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Research Article

Propagation of Medicinal Plant *Coleus forskohlii* (Poir.) Briq. (Pathachur or Galbel)

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Abstract

Propagation studies of *Coleus forskohli*i (Patharcur/aglbel) was conducted at Forestry College nursery of Navsari Agricultural University, Navsari, Gujarat, India in year 2016. There was medium variation in growth attributes with different cutting types, IBA hormone and interaction. The survival and rooting percentage of cuttings was found 100% in all treatments at 45 DAP. The main effect of cuttings on shoot length was with C2 as 18.99, 60.36 and 72.70 cm respectively at 15, 30 and 45 DAP. Interaction effect of both was maximum with the C1H1 (65.83 cm) at 15 DAP; C1H1 (69.72 cm) at 30 DAP and C1H0 (83.08 cm) at 45 DAP. The number of branches was high with C1 (2.33), C3 (3.26 cm) and C2 (9.59) at 15, 30 and 45 DAP respectively. Interaction effect of both was maximum 3.55 with C1H0 and C1H1 at 15 DAP while 9.89 with C2H2 and 11.22 with C2H1 after 30 and 45 DAP respectively. Similarly, the main effect of cuttings on number of leaves in initial 15 and 30 DAP was with C3 (15.77 and 55.02 respectively) but later with C2 (67.19) at 45 DAP. Interaction effect of both shown the maximum with C1H0 and C1H1 (18.33) in initial 15 DAP; C1H2 (67.00) in 30 DAP while C2H1 (76.22) at 45DAP. Basal diameter was found maximum with C2 cuttings (8.73 mm) at 45 DAP while interactions of C X H was maximum with C1H1 (8.98 mm) at 45 DAP. Number of roots was recorded maximum with C1 (24.59) and interaction with C1H1 (43.00) at 45 DAP. Similarly, the main effect of cuttings on root length was observed maximum with C2 (32.78 cm) and interaction effect of C X H shown the maximum with C2 (32.78 cm) at 45 DAP.

Keywords: Coleus froskohlii; Propagation; IBA; Cuttings

Introduction

Medicinal plants cultivation is expanding in agricultural landscape but challenges are from beginning with planting material. There are several plants which has numerable uses in herbal formulations but still not under cultivation either due to lack of planting material or cultivation technology. If in some plants seeds are available but for quality uniform crops needed vegetatively propagated material. The forest of Gujarat state fairly rich in biodiversity of which 748 plants were identified as medicinally important and 270 of these plant species used to prepare ayurvedic medicine. These 270 medicinal plants include 201 species (74%) are indigenous of Gujarat of which 148 species (74%) are naturally grown and 53 species (26%) cultivated [1]. Introduction of highly profitable medicinal and aromatic crops into the existing cropping system without completely replacing the traditional crop is strategy that acquiring acceptance in India [2]. Gujarat is state where many medicinal crops are cultivated as farmers are ready to experiment with new crops and also know the importance of crop diversification for ecological and economic gains. Medicinal plants propagation and cultivation is also required for expansion of herbal drugs market to meet the growing raw material demand of pharmacies [3]. The industrial demand for the medicinal plant is on the rise due to the worldwide buoyancy in the herbal sector for various herbal health care formulations; cosmetic products and nutritional supplements.

C. forskohlii (Poir.) Briq. (Pathachur, Galbel) is an important medicinal crop belongs to family Lamiaceae which contains forskolin (syn. coleonol) in their roots which is used as a drug for hypertension, glaucoma, asthma, congestive heart failures and certain types of cancers. Continuous collection of roots from the wild sources made it listed as an endangered species. The present annual production of about 100 tons from 700 ha in India, cultivation of *C. forskohlii* is picking up because of its economic potential [4].

