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PRODUCTION OF THE STUNTED OLEANDER

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ABSTRACT

A trial was consummated at Orman Botanical Garden, Giza, Egypt throughout 2005/06 and 2006/07 seasons to find out the effects of foliar spraying with either 0, 50, 100 and 150 ppm of paclobutrazol (PP-333) or 0, 1000, 2000 and 3000 ppm of cycocel (ccc) for three times with three weeks interval, pinching treatment and their interaction on growth, flowering and chemical composition of 6-months-old *Nerium oleander* L. transplants grown in 30-cm-diameter black polyethylene bags.

The obtained results exhibited that plant height (cm), stem diameter (cm), branch and leaf No./plant, leaf area (cm^2), root length (cm), as well as the fresh and dry weights of aerial parts and shoots (g) were significantly decreased in both non pinched and pinched plants as a result of spraying with the various levels of either PP-333 or ccc in the two seasons. The best dwarfing result was found due to spraying with 100 ppm of PP-333 and 2000 ppm of ccc, as such two treatments declined the size of treated plants to the optimum size suitable for commercial marketing. Likely, pinching treatment significantly reduced all vegetative and root growth parameters with the exception of branch No./plant character, that was increased in pinched plants with significant differences when compared to the non-pinched ones in both seasons. Moreover, all concentrations of both retardants, as well as pinching treatment delayed flowering and significantly reduced all flowering measurements in both non-pinched and pinched plants except for inflorescence No./plant trait, which was

in the same rank for non-pinched and pinched plants. However, the low level of both PP-333 and ccc (50 and 1000 ppm, respectively) significantly increased number of florets/inflorescence in the two seasons. So, the plants under these two treatments were more attractive.

The content of chlorophyll a, b, carotenoids and indoles (mg/g F.W.) was progressively decreased in the leaves of both non-pinched and pinched plants with elevating of either PP-333 or ccc levels, while phenols content was gradually increased. Paclobutrazol at the rate of 50 ppm, on the other hand, raised the content of chlorophyll a and b in the leaves of non-pinched and pinched plants. However, pinching treatment induced a significant reduction in all previous constituents.

In brief, to obtain a good display of flowering pot *Nerium oleander* L. plants with optimum vegetative and flowering characteristics from the commercial point of view, it is recommended to spray the foliage of non-pinched transplants with either low or medium concentrations of PP-333 (50 and 100 ppm, respectively) or ccc (1000 and 2000 ppm, respectively), and the pinched ones with the only low concentration of either PP-333 (50 ppm) or ccc (1000 ppm), for 3 times with 3 weeks interval.

INTRODUCTION

Nerium oleander L., common oleander or rose-bay, is an evergreen, erect shrub to 4 m height; leaves liner-to oblong-lanceolate to 20-25 cm long, entire, dark dull green; flowers showy in terminal branching cymes, yellowish to rose-pink, red purple or white, sometimes scented; native from Mediterranean region to Japan (Bailey, 1976).

Oleanders are generally grown outdoors in mild climates. They require little attention and are very drought resistant. In cold regions, they are favorite pot or tub plants, and should be cut back and rested after flowering, then potted in loam and rotted manure. Propagated easily by cuttings of mature firm wood, sometimes in water. All parts are very poisonous if eaten (Huxley *et al.*, 1992).

Production of the midget-pot-plants is still a practical and secure way to transfer the big-sized picturesque plants from out-to in-door, and for using them as ornamentals in landscaping of home and petit gardens. The number of consumers who are fond of stunted plants increases day after day. So, trials are still continuous to fined out new

and unique specimens of these products suitable for commercial marketing. In this concern, Wei and Han (1997) reported that applying paclobutrazol at 25, 50, 75 and 100 ppm significantly reduced plant height and shoot number of chrysanthemum. Proietti *et al.,* (1998) indicated that PP-333 application at 2 g. /tree inhibited shoot and root growth of 1-year-old chestnut tree.

On potted sunflower, Daseju *et al.,* (1998) postulated that leaves of plants treated with PP-333 at 16 or 32 mg/pot were smaller and greener than those of untreated ones. Singh *et al.,* (1999) mentioned that spraying of paclobutrazol at 10-30 ppm greatly reduced height, shoot and leaf number of sweet pepper, while number of flowers/plant was increased. Similar observations were also gained by Sarhan *et al.,* (2001) on *Althaea rosa,* Chen *et al.*, (2002) on *Gynura aurantiaca,* Kozak (2002) on *Gloriosa rothschildiana* and Auda *et al.*, (2002) who stated that plant height, branch and leaf No./plant, leaf area and aerial parts and root fresh and dry weight of *Barleria cristata* were significantly declined as a result of PP-333 spraying either at 150 ppm or ccc at 2000 ppm., flowering was delayed, and the first flower diameter and number of spikes/plant were linearly decreased with increasing PP-333 or ccc concentrations.

