ISSN 1110-0419

Annals Of Agric. Sc., Moshtohor,
Vol. 46(4): Ho. 483-497, (2008).

DWARFING OF *THEVETIA PERUVIANA* (PERS.) K. SCHUM. SHRUB

BY

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ABSTRACT

A pot experiment was carried out to investigate the effect of paclobutrazol at the rate of 100 or 200 ppm (as soil drench) and pinching once or twice on *Thevetia peruviana* plants. The obtained results revealed that pinching the plants once decreased the fresh weight of branches, but increased the total carbohydrates and N % in the branches and P % in the leaves. Pinching the plants twice decreased the branch length and dry weight; meanwhile it increased the stem and branch diameter, number of branches and leaves/plant, fresh and dry weights of leaves, chlorophyll a and carotenoids content, P % in branches as well as K % in leaves and branches. Paclobutrazol at 100 ppm caused an increase in the stem and branch diameter, number of leaves/plant, P % in branches and K % in leave, while it decreased the carbohydrates percentage in the leaves. The concentration of 200 ppm of paclobutrazol resulted in a decrease in fresh and dry weights of the branches, but it increased the number of branches/plant, fresh and dry weights of leaves, chlorophyll a, b and carotenoids content in the leaves as well as N and K % in the branches. The interaction between paclobutrazol at 200 ppm and pinching twice decreased the length of branches, but enhanced the stem and branch diameter, number of leaves and branches/plant, fresh and dry weights of leaves as well as the carotenoids content in the leaves.

From the aforementioned results, it could be recommended to use either pinching the plants for two times alone or with the combination with paclobutrazol at 200 ppm in order to produce a compact plant of high vegetative growth characters for useing as a pot plants.

Key words: Paclobutrazol, pinching, *Thevetia peruviana.*

INTRODUCTION

Thevetia peruviana, (Pers.) K. Schum. (Syn. *T. neriifolia*, Juss.ex Steud.), Fam. Apocynaceae is a plant native to Mexico and central America. It is an evergreen tropical shrub or small tree that commonly called lucky nut. *Thevetia* is a tough durable that it inexpensive and easy to grow in most situation. This is a very popular landscaping plant in warmer climates as it does not need much maintenance. The plants are used for sunny decks, patios and other locations around the home. They are also used in a variety of landscape applications including dedges, screens, foundation plantings and borders (Mabberley, 1997).

Pinching is the removal of the growing point of the stem, resulting in the development of 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, 2006).

Paclobutrazol is a plant growth regulator 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 carried out, the total branch number was the highest and dry matter weight was also the highest. Sunitha *et al.* (2007) indicated that pinching significantly increased the number of primary branches of African marigold. El-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 weights 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. The number of leaves was not influenced. Hwang SeungJae *et al.* (2008) mentioned that foliar application of paclobutrazol at 0.5 mg/L 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 pinching and paclobutrazol alone or in combination on vegetative growth and the chemical constituents of *Thevetia peruviana*, (Pers.) K. Schum. plants.

MATERIALS AND METHODS

A pot experiment was carried out at the nursery of the Department of Ornamental Horticulture, Faculty of Agriculture, Cairo University, Giza, during the two successive seasons of 2004/2005 and 2005/2006 to study the effect of pinching and paclobutrazol as a soil drench alone or in combination on vegetative growth and chemical constituents of *Thevetia peruviana* plants. On 22nd November 2004 and 2005, six months old seedlings were transplanted in plastic pots (20 cm) filled with a mixture containing clay and sand at the ratio of 1:1 (v/v). the stems (without branches) were cut back to 25 cm from the rim of the pot on 22nd December 2004 and 2005. All the plants were fertilized with NPK at the ratio of 1:1:1 at the rate of 3g/pot two times. The application started on 22nd January 2005 and 2006 and repeated after two months. The concentrations used of paclobutrazol were 0, 100 or 200 ppm. Fifty ml of each concentration were added to each pot (20 cm) as a soil drench on 22nd February 2005 and 2006 and repeated after two months. The plants were pinched on 22nd March 2005 and 2006 and repeated with some treatments after two months. The plants were irrigated whenever required.

The mechanical and chemical analyses of the soil used in the experiment are shown in Tables (A) and (B).

Table (A): Mechanical analysis of the soil.

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

Table (B): Chemical analysis of the soil.

