Production of stunted specimens from *Jasminum officinale* L. plant.

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ABSTRACT

A pot experiment was carried out at the nursery of Hort. Res. Inst., ARC, Giza, Egypt during 2022 and 2023 seasons to examine the effect of paclobutrazol (PP-333) at 0, 50, 100 and 150 ppm concentrations as foliar spray, pinching and non-pinching treatments and their interactions on growth, flowering and chemical composition of the common white jasmine (*Jasminum officinale* L.) transplants. The obtained results indicated that the mean values of plant height, No. of branches, flowers and leaves/plant, first flower diameter and fresh and dry weights of top growth were gradually decreased with increasing PP-333 application rate, whereas stem diameter, root length, No. of days to flowering and roots fresh and dry weights were progressively increased, with few exceptions in the two seasons. On the other hand, pinching treatment caused a significant decrease in the means of plant height. No. of leaves/plant, root length, as well fresh and dry weights of top growth and roots, but significantly increased the means of stem and flower diameters, No. of branches and flowers/plant, No. of days to flowering compared to non-pinching one in both seasons. The best results was obtained from either pinched plants sprayed with 100 ppm PP-333 or non-pinched ones sprayed with 150 ppm PP-333.Thus, it can be advised to spray the foliage of the pinched common white jasmine transplants with PP-333 (100 ppm) and those of the non-pinched ones with PP-333 (150 ppm), 3 times at a 3 week-intervals to get a best quality specimen of dwarfed plants.

Keywords: Jasmine- Dwarfing- PP-333 and pinching- Vegetative growth- Pot-plants.

INTRODUCTION

Production of dwarfed ornamental plants is still one of the most important choices to transfer it from outdoor to indoor. These downsized distinguished plants can be used well for landscaping the closed and limited-area spaces. Among ornamental plants may be suitable for achieving such choice is the common white jasmine (*Jasminum officinale* L.),[synon. *Jasminum grandiflorum* L.)]. It is a frost hardy, decicuous (sometimes semi-deciduous) climber with weak stem up to 30 ft. tall belongs to Oleaceae family and native to South Asia, the Arabian peninsula, East and Northeast Africa and Himalaya of West China. Leaves opposite, 5-12 cm long, pinnate with 5-7 ovate leaflets to 2.5 inch long and the terminal leaflet is larger. The flowers are white, in clusters (open cymes), produced from summer to early autumn, highly fragrant and contain an essential oil used in perfumery soaps and cosmetics, grown outdoor in warm regions and as greenhouse plant elsewhere. Propagated by cuttings of nearly ripe woods in spring and summer, or ripe wood in autumn, by layers and sometimes by seeds (Beckett, 1985; Heneidy and Marzouk, 2010).

Several peoples are fond of having jasmine plant in their terraces and balconies due to its great amenity and strong fragrance, but this type of scrambling plant spread their growth everywhere with long arch-shaped branches. Thus, it is better to limit its growth to suit decoration of the small area. This was previously achieved by Poppiah and Muthuswamy (1977), Bhattacharjee (1983) and El-Sayed *et al*., (2010) on *Jasminum grandiflorum* using different chemical growth retardants at various concentrations.

On other ornamentals, many reports were decided by Auda et al., (2002**)** on *Barleria cristata*, Barett et al., (2003) on *Petunia hybrida* and *Catharanthus roseus*, Shahin et al., (2006) on *Rudbeckia hirta*,

Mahmoud et al., (2008) on *Nerium oleander*, Asgarian et al., (2013) on *Zinnia*, Shahin et al., (2014) on *Chrysanthemum carinatum*, Noor El-Deen et al., on *Gaillardia pulchella*, Abou-Dahab et al., (2015) on *Russelia equisetiformis*, Narayan (2015) on *Tagetes erecta*, El-Sadek (2016) on *Hibiscus rosa-sinensis* cv. Yellow, Zamani et al., (2016) on rosemary and *Thuja* "Morgan" Heikal (2017) on *Sanchezia nobilis*, Mohammed et al., (2017) on *Lagerstroemia indica*, Deniz and Omer Faruk (2018) on *Fuchsia*, Tawila (2018) on *Celosia cristata*, Naine et al., (2019) on ornamental pepper, Dong et al., (2020) on *Paeonia lactiflora*, Noor El-Deen (2020) on *Ruellia simplex*, Shahin and Moustafa (2021) on *Althaea rosea* and Noor El-Deen and Abou Elghait (2022) on *Hibiscus rosa-sinensis* cv. Cooperi.

However, the goal of this trial is examining the effect of both paclobutrazol and pinching, with their interactions on growth and flowering of the common white jasmine transplants to produce high quality, medium-sized and compact flowering pot plants proper to beautifying the sunny terraces, verandah and any other small-area-open fields.

MATERIALS AND METHODS

A pot experiment was consummated in the open field at the nursery of Hort. Res. Inst., ARC, Giza, Egypt throughout 2022 and 2023 seasons to find out the effect of paclobutrazol (cultar), pinching and their interactions on growth, flowering and chemical composition of the common white jasmine.

Therefore, six-month-old homogenous transplants of *Jasminum officinale* L. with average length of about 20 cm (one branch) were individually transplanted on March, 10th for every season into 20-cm-diameter plastic pots (one transplant/pot) filled with about 3.5 kg of sand+ clay mixture at a ratio of 3:1,v/v. by volume. The physical and chemical properties of the sand and clay used for preparing the growing mixture in the two seasons were determined and illustrated in Table (a).

