Available online at www.ijpab.com

DOI: http://dx.doi.org/10.18782/2320-7051.2699

ISSN: 2320 – 7051

Int. J. Pure App. Biosci. **5 (2):** 1075-1080 (2017)

Research Article

International Journal of Pure & Applied Bioscience

OPEN ACCESS

Effect of Indole Butyric Acid (IBA) On Rooting of Different Carnation (*Dianthus caryophyllus* L.) Genotypes

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Received: 18.03.2017 | Revised: 29.03.2017 | Accepted: 2.04.2017

ABSTRACT

A study on the effect of Indole-3-butyric acid (IBA) on twelve genotypes of carnation (Dianthus caryophyllus L.) was conducted at the division of ornamental crops, Indian Institute of Horticultural Sciences, Hesaraghatta, Bangalore. The study revealed that among the twelve genotypes experimented, the highest per cent of rooting was recorded in the genotype Dark Dona (89 %) followed by Praga (84.50 %), whereas, the lowest rooting per cent was recorded in the genotype Malaga (62.50 %). Similar tendency of superiority was observed for days for root initiation, wherein the genotype Dark Dona took the least number of days for root initiation (16.50 days). The highest number of roots per cutting was recorded in the genotype Bizet (18.75) followed by Dark Dona (16.25). The genotype Bizet was recorded with the highest fresh (7.19 g) and dry weight (57.51 mg) of roots. The lowest fresh weight was recorded in the genotype Darjeeling (4.60 g) and was in par with the genotype Gioele (4.62 g). When it was dry weight of roots the lowest was recorded in the genotype Darjeeling (27.47 mg).

Key words: *Carnation, Indole-3-butyric acid, rooting per cent, root length.*

INTRODUCTION

Carnation plant (*Dianthus caryophyllus* L.), belongs to the family Caryophyllaceae , is one of the important cut flowers in the world , owing its origin to the Mediterranean region. The stems are green with clear nodes, with leaves in pairs aligned opposite to each other. Flowers are borne at the terminal end of the stems, color varying from white to red, and also bicolored. Carnation ranks 2nd in commercial importance next to rose in the world. It has a wide range of colors and excellent keeping quality. They are also used for bedding, pots, borders, edging, indoors and rock gardens. Miniature carnations are now gaining popularity for their potential use in floral arrangement.

Carnation is an important cut flower crop with commercial value owing to its excellent keeping quality and diverse array of colors coupled with forms. It is believed that the perpetual carnation was developed from cross between *D. caryophyllus* and *D. chinensis* and the resultant varied forms have been grouped as standards and spray types.

Cite this article: Gowda P.G., Dhananjaya, M. V. and Kumar, R., Effect of Indole Butyric Acid (IBA) On Rooting of Different Carnation (*Dianthus caryophyllus* L.) Genotypes, *Int. J. Pure App. Biosci.* **5(2):** 1075-1080 (2017). doi: http://dx.doi.org/10.18782/2320-7051.2699

In India, Sim carnations are reported to have been introduced by the Maharaja of Patiala at his farm at Dochi. In India, carnation is grown in and around Nasik, Pune, Kodaikanal, Nilgiris, Kalimpong, Darjeeling, Bangalore, Solan, Palampur, Shimla, Srinagar, Nainital and Chaubattia. The most suitable climate for commercial carnation flower production in India prevails in the Nilgiris and Kodaikanal of Tamil Nadu and parts of Himachal Pradesh.

Commercial carnation is propagated through cuttings. Although, they have a tendency to root well under normal conditions, a little intervention with the use of growth regulators *i. e.* rooting hormones and appropriate media would relatively increase the rooting success. The plant bio-system has its own inventory of plant growth promoting chemicals, nevertheless, endogenous application of PGR's have been reported to improve rooting percentage and root characters in many flower crops.

