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Effect of Paclobutrazol and Pinching on Cestrum Nocturnum Plants

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Abstract

A pot experiment was carried out to investigate the effect of paclobutrazol at the rate of 0, 400,500,600 ppm (as soil drench)and pinching once or twice on Cestrum nocturnum plants. The obtained results revealed that pinching the plants once decreased the fresh weight of branches, but increased N% in the branches and P% in the shoots. Pinching the plants twice decreased the branch length and the dry weight of branch; meanwhile it increased the stem and branch diameter, number of branches, fresh and dry weights of shoots, chlorophyll a and carotenoids content, P% in branches as well as K% in shoots. Paclobutrazol at 400 ppm caused an increase in the stem and branch diameter, number of branches/plant. The concentration of 500 ppm of paclobutrazol decreased the fresh and dry weights of the shoots, but it increased the number of branches/plant, chlorophyllaa,b and carotenoids content in the shoots as well as N and K %in the shoots. The combination between paclobutrazol at 500 ppm and pinching twice decreased the length of branches, but enhanced the stem and branch diameter, number of braches/plant, fresh and dry weights of shoots as well as the carotenoids content in the shoots.

From the aforementioned results, it could be recommended the use of pinching the plants for two times alone or with the treatment of paclobutrazol at 500 ppm in order to produce a compact plant of high vegetative growth characters for using as a pot plants.

Key words: - Cestrum nocturnum, paclobutrazol and pinching

Introduction

Cestrum nocturnum plant: night blooming Jessamine, night Jessamine, night blooming cestrum. Fam: - Solanaceae Description : This sprawling shrub has glossy smooth, simple leaves, 4 - 8feet long vine-like stems reach up to 12 feet in its native habitat, but it seldom reaches more than 4 feet mound in a single season.It blooms in cycles throughout warm weather . Greenish-creamy white tubular flowers rise from above leaves along the stem followed by shiny white, fleshy berries. Although the flowers are not showy to the eye, their sweet scent can over power.

Pinching is the removal of the growing point of the stem, reslting in the development of more side shoots. Pinching the plants will reduce the height of the plant which in turn helps to develop a shorter stockier plant and provide a bushy, heavily branched plant (Mason, 2005).

Paclobutrazol is a plant growth retardent that slows the vegetative growth by inhibiting gibberellin biosynthesis creating more compact plants (Wang and Blessington,1990). It can be used as a tree injection, soil incorporation and basal drench to reduce above ground vegetative growth (Mishra and Mishra, 2006).

Paclobutrazol as growth retardant and pinching can be used for controlling the plant height of ornamental plants. Shibayama and Akasaka (2006) on peach pointed out that when pinched was cariedout , the total branch number and the dry matter weight were the highest. Sunitha et al. (2007) indicated that pinching significantly increased the number of primary branches of African marigold. EI-Quesni et al. (2007) found that foliar application of paclobutrazol at 500 ppm promoted the number of branches. Leaves/plant, stem diameter, fresh and dry wights of Bougainvillea glabra plant organs, but decreased the plant height. Chemical constituents i.e. chlorophyll (a), chlorophyll (b), carotenoids, total carbohydrates, nitrogen and potassium content were increased. Siqueira et al.(2008) showed that paclobutrazol (225 mg a.i/plant) significantly reduced the length, stem diameter and leaf area of "Volkameriano" lemon plants. Thenumber of leaves was not influenced. Hwang SeungJae et al(2008) mentioned that foliar application of paclobutrazol at 0.5 mg/pot: after pinching decreased the plant size and stem diameter of Kalanchoe cultivar "Gold Strike".

Therefore, this investigation was carried out to study the influence of paclobutrazol and pinching alone or in combination on vegetative growth and the chemical constituents of Cestrum nocturnum plants.

Materials and methods

A pot experiment was carried out at the nursery of the Ornamental Horticulture Department, Faculty of Agriculture, Cairo University, Giza, during the two successive years of 2005 and 2006. The aim of this study was to investigate the effect of paclobutrasol as a soil drench and pinches alone or in combination on vegetative growth and chemical constituents of Cestrum noctornum plants.

Plant materials:

Seedlings of Cestrum noctornum used were obtained from a brivete nursery at Geser El-Sewez (Egypt-Cairo).

On 27th February 2005 and 2006, two months old stem (plants) were transplanted in plastic pots (20 cm diameter) filled with a mixture containing clay and sand at the ratio of 1:1 (v/v). The physical and chemical analysis of the used medium were performed before the experiment using the pipette method (Piper, 1947) and are shown in Tables A and B.

Table A. Mechanical analysis of the used soil.

Mechanical analysis	
Sand %	47.64
Silt %	30.56
Clay %	21.80
Soil texture	Sandy clay loam

Table B. Chemical analysis of the used soil.