Cations Meq/L		Anions Meq/L					
Na^+	14.23	HCO_3^-	3.55	pH	7.85	N	290 ppm
K^+	0.67	SO_4^{--}	21.20	E.C.	2.73 mmhos	P	26.73 ppm
Ca^{++}	11.25	Cl^-	11.62	Organic matter	1.28 %	K	43.17 ppm
Mg^{++}	7.28						

The following data were taken in July in the two seasons

A – Vegetative growth:

- Stem diameter (mm) at 5 cm above soil surface.
- Number of branches/plant.
- Branch length (cm).
- Branch diameter (mm).
- Number of leaves/plant.
- Fresh and dry weights of leaves (g)/plant.
- Fresh and dry weights of branches (g)/plant.

B – Chemical constituents:

Photosynthetic pigments (chlorophyll a, chlorophyll b and carotenoids) in fresh leaves.

- Total carbohydrates percentage in leaves and branches.
- Minerals (N, P and K %) in leaves and branches. The chemical analyses were performed as follows:
- Pigments content determination was carried out in fresh leaves as mentioned by Saric *et al.* (1967).
- Total carbohydrates percentage were determined according to Herbert *et al.* (1971).
- Nitrogen percentage was determined using micro-Kjeldahl method (Pregl 1945 and Piper 1947).
- Phosphorus percentage was determined according to Troug and Meyer (1939).
- Potassium percentage was carried out by using operation chart Shimadzu Atomic Absorption Flame Spectrophotometer.

The layout of the experiment was a complete randomized design in factorial experiment. Factor (A) was paclobutrazol treatments and factor (B) was pinching treatments. The experiment included 9 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 0,05 was used to compare the differences between treatments.

RESULTS AND DISCUSSION

A – Vegetative growth:

Stem diameter (mm):

Data in Table (1) revealed that, in both seasons, pinching the plants twice resulted in the thickest stems diameter (16.14 and 18.7 mm, respectively). The thinnest stems (15.68 and 17.60 mm, respectively) were obtained from plants pinched once.

Application of paclobutrazol at the rate of 100 ppm was the most effective treatment in increasing the stem diameter in the two seasons. Whereas, increasing the concentration up to 200 ppm decreased this value in both seasons.

The combined treatments of pinching and paclobutrazol showed that all the treatments increased the stem diameter over the control plants, except the treatment of pinching once with paclobutrazol at the rate of 200 ppm which produced the thinnest stems diameter (14.36 and 15.93 mm, respectively). The thickest stems (17.08 and 19.43 mm, respectively) were formed in plants received paclobutrazol at 200 ppm and pinched twice.

These results are in agreement with Liu XinBao *et al.* (2004) who found that paclobutrazol at the rate of 750 mg/kg increased the stem diameter of *Trifolium repens.* Grossi *et al.* (2005) on ornamental pepper plants mentioned that increasing the paclobutrazol concentration reduced the plant diameter. Abou Dahab and Habib (2005) pointed out that treating the pinched plants of *Barleria* with paclobutrazol at the rate of 400 ppm increased the stem diameter,

Number of branches/plant:

The data (Table 1) indicate that pinching the plants increased the number of branches/plant compared to the control. The greatest number of branches/plant in both seasons (42.46 and 48.55 branches/plant, respectively) was found when the plants were pinched twice.

Application of paclobutrazol showed a pronounced increase in the number of branches/plant in both seasons. Applying paclobutrazol at the concentration of 200 ppm caused the formation of the greatest number of

branches/plant (37.47 and 43.07 branches/ plant, respectively). Whereas, the least value (22.96 and 26.13 branches/plant, respectively) was detected in the control plants.

Concerning the effect of the interaction, data in Table (1) reveal that all the combination treatments significantly increased the number of branches/plant over the control in the two seasons. Treating the plants with paclobutrazol at the rate of 200 ppm and pinched them twice resulted in the greatest number of branches/plant (50 36 and 58 21 branches/plant, respectively).

These findings are in harmony with those pointed out by El-Quesni *et al.* (2007) on *Bougainvillea glabra* and Ibrahim (2008) on pelargonium who found that treating the plants with paclobutrazol increased the number of branches/plant. Sunitha *et al.* (2007) on African marigold, pointed out that pinching the plants significantly increased the number of branches/plant.