Likely, Berett *et al.,* (2003) revealed that uniconazole application as a spray to the surface of media prior to planting at the level of 200 ml/m^2 decreased plant height and flower number of *Petunia hybrida* and *Catharanthus roseus* plants. Moreover, Pasian and Bennett (2004) declared that soaking of ornamental kale (*Brassica oleander* vr. viridis) seeds in paclobutrazol solution (500 or 1000 ppm) for 180 minutes significantly reduced plug height, but increased its thickness.

Recently, Schroeter and Jerzy (2006) found that daminozide and chlormequat at the rate of 690 mg/L. gave the strongest and longest-lasting inhibitory effect on the growth of *Impatiens walleriana* bedding plants. Similarly, Shahin *et al.,* (2006) reported that the best dwarfing effect on shoot and root growth of *Rudbeckia hirta* plant was due to spraying of cycocel at 2000 ppm. such treatment also delayed flowering and decreased flower heads No./plant, flower head diameter, flowering stalk length and period of flowering. Likely, El-Sayed *et al.*, (2007) added that vegetative and root growth of *Dodonaea viscosa* shrub was greatly depressed due to spraying of PP-333 at 100, 200 and 300 ppm.

Chemical composition of the plants is invariably affected by the treatment with growth retardants. That was proved by Auda *et al.,* (2002) who pointed-out that chlorophylls a and b content in the leaves of *Barleria cristata* was progressively decreased with increasing of either ccc or PP-333 concentration, but carotenoids content was increased. Shahin *et al.,* (2006) mentioned that total indoles content in the leaves of *Rudbeckia hirta* plant was cumulatively decreased with raising ccc concentration after the second spray, while the total phenols content was increased. After the third spray, however both indoles and phenols were increased. Pigments content, as well as total carbohydrates and the percentages of N and K in the leaves and roots were linearly decreased with elevating ccc level, while the percent of P showed a slight increase. In addition, El-Sayed *et al.,* (2007) found that the content of chlorophyll a, b, carotenoids and indoles was significantly decreased in the leaves of *Dodonaea viscosa* plants in response to elevation of PP-333 level, whereas phenols content was increased.

With regard to the effect of pinching, Norcini *et al.,* (1993) revealed that pinching potted Bougainvillea cvs. Barbara Karts and Rainbow Gold 4 weeks after transplanting decreased plant height, but increased branch and open inflorescence No./plant. Similarly, were those findings documented by Hugar and Nalawadi (1994) on *Jasminum auriculatum,* Maloupa *et al.,* (2000) on *Vitex agnus-castus*, Adhanm (2001) on *Althaea rosea,* Shalaby (2002) on *Hibiscus sabdariffa* and Auda *et al.,* (2004) who revealed that pinching once or twice after transplanting of *Bougainvillea glabra* plant reduced plant height, but increased branch and leaf No./plant, foliage fresh and dry weights, inflorescences (bracts) No./plant, as well as leaf content of N, K, chlorophyll a and b, and bracts content of total anthocyanins.

The present study, however aims to produce a high quality and medium-sized flowering pot plant of *Nerium oleander* L. for decoration of sunny terraces, verandah and open fields.

MATERIALS AND METHODS

A pot experiment was conducted at Orman Botanical Garden, Giza, Egypt during the seasons of 2005/06 and 2006/07 to explore the effect of paclobutrazol or cycocel spraying, pinching and their interaction on growth controlling, flowering and chemical composition of *Nerium oleander* L. plant.

So, six-months-old transplants of variegated *Nerium oleander* L. with initial height of 25± 2 cm and one branch carries obout 15-17 leaves were transplanted on June, 15th for both seasons into 30-cm-diameter perforated black polyethylene bags (one transplant/bag) filled with 30 kg of a mixture of equal parts of sand and loam, (v/v) in the open field under full sun. A half number of transplants were pinched for one time one month after transplanting (on 15th of July) to a height of 20 cm., while the other half was left pinched non (as a control). After two weeks (on July, 30th), the non-pinched and pinched transplants were sprayed with either paclobutrazol (PP-333 or cultar) at the levels of 0, 50, 100 and 150 ppm or cycocel (ccc or chlormequat) at the levels of 1000, 2000 and 3000 ppm for three times at three weeks interval on the foliage till run off. However, control plants were sprayed with a tap water. In addition, each level of the growth retardants used in the study was combined with non-pinching (N.P) and pinching (P.) treatments to form fourteen interaction treatments.

The layout of the experiment in the two seasons was a factorial in a complete randomized design (Mead *et al.,* 1993) with three replicates as each replicate contained six transplants.

