

Influence of source variation and IBA treatment on *Cinnamomum zeylanicum* cutting propagation

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Abstract: *Cinnamomum zeylanicum* is one of commercially important tree spice having high market demand for its bark and value-added products. Raising a quality planting material for large scale production is one of the important areas to be focused. Cinnamon can be propagated through seeds; but vegetative propagation plays major role to overcome problems associated with seed propagation and produce elite planting material of true to type. The plant growth regulators helps in inducing rooting during vegetative propagation. Success of vegetative propagation is affected by cluster of factors (genotype of species, seasonal variation and growth regulator treatment). The present study was carried out to assess the influence of source variation and different concentrations of IBA treatment on *Cinnamomum zeylanicum* cutting propagation during August- September season. Cuttings were collected from five different sources and treated with 1000 ppm and 2000 ppm IBA. Among the selected sources overall performance of Gejjehalli source was found better (sprouting: 62.66%, rooting: 46.67%, mean number of sprouts: 0.918, mean number of roots: 0.892, sprout length: 2.494 cm and root length: 1.50 cm) followed by Siddapura source with 2000 ppm IBA treatment during August-September season. IBA is least affected by auxin destroying enzymes and characterized by slow translocation. Good results were observed with increase in concentration. From the above studies it is evident that, source or provenances have exhibited significant variation for vegetative propagation which may be due to family and within-family effects, genetic interactions with different concentrations of IBA treatment.

Key words: *Cinnamomum*, Cuttings, IBA, Source variation, Vegetative propagation

Introduction

Vegetative propagation is a technique of propagation of plants by using vegetative organs or part of a plant in order to get true to type offspring (Leakey, 1985). In the present scenario, it is one of the best emerging ways to produce quality planting material with desired character in a short period of time. One of focusing reason for practicing vegetative propagation is to shorten the reproductive cycle of plant or tree and it also plays an important role in consolidating genetic gain, interim or permanent within tree breeding programs which play an important role in tree improvement and breeding practices (Zobel and Talbert, 1984). Plant growth regulators are important supporting factor in successful vegetative propagation. These plant growth regulators help in inducing rooting during vegetative propagation. *Cinnamomum zeylanicum* Blume belongs to family Lauraceae is one of the most important and earliest known tree spice of India. They are widely represented in Asian and American tropics, also with large numbers in Australia, Madagascar Asia, the Pacific islands and Fiji. It is widely cultivated for bark, leaf and immature fruits (Hanumantha and Vasudeva, 2022). As *Cinnamomum* seed belongs to recalcitrant category and loose its viability within 20-40 days (Kannan and Balakrishnan, 1967). Compare to other spice species *Cinnamomum* is more genetically diverse (Krishnamoorthy *et al.*, 1996). Due to cross pollination, elite plant material to mother plant cannot be obtained from seeds (Subasinghe *et al.*, 2016). Moreover, it is difficult to produce seedlings during off season (non-seeding period) and to produce seedlings quickly (faster growth) from seed propagation. Vegetative propagation technique helps to overcome all these drawbacks of seed propagation. Several

works have shown good results in stem cutting propagation of *Cinnamomum* species with pair of half reduced leaves (Nurhayati *et al.*, 2020; Hanumantha, 2020; Hrideek *et al.*, 2021; Rema and Krishnamoorthy, 1993; Asare *et al.*, 2014). Studies on variation in rooting response of cinnamon cuttings among different sources are very scanty. Hence, the present investigation was carried out to study the source variation in rooting response of selected sources.

Material and methods

The present study was conducted in mist chamber condition at College of Forestry, Sirsi (14° 36' 49.0" N; 74° 50' 59.0" E). Five different sources were identified for collection of cuttings based on previous works (Hanumantha, 2020) in Uttara Kannada (Jaddigadde, Kankodlu and Siddapura), Shivamogga (Manchale) and Haveri (Gejjehalli) districts and basic site data of plantations were collected. Semi hardwood cuttings of length 15-20 cm and 8-12 mm diameter with 3-4 nodes and pair of half reduced leaves were collected from five selected trees from each source during August-September. After collecting cutting from mother tree they are wrapped with moist gunny bag to avoid desiccation and after thirty minutes cuttings were treated with prepared IBA solution (1000 ppm, 2000 ppm) and water (control) by dipping basal portion of cuttings for 10-15 min to enhance rooting. Treated cuttings were planted in root trainers with coir pith as media and tagged. Planted root trainers were placed in a mist chamber provided with sprinkler facility and sprouting in the cuttings were monitored weekly. After three months of planting cuttings were evaluated for sprouting and rooting parameters.