CationsMeq/L		Anions Meq/L					
Na+	14.23	HCO-	3.55	pH	7.85	N	290 ppm
K+	0.67	SO4-	21.20	E. C.	2.73 mmhos	P	26.73 ppm
Ca++	11.25	Cl-	11.62	Organic matter	1.28 %	K	43.17ppm
Mg++	7.28						

E.C.: Electrical conductivity

Experimental procedures:

The plants (with two branches) were cut back to 35 cm from the pot surface. On 27th march 2005 and 2006 all the plants were fertilized with NPK at the ratio of 1:1:1 at the rate of 3g / pot four times. The application started on 27 April 2005 and 2006 and repeated every three months. The concentrations used of Paclobutrazol at the rate of 0, 400,500 or 600 ppm were used. Fifty ml of each concentration were added to each pot (20 cm diameter) as a soil drench on 27th April 2005 and 2006 and repeated every three months for four times. The plant were pinched on 27th June 2005 and 2006 and repeated with some treatments after three months. The plants were irrigated whenever needed. The treatments were done:

1. Control (with out pinching and pacloputrazol).
2. Pinching once.
3. Pinching twice.
4. Pacloputrazolat the rate of 400 ppm.
5. Pacloputrazol at the rate of 400 ppm + Pinching once.
6. Pacloputrazolat the rate of 400 ppm + Pinching twice.
7. Pacloputrazol at the rate of 500 ppm.
8. Pacloputrazol at the rate of 500 ppm + Pinching once.
9. Pacloputrazol at the rate of 500 ppm + Pinching twice.
10. Pacloputrazol the rate of at 600 ppm.
11. Pacloputrazol at the rate of 600 ppm + Pinching once.
12. Pacloputrazol at the rate of 600 ppm + Pinching twice.

The following data were recoded every four months in the two years (2005 and 2006) and the end of experiment at (2007).

A. Vegetative growth:

- Number of branches / plant.
- Branch length (cm).
- Stem diameter (cm).
- Fresh and dry weights of vegetative growth (g) / plant.
- Fresh and dry weights of roots (g) / plant.

B. Chemical constituents:

- Chlorophylls (a) and (b) and carotenoids contents in the fresh leaves (mg/g/Fw).
- Elements contents (N, P and K) in the shoots (percentage).

Chemical analysis procedures:

1. Pigments determination:

Chlorophylls and carotenoids contents with leaves determination was carried out in fresh leaves samples according to Saric et al. (1967).

2. Total carbohydrates determination:

Total carbohydrates contents in shoots were determined according to Herbert et al. (1971).

3. Nutrient elements determination:

A. Nitrogen determination(percentage):

Nitrogenpercentage was determined by modified Micro Kjeldahl method as described by Pregl (1945) and Piper (1947).

B. Phosphorus determination:

Phosphorus content was determined according to Troug and Meyer (1939).

C. Potassium determination:

Operation chart of Shimadzu Atomic Absorption / Flame Spectrophotometer AA-646 with a boiling air acetylene burner and recorded read out was used to determine potassium.

Experimental design and statistical analysis:

The layout of the experiment was a complete randomized in factorial experiment. Factor (A) was paclobutrazol treatments and factor (B) was pinching

treatments. The experiment included 12 treatments with 3 replicates. Each replicate consisted of 5 plants. The statistical analysis was carried out according to Snedecor and Cochran (1982). L.S.D. at 0.o5 was used to compare the differences between means of different treatments.

Results and discussion

A- Effect on vegetative growth:

1-Number of branches / plant:

From the data in Table (1) it can be observed that pinching the plants increased the number of branches / plant over the control in the first season season, The greatest number of branches / plant (4.00 branches / plant) was found in the plants pinched once in the first season. In the second the control plants had the greatest number of branches / plant (6.75 branches / plant). The least number of branches / plant (3.42 branches / plant) was formed in the control plants in the first season, however in the second one, pinching the plants once and twice with the contralcaused the least number of branches / plant.

As for paclobutrazolIn both seasons, the control plants had the greatest number of branches / plant (4.33 and 6.89 branches / plant, respectively). The least number of branches / plant (2.89 branches / plant) was obtained as a result of treating the plants with paclobutrazol at the rate of 400 ppm in the first season and 500 ppm (4.89 branches / plant) in the second one.

For combination between paclobutrazol and Pinching the plants once or twice increased the number of branches / plant (5.00 branches / plant) in the first season. The control plants had the greatest number of branches / plant in the second season. The least number of branches / plant (2.67 branches / plant) was formed as a result of treating the plants with paclobutrazol at 400 ppm eitheralone or with pinching twice in the first season. In the second one, the least number of branches / plant (4.67 branches / plant) was found in the plants received paclobutrazol at the rate of 400 ppm and pinching once and the rate of 500 or 600 with pinching twice

Similar results were obtained by Rai et al. (2006) on tomato cv. Manileima found that all the concentrations of PP333 (20, 30, 40 and 50 mg /litre) significantly reduced plant height and internode length, but increased the number of branches, number of secondary root. PP333 at 30 and 40 mg/litre was best for increasing the number of branches and number of secondary roots. El-Quesni et al. (2007) on Bougainvillea glabraSunitha et al. (2007) on African marigold, pointed out that pinching the plants significantly increased the number of branches/plant and Ibrahim (2008) on pelargonium who found that treating the plants with paclobutrazol increased the number of branches/plant.

2-Branch length (cm):

In Table (1) the data show that pinching the plants increased the length of branches over the control plants in the two season. In the first seasons, the tallest branches (63.80 cm) were obtained from pinching the plants twice in the first season. In the second one,pinching the plants once resulted in the tallest branches (69.13 cm). The control plants had the shortest branches (56.22 and 63.19 cm, respectively) in both seasons.

Treating the plants with paclobutrazol caused a significant increase in the length of the branches in the two seasons. Application of paclobutrazol at the concentration of 400 ppm resulted in tallest branches (66.81 and 67.21 cm, respectively) in both seasons. The shortest branches (55.60 and 64.03 cm, respectively) were found in the control plants in the two seasons.