At the end of each season (on September, 15th), the following data were recorded: plant height (cm), stem diameter at the base (cm), branch and leaf No./plant, leaf area (cm^2), the longest root length (cm) and the aerial parts and roots fresh and dry weights (g). Moreover, number of days from transplanting to first floret opening (day), first floret diameter (cm), inflorescence No./plant, floret No./inflorescence and stalk length (cm) were also registered. After three weeks from the last spray, fresh leaf samples were taken from the middle part of the plants to determine pigments content (chlorophyll a, b and carotenoids) according to Moran (1982), total indoles (A.O.A.C., 1990) and total phenols (William *et al.,* 1965) as mg/g. F.W.

Data were then, tabulated and subjected to analysis of variance using SAS program (1994) and Duncan's Multiple Range Test (1955) was used to test the significancy level among the means of various treatments.

RESULTS AND DISCUSSION

I. Effect of growth retardants, pinching and their interaction on vegetative and root growth parameters:

According to data presented in Tables (1) and (2), it is evident that as the concentrations of either PP-333 or ccc applied to oleander transplants were increased, the final height (cm), stem diameter at the base (cm), branch and leaf No./plant, leaf area (cm^2), the longest root length (cm), as well as the fresh and dry weights of aerial parts and roots (g) were decreased with different levels of significance in all acces of the two seasons. The highest decrement in the previous parameters (more than 70%) was found due to the highest concentrations of either growth retardants used in the study, as such concentrations gave, in general the utmost minimum-sized plants. However, the medium concentrations (100 ppm for PP-333 and 2000 ppm for ccc) resulted the best dwarfing effect, as they reduced the size of plants to the optimum size (where from height, branching and leaf number and area), that was going with the container size suitable for marketing.

A similar trend was attained in the matter of pinching treatment, which significantly reduced all vegetative and root growth traits, with the exception of branch No./plant character that was increased in pinched plants with significant differences when compared to the non pinched ones in the two seasons. However, the best performance of the stunted plants was obtained from those ones when were pinched and sprayed with either 100 ppm of PP-333 or 2000 ppm of ccc.

Such gains may indicate the direct role of growth retardants in depressing stem elongation by reducing cell division and extension in the subapical merstematic zone of the stem (Kozak, 2002) or by inhibition of cytokinin and gibberelin biosynthesis (Barett *et al.*, 2003). Pinching, however release the plant from apical dominance, and hence activates the lateral buds, which in turn gave more branches on the constant height of pinched stem. Similar results were also obtained by Dasoju *et al.*, (1998) on sunflower, Singh *et al.*, (1999) on sweet pepper, Sarhan *et al.*, (2001) on *Althaea rosea*, Pasian and Bennett (2004) on ornamental kale and Schroeter and Jerzy (2006) on *Impatiens walleriana.*

Table (1): Effect of growth retardants, pinching and their interaction on vegetative growth of *Nerium oleander* L. plant during 2005/2006 and 2006/2007 seasons

Pinching treatments / Growth retardants treatments (ppm)	Plant height (cm)			Stem diameter (cm)			Branch No./plant			Leaf No./plant			Leaf area (cm²)		
	N.P	P.	Mean	N.P	P.	Mean	N.P	P.	Mean	N.P	P.	Mean	N.P	P.	Mean
	First season 2005/2006														
Control	120.30 a	73.60 c	96.95 a	1.60 a	0.87 cd	1.24 a	5.00 b	7.38 a	6.19 a	99.00 a	82.53 a	90.77 a	61.00 a	34.78 ed	47.89 a
50 PP-333	84.67 b	58.00 ed	71.34 b	1.18 b	0.70 d	0.94 b	3.00 c	5.00 b	4.00 b	83.56 a	76.41 b	79.99 b	45.20 c	29.56 e	37.38 b
100 PP-333	53.21 e	32.78 g	43.00 d	0.87 cd	0.56 e	0.72 c	3.00 c	4.00 cb	3.50 bc	70.00 bc	42.00 c	56.00 c	38.27 d	24.30 f	31.29 c
150 PP-333	35.46 gf	19.50 i	27.48 e	0.70 d	0.50 e	0.60 d	1.00 d	3.00 c	2.00 d	22.13 e	29.15 d	25.64 d	31.40 e	20.00 g	25.70 d
1000 ccc	85.00 b	41.46 f	63.23 c	1.21 b	0.65 de	0.93 b	3.00 c	2.76 cd	2.88 c	78.00 b	73.18 bc	75.59 bc	58.76 b	18.30 gh	38.53 b
2000 ccc	66.16 d	28.33 h	47.25 d	0.96 c	0.50 e	0.73 c	3.00 c	4.00 cb	3.50 bc	75.00 b	46.11 c	60.56 c	36.50 d	16.70 h	26.60 d
3000 ccc	32.28 g	20.00 i	26.14 e	0.65 de	0.50 e	0.58 d	1.00 d	4.00 cb	2.00 d	21.72 e	30.48 d	25.88 d	23.20 f	15.63 h	19.42 e
Mean	68.15 a	39.10 b		1.02 a	0.61 b		2.71 b	4.31 a		64.14 a	54.27 b		42.48 a	22.75 b	
	Second season 2006/2007														
Control	116.50 a	68.39 c	92.45 a	1.48 a	0.88 c	1.18 a	5.00 b	6.93 a	5.97 a	96.33 a	83.27 a	89.80 a	61.46 a	42.40 bc	51.93 a
50 PP-333	80.78 bc	45.36 e	62.07 b	1.12 b	0.72 d	0.92 b	3.00 d	4.76 b	3.88 b	80.70 ab	75.50 b	78.10 b	46.33 b	28.39 d	37.36 b
100 PP-333	55.12 d	28.10 g	41.61 c	0.83 cd	0.53 e	0.68 c	3.00 d	3.80 c	3.40 bc	67.26 cb	44.00 c	55.63 c	38.90 c	21.73 e	30.32 c
150 PP-333	37.33 f	20.00 h	28.67 d	0.70 d	0.51 e	0.61 dc	1.00 e	2.76 de	1.88 d	25.10 de	30.15 d	27.63 d	29.50 d	18.35 ef	23.93 d
1000 ccc	83.90 b	40.93 ef	62.42 b	1.16 b	0.68 de	0.92 b	3.00 d	2.50 ed	2.75 c	79.43 ab	71.86 bc	75.65 b	61.00 a	17.50 fe	39.25 b
2000 ccc	61.76 cd	26.71 g	44.24 c	0.89 c	0.51 e	0.70 c	2.78 de	4.00 c	3.39 bc	74.90 b	44.00 c	59.45 c	34.38 c	15.22 f	24.80 d
3000 ccc	33.25 gf	18.92 h	26.09 d	0.63 ed	0.51 e	0.57 d	1.00 e	3.75 c	2.38 cd	20.36 e	20.13 e	20.25 e	20.90 e	14.17 f	17.54 e
Mean	66.95 a	35.20 b		0.97 a	0.62 b		2.68 b	4.07 a		63.44 a	52.70 b		41.78 a	22.54 b	

