sprout initiation among the various propagation conditions [18].

TABLE 2
The effect of plant growth regulator on sprouting days, survival percentage, leaf area and plant height shooting

Treatment detail	Days taken for sprout initiation (15 DAP)	Survival (%) (90 DAP)	Leaf area (90 DAP)	Plant height (90 DAP)
T1	15.93	48.43	49.6	66.93
T2	15.76	35.43	54.8	76.2
T3	12.13	30.03	62.36	83.23
T4	15.43	24.4	49.36	70.86
T5	14.5	60.8	68.8	85.33
T6	16.46	56.4	62.52	66
T7	17.06	56.13	63.36	78.3
T8	15.8	43.2	52.76	73.23
T9	15.6	56.23	65.66	78.26
MEAN	15.4	45.67	58.8	75.37
CD	2.39	5.33	2.24	5.14

SE (m)	0.79	1.76	0.74	1.7

Shoot length (30, 60 and 90 DAP)

The acquired data concerning the impact of diverse planting dates, IBA and NAA application, and their combinations on the shoot length after 30 days of planting is showcased in Table 3. The results indicate a noteworthy influence of both planting date and IBA and NAA on the shoot length observed 30 days after planting. The longest (7.3 cm) shoot was recorded at T5 (IBA 3000 ppm+NAA 1000 ppm) planting, which was significantly higher than other date of planting followed by T4 (soil+vermi-compost +sand+coco-peat+IBA 6000 ppm) (6.83). Whereas, the shortest (3.73 cm) shoot was recorded at T1 (soil+IBA 3000 ppm). The acquired data concerning the impact of diverse planting dates, IBA and NAA application, and their combinations on the shoot length after 60 days of planting is showcased in Table 3. The results indicate a noteworthy influence of both planting date and IBA and NAA on the shoot length observed 60 days after planting. The longest (9.1 cm) shoot was recorded at T5 (IBA 3000 ppm +NAA 1000 ppm) planting, which was significantly higher than other date of planting followed by T9 (Control) (9.03). Whereas, the shortest (4.83 cm) shoot was recorded at T1 (Soil+IBA 3000 ppm). The acquired data concerning the impact of diverse planting dates, IBA and NAA application, and their combinations on the shoot length after 90 days of planting is showcased in Table 3. The results indicate a noteworthy influence of both planting date and IBA and NAA on the shoot length observed 90 days after planting. The longest (10.33 cm) shoot was recorded at T5 (IBA 3000 ppm +NAA 1000 ppm) planting, which was significantly higher than other date of planting followed by T9 (control) (9.66). Whereas, the shortest (5.93 cm) shoot was recorded at T1 (soil+IBA 3000 ppm).

TABLE 3

The effect of plant growth regulator on shoot length, diameter of shoot, no. of sprout per cutting and no. of leaves per cutting

Treatment details	Shoot length			Diameter of shoot			No. of sprout per cutting			No. of leaves per cutting		
	30 DAP	60 DAP	90 DAP	30 DAP	60 DAP	90 DAP	30 DAP	60 DAP	90 DAP	30 DAP	60 DAP	90 DAP
T1	3.75	4.83	5.93	0.8	1.1	1.53	6.33	6.2	3.13	4.06	5.16	6.26
T2	5.23	6.23	7.4	1.1	1.4	1.76	9.26	7.3	5.4	5.1	4.46	4.7
T3	6.3	6.93	8.23	1.1	1.5	1.7	8.5	7.9	5.66	4.96	4.8	5.66
T4	6.83	8.3	9.5	0.86	1.56	1.9	9.23	7.5	6.6	3.26	4.16	8.26
T5	7.3	9.1	10.33	1.56	1.8	2.66	11.36	9.8	7.33	5.7	7	8.93
T6	6.43	7.33	7.46	1.23	1.53	1.86	10.1	4.86	5.9	4.73	4.8	6.03
T7	5.6	6.46	6.76	1.1	1.5	1.83	8.86	8.5	6.26	4.36	6.26	8.3
T8	5.36	6.36	7.7	1.36	1.7	2.16	10.56	9.23	6.33	4.73	5.33	6.4
T9	6.76	9.03	9.66	1.2	1.5	2.2	11.06	8.6	6.63	4.3	4.86	7.96
MEAN	5.94	7.17	8.1	1.14	1.51	1.95	9.47	7.76	5.91	4.57	5.2	6.94
CD	1.03	1.03	1.23	0.28	0.2	0.2	2.14	1.22	1.63	1.2	1.66	1.88
SE (m)	0.34	0.34	0.4	0.09	0.06	0.06	0.7	0.4	0.5	0.39	0.54	0.62