Table (a): The physical and chemical properties of the sand and clay used in 2022 and 2023 seasons.

Soil texture	Particle size distribution (%)				S.P.	pH	E.C. (dS/m)	Cations (meq/L)				Anions (meq/L)		
	Coarse sand	Fine sand	Silt	Clay				Ca^{++}	Mg^{++}	Na^{+}	K^{+}	HCO_3^{-}	Cl^{-}	SO_4^{--}
Sand	89.03	2.05	0.40	8.52	23.01	7.93	3.56	7.50	1.63	33.60	0.50	3.20	22.00	18.03
Clay	7.54	22.28	30.55	39.63	55.00	8.00	2.21	7.82	2.12	15.40	0.75	6.60	8.20	11.29

After 10 days from transplanting, a half number of transplants were pinched for one time (March, 20th), while the other half was left without pinching (as a control). One month later (on April, 20th), the foliage of pinched and non-pinched plants were sprayed till run off point with paclobutrazol (PP-333 or cultar) solution at 0, 50, 100 and 150 ppm concentrations, 3 times with 3-weeks interval. However, the control transplants were sprayed with tap water. Besides, each level of PP-333 was factorially combined with pinching (P.) and non-pinching (N.P.) treatments to create eight interaction treatments in a factorial experiment based on a complete randomized design, replicated thrice, which was accomplished in the two seasons (Mead et al., 1993), as each replicate contained five transplants. Furthermore, all transplants ware fertilized three times, throughout the course of the study, with NPK (19:19:19 + micronutrients) fertilizer at 2 g/transplant commencing of the first of May with one-month interval, while the other agricultural practices needed for such plantation were carried out in time as gardener did.

At the end of each season (on 15th of September), the data were recorded as follows: plant height (cm), stem diameter at the base (cm), number of branches and leaves/plant, the longest root length (cm), number of days to first flower opening (day), number of flowers/plant, first flower diameter (cm), as well as top growth, roots and first flower fresh and dry weights (g). In fresh leaf samples taken from the middle parts of the plants, photosynthetic pigments (chlorophyll a, b and carotenoids, mg/g f.w.) were determined according to the method of Sumanta et al., (2014), while in dry ones, the percentages of total carbohydrates (Herbert et al., 1971) and nitrogen, phosphorus and potassium (Chapman and Pratt, 1975) were measured.

Data were then tabulated and only the morphological and flowering ones were statistically analyzed using the Assistant Software Program designed by Silva and Azevedo (2016), followed by Duncan's New Multiple Range t-Test (Steel and Torrie, 1980) for means comparison.

RESULTS

Effect of paclobutrazol, pinching and their interactions on:

I. Vegetative and root growth parameters:

It is evident from data presented in Tables (1, 2 and 3) that as the concentration of PP-333 was increased the mean values of plant height (cm), No. branches/plant and No. leaves/plant were gradually decreased with significant differences relative to the means of control treatment in the two seasons. Hence, PP-333 treatment at 150 ppm concentration gave, in general the least values of the previous three characters causing more than 57.9, 52.0 and 51.3% reduction in the three aforementioned traits, respectively. The opposite was the right regarding stem diameter (cm) and root length (cm) traits, as the means of stem diameter were significantly increased by all pp-333 concentrations, with the superiority of 50 ppm one which gave the widest stem diameter in the first season (0.472 cm), while in the second one all PP-333 levels raised the means of such trait to maximum with the dominance of 150 ppm one (0.437 cm). Likewise, the mean values of root length were significantly improved by various levels of PP-333 in most cases of the 1st season, but in the 2nd one, 50 ppm PP-333 treatment was the only one which significantly elongated the root length to maximum (30.87 cm) compared to control, whereas 100 and 150 ppm levels significantly reduced it (Table, 3).

On the other side, pinching treatment resulted in reducing of plant height from 56.83 cm (in non-pinched plans) to 44.97 cm, No. leaves from 74.44 to 67.56 leaves and root length from 26.66 to 24.15 cm in the 1st season. Similarly, was the trend in the 2nd season. Concerning the effect of pinching on both stem diameter and No. branches traits, the opposite was the right.

Also, interaction treatments showed a great variation in their effects on vegetative and root growth attributes, where the tallest plants and the highest No. leaves were obtained by combining between control and non-pinching treatments in both seasons, whereas the greatest No. branches was achieved by interacting between control and pinching treatments. The widest stem diameter, however was attained in the first season by the connecting between PP-333 at any level and pinching treatment and in the second one by connecting between PP-333 at only 100 and 150 ppm levels and pinching treatment. The longest roots length, were acquired by the combined treatment of PP-333 at 50 ppm level + non-pinching combination in the two seasons. On the contrary, the least records of growth characters, were obtained fulfilled in the two seasons by 150 ppm PP-333 + pinching interaction, followed by 150 ppm PP-333 + non-pinching one.

Table (1): Effect of paclobutrazol, pinching and their interactions on plant height and stem diameter of Jasminum officinale L. plant during 2022 and 2023 seasons.