* PP-333: Paclobutrazol, ccc: Cycocel, N.P.: Non-pinching and P. pinching

* Means within a column or row having the same letters are not significantly different according to Duncan's Multiple Range Test (DMRT) at 5% level.

Table (2): Effect of growth retardants, pinching and their interaction on root length and aerial parts and roots fresh and dry weights (g.) of *Nerium oleander* L. plant during 2005/2006 and 2006/2007 seasons

Pinching treatments / Growth retardants treatments (ppm)	Root length (cm)			Aerial parts F.W. (g)			Roots F.W. (g)			Aerial parts D.W. (g)			Roots D.W. (g)		
	N.P	P.	Mean	N.P	P.	Mean	N.P	P.	Mean	N.P	P.	Mean	N.P	P.	Mean
	First season 2005/2006														
Control	45.40 a	38.00 b	41.70 a	135.38 a	31.86 d	83.62 a	30.65 a	18.34 b	24.50 a	37.85 a	12.32 c	25.09 a	11.15 a	7.63 b	9.39 a
50 PP-333	36.00 b	34.13 bc	35.07 b	78.46 b	29.08 d	53.77 b	15.98 c	12.56 cd	14.27 b	25.38 b	10.97 d	18.18 b	5.27 c	5.16 c	5.22 b
100 PP-333	32.17 cb	21.36 de	26.77 d	36.70 e	15.60 e	26.15 c	11.37 d	10.31 ed	10.84 c	13.17 c	6.98 e	10.08 c	3.26 de	4.81 ed	4.04 c
150 PP-333	28.00 cd	13.15 e	20.58 e	12.78 f	10.28 g	11.53 d	12.10 dc	9.53 e	10.82 d	4.76 g	4.68 g	4.72 e	3.35 e	3.10 ef	3.23 d
1000 ccc	34.79 bc	23.70 d	29.25 c	84.81 b	13.20 e	49.01 b	18.92 b	9.40 e	14.16 b	26.25 b	5.93 f	16.09 b	6.40 bc	3.50 e	4.95 b
2000 ccc	30.00 c	20.33 ed	25.17 d	33.83 d	12.40 f	23.12 c	13.21 cd	8.27 fe	10.74 c	12.16 c	5.21 fg	8.69 d	5.14 c	3.43 e	4.29 c
3000 ccc	26.10 dc	12.00 e	19.05 e	12.03 f	10.33 g	11.18 d	10.68 ed	7.40 f	9.04 e	5.40 f	4.70 g	5.05 e	4.17 ed	3.00 f	3.59 d
Mean	33.21 a	23.24 b		56.28 a	17.54 b		16.13 a	10.83 b		17.85 a	7.26 b		5.53 a	4.38 b	
	Second season 2006/2007														
Control	46.00 a	35.67 b	40.84 a	130.50 a	28.89 d	79.70 a	31.00 a	16.48 b	23.74 a	35.61 a	10.86 d	23.24 a	11.20 a	6.85 b	9.03 a
50 PP-333	35.78 b	32.50 cb	34.14 b	74.29 b	22.53 e	48.41 b	15.71 cb	12.07 c	13.89 b	23.72 b	7.88 e	15.80 b	4.91 cd	4.79 dc	4.85 b
100 PP-333	31.46 c	20.88 ef	26.17 d	36.83 e	14.81 f	25.82 c	11.52 cd	10.46 d	10.99 c	13.20 c	5.67 fe	9.44 c	3.30 de	4.73 dc	4.02 b
150 PP-333	28.00 dc	13.56 f	20.78 e	12.87 g	10.33 h	11.60 d	11.89 cd	9.62 ed	10.76 c	5.00 fg	4.71 g	4.86 d	3.33 de	3.18 ed	3.26 c
1000 ccc	33.63 bc	23.28 e	28.46 c	81.50 b	12.78 g	47.14 b	17.98 b	9.33 e	13.66 b	25.08 b	5.54 f	15.31 b	5.76 c	3.46 d	4.61 b
2000 ccc	28.50 dc	20.00 ef	24.25 de	31.24 e	12.07 g	21.66 c	12.76 c	8.21 f	10.49 c	11.27 cd	4.86 g	8.07 c	4.89 cd	3.32 de	4.11 b
3000 ccc	25.33 d	12.00 f	18.67 f	12.17 g	9.58 h	10.88 d	9.87 ed	6.79 g	8.33 d	5.31 f	4.35 g	4.83 d	3.70 d	2.78 e	3.24 c
Mean	32.67 a	22.56 b		54.20 a	15.86 b		15.82 a	10.42 b		17.03 a	6.27 b		5.30 a	4.16 b	

