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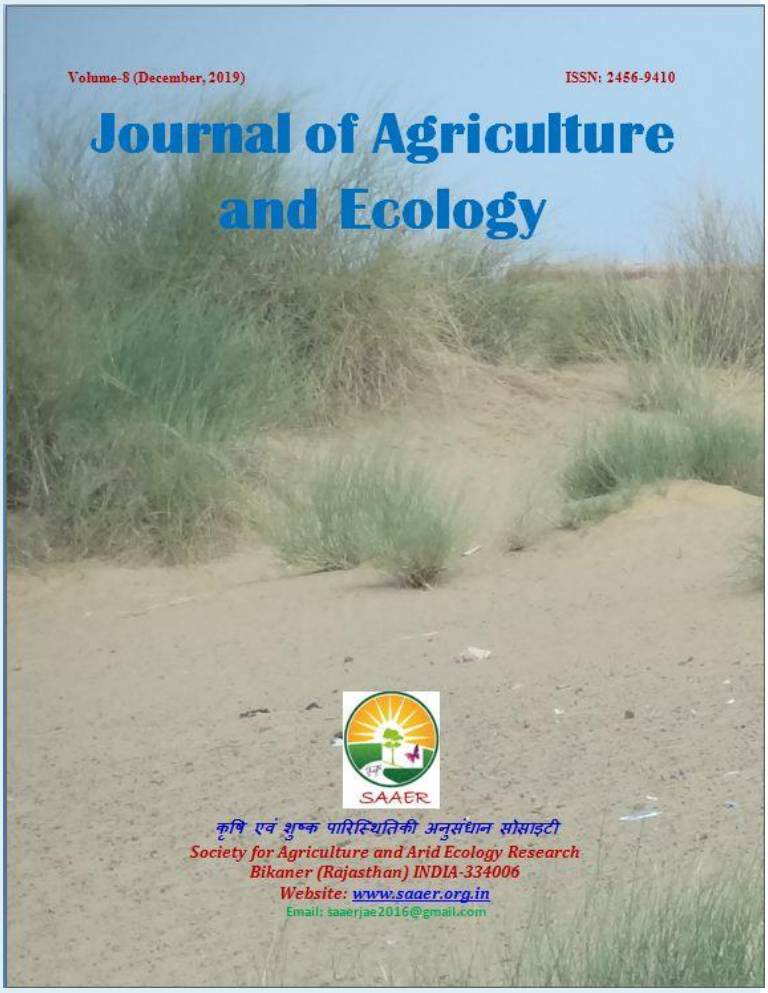

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Studies of the effect of growth promoting hormones on rooting of cutting in Caralluma (*Caralluma sarkariae*) Lavranos & Frandsen

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Abstract

Caralluma sarkariae is a succulent herb belongs to the family of Apocyanaceae. The population of *Caralluma sarkariae*is found growing in a secluded area at Nagamalai hills of Madurai, Tamil Nadu. The crop with its immense medicinal value such as anti-obesity and anti-diabetic properties need to be explored and promoted in non-traditional areas. Hence the experiment was taken up to study the effect of growth regulators on rooting of cuttings in *Caralluma sarkariae.* The results revealed that, the use of growth regulators greatly influenced on growth parameters particularly shoot and root length, when side shoots were treated with IBA 200 ppm.

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Introduction

Caralluma sarkariae (2n = 22, Family: Apocynaceae), the endemic succulent herb is an important indigenous medicinal plant with restricted distribution in India. *Caralluma* species have been documented in the Arabic and Indian traditional medicines. This plant contains glycosides which are reported to be the main reason for the medicinal activity (Ramesh et al. 1999). Pharmacological activities of *Caralluma* species have been reported for appetite suppression, anti-obesity activities, anti-inflammatory activity, analgesic activity, anxiolytic activity, antiatherogenic activity, wounds healing and antibacterial activity (Devi & Dhamotharan 2016).*Caralluma sarkariae* has been reported to be distributed in few habitats of Madurai district in Tamil Nadu and the range of variation in distribution, floral features such as hairiness, striation patterns in the species was reported (Aditya 2009). In India, *Caralluma* is cooked as a vegetable and is used in preserves such as chutneys and pickles. It is also eaten raw. In Western India, *Caralluma fimbriata* is a famine food suppressing appetite and for quenching thirst. The hunting tribe's chew chunks of the *Caralluma* cactus to suppress hunger and thirst when on a long hunt.