Materials and Methods

The present investigation of Propagation of *C. froskhlii* was conducted during the year 2016, at the Forestry Nursery, College of Forestry, Navsari Agricultural University, Navsari, Gujarat, India. The climate of experimental area is typically tropical, characterized by fairly hot summer, moderate cold winter and humid warm monsoon. The average/mean minimum and maximum temperature during the course of experiment varied from 16.70C to 33.20C and the average RH recorded was 85%. Two IBA concentrations (100 ppm and 200 ppm) were applied along with control on three different types of cuttings (terminal, middle and basal portion) of 10 to 15 cm length in 10 x 15 cm sized perforated polythene bags with standard nursery (Soil: Sand: FYM = 1:2:1) to study their effect on growth and rooting of *Coleus froskohlii.* The shoot and root characters viz. plant height, number of leaves per plant, number of branches per plant, survival percentage, length of root, basal diameter, number of roots per cutting, rooting percentage and leaf parameters were recorded.

Results and Discussion

C. froskohlii is also commercially propagated through cuttings. The survival and rooting percentage of cuttings was found 100% in all treatments at 45 DAP reflected that it is an easily propagated species from any portions of plants even without hormone treatments but growth of seedlings may vary later stage. Similar findings are also reported by Kathiresan., *et al.* (2010) and Soufil., *et al.* (2018) in *C. aromaticus* [5,6] and Tiwari and Das. (2010), Manmohan., *et al.* (2012) in other medicinal plants like *Habenaria intermedia, Microstylis wallichii* etc. [7,8]. There was medium variation in growth attributes in different treatments. The main effect of cuttings on shoot length was found with C2 as 18.99, 60.36 and 72.70 cm respectively at 15, 30and 45 DAP. Interaction effect of cuttings and hormone was found significant for shoot length maximum with C1H1 (65.83 cm) at 15 DAP; C1H1 (69.72 cm) at 30 DAP and C1H0 (83.08 cm) at 45 DAP. The main effect of cuttings on number of branches by cuttings was found with C1 (2.33), C3 (3.26 cm) and C2 (9.59) at 15, 30 and 45 DAP respectively.

Similarly, the main effect of hormone was with H1 i.e. 1.48, 7.89 and 9.26 at 15, 30 and 45 DAP respectively. Interaction effect of cuttings and hormone was significant for number of branches shown the maximum 3.55 with C1H0 and C1H1 at 15 DAP while 9.89 with C2H2 and 11.22 with C2H1 after 30 and 45 DAP respectively. The main effect of cuttings on number of leaves in initial 15 and 30 DAP was found with C3 (15.77 and 55.02 respectively) but later C2 gave maximum 67.19 at 45 DAP. Interaction effect of C X H was significant for number of leaves which was maximum with C1H0 and C1H1 (18.33) in initial 15 DAP; C1H2 (67.00) at 30 DAP and C2H1 (76.22) at 45 DAP.

	Shoot length (cm)		Number of leaves/plant		Number of branches/ plant	
Cutting Treatment (C)	**15 DAP**	**30 DAP**	**15 DAP**	**30 DAP**	**15 DAP**	**30 DAP**
C1	18.68	53.35	13.70	43.96	2.33	5.67
C2	18.99	60.36	13.55	48.78	2.22	6.59
C3	18.73	59.12	15.77	55.02	2.22	8.27
S.Em. ±	0.90	2.54	0.47	1.64	0.11	0.28
C.D. at 5%	2.67	7.54	1.40	4.87	0.32	0.82
Hormone Treatment (H)						
H0	24.73	67.96	17.88	65.44	3.48	7.78
H1	17.67	54.44	11.44	52.11	1.48	7.89
H2	13.99	50.43	13.70	30.20	1.81	4.86
S.Em. ±	0.90	2.54	0.47	1.64	0.11	0.28
C.D. at 5%	2.67	7.54	1.40	4.87	0.32	0.82
Interaction (CXH)						
C1H0	23.06	67.77	18.33	63.22	3.55	7.78
C1H1	25.62	69.72	18.33	66.11	3.55	7.67
C1H2	25.51	66.40	16.99	67.00	3.33	7.89
C2H0	19.30	47.16	11.77	45.78	1.55	6.67
C2H1	16.50	52.53	8.22	50.78	1.33	7.11
C2H2	17.21	63.62	14.33	59.78	1.55	9.89
C3HO	13.68	45.12	11.00	22.89	1.89	2.56
C3H1	14.83	58.82	14.11	29.44	1.77	5.00
C3H2	13.46	47.34	16.00	38.28	1.78	7.03
S.Em. ±	1.56	4.39	0.82	2.84	0.18	0.48
C.D. at 5%	4.63	13.05	2.42	8.43	0.55	1.42
C.V. %	14.36	13.21	9.85	9.98	14.17	12.06

Table 1: Effect of type of cuttings (C) and IBA hormone (H) on Shoot length, Number of leaves, and Number of branches of *Coleus froskohlii* at 15 and 30 DAP.