The standard shoot length in this study was significantly influenced by the kinds of cuttings used and the growing conditions that were chosen, as well as by the combinations of these factors. At 30, 60, and 90 days after planting, the longest shoot lengths were seen in hardwood cuttings (3.07, 4.46, and 6.19 cm) and soilrite (2.49, 3.69, and 4.98 cm), in comparison to other cutting types and growth media. When it comes to interactions, the longest shoots were measured 30, 60, and 90 days after planting, measuring 3.75 cm for T10-M4 soilrite+C1 hardwood cutting, 4.87 cm for T10-M4 soilrite+C1 hardwood cutting, and 6.40 cm for T7-M3 sand+C1 hardwood cutting. On the other hand, T12-M4 soilrite+C3 shoot-tip cutting at 30, 60, and 90 showed the fewest sprouts per cutting (6.90, 4.63, and 2.67) [19].

Diameter of shoot (30, 60 and 90 DAP)

The acquired data concerning the impact of diverse planting dates, IBA and NAA application, and their combinations on diameter of shoot after 30 days of planting is showcased in Table 3. The results indicate a noteworthy influence of both planting date and IBA and NAA on diameter of shoot observed 30 days after planting. The thickest (1.56 mm) shoot was recorded at T5 (IBA 3000 ppm+NAA 1000 ppm) planting, which was significantly higher than other date of planting followed by T8 (IBA 6000 ppm+NAA 1000 ppm) (1.36). Whereas, the thinnest (0.8 mm) shoot was recorded at T1 (soil+IBA 3000 ppm). The acquired data concerning the impact of diverse planting dates, IBA and NAA application, and their combinations on diameter of shoot after 60 days of planting is showcased in Table 3. The results indicate a noteworthy influence of both planting date and IBA and NAA on diameter of shoot observed 60 days after planting.

The thickest (1.8 mm) shoot was recorded at T5 (IBA 3000 ppm+NAA 1000 ppm) planting, which was significantly higher than other date of planting followed by T8 (IBA 6000 ppm+NAA 1000 ppm) (1.70). Whereas, the thinnest (1.1 mm) shoot was recorded at T1 (soil+IBA 3000 ppm). The acquired data concerning the impact of diverse planting dates, IBA and NAA application, and their combinations on diameter of shoot after 90 days of planting is showcased in Table 3. The results indicate a noteworthy influence of both planting date and IBA and NAA on diameter of shoot observed 90 days after planting. The thickest (2.66 mm) shoot was recorded at T5 (IBA 3000 ppm+NAA 1000 ppm) planting, which was significantly higher than other date of planting followed by T9 (Control) (2.20). Whereas, the thinnest (1.53 mm) shoot was recorded at T1 (soil+IBA 3000 ppm).

Number of shoots per cutting (30, 60 and 90 DAP)

The acquired data concerning the impact of diverse planting dates, IBA and NAA application, and their combinations on after number of shoots per cutting 30 days of planting is showcased in Table 3. The results indicate a noteworthy influence of both planting date and IBA and NAA on observed number of shoots per cutting 30 days after planting. The higher number (11.36 mm) shoot was recorded at T5 (IBA 3000 ppm+NAA 1000 ppm) planting followed by T9 (Control) (11.06), which was significantly higher than other date of planting. Whereas, the lowest (6.33 mm) shoot was recorded at T1 (Soil+IBA 3000 ppm). The acquired data concerning the impact of diverse planting dates, IBA and NAA application, and their combinations on after Number of shoots per cutting 60 days of planting is showcased in Table 3. The results indicate a noteworthy influence of both planting date and IBA and NAA on observed Number of shoots per cutting 60 days after planting. The higher number (9.8 mm) shoot was recorded at T5 (IBA 3000 ppm+NAA 1000 ppm) planting, which was significantly higher than other date of planting followed by T8 (IBA 6000 ppm+NAA 1000 ppm) (9.23). Whereas, the lowest (4.86 mm) shoot was recorded at T6 (IBA 4000 ppm+NAA 1000 ppm).