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Caralluma is difficult to germinate through seeds and successful attempts were made to improve the seed germination as well as vegetative methods (Samydurai & Thangapandian 2012). The Growth regulators can help in induction of early and enhanced rooting. Auxin is one of the important plant growth regulator and the main role of auxin is stimulation and initiation of roots from cuttings (Cline 2000).

Materials and Methods

The experimental nursery was located at Botanical Garden, Department of Medicinal and Aromatic Crops, Horticultural College and Research Institute, TNAU, Coimbatore during 2017-2018.*Caralluma sarkariae* planting materials were collected from Horticultural College and Research Institute, Periyakulam, Theni district. The plant collection site is located at an altitude of 300 m above mean sea level with geographical bearing of $10^{o}12'$N latitude and $77^{o}35'$E longitude. The collected plants given to Botanical Survey of India for species authentication. The experiment was consisted of two factors *viz.*, type of cutting and growth regulators and main stem (F_1) and side shoots (F_2) were taken for planting. The prepared stem cuttings were dipped in freshly prepared plant growth regulator of concerned treatments solution. After the treatment, every group of treated stem cuttings were planted in 10 poly bags per treatments. The experiment was laid out in FCRD with three replications.The treatments details were given below.

Factors (F)	Treatment with concentrations
Main stem(F_1)	T_1-IBA 200 ppm
	T_2-IBA 400 ppm
	T_3-IBA 600 ppm
	T_4-IBA 800 ppm
	T_5-IBA1000 ppm
Side-shoots (F_2)	T_6-IAA 200 ppm
	T_7-IAA 400 ppm
	T_8-IAA 600 ppm
	T_9-IAA 800 ppm
	T_{10}-IAA1000 ppm
	Control

Results and Discussion

Significant variation was observed among plant growth regulators, stem cuttings and their interactions. Among the two propagules *viz.*,main shoot and side shoot, the side shoot recorded the highest mean shoot length of 13.32 cm as compared to the main shoot of 10.89 cm. Between the growth regulators, the shoot length was highest of 15.82 cm in IBA 200 ppm (T_1) followed by IBA 400 ppm (T_2) and the lowest of 9.82 cm in IBA 1000 ppm (T_5). The interaction effect was significant indicating that, the highest shoot length of 17.34 cm was recorded in main stem treated with IBA 200 ppm followed by IAA 600 ppm with 13.04 cm and the lowest of 8.54 cm in IBA 600 ppm.The root length was highest (7.31cm) in side shoots while it was 5.91 cm in main stem. The mean root length of growth regulators indicated that, the highest mean root length of 9.64 cm was observed in IAA 1000 ppm (T_{10}) followed by IAA 600 ppm (T_8). While low mean root length was observed in IBA 1000 ppm (T_5) which recorded 3.98 cm. The interaction effect was also significant which indicated that, the highest root length of 10.46 cm was