Table (1): Effect of paclobutrazol and pinching on stem diameter (mm) and number of branches/plant of *Thevetia peruviana* plant during the two seasons of 2004/2005 and 2005/2006

Paclobutrazol (A) / Pinching (B)	First season							
	Stem diameter (mm)				Number of branches/plant			
	0	100	200	Mean	0	100	200	Mean
0	15.20	16.83	15.33	15.79	11.00	25.67	30.70	22.46
Once	16.50	16.17	14.36	15.68	24.18	29.20	31.34	28.24
Twice	15.35	16.00	17.08	16.14	33.69	43.33	50.36	42.46
Mean	15.68	16.33	15.59		22.96	32.73	37.47	
LSD at 0.05	A = 0.67 B = 0.67 A × B = 1.16				A =1.24 B = 1.24 A × B = 2.14			
	Second season							
0	16.63	18.95	17.25	17.61	12.33	29.05	34.70	25.36
Once	18.56	18.30	15.93	17.60	27.67	32.68	36.30	32.22
Twice	16.88	18.19	19.43	18.17	38.40	49.03	58.21	48.55
Mean	17.36	18.48	17.54		26.13	36.92	43.07	
LSD at 0.05	A = 1.50 B = 1.50 A × B = 3.05				A = 1.14 B = 1.14 A × B = 1.98			

Branch length (cm):

In Table (2) the data show that pinching the plants significantly decreased the length of the branches than the control in both seasons. Pinching the plants twice was the most effective treatments.

Treating the plants with paclobutrazol caused a significant decrease in the length of the branches in the two seasons. Increasing the concentration of paclobutrazol up to 200 ppm resulted in the shortest branches (16.50 and 21.48 cm, respectively).

Concerning the combination effect between the paclobutrazol and pinching, the data indicate that all the treatments decreased the length of the branches than the control in the two seasons except the concentration of paclobutrazol at 100 ppm alone which led to the tallest branches (66.17 and 70.11 cm, respectively). The shortest branches (11.90 and 17. 74 cm, respectively) were found in the plants treated with paclobutrazol at the rate of 200 ppm and pinched twice in the two seasons.

The reduction in branch length due to paclobutrazol was reported by other investigators such as Karaguzel *et al.* (2004) on *Lupinus varius* and Pinto *et al.* (2005) on zinnia who mentioned that paclobutrazol significantly reduced the length of side branches.

Branch diameter (mm):

The data shown in Table (2) point out that pinching the plants twice increased the branche diameter over the control in both seasons.

Supplying the plants with paclobutrazol at the rate of 100 ppm resulted in the thickest branch diameter (7.77 and 8.78 mm, respectively) in the two seasons. Meanwhile, more concentration of paclobutrazol decreased the branch diameter, even less than the control, same as in branch length.

All the interaction treatments between paclobutrazol and pinching increased the branch diameter over the control plants, except the combination treatment between paclobutrazol at the rate of 200 ppm and pinching the plants once in the two seasons, which led to the thinnest branches (6.53 and 7,35 mm, respectively). Treating the plants with paclobutrazol at the rate of 100 ppm alone caused the formation of the thickest branches (8.29 and 9.53 mm, in the first and second seasons, respectively). This followed by the treatment of paclobutrazol at the rate of 200 ppm and pinching the plants twice.

Table (2): Effect of paclobutrazol and pinching on branch length (cm) and diameter (mm) of *Thevetia peruviana* plant during the two seasons of 2004/2005 and 2005/2006

Paclobutrazol (A) / Pinching (B)	Branch length (cm)				Branch diameter (mm)			
	0	**100**	**200**	**Mean**	**0**	**100**	**200**	**Mean**
First season								
0	56.50	66.17	22.38	48.35	6.92	8.29	6.90	7.37
Once	38.75	20.75	15.22	24.91	7.68	7.94	6.53	7.38
Twice	30.13	19.04	11.90	20.36	7.22	7.09	8.22	7.51
Mean	41.79	35.32	16.50		7.27	7.77	7.22	
LSD at 0.05	**A** = 1.08 **B** = 1.08 **A × B** = 1.88				**A** = 0.46 **B** = 0.46 **A × B** = 0.79			
Second season								
0	62.63	70.11	26.62	53.12	7.79	9.53	7.86	8.39
Once	42.65	24.83	20.09	29.19	8.74	8.83	7.35	8.31
Twice	35.14	21.94	17.74	24.94	8.32	7.98	9.25	8.52
Mean	46.81	38.96	21.48		8,28	8.78	8.15	
LSD at 0.05	**A** = 0.83 **B** = 0.83 **A × B** = 1.43				**A** = 0.44 **B** = 0.44 **A × B** = 0.77			

Number of leaves/plant:

The data in Table (3) reveal that pinching the plants increased the number of leaves/plant over the control in both seasons. The plants pinched twice had the greatest number of leaves/plant (629.2 and 698.9 leaves/plant, respectively).