Indole butyric acid (IBA) and Naphthalene Acetic Acid (NAA) have been found to positively affect the rooting phenomena in plants. Amine and Hashim[2] (1992) reported that treating "Spider" chrysanthemum cuttings with IAA and IBA at concentrations 0, 100, 200, 300 or 400 ppm significantly increased the dry weight of roots and number of roots compared with non-treated cuttings. Debasis[8] found that soaking "Super White" *Chrysanthemum indicum* cuttings with NAA at concentration of 2000 ppm significantly increased the growth of the roots, germination percentage and the number of roots. Ranpise *et al*[18]., studied the effect of different levels of IBA on rooting, growth and flower yield of chrysanthemum cv. Sonali Tara and reported maximum survival percentage with IBA at 2000ppm followed by IBA at 1000ppm. Khelwale *et al*[12]., studied the influence of different concentrations of IBA and media on root parameters in propagation of carnation cv. Guadina and recorded highest percentage of rooting with IBA at 125ppm. Grewal *et al*[10]., studied the effect of IBA and NAA on rooting of chrysanthemum terminal cuttings and indicated that cuttings with IBA at 400ppm performed well with respect to percentage of rooting.

Panahi and Morteza[16], studied the effect of auxins on rooting and flowering of carnation cultivars (*Dianthus caryophyllus* L.) and recorded highest number of roots per cutting with IBA at 100ppm. Sidhu and Singh[20] studied the effect of auxins on rooting of terminal cuttings of *Chrysanthemum morifolium* cv. Flirt and recorded highest number of roots per cutting with IBA at 250ppm. Bhuse *et al*[3]., studied the effect of time of planting, type of cutting and plant growth regulators on rooting in *Pelargonium graveolens* L. and recorded maximum number of roots per cutting and length of roots with IBA at 750ppm.

MATERIAL AND METHODS

The present experiment was conducted at the division of ornamental crops, Indian Institute of Horticultural Sciences, Hesaraghatta, Bangalore during November 2015 to March 2016, to study the effect of rooting hormone *viz*., Indole butyric acid on rooting success in different carnation genotypes. In the experiment, terminal cuttings of twelve genotypes of carnation *viz.*, Dona, Bizet, Darjeeling, Hunza, Praga, Gioele, Golem, Soto, Luna, Spike, Dark Dona and Malaga were treated with 200 ppm IBA (Indole butyric acid) and were recorded for their rooting success. The experiment was laid out in Completely Randomized Design, with four replications. The basal portion of the cuttings was dipped in Indole butyric acid for 10 minutes. Treated cuttings were planted in portrays containing coir pith as the media. Under each replication 25 cuttings were

planted. Temperature was maintained at 18-25°C, and relative humidity at 80-85 % within a low tunnel shaped polythene covered structure. The rooting substrate was treated with 0.3% Carbendazim to control fungal infection.

Observations were recorded on different root characteristics of the cuttings every two days once to be precise. The cuttings were picked randomly, and days from planting to formation of root initials were considered as days taken for rooting. Per cent rooting was determined by counting the number of rooted cuttings per replication and dividing this by the total number of cuttings per replication. For number of roots per cutting, all the roots originating from the cuttings were counted, and, the total number of roots was divided by the total number of rooted cuttings. All roots produced per replication were collected and their length was measured; the sum of the length was divided by the total number of cuttings to calculate average root length. The weight of freshly harvested roots was determined and weight per rooted cutting was taken as fresh weight of root. Freshly harvested roots of rooted cuttings were dried in an oven at 60°C for 48 hours to a constant weight, and weight of dried roots per rooted cutting was taken as the dry weight of root. All the data were analyzed statistically as per Gomez and Gomez[9] and Chandel[4].

RESULTS AND DISCUSSION

The investigation on the effect of Indole butyric acid (IBA) on rooting of different carnation (*Dianthus caryophyllus* L.) genotypes carried out at the division of Ornamental crops, Indian Institute of Horticultural Sciences, Hesarghatta, Bangalore showed significant difference for rooting per cent, days to root initiation, root length, number of roots per cutting, fresh weight of roots and dry weight of roots.

Among the twelve carnation genotypes treated with IBA at 200 ppm, the highest rooting per cent was recorded in the genotype Dark Dona (89 %) followed by Praga (84.50 %), whereas, the lowest rooting per cent was recorded in the genotype Malaga (62.50 %). Similar results w. r. t rooting were reported by Renuka *et al*[19]., and Copes *et al*[6]., which revealed that IBA appeared to have broad range of root enhancing ability. Confirmatory results were also reported by Grewal *et al*[10]., in chrysanthemum and Gupta *et al*[11]., in bougainvillea cv. Pallavi. Similar tendency of superiority was observed for days for root initiation, wherein the genotype Dark Dona took the least number of days for root initiation (16.50 days). On the other hand, highest number of days for root initiation was recorded to be on par amongst the genotypes Gioele (23.75 days), Hunza (21.75 days), Praga (21.75 days) and Golem (21.50 days). These results were in confirmatory with the reports of Grewal *et al*[10].