recorded in main stem when used as a propagule treated with IAA 1000 ppm. The lowest length of 2.83 cm was recorded in main stem treated with IBA 1000 ppm.The side shoots recorded more number of shoots of 2.29cm when compared to the main shoots of 2.10cm. Among the various growth regulators treatments, IBA 200 ppm (T_1) recorded highest number of shoots (3.10) followed by IBA 1000 (T_5) and 600 ppm (T_3) with 2.50cm and lowest in IAA 400 ppm (T_7) of 1.70cm. The interaction effect was significant indicating that, the highest number of shoots with 3.60cm was recorded in the main shoots treated with IBA 200 ppm and lowest in IAA 1000 ppm with 0.40cm and the side shoots treated with IAA 1000 ppm 0.80cm (Table 1). High mean number of roots was observed in side shoots of 22.34cm followed by main shoots of 14.65cm. Between the growth regulators, IBA 200 ppm (T_1) recorded the highest number of roots 26.90cm followed by IAA 600 ppm (T_8) with 23.70cm, IAA 800 ppm (T_9) 23.00 and IBA 400 ppm (T_2) 21.00. Among interactions effects, the side shoots treated with IBA 800 ppm recorded the highest number of roots of 31.40cm followed by the main stems treated with IBA 200 ppm of 27.40cm, side shoots with IBA 400 ppm of 27.00cm and IBA 200 ppm of 26.40cm. Whereas the lowest values on interaction was observed in main stem treated with IAA 200 ppm of 9.00cm followed by IAA 400 ppm of 9.20cm. Higher establishment percentage was observed in the side shoots with 82.72 % followed by 42.42 %. Between the growth regulators, IBA 200 ppm (T_1) recorded the highest percentage of 76.66 % followed by IBA 400 ppm (T_2) and lowest establishment per cent in IAA 800 ppm of 53.33 %. The interaction effect was significant indicating that, the side shoots treated with IBA 200 ppm, 400 ppm and also the control recorded the highest establishment percentage 100 % followed by 86.66 % in IBA 600 ppm. The lowest percentage of establishment (36.66 %) was observed the main shoots treated with IAA 400 ppm and 600 ppm. High mean on rooting percentage was observed in main shoots 42.42 % followed by side shoots with 79.99 %. Between the growth regulators, IBA 200 ppm recorded the highest rooting percentage of 71.66 % while IAA 800 ppm (T_9) recorded the lowest with 53.33 %. Among the interaction, the highest rooting percentage 90.00 was recorded in side shoots treated with IBA 200 ppm. The lowest rooting percentage was recorded in side shoots treated with IAA 400 ppm and 600 ppm with 36.66 % respectively (Table 2).

In the present experiment, the side shoots performed better than the main stem. *Caralluma* is a succulent plant and rooting is often correlated with the maturity of tissues. The main stem is often hardy as compared to the side shoots which are young and responds to rooting. Moreover, the side shoots emerges out of the main stem and has a basal node which strikes root easily when in contact with the media. This is probably the reason why the side shoots performed better in establishment and plant growth. Aruna et al. (2009) reported that xerophytic plants such as Caralluma are best propagated by separation of side shoots which respond to rooting when compared to the hardy shoots. Among the growth regulators, IBA at 200 ppm recorded

higher shoot length than the control. IBA is the most effective hormone and also persistent which helps in early sprouting. It do not translocate from the place of application which helps in cell elongation and growth stimulation thereby results in longer shoots. Similar report on the action of IBA on shoot characters was reported by (Ingle & Venugopal 2009) in *Stevia rebaudiana* and (Murthy et al. 2010) in vanilla. Among the type of cuttings, main stem as a propagule recorded high number of shoots, shoot length, compared to the side shoot. It may be due to the presence of auxin in the main stem which enhanced the cell division and cell enlargement and resulted in improved vegetative growth (Evans 1973). Moreover the combined effects on treatment of main stem with IBA at lower concentration were observed with positive results. Similar trend was followed in the findings of (Francis et al. 1993) in black pepper, allspice by (Rema et al. 2008), bael by (Yashwanti et al. 2017) and guggal by (Jitendra et al. 2009). In *Caralluma sarkariae*, higher root length was recorded in the side shoots when compared to the main stem. Among the growth regulators, IAA 1000 ppm resulted in higher root length. The better length of roots is probably due to the presence of auxin for early differentiation and enhancement of cell division. Acidification is a process in which auxin synthesis the structural protein for increasing the formation of root length (Audus 1963). The findings of (Alagesaboopathi 2012) in *Andrographis macrobotrys* corroborated with results of the present study. The number of roots were also found to be higher in side shoots treated with IBA 200 ppm. The growth regulator IBA has high ability to promote root initiation (Rout & Das 1994) and it produces strong and fibrous root system (Hitchcock & Zimmerman 1940). Side shoots treated with IBA 200 ppm and 400 ppm registered the highest establishment percentage of shoots. Auxins like IBA and IAA when used at lower concentration results in better rooting and plant establishment. Use of lower concentrations of IBA and IAA are also helpful for elongation of roots paving way for better field establishment as explained by (Prakash 2005) in Nerium.