Treating the plants with paclobutrazol at the rate of 100 ppm had a significant effect in increasing the number of leaves/plant in the two seasons. Increasing the concentration of paclobutrazol decreased the number of leaves/plant, even less than the control.

All the interaction treatments between paclobutrazol and pinching significantly increased the number of leaves/plant over the control plants in both seasons, except the concentration of paclobutrazol at 200 ppm alone or with pinching once. The greatest number of leaves/plant (700.0 and 778.3 leaves/plant, in the first and second seasons, respectively) was formed in the plants treated

with paclobutrazol at the rate of 200 ppm and pinched twice. The least number of leaves/ plant (393.3 and 436.7 leaves/plant, respectively) was found in the plants treated with paclobutrazol at the rate of 200 ppm and pinched once in the two seasons.

Similar results on paclobutrazol application were obtained by Singh (2004) on African marigold and Chanana and Gill (2007) on peach trees, they reported that paclobutrazol significantly increased the number of leaves/plant.

Table (3): Effect of paclobutrazol and pinching on the number of leaves/plant of *Thevetia peruviana* plant during the two seasons of 2004/2005 and 2005/2006

Paclobutrazol (A) / Pinching (B)	First season				Second season			
	0	100	200	Mean	0	100	200	Mean
0	424.3	535.1	416.4	458.6	471.0	594.1	462.3	509.2
Once	651.7	550.1	393.3	531.7	723.3	610.6	436.7	590.2
Twice	588.0	559.7	700.0	629.2	652.7	665.7	778.3	698.9
Mean	554.7	561.6	503.2		615.7	623.5	559.1	
LSD at 0.05	A = 2.6 B = 2.6 A × B = 4.5				A = 4.6 B = 4.6 A × B = 7.9			

Fresh and dry weights of leaves (g):

From the data in Table (4) it can be observed that pinching the plants increased the fresh and dry weights of the leaves than the control in the two seasons. The heaviest fresh and dry weights of the leaves resulted from pinching the plants twice. The values were 70.1 and 75.9 g, respectively for the fresh weight and 22.0 and 25.5 g, respectively for the dry weight. This may be due to the increase in the number of leaves/plant.

Paclobutrazol treatments had a greatest effect on increasing the fresh and dry weights of the leaves. The heaviest fresh and dry weights of leaves were due to the application of paclobutrazol at the rate of 200 ppm. The values were 67.3 and 72.9 g, respectively for the fresh weight and 20.9 and 23.7 g, respectively for the dry weight. The least fresh and dry weights of leaves were detected on the control plants.

Regarding the effect of the interaction, the data show that most of the interaction treatments increased the fresh and dry weights of leaves over the control. Supplying the plants with paclobutrazol at the rate of 200 ppm and pinching them twice led to the heaviest fresh and dry weights of leaves. This may be due to the increase in the number of leaves/plant. The plants treated with paclobutrazol alone at the rate of 200 ppm had the least fresh and dry weights.

The previous findings are in parallel with those of Abou Dahab and Habib (2005) on *Barleria cristata* who stated that the fresh and dry weights of aerial parts were increased by pinching. Navita Ghai and Gurpreet (2005) on *Brassica hybrid* pointed out that paclobutrazol enhanced the dry matter accumulation in plant parts.

Fresh and dry weights of branches (g):

The data presented in Table (5) indicate that the control plants had the heaviest fresh and dry weights of branches in the two seasons (142.0 and 149.3 g, respectively for the fresh weight and 62.1 and 69.9 g, respectively for the dry weight). This may be due to the increase in the length of the branches. Pinching the plants once resulted in the least fresh weight of the branches (132.3 and 140,6 g, respectively). Whereas, pinching the plants twice resulted in the least dry weight of the branches (58.6 and 63.9 g, respectively) in the two seasons.