PP-333 treatments	Plant height (cm)			Stem diameter (cm)		
	Pinching	Non-pinching	Mean	Pinching	Non-pinching	Mean
First season; 2022						
Control	55.05c	68.11a	61.58A	0.420cd	0.310e	0.365C
50 ppm	49.48d	61.95b	55.71B	0.497a	0.447bc	0.472A
100 ppm	42.45e	55.83c	49.14C	0.463ab	0.400d	0.432B
150 ppm	32.89f	41.44e	37.17D	0.477ab	0.397d	0.437B
Mean	44.97B	56.83A		0.464A	0.388B	
Second season; 2023						
Control	52.25d	71.56a	61.91A	0.443c	0.333e	0.388B
50 ppm	46.72e	62.92b	54.82B	0.483b	0.370d	0.427A
100 ppm	39.44f	54.78c	47.11C	0.517a	0.347de	0.432A
150 ppm	29.90g	37.87f	34.39D	0.533a	0.340de	0.437A
Mean	42.08B	57.03A		0.494A	0.348B	

- Means within a column or row having the same letters are not significantly different according to DMR t-T at 5 % level.

Table (2): Effect of paclobutrazol, pinching and their interactions on No. branches and leaves per Jasminum officinale L. plant during 2022 and 2023 seasons.

PP-333 treatments	No. branches/plant			No. leaves/plant		
	Pinching	Non-pinching	Mean	Pinching	Non-pinching	Mean
First season; 2022						
Control	9.11a	6.56c	7.83A	82.67b	85.78a	84.22A
50 ppm	8.06b	5.89d	6.97B	70.22d	76.77c	73.50B
100 ppm	7.00c	5.50d	6.25C	50.78f	63.00e	56.89C
150 ppm	4.61e	3.67f	4.14D	45.89g	43.56g	44.72D
Mean	7.19A	5.40B		62.39B	67.28A	
Second season; 2023						
Control	9.11a	6.28d	7.70A	91.05b	98.20a	94.63A
50 ppm	7.78b	5.28e	6.53B	75.94d	84.84c	80.39B
100 ppm	6.78c	4.82f	5.80C	56.21f	67.68e	61.95C
150 ppm	4.59f	3.30g	3.95D	47.01g	47.03g	47.02D
Mean	7.07A	4.92B		67.56B	74.44A	

- Means within a column or row having the same letters are not significantly different according to DMR t-T at 5 % level.

Table (3): Effect of paclobutrozal, pinching and their interactions on root length and No. days to first flower opening (day) of *Jasminum officinale* L. plant during 2022 and 2023 seasons.

PP-333 treatments	Root length (cm)			No. days to first flower opening (day)		
	Pinching	Non-pinching	Mean	Pinching	Non-pinching	Mean
First season; 2022						
Control	22.63d	22.50d	22.57B	173.3f	193.2c	183.3C
50 ppm	23.56cd	30.50a	27.03A	194.5c	186.8d	199.7A
100 ppm	27.77b	28.60ab	28.18A	213.0b	177.0e	195.0B
150 ppm	22.63d	25.03c	23.83B	216.7a	175.7ef	196.2B
Mean	24.15B	26.66A		199.4A	183.21B	
Second season; 2023						
Control	26.82b	27.24b	27.03B	190.8cd	191.2c	191.0B
50 ppm	25.72bc	36.02a	30.87A	188.1de	187.2c	187.6C
100 ppm	23.22de	26.43bc	24.83C	212.4b	172.2f	192.3B
150 ppm	22.12e	24.51cd	23.31D	216.2a	173.6f	194.9A
Mean	24.47B	28.55A		201.9A	181.0B	

- Means within a column or row having the same letters are not significantly different according to DMR t-T at 5 % level.

1- Flowering characteristics:

Data recorded in Table (3) showed that both PP-333 at different concentrations and pinching treatment delayed flowering with various significance levels relative to control treatment in the two seasons. Thus, the least No. days to flowering, i.e., the greatest precocity was attained in both seasons by control plants (no PP-333), which flowered in the 1st season after 183.3 days and after 191.0 days in the 2nd one, as well as and by non-pinched plants ones, which flowered after 183.21 and 181.0 days in the two seasons, successively. As a result, the greatest earliness was achieved in both seasons by combining between the non-pinching treatment and foliar spraying with PP-333 at either 100 or 150 ppm concentration. It was also noticed ,in both seasons, that the mean values of both No. flowers/plant and first flower diameter (cm) were progressively declined with increasing PP-333 level(with few exceptions) in both seasons, as well by non-pinching treatment with significant differences in most cases of the two seasons. However, the highest No. flowers/plant was attained in the first season by 50 ppm PP-333 treatment alone (11.3 flowers/plant), while in the second one by both control (10.6 flowers) and 50 ppm PP-333 treatment (11.4 flowers/plant). Pinching treatment significantly increased elevated No. the formation of flowers from 6.87 flowers in Non-pinched plants to 11.71 flowers in the 1st season and from 7.36 flowers to 12.19 flowers in the 2nd one, and significantly increased the first flower diameter from 3.20 and 3.38 (cm) in non-pinched plants to 3.53 and 3.59 cm in pinched ones in the two seasons, consecutively (Table, 4).

Besides, interactions between control and 50 ppm PP-333 treatment and pinching gave the highest No. flowers/plant in both seasons, whilst the combined treatment between control and 100 ppm PP-333 treatment and pinching achieved in the 1st season the widest diameter of first flower, but in the 2nd one, it was occurred by binding between control and 50 ppm PP-333 treatments and pinching one (Table, 4).