Conclusion

It is an evident from the present study that, *Caralluma sarkariae* can be propagated through stem cuttings. The growth regulators had remarkable influence on enhancing the growth parameters (shoots and roots), thereby increase in plant establishment rate. Among the different growth regulators IBA 200 ppm was found to the best for multiplication of *Caralluma sarkariae* by stem cuttings in side shoots.

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Table 1. Effect of PGR on shoot length, root length and number of shoots

S.No	Treatments	Shoot length (cm)		Mean	Root length (cm)		Mean	No .of. Shoots (cm)		Mean
		Main stems	Sideshoots		Main stems	Sideshoots		Main stems	Sideshoots	
1	T_1	17.34	14.30	15.82	7.34	6.46	6.90	3.60	2.60	3.10
2	T_2	12.66	14.48	13.57	5.30	5.42	5.36	2.40	2.60	2.50
3	T_3	8.54	12.20	10.37	4.38	7.60	5.99	1.80	3.20	2.50
4	T_4	9.08	13.46	11.27	3.08	6.82	4.95	2.40	2.20	2.30
5	T_5	10.20	9.44	9.82	2.83	5.14	3.98	2.00	3.20	2.60
6	T_6	9.14	14.46	11.80	4.80	6.04	5.42	2.40	2.00	2.20
7	T_7	8.68	14.66	11.67	5.12	9.12	7.12	1.40	2.00	1.70
8	T_8	13.04	15.46	14.25	7.86	9.90	8.88	2.40	2.40	2.40
9	T_9	12.30	10.94	11.62	8.15	7.66	7.90	2.40	1.20	1.80
10	T_1	8.78	12.42	10.60	10.46	8.82	9.64	0.40	0.80	0.60
11	Control	10.10	14.78	12.44	5.75	7.50	6.62	2.00	3.00	2.50
Mean		10.89	13.32	12.11	5.91	7.31	6.61	2.10	2.29	2.20
		P	PGR	P×PGR	P	PGR	P×PGR	P	PGR	P×PGR
SE(d)		0.05	0.13	0.18	0.03	0.07	0.11	0.01	0.02	0.04
CD(P=0.05)		0.11	0.27	0.38	0.06	0.16	0.22	0.02	0.05	0.08

Table 2. Effect of PGR on number of roots, establishment and rooting percentage

S.No	Treatments	No of roots (cm)		Mean	Establishment%		Mean	Rooting %		Mean
		Main stems	Sideshoots		Main stems	Sideshoots		Main stems	Sideshoots	
1	T_1	27.40	26.40	26.90	53.33	100.00	76.66	53.33	90.00	71.66
2	T_2	15.00	27.00	21.00	50.00	100.00	75.00	50.00	83.33	66.66
3	T_3	10.20	23.00	16.60	43.33	86.66	64.99	43.33	83.33	63.33
4	T_4	11.40	31.40	21.40	40.00	80.00	60.00	40.00	80.00	60.00
5	T_5	17.33	22.40	19.86	50.00	66.66	58.33	50.00	66.66	58.33
6	T_6	7.00	21.60	14.30	40.00	83.33	61.66	40.00	83.33	61.66
7	T_7	9.20	18.20	13.70	36.66	80.00	58.33	36.66	80.00	58.33
8	T_8-	24.20	23.20	23.70	36.66	73.33	54.99	36.66	73.33	54.99
9	T_9	22.25	23.75	23.00	40.00	66.66	53.33	40.00	66.66	53.33
10	T_1	7.75	17.00	12.37	46.66	73.33	59.99	46.67	73.33	60.00
11	Control	9.50	11.80	10.65	30.00	100.00	65.00	30.00	100.00	65.00
Mean		14.65	22.34	18.50	42.42	82.72	62.57	42.42	79.99	61.21
		P	PGR	P×PGR	P	PGR	P×PGR	P	PGR	P×PGR
SE(d)		0.06	0.16	0.22	0.32	0.75	1.07	0.27	0.63	0.90
CD(P=0.05)		0.13	0.32	0.45	0.65	1.53	2.16	0.54	1.28	1.82

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