Table (4): Effect of paclobutrazol and pinching on fresh and dry weights of leaves (g) of *Thevetia peruviana* plant during the two seasons of 2004/2005 and 2005/2006

Paclobutrazol (A) / Pinching (B)	First season							
	Fresh weight of leaves (g)				Dry weight of leaves (g)			
	0	100	200	Mean	0	100	200	Mean
0	55.0	60.1	51.7	55.6	19.2	20.0	16.9	18.7
Once	70.0	61.3	55.2	62.2	23.6	20.4	18.1	20.7
Twice	52.7	62.4	95.1	70.1	17.8	20.4	27.6	22.0
Mean	59.2	61.3	67.3		20.20	20.3	20.9	
LSD at 0.05	A = 1.9 B = 1.9 A × B = 3.2				A = 0.6 B = 0.6 A × B = 1.0			
	Second season							
0	60.7	66.4	57.1	61.4	21.1	23.0	18.6	20.9
Once	77.3	67.6	61.1	68.7	26.9	23.4	21.0	23.8
Twice	58.0	69.0	100.7	75.9	20.6	24.5	31.4	25.5
Mean	65.3	67.7	72.9		22.9	23.6	23.7	
LSD at 0.05	A = 1.6 B = 1.6 A × B = 2.7				A = 1.3 B = 1.3 A × B = 2.3			

The paclobutrazol treatments decreased the fresh and dry weights of branches than the control in both seasons. The least fresh and dry weights of the branches were detected in the plants treated with paclobutrazol at the rate of 200 ppm. The values were 120.9 and 126.7 g, respectively for the fresh weight and 50.3 and 54.3 g, respectively for the dry weight. This may be due to the reduction in the length and diameter of the branches.

As for the interaction, the heaviest fresh and dry weights of the branches resulted from treating the plants with paclobutrazol alone at the rate of 100 ppm (160.0 and 168.6 g, respectively for the fresh weight and 69. 4 and 80.4g, respectively for the dry weight). This may be as a result of the increase in the length and diameter of the branches. The least fresh and dry weights of the branches was found in the plants treated with paclobutrazol at the rate of 200 ppm and pinched once. The values were 103.3 and 109.7 g, respectively for the fresh weight and 47.5 and 50.1 g, respectively for the dry weight.

These results are in agreement with those finding by Grossi *et al.* (2005) on ornamental pepper plants and Ding Cheng Long *et al.* (2005) on *Festuca arundinacea* who found that increasing the paclobutrazol concentration reduced the plant dry mass. Abou Dahab and Habib (2005) on *Barleria cristata* indicated that the fresh and dry weights of aerial parts were decreased by paclobutrazol.

B – Chemical constituents:

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

The data (Table 6) point out that the highest content of chlorophyll a (1.07 and 1.00 mg/g FW, respectively) was detected in the leaves of the plants pinched twice, while the least content (0.95 and 0.88 mg/g FW, respectively) was found in the leaves of the plants pinched once.

Using paclobutrazol at the rate of 200 ppm produced the highest amount of chlorophyll a (1.31 and 1.23 mg/g FW, respectively) in both seasons. The control plants had the least content (0.68 and 0.60 mg/g FW, respectively).

As for the combination treatments, the data show that all the treatments increased the chlorophyll a content over the control. Applying the plants with paclobutrazol at the rate of 200 ppm resulted in the highest amount of chlorophyll a (1.52 and 1.42 mg/g FW, respectively) in the two seasons.

Table (5): Effect of paclobutrazol and pinching on fresh and dry weights of branches (g) of *Thevetia peruviana* plant during the two seasons of 2004/2005 and 2005/2006

Paclobutrazol (A) / Pinching (B)	First season							
	Fresh weight of branches (g)				Dry weight of branches (g)			
	0	100	200	Mean	0	100	200	Mean
0	149.3	160.0	116.7	142.0	65.6	69.4	51.1	62.1
Once	153.4	140.2	103.3	132.3	68.9	63.2	47.5	59.9
Twice	146.7	135.1	142.7	141.5	65.5	58.0	52.2	58.6
Mean	149.8	145.1	120.9		66.7	63.6	50.3	
LSD at 0.05	A = 1.9 B = 1.9 A × B = 3.3				A = 1.5 B = 1.5 A × B = 2.5			
Second season								
0	156.8	168.6	122.5	149.3	73.2	80.4	56.2	69.9
Once	163.7	148.4	109.7	140.6	76.8	66.2	50.1	64.4
Twice	152.4	139.8	147.8	146.6	72.0	63.1	56.7	63.9
Mean	157.6	152.3	126.7		74.0	69.9	54.3	
LSD at 0.05	A = 1.3 B = 1.3 A × B = 2.2				A = 1.0 B = 1.0 A × B = 1.8			