* PP-333: Paclobutrazol, ccc: Cycocel, N.P.: Non-pinching and P. pinching

* Means within a column or row having the same letters are not significantly different according to Duncan's Multiple Range Test (DMRT) at 5% level.

II. Effect of growth retardants, pinching and their interaction on flowering:

It is obvious from data shown in Table (3) that concentrations of both PP-333 and ccc delayed flowering of oleander plants with various significant differences when compared to untreated ones in both seasons. Pinching also induced a significant delay in flowering of pinched plants comparing with non-pinched ones in the two seasons.

However, the largest number of days to flowering in both reasons was noticed in pinched plants sprayed with ccc at the level of 1000 ppm, whereas pinched ones treated with the medium and high levels of ccc (2000 and 3000 ppm, respectively) failed to flower throughout this study, which may due to its very limited growth. In general, non-pinched plants gave better flowering measurements than pinched ones, except for inflorescence No.,/plant character, which was in the same rank for both. Moreover, the low level of both PP-333 and ccc (50 and 100 ppm, respectively) significantly increased the means of floret No./inflorescence in the two seasons. So, the plants under such treatments were more attractive.

Although there was a reduction in mean number of inflorescences born on the treated plants, the corresponding reduction in plant height, branching, as well as leaf No. and area improved the appearance of the stunted oleander as a flowering pot aplant, especially those non-pinched and treated with low and medium levels of either PP-333 (50 and 100 ppm, Photo 1) or ccc (1000 and 2000 ppm, Photo 2), whereas for pinched plants, spraying with only the medium concentration of PP-333 (100 ppm, Photo 3) and the low one of ccc (1000 ppm, Photo 4) was preferable.

The forementioned results, however are in accordance with those indicated by Chen *et al.,* (2002) on *Gynura aurantiaca*, Auda *et al.,* (2002) on *Barleria cristata* , Barett *et al.,* (2003) on *Petunia hybrida* and *Catharanthus roseus* and Shahin *et al.,* (2006) on *Rudbeckia hirta.*

Table (3): Effect of growth retardants, pinching and their interaction on flowering of *Nerium oleander* L. plant during 2005/2006 and 2006/2007 seasons