Concerning the effect of the interaction, data in Table (1) indicate that the tallest branches (77.30 cm) were formed in the plants supplied with paclobutrazol at the concentration of 400 ppm and pinched twice in the first seasons, while in the second one the same concentration of paclobutrazol with pinching once gave the tallest branches (75.73 cm). The shortest branches (51.70 and 61.07 cm, respectively) were formed due to the application of paclobutrazol at the rate of 600 ppm without pinching.

These findings are in harmony with those pointed out by Karaguzel et al. (2004) on Lupinusvarius and Pinta et al. (2005) on zinnia who mentioned that paclobutrazol significantly reduced the length of side branches. Moraes et al. (2005) found that plant height of tomato (468 BGH accession) was reduced by 20% when the paclobutrazol concentration was increased up to 30 mg a.i. litre (foliar application). Similar effects were observed with regard to internode length. Grossi et al. (2005) sprayed the canopy of ornamental pepper (Capsicum chinensecv. Pitanga) with paclobutrazol at 0, 30, 60, 90, 120 or 150 mg a.i. litre or applied as drench a soil at 0, 5, 10, 15, 30 or 60 mg a.ilitre. They found that increasing the paclobutrazol concentration reduced plant height. Currey et al. (2010) found that paclobutrazol (2.0 or 4.0 ppm) suppressed final stem length of Calibrachoa hybrid. Final height of pansy was suppressed by each concentration of paclobutrazol.

3-Stem diameter:

As for pinching the data in Table (1) revealed that, in the first season, pinching the plants twice resulted in the thickest stems (2.69 cm), while in the second one, the thickest stems (1.69 cm) were found in the plants pinched once. The thinnest stems (2.58 cm) were obtained from the plants pinched once in the first season. In the second one, the control plants had the thinnest stems (1.51 cm).

Application of paclobutrazol at the rate of 400 ppm was the most effective treatment in increasing

the stem diameter (3.6 cm) in the first season, meanwhile in the second year, applying the plants with the rate of 600 ppm led to the thickest stems (1.69). The thinnest stems (2.06 and 1.50 cm, respectively) were obtained from the control plants in the two years.

The combined treatments of pinching and paclobutrazol showed that all treatments which were used increased the stem diameter campaneto the control in both years, except the treatments at the rate of 400 ppm of paclobutrazol alone and 500 ppm of paclobutrazolwith pinching once in the second season. In the first seasons, the thickest stems (3.60 cm) were observed in the plants treated with paclobutrazol alone at 400 ppm. In the second one, pinching the plants once plus the same concentration of paclobutrazol resulted in the thickest stems (2.06). The control plants had the thinnest stems (1.97 cm) in the first season. In the second one, the plants pinched once and supplied with paclobutrazol at 500 ppm showed the thinnest stems (1.37 cm) followed by 400 ppm of paclobutrazol alone (1.38 cm).

These results were in agreement with those obtained by Liu XinBao et al. (2004) who found that paclobutrazol at the rateof 750mg/kg inereased the stem diameter of Trifoliumrepens. Grossi et al. (2005) on ornamental pepper plants mentioned that in creasing the paclobutrazol concentration reduced the plant dimeter. AbouDahab and Habib (2005) pointed out that treating the pinched plants of Barleria with paclobutrazol at the rate of 400 ppm increased the stem diameter. Qin Li and Zhang YueChen (2010) showed that spraying paclobutrazol could decrease plant height, increase stem diameter, potato yield and quality obviously, raise leaf photosynthetic rate and contents of chlorophyll, soluble sugar and starch, and reduce water content.

Table 1. Effect of paclobutrazol and pinching treatments on the stem diameter (cm), number of branches / plant and branch length (cm) of Cestrum nocturnum plants during the two years of 2005 and 2006.

Paclobutrazol (A)	First season														
	Number of branches /plant					Branch length (cm)					Stem diameter (cm)				
Pinching (B)	0	400	500	600	Mean	0	400	500	600	Mean	0	400	500	600	Mean
0	3.00	2.67	3.67	4.30	3.42	58.67	54.13	60.37	51.70	56.22	1.97	3.60	2.67	2.50	2.68
Once	5.00	3.33	4.00	3.67	4.00	56.33	69.00	52.33	57.80	58.87	2.03	2.80	2.60	2.87	2.58
Twice	5.00	2.67	4.00	3.33	3.75	51.80	77.30	64.10	62.00	63.80	2.17	2.40	3.40	2.60	2.69
Mean	4.33	2.89	3.89	3.78		55.60	66.81	58.93	57.17		2.06	2.93	2.89	2.66	
LSD at 0.05	A = 0.71 B = 0.61 A x B = 1.22					A = 1.28 B = 1.11 A x B = 2.22					A = 0.18 B = 0.16 A x B = 0.32				
	Second season														
0	8.67	6.67	5.00	6.67	6.75	64.87	62.77	67.07	61.07	63.19	1.44	1.38	1.54	1.69	1.51
Once	6.67	4.67	5.00	5.00	5.33	64.30	75.73	64.27	72.20	69.13	1.60	2.06	1.37	1.74	1.69
Twice	5.33	5.67	4.67	4.67	5.08	62.93	63.13	69.17	66.63	65.47	1.47	1.46	1.80	1.65	1.59
Mean	6.89	5.67	4.89	5.44		64.03	67.21	65.83	66.63		1.50	1.63	1.57	1.69	
LSD at 0.05	A = 0.84 B = 0.73 A x B = 1.46					A = 0.97 B = 0.87 A x B = 1.68					A = 0.04 B = 0.03 A x B = 0.06				

4-Shoot fresh weight (g):

Concering of the pinching the data shown in Table (2) pointed out that pinching the plants twice increased the fresh weight of shoots (138.75 and 217.18 g, respectively) in both seasons. The control plants had the lights shoots (98.13 g) in the first season, while in the second one the lightest branches (166.13 g) were formed in the plants pinched once.