Table 1. Effect of IBA treatment and source of *C. zeylanicum* on per cent sprouting and per cent rooting of macro cuttings

Sources	Per cent sprouting				Per cent rooting			
	Control	1000 ppm	2000 ppm	Mean	Control	1000 ppm	2000 ppm	Mean
Gejjehalli	26.66 (30.63)	46.64 (43.08)	62.66 (52.75)	45.32 (42.15)	00.00 (00.00)	33.34 (35.12)	46.67 (43.05)	26.67 (26.06)
Jaddigadde	04.02 (09.00)	12.00 (17.78)	17.34 (22.04)	11.12 (16.27)	00.00 (00.00)	06.67 (11.56)	13.33 (18.81)	06.67 (10.12)
Kankodlu	02.66 (04.28)	12.00 (17.33)	24.02 (26.51)	12.89 (16.04)	00.00 (00.00)	06.67 (13.26)	17.33 (22.16)	08.00 (11.81)
Manchale	05.34 (10.28)	15.98 (23.33)	22.66 (28.30)	14.66 (20.64)	00.00 (00.00)	08.00 (14.55)	16.00 (23.22)	08.00 (12.59)
Siddapura	13.32 (21.15)	26.66 (30.82)	45.32 (42.20)	28.43 (31.39)	00.00 (00.00)	20.00 (26.31)	38.67 (38.21)	19.56 (21.51)
Mean	10.40 (15.07)	22.66 (26.47)	34.40 (34.36)		00.00 (00.00)	14.93 (20.16)	26.40 (29.09)	
S Em± (Source)			2.48			1.82		
C.D @ 5% (Source)			7.03			5.15		
S Em± (Treatments)			1.92			1.41		
C.D @ 5% (Treatments)			5.45			3.99		
S Em± (S×T)			4.30			3.15		
C.D @ 5% (S×T)			NS			8.92		

* Values in parentheses are arcsine transformed values

* NS= Non significant

Results and discussion

The present study revealed significant variation in per cent rooting, number of sprouts, number of roots and root length due to interaction effect of source and IBA treatment; but there was no significant variation in per cent sprouting and sprout length due to interaction effect of source and IBA treatment. Maximum sprouting of 62.66 per cent was observed in Gejjehalli source with 2000 ppm IBA and lowest of 2.66 per cent sprouting was observed in Kankodlu cuttings without IBA treatment (Kankodlu). Maximum rooting observed in Gejjehalli source (46.67%) followed by Siddapura source (38.67%) with 2000 ppm IBA treatment (Table 1). Maximum mean number of sprouts of 0.918 observed in Gejjehalli source with 2000 ppm IBA treatment (Table 1). Maximum mean number of roots of 0.990 observed in Siddapura source which is on

par with Gejjehalli source with 2000 ppm IBA treatment (Table 2). Maximum sprout length of 2.494 cm was observed in Gejjehalli source with 2000 ppm IBA treatment followed by Siddapura source (0.993) (Table 1). Maximum root length of 1.50 cm was observed with 2000 ppm IBA treatment in Gejjehalli source which is on par with Siddapura source (1.136 cm) (Table 3). Mean of selected sources varied significantly where overall performance of Gejjehalli source found better (sprouting-45.32%; rooting- 26.67 %; No. of sprouts-0.595; sprout length-1.657 cm; root length- 0.821 cm) followed by Siddapura source. Further, mean of IBA treatment also showed significant difference where 2000 ppm IBA concentration gave better results than the other treatment for all sprouting and rooting. But no root development was reported in control for all the sources (00.00%).

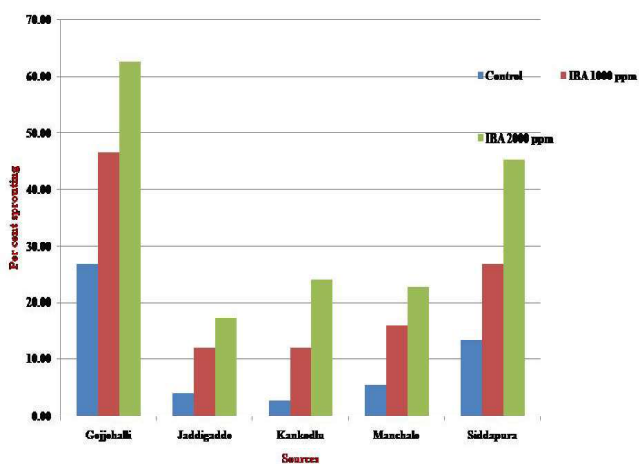


Fig 1: Effect of IBA treatment and source on per cent sprouting of macro cuttings in *C. zeylanicum* during August - September