Pinching treatments / Growth retardants treatments (ppm)	No. days from planting to first floret opening (days)			First floret diameter (cm)			Inflorescence No./plant			Floret No./inflorescence			Stalk length (cm)		
	N.P	P.	Mean	N.P	P.	Mean	N.P	P.	Mean	N.P	P.	Mean	N.P	P.	Mean
	First season 2005/2006														
Control	334.33 f	363.41 c	348.87 d	5.50 a	4.10 c	4.80 a	3.33 a	2.67 b	3.00 a	30.33 b	13.16 d	21.75 c	12.80 a	5.18 c	8.99 a
50 PP-333	336.50 fe	366.00 c	351.25 c	4.61 b	3.80 d	4.21 b	2.10 c	2.00 c	2.05 b	46.00 a	18.21 c	32.11 a	7.83 b	3.70 d	5.77 b
100 PP-333	338.75 ef	372.18 b	355.47 b	4.56 b	3.60 d	4.08 c	2.00 c	2.00 c	2.00 b	32.67 b	13.50 d	23.09 c	7.67 b	2.65 e	5.16 cb
150 PP-333	342.00 e	371.76 b	356.88 b	4.55 b	3.60 d	4.08 c	1.00 d	2.00 c	1.50 c	18.20 c	9.00 e	13.60 d	4.60 dc	2.00 e	3.30 d
1000 ccc	341.33 e	423.33 a	382.33 a	5.00 ba	3.33 e	4.17 cb	2.00 c	1.33 dc	1.67 c	47.50 a	10.00 e	28.75 b	9.10 ab	3.50 d	6.30 b
2000 ccc	348.33 d	--	348.33 d	4.53 cb	--	4.53 ba	2.00 c	--	2.00 b	31.33 b	--	31.33 a	4.75 c	--	4.75 c
3000 ccc	351.00 d	--	351.00 c	4.53 cb	--	4.53 ba	1.00 d	--	1.00 d	20.67 c	--	20.67 cd	3.40 de	--	3.40 d
Mean	341.75 b	379.34 a		4.10 a	3.69 b		1.92 a	2.00 a		32.39 a	12.78 b		7.16 a	3.41 b	
	Second season 2006/2007														
Control	335.50 e	368.26 cb	351.88 d	5.62 a	4.23 c	4.93 a	3.36 a	2.43 b	2.90 a	32.46 b	12.00 ed	22.23 b	13.00 a	4.86 d	8.93 a
50 PP-333	336.81 e	369.73 cb	353.27 c	4.76 b	3.92 dc	4.34 b	2.00 c	2.00 c	2.00 b	44.85 a	18.00 cd	31.43 a	8.53 c	3.50 e	6.02 b
100 PP-333	339.00 ed	374.00 b	356.50 b	4.63 cb	3.57 d	4.10 c	2.00 c	2.00 c	2.00 b	32.00 b	14.10 d	23.05 b	8.00 c	2.61 f	5.31 cb
150 PP-333	343.21d	376.50 b	359.86 b	4.57 c	3.62 d	4.10 c	1.00 d	2.00 c	1.50 c	20.00 c	8.00 e	14.00 c	4.50 d	1.89 g	3.20 d
1000 ccc	345.00 d	424.00 a	384.50 a	5.18 ab	3.47 e	4.33 c	2.00 c	1.00 d	1.50 c	48.17 a	10.00 e	29.09 a	9.31 b	3.60 e	6.46 b
2000 ccc	351.17 dc	--	351.17 c	5.00 ba	--	5.00 a	2.00 c	--	2.00 b	32.00 b	--	32.00 a	4.67 d	--	4.67 c
3000 ccc	355.00 c	--	355.00 b	4.68 b	--	4.68 b	2.00 c	--	2.00 b	21.56 c	--	21.56 bc	3.36 ef	--	3.36 d
Mean	343.67 b	382.50 a		4.92 a	3.76 b		2.05 a	1.89 a		33.01 a	12.42 b		7.34 a	3.29 b	

* PP-333: Paclobutrazol, ccc: Cycocel, N.P.: Non-pinching and P. pinching

* Means within a column or row having the same letters are not significantly different according to Duncan's Multiple Range Test (DMRT) at 5% level.

III. Effect of growth retardants, pinching and their interaction on chemical composition:

Data of some chemical constituents registered in Table (4) exhibit that the content of chlorophyll a, b, carotenoids and indoles as mg/g F.W. was progressively decreased in the leaves of both non-pinched plants with elevating of either PP-333 or ccc concentrations, while phenols content was cumulatively increased. However, paclobutrazol at the rate of 50 ppm was found to raise the content of chlorophyll a, b in the leaves of either non-pinched or pinched plants.

These gains many indicate the role of growth retardants in depressing biosynthesis of some growth promoters (as indoles) coupled with elevationing the content of some inhibitors (as phenols) in the tissues of treated plants (Kozak, 2002).

On the same line, were those results obtained by Dasoju *et al.*, (1998) on sunflower, Pasian and Bennett (2004) on ornamental kale, Shahin *et al* (2006) on *Rudbeckia hirta* and El-Sayed *et al.*, (2007) on *Dodonea viscosa.*

Table (4): Effect of growth retardants, pinching and their interaction on some chemical constituents content in the leaves of *Nerium oleander* L. plant during 2006/2007 season.