Supplying the plants with paclobutrazol at the rate of 400 ppm resulted in the heaviest branches (135.00 g) in the first season. However, the concentration of 600 ppm was the most effective in increasing the shoot fresh weight (233.08 g) in the second one. The control plants had the lightest shoots (90.83 g) in the first season. But in the second one the lightest shoots (168.07 g) were obtained from the plants received paclobutrazol the concentration of 400 ppm.

All the combination treatments between paclobutrazol and pinching increased the fresh weight over the control plants in the first season. Treating the plants with paclobutrazol at the concentration of 400 or 600 ppm plus pinching twice resulted in the formation of the heaviest shoots (155.00 g), while the control plants had the lightest shoots (70.00 g) in the first season. In the second one, the heaviest shoots (248.09 g) were obtained from the plants supplied with 500 or 600 ppm paclobutrazol and pinched twice. The lightest shoots(128.83 g) were formed as a result of treating the plants with the same concentration of paclobutrazoland pinching once.

5-Shoot dry weight (g):

The data presented in Table (2) indicate that in the first season, pinching the plants once increased the dry weight of shoots (51.25 g). This may be due to the increase in the number of branches / plant. The control plants had the least dry weight of shoots (34.75 g). In the second season, pinching the plants twice was the most effective in increasing the dry

weight of shoots (54.44 g), while pinching the plants once resulted in the lightest shoots (40.47 g).

Application of paclobutrazol increased the dry weight of shoots over the control in the first season. The heaviest shoots (51.33 g) were found in the plants treated with paclobutrazol at the rate of 400 ppm. This may be due to the increase in the length of branches. The control plants had the lightest shoots (37.17 g). In the second season, the heaviest shoots (51.97 g) were obtained from the control plants. The lightest shoots (44.67 g) were formed as a result of treating the plants with paclobutrazol at the concentration of 400 ppm.

As for the combination, the heaviest dry weight of shoots (62.50 g) resulted from treating the plants with paclobutrazol at the concentration of 400 ppm and pinching once in the first season. The lightest dry weight of shoots (29.00 g) was found in the control plants. In the second one, the heaviest shoots (63.65 g) were obtained from the plants received paclobutrazol at the rate of 500 ppm and pinched twice.Applyingpaclobutrazol at the concentration of 600 ppm and pinching the plants once resulted in the lightest dry weight of shoots (31.30 g).

These results are in harmony with those attained by Grossi et al. (2005) on ornamental pepper plant and Ding ChengLong et al.(2005) on Festucaarundinacea who found that increasing the paclobutrazol concentration reduced the plant dry mass. AbouDahab and Habib (2005) on Barleriacristata indicated that the fresh and dry weights of aerial parts were decreased by paclobutrazol. PartidaRuvalcaba et al. (2007) treated Capsicum annuum var. 'California Wonder' and eggplant (Solanummelongena var. 'Dalia') with PBZ at 0 (control), 100, 150, 200, 250, 300 and 350 mg. They found that PBZ increased biomass production of root and shoot in both plants species, compared to the control; 150 mg L was the best dosage for bell pepper because it increased 1.1 times the length, 3.7 times the fresh matter and 13 times the dry matter of roots, and it increased 1.5 and 6.7 times the fresh and dry matter of shoots, respectively. In eggplant roots PBZ caused a gain of 1.3 times in fresh matter and 71% in dry matter, and in shoots it increased 81% the fresh matter and 89% the dry matter. Samia (2008) indicated that application of three foliar sprays of paclobutrazol at 10, 20 and 30 ppm, at 3- week intervals were to potted plants of Anisacanthuswrightii significantly decreased most of the studied characteristics (plant height, leaves number, fresh and dry weights of leaves, fresh and dry weights of vegetative parts, root length and fresh and dry weights of roots). The application of high concentrations of paclobutrazol decreased chlorophyll a and b. Also, total carbohydrates were linearly decreased with raising paclobutrazol concentration. Roghaieh et al. (2011) indicated that lower concentrations of paclobutrazol (1, 2 and 4 micro M) are able to increase salinity resistance of tomato. Leaf numbers, shoot and root fresh weight increased by paclobutrazol treatments in medium containing 50 mM of NaCl. Saraswathy et al.(2011) showed that the values of root length, root girth, primary root weight, root fresh and dry weights, and root bark weight per plant of Withaniasomnifera were greatest under pinching.

Table 2. Effect of paclobutrazol and pinching on the shoot fresh and dry weights (g) of Cestrum nocturnum plants during the two years of 2005 and 2006.