Table (4): Effect of paclobutrozal, pinching and their interactions on No. flowers/plant and first flower diameter (cm) of *Jasminum officinale* L. plant during 2022 and 2023 seasons.

PP-333 treatments	No. flowers/plant			First flower diameter (cm)		
	Pinching	Non-pinching	Mean	Pinching	Non-pinching	Mean
First season; 2022						
Control	13.40a	5.80e	9.60B	3.77a	3.47bc	3.62A
50 ppm	14.53a	8.07b-d	11.30A	3.40b-d	3.27cd	3.33B
100 ppm	9.83b	7.17c-e	8.50BC	3.60ab	3.17d	3.38B
150 ppm	9.07bc	6.73de	7.75C	3.37b-d	2.90e	3.13C
Mean	11.71A	6.87B		3.53A	3.20B	
Second season; 2023						
Control	14.67a	6.53d	10.60A	3.80a	3.60ab	3.70A
50 ppm	14.50a	8.30cd	11.40A	3.60ab	3.47bc	3.53B
100 ppm	10.33b	7.60cd	8.97B	3.53bc	3.37c	3.45B
150 ppm	9.27bc	7.00d	8.13B	3.43bc	3.07d	3.25C
Mean	12.19A	7.36B		3.59A	3.38B	

- Means within a column or row having the same letters are not significantly different according to DMR t-T at 5 % level.

3. Fresh and dry weights of top growth, roots and first flower:

It is obvious from data averaged in Table (5) that the mean values of top growth fresh and dry weights (g) were linearly decreased in response to the progressive increment in PP-333 level to be minimum in the two seasons by 150 ppm level. Pinching treatment also reduced the means of such trait to be significantly less than those recorded by non-pinching one. Accordingly, the heaviest top growth fresh and dry weights were produced by binding between control treatment and non-pinching one, whereas the lightest were attained by

interacting between 150 ppm PP-333 treatments and pinching one.

Table (5): Effect of paclobutrozal, pinching and their interactions on top growth fresh and dry weights of *Jasminum officinale* L. plant during 2022 and 2023 seasons.

PP-333 treatments	Top growth F.W. (g)			Top growth D.W. (g)		
	Pinching	Non-pinching	Mean	Pinching	Non-pinching	Mean
First season; 2022						
Control	21.40b	24.43a	22.91A	8.37ab	9.20a	8.78A
50 ppm	19.97c	20.50bc	20.23B	7.77b	7.57b	7.67B
100 ppm	15.13e	17.30d	16.22C	5.43c	6.27c	5.85C
150 ppm	11.97f	16.60d	14.28D	4.27d	5.80c	5.03D
Mean	17.12B	19.71A		6.46B	7.21A	
Second season; 2023						
Control	22.87b	26.03a	24.45A	8.37b	9.67a	9.02A
50 ppm	21.03c	23.57b	22.30B	7.87b	8.00b	7.93B
100 ppm	16.70e	18.27d	17.48C	5.57d	6.57c	6.07C
150 ppm	12.37f	12.77f	12.57D	4.43e	5.10de	4.77D
Mean	18.24B	20.16A		6.56B	7.33A	

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Concerning the fresh and dry weights of roots (g), the heaviest values were obtained from plants sprayed with either 50 or 100 ppm PP-333 levels in the 1st season and sprayed with only 50 ppm PP-333 level alone in the 2nd one and in non-pinched plants in the two seasons, as well (Table, 6). Further, combining between either 50 or 100 ppm PP-333 levels and non-pinching treatment gave the utmost heavy roots f.w. in both seasons, while the heaviest roots d.w. were acquired in the two seasons by either control or 50 ppm PP-333 level + non-pinching combined treatments.

Table (6): Effect of paclobutrozal, pinching and their interactions on roots fresh and dry weights of *Jasminum officinale* L. plant during 2022 and 2023 seasons.

PP-333 treatments	Roots F.W. (g)			Roots D. W. (g)		
	Pinching	Non-pinching	Mean	Pinching	Non-pinching	Mean
First season; 2022						
Control	4.87c	7.22b	6.04B	2.46cd	3.03ab	2.75B
50 ppm	6.50b	9.22a	7.86A	2.93b	3.26a	3.10A
100 ppm	6.77b	8.97a	7.87A	2.74bc	2.61c	2.67B
150 ppm	5.53c	7.11b	6.32B	2.28d	2.31d	2.29C
Mean	5.92B	8.13A		2.60B	2.80A	
Second season; 2023						
Control	5.33e	7.40c	6.37B	2.60c	3.50ab	3.05AB
50 ppm	6.30d	9.20a	7.75A	2.77c	3.60a	3.18A
100 ppm	5.17ef	8.20b	6.68B	2.53c	3.27b	2.90B
150 ppm	4.77f	6.40d	5.58C	2.23d	2.70c	2.47C
Mean	5.39B	7.80A		2.53B	3.27A	

- Means within a column or row having the same letters are not significantly different according to DMR t-T at 5 % level.