	Shoot length (cm)	Number of branches /plant	Number of leaves /plant	Basal diameter (mm)	Number of roots /plant	Root length (cm)
Cutting Treatment (C)						
C1	66.63	6.93	50.33	7.24	24.59	28.33
C2	72.70	9.59	67.19	8.73	33.67	32.78
C3	69.14	8.41	59.07	7.67	28.63	32.21
S.Em. ±	3.29	0.26	2.78	0.27	1.40	1.16
C.D. at 5%	9.77	0.76	8.24	0.81	4.15	3.44
Hormone Treatment (H)						
H0	80.66	8.56	61.56	8.88	40.00	34.64
H1	65.94	9.26	64.30	7.80	30.96	32.92
H2	61.87	7.11	50.74	6.96	15.93	25.76
S.Em. ±	3.29	0.26	2.78	0.27	1.40	1.16
C.D. at 5%	9.77	0.76	8.24	0.81	4.15	3.44
Interaction (CXH)						
C1H0	83.08	8.67	61.89	8.92	40.11	34.73
C1H1	79.89	8.33	59.56	8.98	43.00	37.16
C1H2	79.01	8.67	63.22	8.73	36.89	32.03
C2H0	58.52	6.33	42.89	6.02	19.89	29.94
C2H1	68.72	11.22	76.22	8.74	37.56	30.06
C2H2	70.57	10.22	73.78	8.64	35.44	38.77
C3HO	58.29	5.78	46.22	6.78	13.78	20.32
C3H1	69.48	9.22	65.78	8.45	20.44	31.13
C3H2	57.83	6.33	40.22	5.64	13.56	25.83
S.Em. ±	5.70	0.45	4.81	0.47	2.42	2.01
C.D. at 5%	16.93	1.32	14.28	1.40	7.18	5.97
C.V. %	14.20	9.30	14.14	10.34	14.46	11.18

Table 2: Effect of type of cuttings (C) and IBA hormone (H) on shoot length, Number of leaves, Number of branches, Basal diameter, Number of roots and Root length in *Coleus froskohlii* cuttings at 45 DAP.

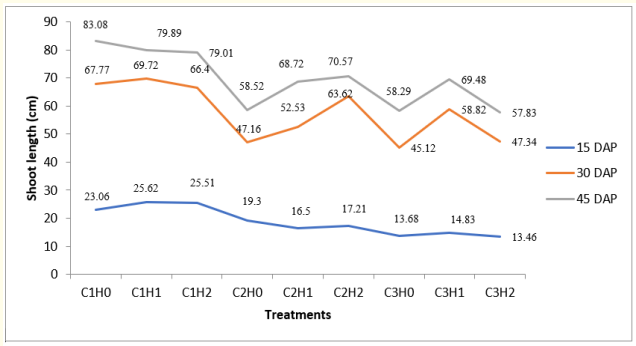

Figure 1: Effect of IBA hormone (H) and types of cuttings (C) on shoot length in Coleus froskohlii cuttings at 15, 30 and 45 DAP.