Paclobutrazol (A) Pinching (B)	First season									
	Shoot fresh weight (g)					Shoot dry weight (g)				
	0	400	500	600	Mean	0	400	500	600	Mean
0	70.00	110.00	110.00	102.50	98.13	29.00	37.50	37.50	35.00	34.75
Once	77.50	140.00	127.00	125.00	117.50	37.00	62.50	55.00	50.00	51.25
twice	125.00	155.00	120.00	155.00	138.75	45.00	54.00	40.00	50.00	47.25
Mean	90.83	135.00	119.17	127.50		37.17	51.33	44.17	45.00	
LSD at 0.05	A = 2.20 B = 1.91 A x B = 3.82					A = 2.35 B = 2.04 A x B = 4.07				
	Second season									
0	243.56	170.23	154.86	255.22	205.97	59.89	41.79	37.44	61.89	50.25
Once	195.44	157.46	128.83	128.83	166.13	50.06	44.76	35.73	31.30	40.47
twice	178.87	176.53	248.09	248.09	217.18	45.95	47.46	63.65	60.72	54.44
Mean	207.20	168.07	177.26	233.08		51.97	44.67	45.60	51.30	
LSD at 0.05	A =1.93 B = 1.67 A x B = 3.34					A = 1.91 B = 1.65 A x B = 3.31				

6-Root fresh weight (g):

From the data in Table (3) it can be noticed that the heaviest roots (151.25 and 143.73 g, respectively) were found in the plants pinched twice, in both seasons. In the first season, the control plants had the lightest roots (105.63 g), while in the second one the lightest roots (116.14 g) were obtained from the plants pinched once.

In the first season, all the concentrations of paclobutrazol increased the fresh weight of roots over the control. The heaviest roots (180.83 g) were formed on the plants treated with paclobutrazol at the rate of 400 ppm. The control plants had the lightest roots (108.33 g). in the second season, treating the plants with paclobutrazol at concentration of 600 ppm caused the heaviest roots (150.97 g), while the application of paclobutrazol at the rate of 500 ppm resulted in the lightest roots (112.51 g).

Concerning the interaction between paclobutrazol and pinching the data reveal that, in the first season all the interactions increased the fresh weight of roots over the control. The heaviest roots (230.00 g) were obtained from supplying the plants with paclobutrazol at the concentration of 400 ppm and pinching twice. The lightest roots (95.00 g) were found in the control plants. In the second season, the concentration of paclobutrazol at 600 ppm with pinching twice caused the heaviest roots (191.05 g). Treating the plants with paclobutrazol alone at the rate of 500 ppm resulted in the lightest roots (79.35 g).

7-Root dry weight (g):

The data in Table (3) showed that in both seasons, pinching the plants increased the dry weight of roots over the control. Pinching the plants twice resulted in the heaviest roots (63.75 and 45.17 g, respectively). The control plants had the lightest roots (42.50 and 35.26 g, respectively).

Application of paclobutrazol at the concentration of 400 ppm caused the formation of the heaviest roots (70.00 g) in the first season, meanwhile in the second one; the control plants had the heaviest roots (43.21 g).The lightest roots (44.17 and 33.84 g, respectively) were found as a result of treating the plants with paclobutrazol at the rate of 500 ppm in the two seasons.

For the combination between paclobutrazol and pinching,it can be observed that, in the first season,the heaviest roots (90.00 g) were found from treating the plants with paclobutrazol at the rate of 400 ppm and pinching twice. The lightest roots (32.50 g) were obtained from treating the plantswithpaclobutrazol at 600 ppm alone. In the second season, application of paclobutrazol at the rate of 600 ppm and pinching the plants twice increased the dry weight of roots (57.42 g). Treating the plants with paclobutrazol at concentration of 500 ppm without pinching led to the lightest roots (18.33 g).

Table3. Effect of paclobutrazol and pinching on the Root fresh and dry weights (g) of Cestrum nocturnumplants during the two years of 2005 and 2006.

Paclobutrazol (A)	First season									
	Root fresh weight:					Root dry weight:				
Pinching (B)	0	400	500	600	Mean	0	400	500	600	Mean
0	95.00	125.00	100.00	102.00	105.63	45.00	52.50	40.00	32.50	42.50
Once	90.00	187.50	160.00	120.00	139.38	35.00	67.50	52.50	45.00	50.00
twice	140.00	230.00	105.00	130.00	151.25	62.50	90.00	40.00	62.50	63.75
Mean	108.33	180.83	121.67	117.50		47.00	70.00	44.17	46.67	
LSD at 0.05	A = 2.39 B = 2.07 A x B = 4.14					A = 2.39 B = 2.07 A x B = 4.14				
	Second season									
0	166.39	113.05	79.35	153.15	127.98	52.34	30.99	18.33	39.37	35.26
Once	92.92	151.77	111.16	108.70	116.14	27.25	51.44	37.48	29.43	36.40
twice	156.46	80.39	147.02	191.05	143.73	50.06	27.48	45.73	57.42	45.17
Mean	138.59	115.07	112.51	150.97		43.21	36.64	33.84	42.07	
LSD at 0.05	A = 2.20 B = 1.90 A x B = 3.81					A = 2.20 B = 1.90 A x B = 3.81				

These results agreed with those obtained by Samia (2008) indicated that application of three foliar sprays of paclobutrazol at 10, 20 and 30 ppm, at 3- week intervals were to potted plants of Anisacanthuswrightii significantly decreased most of the studied characteristics (plant height, leaves number, fresh and dry weights of leaves, fresh and dry weights of vegetative parts, root length and fresh and dry weights of roots). The application of high concentrations of paclobutrazol decreased

chlorophyll a and b. Also, total carbohydrates were linearly decreased with raising paclobutrazol concentration. Seleguini et al. (2011) reported that application of Paclobutrazol - PBZ (0, 50 and 100 mg L)in drench on tomato seedlings resulted in lower weight loss. Saraswathy et al.(2011) showed that the values of root length, root girth, primary root weight, root fresh and dry weights, and root bark weight per plant of Withaniasomnifera were greatest under pinching.