Regarding first flower fresh and dry weights (g), data in Table (7) clear that the means of these two criteria were descendingly decreased as the level of PP-333 was increased, with the prevalence of both control and 50 ppm PP-333 treatments, which gave means very close together. However, the least fresh and dry weights of the first flower was attributed to the highest rate of PP-333 (150 ppm). Pinching treatment significantly improved the mean values of such two traits more than non-pinching one in the 1st season, while in the 2nd one, the differences were non-

significant. The effect of interactions was limited on first flower fresh and dry weights in most cases of both seasons, except of their effects on fresh weight in the first season, which was greatly variable, with the mastership of 50 ppm PP-333 + pinching interaction, that maximized first flower f.w. to the highest value (0.177g) over all other interactions.

Table (7): Effect of paclobutrozal, pinching and their interactions on first flower fresh and dry weights (g) of *Jasminum officinale* L. plant during 2022 and 2023 seasons.

PP-333 treatments	First flower F.W. (g.)			First flower D.W. (g.)		
	Pinching	Non-pinching	Mean	Pinching	Non-pinching	Mean
First season; 2022						
Control	0.157b	0.143bc	0.150A	0.050a	0.037ab	0.043A
50 ppm	0.177a	0.123de	0.150A	0.043ab	0.033ab	0.038AB
100 ppm	0.140b-d	0.110ef	0.125B	0.040ab	0.027b	0.033AB
150 ppm	0.127c-e	0.103f	0.115B	0.033ab	0.023b	0.028B
Mean	0.150A	0.120B		0.042A	0.030B	
Second season; 2023						
Control	0.167a	0.167a	0.167A	0.050a	0.050a	0.050A
50 ppm	0.167a	0.157ab	0.162A	0.050a	0.047ab	0.048A
100 ppm	0.150a-c	0.140b-d	0.145B	0.043ab	0.037ab	0.40AB
150 ppm	0.137cd	0.123d	0.130C	0.037ab	0.027b	0.032B
Mean	0.155A	0.147A		0.045A	0.040A	

- Means within a column or row having the same letters are not significantly different according to DMR t-T at 5 % level.

4. Chemical composition of the leaves:

As shown in Table (8), it is obvious that as the concentration of PP-333 was increased, the concentrations of chlorophyll a, b and carotenoids (mg/g f.w.) were, in parallel increased with few exceptions. Pinching treatment resulted in higher concentrations of chlorophyll a and b than non-pinching one, but both pinched and non-pinched plants contained nearly the same (0.292 and 0.297 mg/g f.w, respectively) of carotenoids. Hence, the highest concentrations of chlorophyll a and b were obtained by 150 ppm PP-333 level + pinching interactions (2.313 and 1.007 mg/g f.w. respectively) followed by 150 ppm PP-333 level + non-pinching one (1.997 and 0.963 mg/g f.w.), consequently, whereas the highest concentration of carotenoids was get by the interacting between both 100 ppm PP-333 + pinching and 150 ppm PP-333 + non-pinching combined treatments (0.325 and 0.327 mg/g f.w., in successive manner).

Table (8): Effect of Paclobutrozal, pinching and their interactions on pigments concentrations in the leaves of *Jasminum officinale* L. plant during 2023 season.

PP-333 treatments	Chlorophyll a (mg/g f.w.)			Chlorophyll b (mg/g f.w.)			Carotenoids (mg/g f.w.)		
	Pinching	Non-pinching	Mean	Pinching	Non-pinching	Mean	Pinching	Non-pinching	Mean
Control	1.774	1.789	1.782	0.778	0.704	0.741	0.263	0.266	0.265
50 ppm PP_{333}	1.819	1.891	1.855	0.836	0.825	0.831	0.281	0.320	0.301
100 ppm PP_{333}	1.931	1.756	1.844	0.898	0.856	0.877	0.325	0.275	0.300
150 ppm PP_{333}	2.313	1.997	2.155	1.007	0.963	0.985	0.297	0.327	0.312
Mean	1.959	1.858		0.880	0.837		0.292	0.297	

A similar trend to that of pigments was also occurred concerning the concentrations of total carbohydrates, N and K as percentages with few exceptions (Table, 9). The opposite was the right in aspect of P %, which was linearly diminished with

elevating the PP-333 application rate, and the non-pinching treatment increased P % (0.260 %) more than pinching one (0.208 %). As a result, the highest percentages of P were acquired by combining between control treatment and either pinching or non-pinching one (0.350 and 0.281 %, respectively).

Table (9): Effect of paclobutrozal, pinching and their interactions on total carbohydrates, N, P and K concentrations in the leaves of *Jasminum officinale* L. plant during 2023 season.

PP-333 treatments	Total carbohydrates (%DW)			N (%DW)			P (%DW)			K (%DW)		
	Pinching	Non-pinching	Mean	Pinching	Non-pinching	Mean	Pinching	Non-pinching	Mean	Pinching	Non-pinching	Mean
Control	19.880	17.751	18.816	1.375	1.263	1.319	0.350	0.281	0.316	1.823	1.575	1.699
50 ppm	23.614	24.737	24.176	1.830	1.516	1.673	0.162	0.248	0.205	1.875	1.676	1.776
100 ppm	25.217	39.234	32.226	2.851	1.678	2.265	0.169	0.259	0.214	1.853	1.693	1.773
150 ppm	28.565	40.273	34.419	2.173	1.923	2.048	0.149	0.251	0.200	2.025	1.678	1.852
Mean	24.319	30.499		2.057	1.595		0.208	0.260		1.894	1.656	

From going, it can be proposed to spray the foliage of pinched common white jasmine trees plants with 100 ppm of PP-333 and those now pinched ones with 150 ppm of PP-333, three times with 3 weeks interval to obtain the most suitable dwarf, floriferous and compact specimens reliable for commercial marketing.