The acquired data concerning the impact of diverse planting dates, IBA and NAA application, and their combinations on after number of shoots per cutting 90 days of planting is showcased in Table 3. The results indicate a noteworthy influence of both planting date and IBA and NAA on observed number of shoots per cutting 90 days after planting. The higher number (7.33) shoot was recorded at T5 (IBA 3000 ppm+NAA 1000 ppm) planting, which was significantly higher than other date of planting followed by T9 (Control) (6.63). Whereas, the lowest (4.86 mm) shoot was recorded at T6 (IBA 4000 ppm+NAA 1000 ppm). The impact of growth regulators and the type of cuttings, alongside their combinations, was found to significantly influence the average number of sprouts per cutting. The highest number of sprouts was observed in hardwood cuttings (9.79, 8.29, and 5.11) and rootex (9.49, 8.49, and 5.90) compared to other cutting types and PGRs at 30, 60, and 90 days after planting, respectively. Regarding interactions, the maximum number of sprouts per cutting (12.05, 10.05, and 6.10) was documented in T19-C-hardwood cuttings+G7 rootex [18].

Number of leaves per cutting (30, 60 and 90 DAP)

The acquired data concerning the impact of diverse planting dates, IBA and NAA application, and their combinations on after Number of leaves per cutting 30 days of planting is showcased in Table 3. The results indicate a noteworthy influence of both planting date and IBA and NAA on observed Number of leaves per cutting 30 days after planting. The higher number (5.70) of leaves was recorded at T5 (IBA 3000 ppm+NAA 1000 ppm) planting, which was significantly higher than other date of planting followed by T2 (soil+vermicompost+IBA 4000 ppm) (5.10). Whereas, the lowest (3.26) leaves was recorded at T4 (soil+vermicompost+sand+coco-peat +IBA 6000 ppm). The acquired data concerning the impact of diverse planting dates, IBA and NAA application, and their combinations on after Number of leaves per cutting 60 days of planting is showcased in Table 3. The results indicate a noteworthy influence of both planting date and IBA and NAA on observed number of leaves per cutting 60 days after planting. The higher number (7) of leaves was recorded at T5 (IBA 3000 ppm+NAA 1000 ppm) planting, which was significantly higher than other date of planting followed by T7 (IBA 5000 ppm+NAA 1000 ppm) (6.26). Whereas, the lowest (4.16) leaves was recorded at T4 (soil+vermi-compost+sand+coco-peat+IBA 6000 ppm).

The acquired data concerning the impact of diverse planting dates, IBA and NAA application, and their combinations on after Number of leaves per cutting 90 days of planting is showcased in Table 3. The results indicate a noteworthy influence of both planting date and IBA and NAA on observed number of leaves per cutting 90 days after planting. The higher number (8.93) of leaves was recorded at T5 (IBA 3000 ppm+NAA 1000 ppm) planting, which was significantly higher than other date of planting followed by T7 (IBA 5000 ppm+NAA 1000 ppm) (8.30). Whereas, the lowest (4.70) leaves was recorded at T2 (soil+vermicompost+IBA 4000 ppm). Different growth regulators and types of cuttings, along with their combinations, demonstrated significant impacts on the average leaf count per cutting. Hardwood cuttings and Rootex exhibited the highest leaf counts (4.76, 6.73, and 7.72 for hardwood cuttings; 5.29, 7.46, and 8.19 for Rootex) compared to other cutting types and plant growth regulators (PGRs) at 30, 60, and 90 days after planting, respectively. Within the interaction, the highest leaf count per cutting (5.68, 8.15, and 9.15) was observed in T19 (consisting of C1 Hardwood cuttings+G7 Rootex). Conversely, the lowest leaf count per cutting (3.05 for T15-C3 Shoot-tip cutting+G5 IBA 3,000+PHB 750 ppm; 4.12 for T12-C3 Shoot-tip cutting +G4 IBA 2,000+PHB 750 ppm; and 5.12 for T12-C3 shoot-tip cutting+G4 IBA 2,000+PHB 750 ppm) was recorded at 30, 60, and 90 days after planting [18].