Table (6): Effect of paclobutrazol and pinching on chlorophyll a, B and carotenoids content (mg / g FW) in the leaves of *Thevetia peruviana* plant during the two seasons of 2004/2005 and 2005/2006

Paclobutrazol (A) / Pinching (B)	First season											
	Chlorophyll (a)				Chlorophyll (b)				Carotenoids			
	0	100	200	Mean	0	100	200	Mean	0	100	200	Mean
0	0.48	0.97	1.52	1.00	0.25	0.42	0.79	0.49	0.38	0.43	0.49	0.43
Once	0.90	1.03	0.94	0.95	040	0.53	0.48	0.47	0.44	0.47	0.43	0.45
Twice	0.67	1.07	1.47	1.07	0.27	0.48	0.60	0.45	0.41	0.42	0.52	0.45
Mean	0.68	1.02	1.31		0.30	0.48	0.60		0.41	0.44	0.48	
LSD at 0.05	A = 0.02 B = 0.02 A × B = 0.03				A = 0.03 B = 0.03 A × B = 0.04				A = 0.01 B = 0.01 A × B = 0.02			
Second season												
0	0.40	0.91	1.42	0.91	0.14	0.34	0.58	0.35	0.36	0.39	0.44	0.40
Once	0.78	0.97	0.88	0.88	0.19	0.41	0.43	0.34	0.39	0.41	0.40	0.40
Twice	0.63	0.97	1.40	1.00	0.15	0.38	0.50	0.35	0.38	0.41	0.43	0.41
Mean	0.60	0.95	1.23		0.16	0.38	0.50		0.38	0.40	0.42	
LSD at 0.05	A = 0.01 B = 0.01 A × B = 0.02				A = 0.02 B = 0.02 A × B = 0.03				A = 0.02 B = 0.02 A × B = 0.03			

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

The data in Table (6) indicate that the control plants had the highest content of chlorophyll b (0.49 and 0.35 mg/g FW, in the first and second season, respectively). Pinching the plants twice reduced the amount of chlorophyll b to the lowest content (0.45 mg/g FW) in the first season. While, in the second one, the least amount (0.34 mg/g FW) was detected in the leaves of the plants pinched once.

Treating the plants with paclobutrazol increased the chlorophyll b content over the control in both seasons, same as in chlorophyll a. the concentration of 200 ppm led to the greatest content of chlorophyll b (0.62 and 0.50 mg/g FW, respectively).

Regarding the effect of the interaction between paclobutrazol and pinching, the data reveal that all the treatments had a synergistic effect in increasing the amount of chlorophyll b than the control. the greatest amount (0.79 and 0.58 mg/g FW, in the first and second seasons, respectively) was determined in the leaves of the plants supplying with paclobutrazol at the rate of 200 ppm alone.

Carotenoids content (mg/g FW):

The data in the same table show that pinching the plants increased the carotenoids content over the control plants in both seasons. The greatest amount (0.45 and 0.41 mg/g FW, respectively) was formed as a result of pinching the plants twice.

The paclobutrazol treatments had a great effect on increasing the carotenoids content in the two seasons. The plants treated with paclobutrazol at the rate of 200 ppm had the greatest amount of the carotenoids (0.48 and 0.42 mg/g FW, in the first and second seasons, respectively). The least carotenoids content (0.41 and 0.38 mg/g FW, respectively) was determined in the leaves of the control plants.

Concerning the combination treatments, the data reveal that, same as in chlorophyll a and b, all the treatments had a pronounced effect in increasing the carotenoids content in the two seasons. Supplying the plants with paclobutrazol at the rate of 200 ppm and pinching them twice led to the greatest content of the carotenoids (0.52 mg/g FW) in the first season, while in the second one the concentration of 200 ppm alone was the most effective treatment in this concern. The least content of the carotenoids (0.38 and 0.36 mg/g FW, in the first and second seasons, respectively) was determined in the leaves of the control plants.

These results are in harmony with those attained by Liu XinBao *et al.* (2004) on *Trifolium repens*, Abdella (2005) on snapdragon and El-Quesni (2007) on *Bougainvillea glabra* who mentioned that the paclobutrazol treatments increased chlorophyll (a), chlorophyll (b) and carotenoids content. Abou Dahab and Habib (2005) on *Barleria cristata* found that pinching gave the highest chlorophyll content in the leaves. Pinching + PP-333 increased chlorophyll (a) and carotenoids contents compared to the control.