Maximum basal diameter in C2 (8.73 mm) recorded as main influence of cuttings at 45 DAP while the main effect of IBA hormone was not reflected as H0 (8.88mm) gave highest basal diameter at 45DAP. Significantly maximum basal diameter was recorded with C1H1 (8.98 mm) at 45 DAP. Similarly, main influence of cuttings on number of roots was recorded maximum with C1 (24.59) Interaction of C X H on number of roots was maximum with C1H1 (43.00) at 45 DAP. The main effect of cuttings on root length was observed maximum with C2 (32.78 cm). Interaction effect of cuttings and hormone was significant for root length shown the maximum in C2 (32.78 cm) at 45DAP. Number of roots at decrease concentration of IBA is attributed to more root length per cuttings and vegetative growth of per cuttings by utilizing applied IBA at low concentration. Similar results have been reported by Bhattacharjee and Thimmappa (1992) and Devendra., *et al.* (2015) in patchouli [9,10]. Swamy and Rao [11] confirmed that coleus (*Plectranthus forkohlii* (willd.) Briq.) stem cuttings treated with brassinosteroids gave more root formation and root growth over control. Tiwari and Das (2010) also reported in C. forskohlii the maximum sprouting, node sprouting and survival for cuttings treated with IBA @ 100 ppm as liquid and in powder formulation irrespective of diameter and length comparable with control and water dip treatment. Sprouting and survival of thin cuttings of four nodal length were highest compared to other treatments but we found no significant role of cuttings in sprouting and rooting but certainly on growth attributes of cuttings [7]. The germination and propagation is also enhanced with application of biofertilisers [12]. Sundharaiya., *et al.* (2000) in *C. forskohlii* also confirmed the terminal cuttings supplemented with 500 ppm IBA recorded the highest rooting percentage of 74.62% and 81.75%, respectively [13]. Similarly, Kathiresan

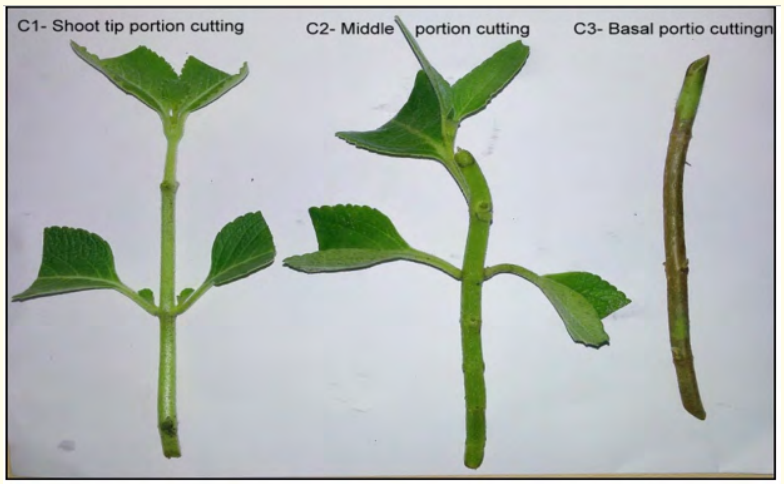

Plate 1: Propagation of *Coleus forskohlii.*

RM., *et al*. (2010) in Coleus aromaticus. terminal slips were best suited for the purpose of propagation [4]. Swamy and Rao (2010) confirmed that coleus (Plectranthus forkohlii (willd.) Briq.) stem cuttings treated with brassinosteroids gave more root formation and root growth over control [11]. Tiwari and Das (2010) also reported in C. forskohlii the maximum sprouting, node sprouting and survival for cuttings treated with IBA @ 100 ppm [7]. Kalaiarasan and John (2011) also reported stem cuttings of C. aromaticus treated with IAA and IBA (50 ppm) showed better results in terms of number of leaves, number of roots, roots length and leaf length than untreated stem cuttings [14]. Propagation materials in macro propagation play an important role either by root cuttings, shoot cuttings or tuber/rhizomes [15].

Conclusion

Medicinal plants propagation and cultivation is major thrust area for to meet the growing raw material demand of pharmacies. In Medicinal plants availability of planting material, specialize agrotechniques, processing and unregulated market put hindrance for their large scale adoption for sole cropping. Development propagation techniques and nurseries for availability of quality planting material are equally essential. *C. forkohlii* is propagated by cuttings gave 100% rooting and survival still there was variation in growth attributes like shoot length, number of leaves, branches, leaf and root characters with different type of cuttings as well as IBA concentration during the nursery period. This study will help in development of mass propagating material for cultivation of aromatic crop of Patharchur or Galbel (*C. forkohlii*) in sole crop or as intercrops in orchards and agroforests.

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