Discussion

The results of this study showed that PP-333 treatments caused in most cases a reduction in some characters, mainly plant height, No. branches and leaves, flower number and diameter and fresh and dry wrights of some plant organs, especially at the high concentration. This may be due to that PP-333 increases the production of ABA, which is accompanied with GA_3 and auxin decrement in the subapical meristematic zone of the stem, and consequently retards stem elongation by reducing cell division and enlargement (Zamani et al., 2016). In this regard, Barbosa et al., (2008) declared that paclobutrazal is a growth retardant that inhibits the biosynthesis of GA_3. Asgarian et al., (2013) cited that the height of plants could be decreased by PP-333 treatments through shortening internode length. Besides, Li et al., (2005) noticed that the new semi-dwarf genes [sd-9 (t)], sd-g and eui genes in rice varieties/lines were the most sensitive to PP-333 treatments, whereas multi-gene combination variety 83N1041 and DM107-4 with d-59 were greatly insensitive.

Supporting observations to the previous results were record by Pappiah and Muthuswamy (1977) who found that applying MH at 1000-3000 ppm, CCC at 50-1500 ppm and ethrel at 100-500 ppm to 3-year-old-plants of *Jasminum grandiflorum* at bimonthly intervals starting 45 days after pruning in late December reduced plant and shoot lengths and delayed flowering. Likewise, Bhattacharjee (1983) reported that spraying CCC or B-9 at 1000-5000 ppm and ethrel at 500-2000 ppm retarded vegetative and root growth of *J. grandiflorum* plants. Corolla tube length and flower diameter were also reduced. On *J. officinale* sprayed with PP-333 at 0, 50, 100 and 200 ppm concentrations for either 3 times with 5 days interval or 2 times with 30 days interval, El-Sayed at al. (2010) revealed that plant height, No. branches and leaves/plant, as well as leaves, stem and roots fresh and dry weights were gradually decreased with increasing PP-333 concentration, except of 200 ppm PP-333 treatment which acquired higher No. branches and leaves than 100 and 150 ppm levels and heavier dry weights of leaves, stem and roots, especially when applied 2 times with 30 days interval. Flowering was also delayed by most of PP-333 treatments and No. flowers/plant was linearly decreased with increasing PP-333

rate. The first flower diameter was not affected by either treatment used in this study, except of PP-333 at 200 ppm treatment, thrice with 15 days interval, which significantly reduced the mean values of such trait to minimum.

On the other ornamentals, similar results were reported by Asgarian et al., (2013) who stated that PP-333 at 10, 20 and 30 ppm concentrations caused a significant reduction in height of zinnia main stem and number and length of lateral branches. Abou-Dahab et al., (2015) recommended to pinch *Russelia equisetiformis* plants for two times plus spraying them with PP-333 at either 150 or 200 ppm concentration for producing stunted specimens of good quality. Narayan (2015) observed that cultar at 35 ppm concentrations was more effective in reducing growth of marigold (*Tagetes erecta*) plant than NAA (at 400 ppm concentration), as it reduced plant height from 66.36 (by NAA) to 38.49 cm, No. branches/plant from 17.51 (by NAA) to (10.02), No. leaves/plant from 172.32 to 101.01, No. roots/plant from 16.14 to 10.25, tap root length from 25.22 to 18.25 cm, No. flowers/plant from 30.42 to 16.23, flower diameter from 5.96 to 3.01 cm, flower size from 28.56 to 22.22 cm^3, flower f.w. from 9.73 to 7.06 g and flower d.w. from 2.51 to 1.95 g.

On *Hibiscus rosa-sinensis* cv. Yellow, El-Sadek (2016) advised to spray the foliage of pinched plants with PP-333 at 40 ppm concentration to produce the well compact, dwarfed plants. Zamani et al., (2016) mentioned that paclobutrazol and trinexapac-ethyl are the most effective and least harmful growth retardants widely used for inducing more dwarf and denser plants with both darker and thicker leaves. Thus, they carried out a study to investigate the effect of these two retarders; PP-333 at 1000 and 4000 ppm and trinexapac-ethyl at 1000 ppm concentration on growth of rosemary and thuja "Morgan" as two hedge plants and found that such treatments decreased plant height and width, wet and dry weights of vegetative pruned parts and internode elongation. Likewise, Heikal (2017) postulated that spraying the foliage of *Sanchezia nobilis* plant with PP-333 at 24 mg/l concentration decreased all the studied growth traits, in terms of plant height, stem diameter, leaf area, root length, No. leaves and inflorescences, as well as fresh and dry weights of leaves, shoots, roots and inflorescences. On the contrary, Mohammed et al., (2017) on *Lagerstroemia indica* treated with different concentrations and application methods of PP-333, claimed that application of PP-333 either as foliar spray or as soil drench at 3000- 4500 ppm reduced plant height by about 75 and 90 % compared to control plant, respectively, whereas PP-333 at 1500 ppm applied as soil drench increased No. flowers by 25 % and at 3000 ppm as foliar spray increased it by 21% over control plants. The foliar application of PP-333 produced significantly more leaves and branches compared to those produced by the soil drench method.