B- Chemical constituents:

1-Chlorophyll (a) content (mg/g FW):

The data in Table (4) reveal that, in both seasons, the highest content of chlorophyll a (5.31 and 10.62 mg/g FW, respectively) was detected in the leaves of the unpinchedplants,While the least content (3.18 and 6.37 mg/g FW, respectively) was found in the leaves of the plants pinched twice.

Using of paclobutrazol at 600 ppm produced the highest amount of chlorophyll a (7.32 and 14.54 mg/g FW, respectively) in both seasons. The control plants had the least content (3.32 and 6.65 mg/g FW, respectively).

The combined treatments of pinching and paclobutrazol showed that all the treatments increased the chlorophyll a content over the pinchingonce. Applying the plants with paclobutrazol at the rate of 600 ppm and pinching once resulted in the highest amount of chlorophyll a (9.77and 19.24 mg/g FW, respectively) in the two seasons. The leaves of the plants pinched twice without applying paclobutrazol had the least content of chlorophyll a (2.41 and 4.82 mg/g FW, respectively) in the two season.

2-Chlorophyll (b) content (mg/g FW):

From the data in Table (4) it can be noticed that the control plants had the highest content of chlorophyll b (1.89 and 3.77 mg/g FW, in the first and second season, respectively).Pinching the plants twice reduced the amount of chlorophyll b to the lowest content (0.78 and 1.57mg/g FW,respectively) in the two seasons.

Treating the plants with paclobutrazol increased chlorophyll b content over the control in both seasons; same as in chlorophyll a. The concentration of 500 ppm led to the greatest content of chlorophyll b (1.98 and 3.96mg/g FW, respectively) in both seasons.The least content (0.60 and 1.20 mg/g FW, respectively) were determined in the leaves of the control plants in the two seasons.

Regarding the effect of the interaction between paclobutrazol and pinching, the data reveal that the greatest amount of chlorophyll b (2.48 and 4.96 mg/g FW, in the first and second season, respectively) was determined in the leaves of the plants supplying with paclobutrazol alone at the rate of 400 ppm. The least content (0.29 and 0.58 mg/g FW, respectively) was found in the leaves of the plants treated with paclobutrazol at 400 ppm and pinched twice.

3-Carotenoids content (mg/g FW):

The data in the same Table show that pinching the plants once increased the carotenoids content (2.53 and 5.06 mg/g FW, respectively) in the two seasons over the other treatments. While, the least content (1.82 and 3.63 mg/g FW, respectively) was formed as a result of pinching the plants twice, in both seasons; same as in chlorophylls a and b.

Same as in chlorophyll a, treating the plants with paclobutrazol caused a great effect on increasing the carotenoids content in the two seasons.The plants treated with paclobutrazol at the rate of 600 ppm had the greatest amount of carotenoids (2.78 and 5.57 mg/g FW in the first and second seasons, respectively). The least carotenoids content (1.10 and 2.19 mg/g FW, respectively) was determined in the leaves of the control plants, in the two seasons.

Concerning the combination treatments, the data reveal that,same as in chlorophyll a, supplying the plants with paclobutrazol at the rate of 600 ppm and pinching them once led to the greatest content of carotenoids (4.72 and 9.44 mg/g FW, respectively) in the two season. The least content of carotenoids (0.64 and 1.28 mg/g FW, in both season, respectively) was determined in the leaves of the plants pinched twice.

These results are in harmony with those pointed out by Liu XinBao et al. (2004) on Trifoliumresens,Abdella (2005) on snapdragon and El-Quesni (2007) on Bougainvillea glabrawho mentioned that paclobutrazol treatments increased chlorophyll (a), chlorophyll (b) and carotenoids content. AbouDahab and Habib (2005) on Barleriacristatafound that pinching gave the highest chlorophyll content in the leaves. Pinching + pp-333 increased chlorophyll (a) and carotenoids contents compared to the control.Samia (2008) indicated that application of paclobutrazol at 30 ppm, to potted plants of Anisacanthuswrightii decreased chlorophyll a and b. Arup Ghosh et al. (2011)on Jatrophacurcas demonstrated that paclobutrazol application along with pruningenhanced chlorophyll content and increased photosynthetic rate.

Table 4. Effect of paclobutrazol and pinching on the chlorophylls a,b and carotenoids content (mg/g FW) in the leaves ofCestrumnocturnum plants during the two years of 2005 and 2006.