Pinching treatments / Growth retardants treatments (ppm)	Chlorophyll a (mg/g F.W.)			Chlorophyll b (mg/g F.W.)			Carotenoids (mg/g F.W.)			Indoles (mg/g F.W.)			Phenols (mg/g F.W.)		
	N.P	P.	Mean	N.P	P.	Mean	N.P	P.	Mean	N.P	P.	Mean	N.P	P.	Mean
	2006/2007														
Control	1.499	1.308	1.404	0.878	0.809	0.844	3.542	3.258	3.400	0.197	0.201	0.199	0.174	0.181	0.178
50 PP-333	1.513	1.381	1.447	0.903	0.831	0.867	3.134	2.880	3.007	0.188	0.190	0.189	0.181	0.193	0.187
100 PP-333	1.210	1.113	1.162	0.789	0.728	0.759	3.037	2.794	2.916	0.179	0.172	0.176	0.209	0.218	0.214
150 PP-333	0.900	0.833	0.867	0.741	0.689	0.715	2.856	2.628	2.742	0.157	0.164	0.161	0.223	0.233	0.228
1000 ccc	0.879	0.809	0.844	0.670	0.626	0.648	2.710	2.485	2.598	0.180	0.186	0.183	0.254	0.198	0.226
2000 ccc	0.793	0.727	0.760	0.581	0.533	0.557	1.893	1.748	1.821	0.146	0.155	0.151	0.268	0.253	0.261
3000 ccc	0.683	0.635	0.659	0.357	0.361	0.359	0.927	0.946	0.937	0.139	0.127	0.133	0.297	0.279	0.288
Mean	1.068	0.972		0.703	0.654		2.586	2.391		0.170	0.171		0.229	0.222	

* PP-333: Paclobutrazol, ccc: Cycocel, N.P.: Non-pinching and P. pinching

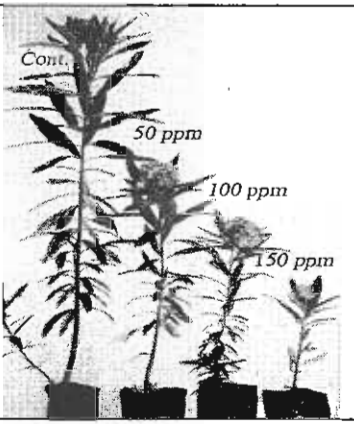

Photo (1) Effect of PP-333 at different levels on growth and flowering of non-pinched *Nerium oleander* transplants.

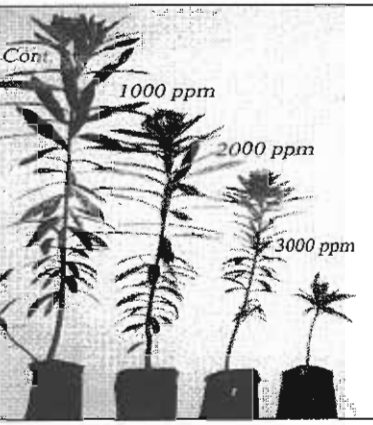

Photo (2) Effect of ccc at different levels on growth and flowering of non-pinched *Nerium oleander* transplants.

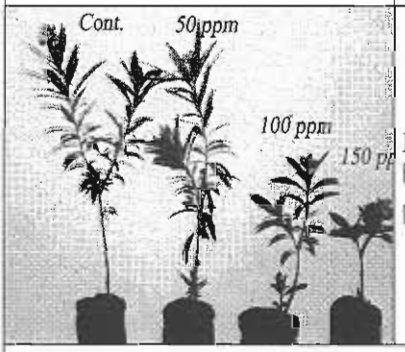

Photo (3) Effect of PP-333 at different levels on growth and flowering of pinched *Nerium oleander* transplants.

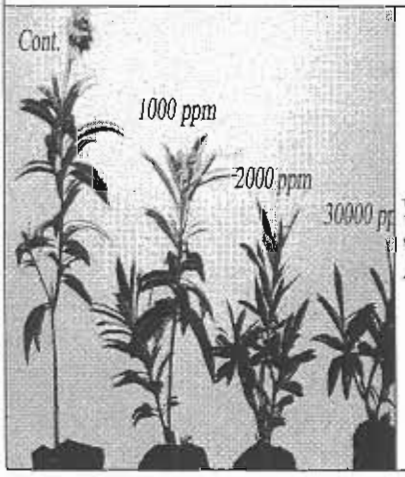

Photo (4) Effect of ccc at different levels on growth and flowering of pinched *Nerium oleander* transplants.

It was noticed from data in Table (4) that the content of chlorophyll a, b and carotenoids in the leaves of non-pinched plants was higher than that in the leaves of pinched ones. The opposite was the right concerning the content of indoles, as it was higher in the pinched than in non-pinched plants. That may be due to translocation of the formed metabolites to the new produced branches which were resulted from pinching and consequently continuation of the plants in vegetative growth. However, such findings are in harmony with those attained by Maloupa *et al.,* (2000) on *Vitex agnus-castus*, Adham (2001) on *Althaea rosea* and Shalaby (2003) on *Hibiscus sabdariffa.*

According to the previous results, it could be recommended to spray the foliage of non-pinched six-months old *Nerium oleander* L. transplants grown in 30-cm-diameter container with either PP-333 at 50 and 100 ppm or ccc at 1000 and 2000 ppm, and the pinched ones with either 50 ppm of PP-333 or 1000 ppm of ccc, for 3 times with 3 weeks interval to get the most suitable dwarf, flowering pot plants reliable for commercial marketing.