On 13-17 cm in height potted fuchsia plants, Deniz and Omer Faruk (2018) elicited that pouring application of PP-333 (12.5 ppm) caused significant shortening of plant height (21.7 cm) compared to control (38.0 cm), with smaller flower size. Maine et al. (2019) on ornamental pepper cv. Pyramid, elucidated that foliar application of PP-333 produced robust seedlings with reduced size and desirable characteristics for ornamental purposes. Similarly, Dong et al., (2020) reported that either uniconazole or PP-333 at a concentration of 40 mg/l reduced plant height and leaf area of *Paeonia lactiflora* potted plants with increasing stem diameter. Such treatments were less effect on flowering, but were the best for dwarfing this plant and ideal for giving compact, strong stem and darker leaves, which greatly improved the ornamental value of *P. lactiflora* as pot plant.

Additional reports were also revealed by Noor El-Deen (2020) who decided that single

pinching + foliar spraying with PP-333 at 100 ppm was the superior combined treatment suitable for reducing the height of *Ruellia simplex* plants with increasing No. branches and flowers, but decreasing, No. leaves/plant, giving the best compact, dense and flowering pot plant. Similarly, Shahin and Moustafa (2021) produced a good dwarf specimen from *Althaea rosea* plant suit for house beautification in winter by the foliar spray with CCC at 3000 ppm concentration, 3 times with one month interval. Recently, Noor El-Deen and Abou-Elghait (2022) clarified that increasing PP-333 concentration up to 150 ppm resulted the least values of plant height, No. branches and leaves and No. flowers/plant with the lightest vegetative growth fresh and dry weights in *Hibiscus rosa-sinensis* cv. Cooperi plant, except of PP-333 at 100 ppm level which recorded the best values.

The results, also exhibited that pinching treatment reduced the mean values of most growth attributes relative to non-pinching treatment, with the exception of stem diameter and No. branches and flowers/plant. This may be ascribed to that pinching cancels the apical dominance of the terminal bud and induces redistribution for auxins, leading to activate the lateral buds, which in turn give more branches and flowers on the constant height of the pinched stem (Mahmoud et al., 2008).

Analogous results were also detected by Abou-Dahab et al., (2015) who noticed that pinching of *Rusellia equisetiformis* plant for only one time gave the highest No. lateral shoots and flowers/plant, with rising their fresh and dry weights, whereas pinching them for two times greatly reduced plant height, but increased No. main shoots, root length and No. root/plant. On *Hibiscus rosa-sinensis* cv. Yellow El-Sadek (2016) affirmed that pinching decreased plant height and flowers fresh and dry weights, but elevated No. side branches.

Another findings can be fortified the previous results of pinching treatment were attained, as well by Mahmoud et al., (2008) who revealed that pinching *Nerium oleander* transplants for one time after one month from transplanting significantly increased No. branches compared to non-pinched plants, while significantly decreased plant height, stem diameter, No. leaves, leaf area, root length, aerial parts and roots fresh and dry weights, No. days to flowering and floret diameter. No. inflorescences/ plant were closely near together in pinched and non-pinched plants. Likewise, Noor El-Deen (2020) found that the sole pinching treatment after one month from transplanting gave the dense foliage and compact plants of *Ruellia simplex*.

The results of such study also implied that PP-333 treatments improved concentrations of pigments, total carbohydrates, N and K, but P concentration was reduced. On the other side, pinching treatment enhanced chlorophyll a and b, N and K concentrations over non-pinching one, which raised carotenoids, total carbohydrates and P concentrations in the leaves of pinched plants. This may be reasonable, where the most scientists affirmed that PP-333 not only increases chlorophyll biosynthesis, but also increases GA_3 and IPA (isopentenyladenosine) formation with simultaneous disappearing of ABA (Barbosa et al., 2008).

The aforestated gains are in accordance with those postulated by El-Sayed et al., (2010) who observed that pigments concentration in the leaves of *Jasminum officinale*, especially carotenoids was gradually increased with uptaking PP-333 concentration. On other ornamentals, Mahmoud et al., (2008), noticed that PP-333 at 50 ppm level raised chlorophyll a and b content in the leaves of pinched and non-pinched oleander plants, while pinching alone caused a significant reduction in pigments, indoles and phenols content. Adversely, Shahin et al., (2014) found that PP-333 at 50 or 100 ppm concentration increased the leaf

content of chlorophyll a, b, carotenoids, total soluble sugars, indoles and phenols in *Chrysanthemum carinatnm* winter annual herb plant. On *Russelia equisetiformis* prepared to use as a pot plant, Abou-Dahab et al. (2015) demonstrated that pinching treatment for two times raised chlorophyll a and carotenoids content to maximum, while chlorophyll b and phenols content was slightly increased, but indoles content was greatly decreed. PP-333 at 150 ppm level gave the highest content of chlorophyll a and b, whereas the highest content of carotenoids was acquired by 200 ppm PP-333 level. Likewise, *Hibiscus rosa-sinensis* cv. Yellow plants sprayed with 40 ppm PP-333 rate with or without pinching had higher concentration of total carbohydrates, indoles and phenols, whilst PP-333 alone at 4 ppm rate as soil drench increased chlorophyll a and b giving darker leaves (El-Sadek, 2016). Besides, Zamani et al., (2016) indicated that spraying the foliage of rosemary and thuja "Morgan" plants with PP-333 at 1000 and 4000 ppm concentrations increased proline, chlorophyll a and b and total chlorophyll (a + b) content more than control plants. Also, foliar application of PP-333 at 16 mg/l markedly increased total carbohydrates and mineral contents in the leaves of *Sanchezia nobilis* plants (Heikal, 2017).