The number of roots per cutting differed significantly amongst the genotypes as influenced by IBA at 200 ppm. The highest number of roots per cutting was recorded in the genotype Bizet (18.75) followed by Dark Dona (16.25). Similarly, the lowest number of roots per cutting was recorded in the genotypes Gioele (11.00) and Darjeeling (12.00). The varietal response to exogenous application of IBA depends on the capacity of the individual genotypes to readily transport them to the sites of utilization where they initiate the formation of adventitious roots[5]. The genotype Spike recorded the longest root length (12.20 cm) which was on par with the genotype Bizet (12.12 cm). The effect of auxins has been reported to enhance rooting through the translocation of carbohydrates and other nutrients to the rooting zone[14].

Table 1: Effect of IBA at 200 ppm on rooting per cent and days taken for root initiation in different genotypes of carnation

Genotypes	Rooting %	Days for root initiation
Dona	83.50	19.75
Bizet	81.00	20.75
Darjeeling	76.50	20.50
Hunza	77.00	21.75
Praga	84.50	21.75
Gioele	80.00	23.75
Golem	83.00	21.50
Soto	76.00	21.25
Luna	70.00	20.50
Spike	82.50	21.25
Dark Dona	89.00	16.50
Malaga	62.50	20.00
SE(m)±	1.488	0.879
CD @ 5%	4.26	2.521

Table 2: Effect of IBA at 200 ppm on number of roots per cutting and root length in different genotypes of carnation

Genotypes	No. of roots /cutting	Root length (cm)
Dona	16.00	11.41
Bizet	18.75	12.12
Darjeeling	12.00	9.79
Hunza	13.25	10.93
Praga	14.50	11.02
Gioele	11.00	9.61
Golem	15.25	11.38
Soto	15.50	11.15
Luna	15.00	11.09
Spike	15.75	12.20
Dark Dona	16.25	11.25
Malaga	13.75	10.91
SE(m)±	0.766	0.246
CD @ 5%	2.197	0.707

According to Davis and Hassig[7], the production of adventitious roots in plants through cell division, multiplication and specialization is also controlled by plant growth substances especially auxins. This implies that treating stem cuttings with auxins can increase the percentage of rooting, root initiation and number of roots.

Table 3: Effect of IBA at 200 ppm on fresh weight and dry weight of roots in different genotypes of carnation

Genotypes	**Fresh weight (g)**	**Dry weight (mg)**
Dona	6.03	38.05
Bizet	7.19	57.51
Darjeeling	4.60	27.47
Hunza	5.44	38.27
Praga	5.43	36.92
Gioele	4.62	29.89
Golem	6.14	35.97
Soto	6.34	38.19
Luna	6.16	37.86
Spike	6.91	49.52
Dark Dona	6.25	46.50
Malaga	5.37	38.00
SE(m)±	0.152	0.671
CD @ 5%	0.437	1.924

The carnation genotypes responded differently on the use of IBA w. r. t fresh and dry weight of roots. The genotype Bizet was recorded with the highest fresh (7.19 g) and dry weight (57.51 mg) of roots. The lowest fresh weight was recorded in the genotype Darjeeling (4.60 g) and was in par with the genotype Gioele (4.62 g). When it was dry weight of roots the lowest was recorded in the genotype Darjeeling (27.47 mg). This characteristic feature can be attributed to the previous parameters such as root length and number of roots per cuttings. It can be observed that the genotype Bizet recorded the highest in all these parameters. Auxins are known to initiate a series of reactions that pave path to the formation of roots. In accordance, auxins are the sole players in the transportation of carbohydrates to these regions of root formation. Thereby, the plants with better response to exogenous auxins had higher accumulation of carbohydrates and recorded higher fresh and dry weight of roots. Higher number of roots, in addition to longer roots, in tip cuttings have resulted in higher fresh and dry weight. Similar results were obtained by Panahi and Morteza[16] who recorded improved root length, and fresh and dry weight per rooted cutting, in carnation with IBA application. Similar results were presented by Ramesh *et al*[17].

Indole Butyric Acid exerts different effects on plant growth and development, e. g. regulating response of plants against biotic and abiotic stresses or increasing plant yield[1], but primarily implicated in adventitious root formation and widely used commercially for the induction of adventitious roots[13,15].

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