Survival percentage (90 DAP)

The acquired data concerning the impact of diverse planting dates, IBA and NAA application, and their combinations on after survival percentage 90 days of planting is showcased in Table 2. The results indicate a noteworthy influence of both planting date and IBA and NAA on observed survival percentage 90 days after planting. The higher percentage (60.8) survival was recorded at T5 (IBA 3000 ppm+NAA 1000 ppm) planting, which was significantly higher than other date of planting followed by T6 (IBA 4000 ppm+NAA 1000 ppm) (56.40). Whereas, the lowest (24.40) survival was recorded at T4 (soil+vermicompost+sand+coco-peat+IBA 6000 ppm). The highest rate of survival (39.50%) was noted in patch budding between the 1st and 15th of August. Survival rates were further influenced by the combined effect of timing and propagation methods in the case of Jamun, with patch budding between the 1st and 15th of August resulting in the maximum survival percentage (90.11%) [1]. The interaction between timing and propagation methods significantly impacted the survival percentage of jamun. Notably, after 90 days post-propagation, the highest survival rate (90.11%) was observed with patch budding between the 1st and 15th of August, while the lowest (8.07%) was observed during the same period in December, also utilizing patch budding [20].

Leaf area (cm^2) (90 DAP)

The acquired data concerning the impact of diverse planting dates, IBA and NAA application, and their combinations on leaf area after 90 days of planting is showcased in Table 2. The results indicate a noteworthy influence of both planting date and IBA and NAA on observed leaf area after 90 days after planting. The higher (68.80) leaf area was recorded at T5 (IBA 3000 ppm+NAA 1000 ppm) planting, which was significantly higher than other date of planting followed by T9 (Control) (65.66). Whereas, the lowest (49.36) leaf area recorded at T4 (soil+vermicompost+sand+coco-peat +IBA 6000 ppm). After analysing the data, it was found that there were differences in leaf area depending on the time and propagation techniques used. Softwood grafting produced the largest leaf area (30.04 cm^2), while semi hardwood cutting produced the smallest (24.90 cm^2). Propagation timing had a significant effect on Jamun leaf area as well; the greatest (28.16 cm^2) was seen in August, and the minimum (25.15 cm^2) in October. In addition, the relationship between propagation techniques and timing affected how long it took for Jamun buds to grow. In August and October, respectively, the maximum (32.88 days) and shortest (22.62 days) durations for semi hardwood cutting and softwood grafting were noted [21].

Plant height (cm) (90 DAP)

The acquired data concerning the impact of diverse planting dates, IBA and NAA application, and their combinations on plant height after 90 days of planting is showcased in Table 2. The results indicate a noteworthy influence of both planting date and IBA and NAA on observed plant height after 90 days after planting. The higher plant height (85.33) was recorded at T5 (IBA 3000 ppm+NAA 1000 ppm) planting, which was significantly higher than other date of planting, followed by T3 (soil +vermicompost+sand+IBA 5000 ppm) (83.23). Whereas, the lowest (66) leaf area recorded at T6 (IBA 4000 ppm+NAA 1000 ppm). The data concerning plant height measured 120 days post-grafting is outlined below. Among the various methods of propagation, plants propagated *via* inarching exhibited the highest average height at 83.79 cm, followed by wedge grafting at 53.24

cm, whereas patch budded plants displayed the lowest average height at 34.00 cm. Regarding the propagation months, average heights ranged from 41.84 cm to 55.48 cm. Maximum heights were observed in plants propagated in February, similar to March, May, and June, while the lowest heights were recorded in August [16,22].

CONCLUSION

The experiment demonstrated that different plant growth regulators and growing media significantly influence the propagation efficiency of *Syzygium cumini* through stem cuttings. The use of IBA (3000 ppm) combined with NAA (1000 ppm) (T5 treatment) proved to be the most effective, showing superior results across multiple parameters, including shoot length, number of leaves per cutting, shoot diameter, and survival percentage. This combination notably enhanced early sprouting, shoot growth, leaf area, and overall plant height. Therefore, for efficient vegetative propagation of *Syzygium cumini*, hardwood cuttings treated with IBA and NAA offer a reliable and practical method, optimizing growth characteristics and survival rates compared to other treatment combinations. These findings contribute valuable insights for future efforts in the large-scale cultivation and propagation of *Syzygium cumini*.