Paclobutrazol(A)	First season														
Pinching (B)	Chlorophyll(a)					Chlorophyll(b)					Carotenoids				
	0	400	500	600	Mean	0	400	500	600	Mean	0	400	500	600	Mean
0	3.79	3.96	4.34	9.14	5.31	0.74	2.48	2.16	2.16	1.89	1.41	2.79	2.37	2.27	2.21
Once	3.77	3.19	4.19	9.77	5.23	0.69	1.51	2.16	1.41	1.44	1.24	1.75	2.41	4.72	2.53
Twice	2.41	3.62	3.65	3.05	3.18	0.37	0.29	1.62	0.85	0.78	0.64	2.89	2.39	1.36	1.82
Mean	3.32	3.59	4.06	7.32		0.60	1.43	1.98	1.47		1.10	2.48	2.39	2.78	
LSD at 0.05	A = 0.19 B = 0.17 A x B = 0.33					A = 0.42 B = 0.36 A x B = 0.72					A = 0.10 B = 0.08 A x B = 0.17				
	Second season														
0	7.58	7.92	8.68	18.28	10.62	1.48	4.96	4.32	4.32	3.77	2.82	5.58	4.74	4.54	4.42
Once	7.54	6.38	8.38	19.24	10.39	1.38	3.02	4.32	2.82	2.89	2.48	3.50	4.82	9.44	5.06
Twice	4.82	7.24	7.30	6.10	6.37	0.74	0.58	3.24	1.70	1.57	1.28	5.72	4.78	2.72	3.63
Mean	6.65	7.18	8.12	14.54		1.20	2.85	3.96	2.95		2.19	4.93	4.78	5.57	
LSD at 0.05	A = 0.21 B = 0.19 A x B =0.37					A = 0.21 B = 0.18 A x B =0.36					A = 0.10 B = 0.08 A x B =0.17				

4-Nitrogen percentage (Shoots):-

The data shown in Table (5) pointed out that pinching the plants significantly decreased the nitrogen percentage in the shoot. The greatest percentage of N (3.46 and 3.78%, respectively) resulted from control plants in the two seasons. The least percentage of N (2.56%) resulted from pinching the plants twice in the first seasons. However, in the second one, the least percentage of N(3.02%) resulted from pinching the plants once.

Regarding the paclobutrazol treatments, the data indicate that, in the first season, the greatest percentage of N (3.39%) was found in the shoot of the plants received paclobutrazol at the rate of 400 ppm.While,the control plants had the least percentage of N (2.43 %). In the second season the greatest percentage of N(4.07%)was found in the plants treated with paclobutrazol at 500 ppm.The least percentage of N (2.94%) was found in the shoot of the plants received paclobutrazol at the rate of 600 ppm.

All the interaction treatments between paclobutrazol and pinching decreased the nitrogen percentage in the first season. Thecontrol plants hadthe greatest percentage of N (4.19%). The least percentage ofN (0.91%) resulted from pinching the plants twice only. In the second season the greatest percentage of N(4.91%) was found in the plants treated withpaclobutrazol at 500ppm and pinched twice. The least percentage of N (2.37%) was detected in the plants received paclobutrazol at 400 ppm and pinching once or 600 ppm with pinching twice.

Table 5. Effect of paclobutrazol and pinching on nitrogen percentage in the shoots of Cestrum nocturnum plants during the two years of 2005 and 2006.

Paclobutrazol (A)	First season					Second season				
	0	400	500	600	Mean	0	400	500	600	Mean
Pinching (B)										
0	4.19	3.29	3.09	3.25	3.46	3.64	3.91	4.05	3.50	3.78
Once	2.18	3.64	3.18	3.23	3.06	3.52	2.37	3.25	2.94	3.02
twice	0.91	3.23	2.80	3.28	2.56	3.41	3.14	4.91	2.37	3.46
Mean	2.43	3.39	3.02	3.25		3.52	3.14	4.07	2.94	
LSD at 0.05	A = 0.16 B = 0.14 A x B =0.28					A = 0.13 B = 0.11 A x B = 0.22				

5-Phosphorus percentage (Shoots):-

From the data in Table (6) it can be noticed that in the first season, the highest percentage of P (0.42) was found in control plants. The least percentage of P (0.33%) was determined in the plants pinched twice. In the second season, the highest percentage of P(0.41%) was found in the plants pinched twice. The least percentage of P (0.32%) was detected in the plants pinched once.

As the effect of paclobutrazol, in the first season,the highest percentage of P (0.42%) was found in the plants treated with 400 ppm.The lowest percentage of P (0.36%) was determined in the plants treated with 500 ppm. In the second season, the data

show that the control plants and the plants treated with 500 ppm paclobutrazol had the highest percentage of P (0.40%). The lowest percentage of P (0.33%) was found in the plants treated with 600 ppm.

Concerning the combination treatments, the data reveal that in the first season, the greatest percentage of P (0.49%) was found in the control plants. The least percentage of P (0.26%) was determined in the plants pinched twice. In the second season, the greatest percentage of P (0.66%) was found in the plants treated with paclobutrazol at 500 ppm and pinched twice. The least percentage of P (0.13%) was detected in the plants pinched once only.

Table 6. Effect of paclobutrazol and pinching on phosphorus percentage in the shoots of Cestrum nocturnum plants during the two years of 2005 and 2006.

Paclobutrazol (A)	First season					Second season				
Pinching (B)	0	400	500	600	Mean	0	400	500	600	Mean
0	0.49	0.43	0.38	0.38	0.42	0.65	0.49	0.20	0.19	0.38
Once	0.47	0.47	0.33	0.38	0.41	0.13	0.37	0.35	0.43	0.32
twice	0.26	0.35	0.36	0.35	0.33	0.43	0.20	0.66	0.36	0.41
Mean	0.41	0.42	0.36	0.37		0.40	0.35	0.40	0.33	
LSD at 0.05	A = 0.04 B = 0.04 A x B =0.08					A = 0.05 B = 0.05 A x B = 0.09				

6-Potassium percentage(Shoots):-

As shown in Table (7) the data reveal that in the first season, pinching, the plants decreased K percentage in the shoots. The greatest percentage of K (2.42%) was found in the control plants. The least percentage of K (2.20%) was determined in the shoots of the plants pinched twice. In the second season,the plants pinched twice had the greatest percentage of K (3.18%). The least percentage of K (2.75%) was found in the plants pinched once.