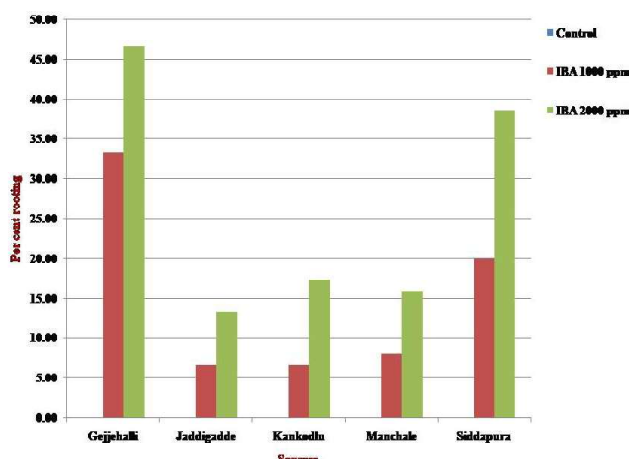


Fig 2: Effect of IBA treatment and source on per cent rooting of macro cuttings in *C. zeylanicum* during August - September

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Table 2. Effect of IBA treatment and source of *C. zeylanicum* on number of sprouts and number of roots per macro cuttings

Sources	Number of sprouts				Number of roots			
	Control	1000 ppm	2000 ppm	Mean	Control	1000 ppm	2000 ppm	Mean
Gejjehalli	0.294	0.572	0.918	0.595	0.000	0.506	0.892	0.466
Jaddigadde	0.066	0.158	0.228	0.151	0.000	0.080	0.238	0.106
Kankodlu	0.026	0.172	0.256	0.151	0.000	0.082	0.334	0.139
Manchale	0.054	0.212	0.320	0.195	0.000	0.158	0.402	0.187
Siddapura	0.174	0.318	0.642	0.378	0.000	0.548	0.990	0.513
Mean	0.123	0.286	0.473		0.000	0.275	0.571	
S Em± source		0.039				0.041		
C.D @ 5% source		0.110				0.116		
S Em± IBA		0.030				0.032		
C.D @ 5% IBA		0.085				0.090		
S Em± S×T		0.067				0.071		
C.D @ 5% S×IBA		0.191				0.201		

* NS= Non significant

Table 3. Effect of IBA treatment and source of *C. zeylanicum* on sprout length (cm) and root length (cm) per macro cuttings

Source	Sprout length (cm)				Root length (cm)			
	Control	1000 ppm	2000 ppm	Mean	Control	1000 ppm	2000 ppm	Mean
Gejjehalli	0.818	1.658	2.494	1.657	0.000	0.964	1.500	0.821
Jaddigadde	0.168	0.458	0.718	0.448	0.000	0.186	0.402	0.196
Kankodlu	0.130	0.376	0.672	0.393	0.000	0.178	0.498	0.225
Manchale	0.180	0.542	0.754	0.492	0.000	0.222	0.464	0.229
Siddapura	0.428	0.928	1.622	0.993	0.000	0.576	1.136	0.571
Mean	0.345	0.792	1.252		0.000	0.425	0.800	
S Em± source		0.127				0.081		
C.D @ 5% source		0.361				0.230		
S Em± IBA		0.099				0.063		
C.D @ 5% IBA		0.280				0.178		
S Em± S×IBA		0.220				0.141		
C.D @ 5% S×IBA		NS				0.399		

* NS= Non significant

Similar work done by Hanumantha (2020) on same sources with different mother trees with IBA 2000 ppm treatment; among different sources Jaddigadde source exhibited maximum rooting of 26 per cent with maximum mean number of shoots per cutting of 1.61, mean number of roots per cutting of 1.77 observed in Siddapura source and highest mean number of leaves per cutting of 3.23 observed in Kankodlu. Even though the sources were same in previous study, mother trees and number of mother trees taken from each source were different indicating variation among individual trees. There are various works on other species showing source variation in vegetative propagation viz, in *Santalum austrocaledonicum* cutting propagation Erromango Island source (Vanuatu Archielago, Oceania) performed better with higher rooting per cent (100) and with higher number of roots (2.5). Physiological aspects including the propagation environment have influence for source variation (Tate and Page, 2018). Work on *Calliandra calothyrsus* by Dick *et al.* (1996) also revealed provenance variation; Honduras provenance performed better with highest rooting per cent (62.00) than the other provenances. Rema and Krishnamoorthy (1993) reported 73.20 per cent rooting, number of roots of 3.7 with root length of 1.63 cm in *Cinnamomum verum* with 2000 ppm IBA treatment. Work on *Cupressus sempervirens* L. By Stankova and Panetsos (1997) showed 42.96 per cent rooting with 2000 ppm IBA treatment.