REFERENCES

1. Baloda S, Sharma JR, Singh S, et al. Effect of time of budding in Jamun (*Syzygium cumini*) under different growing conditions. Int J Agri Sci. 2016;8:1923-1925.
2. Singh IS, Srivastava AK. Genetic diversity-Jamun. Indian Hort. 2000;45:25-28.
3. Stephen A. *Syzygium cuminii* Skeels: A multipurpose tree and its phytotherapic and pharmacological uses. J Phytother Pharmacol. 2012;1:22-32.
4. Singh S, Singh HP, Singh AK, et al. The Jamun (Fruit for Future). Agrotech Publishing Agency, Udaipur, Rajasthan, 2011:1-100.
5. Singh S. Advances in Arid Horticulture. Saroj PL, Awasthi OP, eds. Vol II. ernational Book Distributing Co. Lucknow. 2006:225-242.
6. Benherlal PS, Arumughan C. Chemical composition and *in vitro* antioxidant studies on *Syzygium cuminii* fruit. J Sci Food Agric. 2007;87:2560-2569.
7. Jung S, Lee K, Byun S, et al. Myricetin suppresses UVB-induced skin cancer by targeting fyn. Cancer Res. 2008;68(14):6021-6029.
8. Mohanty S, Cock IE. Bioactivity of *Syzygium jambos* methonolic extracts: Antibacterial activity and toxicity. Pharmacogn Res. 2010;2(1):4-9.
9. Baliga M, Bhat P, Baliga B, et al. Phytochemistry, traditional uses and pharmacology of *Eugenia jambolana* Lam. (Black plum): A Review. Food Res Int. 2011;44(7):1776-1789.
10. Sagrawat H, Mann A, Kharya M, et al. Pharmacological potential of *Eugenia jambolana*: A review. Pharmacogn Mag. 2006;2:96-104.
11. Adelia F, Marcella C, Mercadante Z, et al. Identification of bioactive compounds from jambolao (*Syzygium cuminii*) and antioxidant capacity evaluation in different pH conditions. Food Chem. 2011;126(4):1571-1578.
12. Kumar T, Jayachandran, Aravindhan P, et al. Neutral components in the leaves and seeds of *Syzygium cumini*. Afr J Pharm Pharmacol. 2009;3(11):560-561.
13. Singh S, Singh AK, Bagle BG, et al. The Jamun. ICAR-DKMA. New Delhi, 2010:1-48.
14. Singh S, Singh AK, et al. Standardization of method and time of propagation in jamun (*Syzygium cuminii*) under semi-arid environment of Western India. Indian J Agric Sci. 2006;76(4):242-245.
15. Patel VB, Pandey SN, Singh SK, et al. Variability in jamun (*Syzygium cumini* Skeels) accessions from Uttar Pradesh and Jharkhand. Indian J Hortic. 2005;62:244-247.
16. Singh S, Singh AK, Saroj PL, et al. Genetic divergence in jamun under semi-arid ecosystem of Western India. Indian J Hortic. 2019;76(2):206-211.
17. Roberts EH. Seeds. Thompson JR, ed. Adv Res Technol. 1983;8:9-34.
18. Bhairavi BM, Prakasha DP, Kulapathi H, et al. Influence of plant growth regulators on rooting of stem cuttings in Jamun (*Syzygium cumini* L. eels). Int J Curr Microbiol Appl Sci. 2019;8(9).
19. Bhairavi BM, Prakasha DP, Kulapathi H, et al. Influence of growing media on rooting of stem cuttings in jamun (*Syzigium cumini* L. Skeels). Pharma Innov J. 2022;11(3):412-417.
20. Kaur H, Kaur A, et al. Standardization of propagation techniques in Jamun. Int J Curr Microbiol Appl Sci. 2018;7(10).
21. Muniyappan C, Rajangam J, Kumar CSR, et al. The standardization of method and time of propagation in jamun (*Syzygium cumini*) var. Konkan Bahadoli. J Pharmacogn Phytochem. 2019;8(3):467-471.
22. Murugan S, Devi UP, Parmeshwari NK, et al. Antimicrobial activity of *Syzygium jambos* against selected human pathogens. Int J Pharm Pharm Sci. 2011;3(2):44-47.