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انتـــاج الدفلـــة المقزَّمـــــة

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أجريت هذه التجربة بحديقة الأورمان النباتية، الجيزة، مصر خلال الموسمين المتتاليين: ٢٠٠٥/٢٠٠٦ ، ٢٠٠٦/٢٠٠٧ ، و ذلك لدراسة تأثير الرش إما بالباكلوبيوترازول (PP-333) بتركيزات: صفر، ٥٠، ١٠٠و ١٥٠ جزء في المليون أو بالسيكوسيل (ccc) بتركيزات: ١٠٠٠، ٢٠٠٠، ٣٠٠٠ جزء في المليون ثلاث مرات و بفاصل زمني ثلاثة أسابيع بين كل رشتين، و التطويش و التفاعل بينهما على النمو و التركيب الكيميائي لشتلات الدفلة (*Nerium oleander* L.) عمر ستة أشهر و المنزرعة في أكياس بولي إثيلين سوداء مثقبة قطرها ٣٠ سم.

و لقد أوضحت النتائج المتحصل عليها أن ارتفاع النبات (سم)، قطر الساق (سم)، عدد الأفرع و الأوراق/نبات، مساحة الورقة (سم^2)، طول الجذر (سم)، و كذلك الأوزان الطازجة و الجافة للنموات الخضرية و الجذرية (جم) قد انخفضت معنوياً في كلٍ من النباتات الغير مطوشة و المطوشة نتيجة للرش بالتركيزات المختلفة من الباكلوبيوترازول و السيكوسيل في كلا الموسمين. و لقد تحققت أفضل نتائج للتقزيم عند الرش بالباكلوبيوترازول (بمعدل ١٠٠ جزء في المليون) و بالسيكوسيل (بمعدل ٢٠٠٠ جزء في المليون)، حيث خفضت هاتان المعاملتان حجم النباتات المعاملة الى الحجم الأمثل الملائم للتسويق التجاري. بالمثل فقد خفضت معاملة التطويش جميع قياسات النمو الخضري و الجذري معنوياً، باستثناء عدد الأفرع/نبات و الذي زاد في النباتات المطوشة و بفروق معنوية عند مقارنته بالنباتات الغير مطوشة في كلا الموسمين. علاوة على ذلك، فقد أدت جميع مستويات كلا المقزمين في النباتات العير مطوشة و المطوشة، و كذلك معاملة التطويش الى تأخير الازهار معنوياً و خفض جميع قياسات الإزهار بشكل معنوي أيضاً، باستثناء قياس عدد النورات/نبات و الذي كان متقارباً في كلٍ من النباتات الغير مطوشة و المطوشة، الا أن التركيز المنخفض لكلٍ من الباكلوبيوترازول (٥٠ جزء في المليون) و السيكوسيل (١٠٠٠ جزء في المليون) قد أدى إلى زيادة عدد الزهيرات/نورة بشكل معنوي في كلا الموسمين، مما جعل النباتات المقزمة تحت هذين التركيزين أكثر رونقاً و جمالاً.

و لقد أظهرت النتائج أيضاً حدوث انخفاض تدريجي في محتوى أوراق النباتات الغير مطوشة و المطوشة من كلوروفيللي أ،ب و الكاروتينويدات و الاندولات بزيادة التركيز المستخدم من الباكلوبيوترازول أو السيكوسيل، بينما زاد تدريجياً محتوى الفينولات. على الجانب الآخر، فقد أدى الرش بالباكلوبيوترازول بمعدل ٥٠ جزء في المليون الى زيادة محتوى أوراق النباتات الغير مطوشة و المطوشة من كلوروفيللي أ، ب. بينما أحدثت معاملة التطويش انخفاضاً معنوياً في محتوى جميع المكونات الكيميائية سالفة الذكر.

و عليه، فانه للحصول على نباتات دفلة مقزَّمة تصلح للتسويق كنباتات أصص مزهرة، فانه يوصى برش أوراق الشتلات الغير مطوشة إما بالباكلوبيوترازول (تركيز ٥٠ أو ١٠٠ جزء في المليون) أو بالسيكوسيل (تركيز ١٠٠٠ أو ٢٠٠٠ جزء في المليون)، بينما يفضل رش النباتات المطوشة بالتركيز المنخفض فقط من الباكلوبيوترازول (٥٠ جزء في المليون)، على أن يكون ذلك بمعدل ثلاث مرات و بفاصل ثلاثة أسابيع بين الرشة و الأخرى.