Another documented reports were also decided by Deniz and Omer Faruk (2018) who declared that pouring application of PP_{333} at 12.5 ppm level makes leaves of fuchsia more darker/greener than those of control ones. On *Ruellia simplex*, Noor El-Deen (2020) noticed that single pinching + 100 ppm PP333 (foliar spray) combination resulted the highest records of chlorophyll a and b, carotenoids and total indoles. Similarly, Noor El-Deen and Abou-Elghait (2022) on *Hibiscus rosa-sinensis* cv. Cooperi, claimed that PP_{333} at 100 ppm concentration recorded the highest concentrations of chlorophyll a, b, carotenoids and indoles.

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إنتاج نماذج مقزمة من نباتات الياسمين البلدي

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أجريت تجربة أصص بمشتل معهد بحوث البساتين، مركز البحوث الزراعية، الجيزة، مصر تحت ظروف الجو المكشف خلال موسمي 2022، 2023 لدراسة تأثير الباكلوبيوترازول (PP-333) بتركيزات صفر، 50، 100 و 150 جزء/المليون رشاً على الأوراق، معاملات التطويش وعدم التطويش والتفاعلات بينهما على النمو، الإزهار، والتركيب الكيميائي لنبات الياسمين البلدي (*Jasminum officinale* L)، بقصد إنتاج نباتات مقزمة مزهرة تصلح كنباتات أصص لتزيين/تجميل الأماكن الصغيرة، محدودة المساحة في تجربة عاملية وزعت فيها المعاملات توزيعاً عشوائيا، بتكررات ثلاثة.

أوضحت النتائج المتحصل عليها أن القيم المتوسطة لارتفاع النبات، عدد الأفرع والأوراق/نبات، عدد الأزهار/نبات، قطر أول زهرة وكذلك الأوزان الرطبة والجافة للنمو الخضري ولأول زهرة قد انخفضت تدريجياً بزيادة معدل إضافة الباكلوبيوترازول، بينما زادت تصاعاديا متوسطات قطر الساق، طول الجذر، عدد الأيام من الزراعة حتى الإزهار والوزن الطازج والجاف للجذور، مع بعض الاستثناءات القليلة بكلا الموسمين. على الجانب الأخر، أحدثت معاملة التطويش انخفاضاً معنوياً في متوسطات ارتفاع النبات، عدد الأوراق/نبات، طول الجذر وكذلك الأوزان الطازجة والجافة للنمو الخضري والجذور، بينما أحدثت زيادة معنوية في متوسطات قطر الساق، عدد الأفرع والأزهار/نبات، عدد الأيام من الزراعة حتى الإزهار وأيضاً في متوسط قطر الزهرة مقارنة بمعاملة عدم التطويش في كلا موسمي الدراسة. علاوة على ذلك، فإن معاملات التفاعل المشترك كان لها تاثيرات ملحوظة على مختلف صفات النمو والإزهار وبمستويات معنوية متباينة فيما بينها. إلا أن أفضل النتائج تم الحصول عليها إما من رش النباتات المطوشة بالباكلوبيوترازول (تركيز 100 جزء/المليون) أو رش النباتات الغير مطوشة بنفس المقزم (تركيز 150 جزء/المليون)، حيث أحرزت هاتين التوليفتين التقزيم الأمثل من حيث ارتفاع النبات وعدد الأفرع الملائم لعدد الأوراق وعدد الزهار المتكونة عليها.

أظهرت النتائج أيضاً أن الرش بالباكلوبيوترازول أحدث تحسناً في محتوي الاوراق من كلوروفيل أ، ب، الكاروتينويدات، الكربوهيدرات الكلية، النيتروجين والبوتاسيوم، لكنها خفضت النسبة المئوية للفوسفور. كما أن معاملة التطويش ادت الي تحسينً محتوى الأوراق من كلوروفيل أ، ب، النيتروجين والبوتاسيوم، لكنها خفضت محتوي الاوراق من الكربوهيدرات الكلية والفوسفور مقارنة بمعاملة عدم التطويش. ولقد أدت معاملات التفاعل المشترك بين أعلى تركيز للباكلوبيوترازول (150 جزء/المليون) ومعاملة التطويش أو عدمه إلى زيادة تركيزات الصبغات، الكربوهيدرات الكلية، النيتروجين والبوتاسيوم لأعلى القيم في معظم الحالات، بينما كان العكس صحيحاً فيما يتعلق بتركيز الفوسفور.

طبقاً لهذه النتائج، يمكن النصح برش أوراق شتلات الياسيمن البلدي المطوشة بمحلول الباكلوبيوترازول (تركيز 100 جزء/المليون) والتي لم تطوش بتركيز (150 جزء/المليون)، ثلاث مرات وبفاصل ثلاثة أسابيع بين كل مرتين للحصول على أفضل قيمة جمالية لنباتات الياسيمن البلدي المقزمة، المزهرة في أصص مع أفضل صفات النمو الخضري والزهري من الناحية التجارية.