The concentrations of paclobutrazol increased K% in the shoot, in the first season.The highest percentage (2.81%) was found in the plants treated with 400 ppm. The least percentage of K (1.96%) was found in the control plants.In the second season,the control plants had the greatest percentage of K(3.34%). The least percentage of K (2.57%) was determined in the plants received 400 ppm paclobutrazol.

Regarding the interaction treatments,in the first season,the greatest percentage of K (2.91%) was found in the shoots of the plants treated with 400 ppm paclobutrazol alone. The least percentage of K (1.80%) was found in the shoots of the plants pinched once. In the second season, the plants treated with 500 ppm paclobutrazol and pinched twice had the greatest percentage of K(4.17%).The least percentage of K (2.01%) was found in the shoot of the plants received 400 ppm paclobutrazol and pinched twice.

Table 7. Effect of paclobutrazol and pinching on potassium percentage in the shoots of Cestrum nocturnum plants during the two years of 2005 and 2006.

Paclobutrazol (A)	First season					Second season				
Pinching (B)	0	400	500	600	Mean	0	400	500	600	Mean
0	1.95	2.91	1.95	2.88	2.42	3.90	2.49	2.82	3.10	3.08
Once	1.80	2.76	2.34	2.64	2.39	2.40	3.21	2.55	2.85	2.75
twice	2.13	2.76	1.89	2.01	2.20	3.72	2.01	4.17	2.82	3.18
Mean	1.96	2.81	2.06	2.51		3.34	2.57	3.18	2.92	
LSD at 0.05	A =0.11 B =0.09 A x B =0.19					A = 0.20 B = 0.17 A x B =0.35				

The aforementioned results are in accordance with those obtained by Arzani and Roosta (2004) on apricot trees who found that paclobutrazol decreased nitrogen concentration, while Abdella (2005) on snapdragon noticed that paclobutrazol at 50 or 100 ppm enhanced the total nitrogen. AbouDahab and Habib (2005) on Barleriacristata showed that the contents of N,PandK in the leaves were increased by pinching and paclobutrazol treatments as well as the interaction between them. Arup Ghoshet al. (2011) demonstrated that paclobutrazol (PBZ) application to Jatrophacurcas with pruning enhanced nitrogen content.

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تأثير الباكلوبيرترازول والتطويش على نباتات مسك الليل

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اجرى هذا البحث فى مشتل قسم بساتين الزينة كلية الزراعة – جامعة القاهرة خلال السنوات 2005–2006 فى اصص بلاستيك (قطر 20 سم) مملوءة بخليط من الطمى والرمل بنسبة 1:1 حجما بغرض دراسة تأثير الباكلوبيوترازول بتركيز 0 ،400 ،500، 600 جزء فى المليون والتطويش مرة أو مرتين على تقزيم نباتات مسك الليل حتى يمكن استعمالها كنباتات أصص وقد أوضحت النتائج الآتى :–

- أدى تطويش النباتات مرة واحدة الى نقص فى الوزن الطازج للافرع ، الا أنه أدى الى زيادة محتوى الأفرع من الكربوهيدرات الكليه والنتروجين ومحتوى المجموع الخضرى من الفوسفور .
- تطويش النباتات مرتين أدى الى نقص فى الطول والوزن الجاف للأفرع مع زيادة كل من قطر الساق والأفرع ، الوزن الطازج والجاف للمجموع الخضرى ، محتوى الأوراق من كلوروفيل ا والكاروتينويدات ، ومحتوى الأفرع من الفوسفور وأيضا محتوى الأفرع والجذور من البوتاسيوم .
- أدت معاملة النباتات بالباكلوبيوترازول بتركيز 400 جزء فى المليون اضافة الى التربة الى زيادة فى قطر الساق والأفرع ، محتوى الأفرع من الفوسفور ومحتوىالمجموع الخضرى والجذرى من البوتاسيوم مع النقص فى محتوى الأوراق من الكربوهيدات الكلية .
- معاملة النباتات بالباكلوبيوترازول بتركيز 500 جزء فى المليون أدت الى زيادة عدد الأفرع /نبات ، الوزن الطازج والجاف للمجموع الخضرى ،بالاضافة الى زيادة محتوىالمجموع الخضرى من كلوروفيل ا،ب والكاروتينويدات وأيضا محتوى الأفرع من النتروجين والبوتاسيوم . الا أنها أدت الى نقص فى الوزن الطازج والجاف للأفرع.
- معاملة النباتات بالباكلوبيوترازول بتركيز 500 جزء فى المليون مع التطويش مرتين أدت الى نقص طول الأفرع مع زيادة قطر الساق والأفرع ،عدد الأفرع /النبات ،الوزن الطازج والجاف للمجموع الخضرى ،مع زيادة محتواها من الكاروتينويدات . ولذلك يوصى بتطويش النباتات مرتين فقط أو مرتين مع اضافة الباكلوبيوترازول بتركيز 500 جزء فى المليون للحصول على نباتات متقزمة من مسك الليل ذات نمو خضرى جيد صالحة للاستخدام كنباتات أصص .