From the above studies it is evident that source or provenances have exhibited significant variation for vegetative propagation which may be due to family and within-family effects, genetic interactions (Hanumantha, 2020). These variations are one of the important components to be considered during vegetative propagation of any species. Commercial auxin Indole-3-butyric acid (IBA) is known for its added advantage over other auxins (IAA, NAA). IBA is least affected by auxin destroying enzymes and it stays at the point of application for long period of time as it is characterized by slow translocation (Hrideek *et al.*, 2021). In the present study among 1000 ppm and 2000 ppm IBA treatment maximum success was reported with 2000 ppm IBA treatment. It was observed that, 1000 to 2000 ppm IBA treatment the promoter effect of IBA has been showed increasing trend with increase in concentration; hence, there is possibility of getting even more success with increase in IBA concentration.

Conclusion

Variation among provenance can occur even for same species may be due to genotype, environmental factors, treatment and combined interaction effects of all the factors. Among different concentration of IBA, significantly good results were found with 2000 ppm IBA followed by 1000 ppm and control. Positive effect of IBA treatment on sprouting

and rooting parameters was found with increased concentration of IBA up to 2000 ppm and there is chance of obtaining better success with increase in IBA concentration. Significant source variation was observed among the selected mother trees in sprouting and rooting parameters of cinnamon macro cuttings. Among the selected sources overall

performance of Gejjehalli source was found better for sprouting, rooting, mean number of sprouts, mean number of roots sprout length and root length followed by Siddapura source. Hence the trees from these sources can be recommended for large scale production of seedlings through vegetative propagation.

References

- Asare C M, Owusu E O and Bedeh D K, 2014, Vegetative propagation of *Cinnamomum camphora* L. Presl by shoots cuttings: Effect of shoot physiological age. *Ghana Journal of Agricultural Science*, 47(1): 55-59.
- Dick J M, Bisset H and Mc Beath C, 1996, Provenance Variation in rooting ability of *Calliandra Calothyrsus*. *Forest Ecology and Management*, 87(1-3): 175-184.
- Hanumantha M and Vasudeva R, 2022, Influence of patch geometry, post-bark-extraction-treatment on bark recovery and standardizing number of sprouts for bark harvest from coppices in *Cinnamomum zeylanicum* Blume: implications for sustainable harvesting. *Environmental Monitoring and Assessment*, 194(3): 1-10.
- Hanumantha M, 2020, Assembling genetic evaluation and selection of superior types in *Cinnamomum zeylanicum* Blume, *Ph.D. Thesis*, University of Agricultural Sciences Dharwad, Karnataka, India.
- Hrideek T K, Jijees C M and Suby, 2021, Adventitious root induction in *Cinnamomum heyneanum* and *C. riparium*: The endemic tree species of Western Ghats. *Springer*, 91(1): 163-171
- Kannan K and Balakrishnan S, 1967, A note on the viability of cinnamon seeds. *Madras Agricultural Journal*, 54: 78-79.
- Krishnamoorthy B, Sasikumar B, Rema J, George J K and Peter K V, 1996, Genetic resources of tree spices and their conservation in India, *Plant Genetic Resources Newsletter*, 111: 53-58.
- Leakey R R B, 1985, The capacity for vegetative propagation in trees. In: *Attributes of trees as crop plants* (Ed. Cannell M G R and Jackson J E), NORA books publisher, Abbotts Ripton, Scotland, pp. 110-133.
- Nurhayati H, Supriatna N, Syukur C and Pitono J, 2020, The effect of cutting material and planting medium to the growth of cinnamon (*Cinnamomum zeylanicum* Blume) seedling. In: *1st International Conference on Sustainable plantation; IOP Conference Series: Earth and Environmental Science*, Indonesia, pp. 012024
- Rema J and Krishnamoorthy B, 1993, Rooting response of elite cinnamon (*Cinnamomum verum* Bercht & Presl). *Journal of Spices and Aromatic Crops*, 2: 21-25
- Stankova T and Panetsos K, 1997, Vegetative propagation of *Cupressus sempervirens* L. of Cretan origin by softwood stem cuttings. *Silvae Genetica*, 46(2): 137-143.
- Subasinghe S, Hettiarachchi C S and Iddagoda N, 2016, In-vitro propagation of cinnamon (*Cinnamomum verum* Presl.) using embryos and in vitro axillary buds. *Journal of Advanced Agricultural Technologies*, 3(3): 164-169.
- Tate H T and Page T, 2018, Cutting propagation of *Santalum austrocaledonicum*: the effect of genotype, cutting source, cutting size, propagation medium, IBA and irradiance. *New Forests*, 49(4): 551-570.
- Zobel B and Talbert J, 1984, Applied Forest Tree Improvement. John Wiley and Sons publisher, New York, USA.