Total carbohydrates percentage:

In leaves:

Data (Table 7) reveal that, in the first season, the greatest percentage of total carbohydrates (45.24 %) was found in the leaves of the plants pinched once, while pinching the plants twice resulted in the formation of the least percentage of total carbohydrates (35.06 %). In the second seasons, the control plants had the greatest percentage of total carbohydrates (44.42 %). The least percentage (35.08 %) was determined in the leaves of the plants pinched once.

Application of paclobutrazol reduced the total carbohydrates percentage in the leaves in the two seasons. The least percentage (36.27 %) was found in the leaves of the plants treated with paclobutrazol at the rate of 100 ppm in the first season, while in the second one the concentration of 200 ppm was more effective in reducing the value.

Regarding the interaction treatments, the highest percentage of total carbohydrates (54.19 %) was detected in the plants pinched once only in the first season. Meanwhile, the plants received the paclobutrazol at the rate of 100 ppm and pinched twice had the least percentage of total carbohydrates (32.52 %). In the second season, pinching the plants twice only caused the formation of the greatest percentage of total carbohydrates in the leaves (47.74 %). Treating the plants with paclobutrazol at the rate of 100 ppm and pinching them once resulted in the least percentage of the total carbohydrates (29.44 %).

These results are in harmony with those found by Abou Dahab and Habib (2005) on *Barleria cristata* who found that pinching gave the highest total carbohydrates content in the leaves. Crzu *et al.* (2007) on citrus stated that the application of paclobutrazol caused significant reduction on the level of carbohydrates in the leaves.

In branches:

The results in Table (7) show that, in both seasons, pinching the plants increased the total carbohydrates percentage than the control. The greatest percentage (57.47 and 60.57 %, respectively) was formed as a result of pinching the plants once.

As for the paclobutrazol treatments, in the first season, supplying the plants with the rate of 100 ppm led to the greatest percentage of total carbohydrates (59.13 %). Increasing the concentration up to 200 ppm decreased the total carbohydrates to the lowest percentage (48.44 %). In the second season, the two concentrations of paclobutrazol reduced the total carbohydrates percentage than the control. The least percentage (51.54 %) was found in the branches of the plants treated with paclobutrazol at the rate of 200 ppm.

Concerning the effect of the combination treatments on the total carbohydrates percentage, the data point out that, in both seasons, the greatest percentage (62.95 and 67.46 %, respectively) resulted from pinching the plants for only one time. The least total carbohydrates percentage (47.56 and 49.40 %, respectively) was determined in the branches of the plants received paclobutrazol at the rate of 200 ppm and pinched twice.

These results are in agreement with those obtained by Abdella (2005) on snapdragon and El-Quesni *et al.* (2007) on *Bougainvillea glabra* who mentioned that the paclobutrazol treatments increased the total carbohydrates percentage.

Table (7): Effect of paclobutrazol and pinching on total carbohydrates percentage in the leaves and branches of *Thevetia peruviana* plant during the two seasons of 2004/2005 and 2005/2006

Paclobutrazol (A) / Pinching (B)	First season							
	Leaves				Branches			
	0	100	200	Mean	0	100	200	Mean
0	44.17	37.61	36.12	39.30	49.97	59.72	48.29	52.66
Once	54.19	38.67	42.85	45.24	62.95	60.01	49.47	57.47
Twice	38.31	32.52	34.36	35.06	60.04	57.68	47.56	55.09
Mean	45.56	36.27	37.78		57.65	59.13	48.44	
LSD at 0.05	A = 2.03 B = 2.03 A × B = 3.52				A = 1.32 B = 1.32 A × B = 2.29			
	Second season							
0	42.68	45.26	45.32	44.42	54.16	62.89	52.01	56.35
Once	40.72	29.44	35.09	35.08	67.46	61.07	53.20	60.57
Twice	47.74	42.61	33.49	41.28	65.11	62.10	49.40	58.87
Mean	43.71	39.10	37.97		62.24	62.02	51.54	
LSD at 0.05	A = 1.84 B = 1.84 A × B = 3.18				A = 1.33 B = 1.33 A × B = 2.30			

Nitrogen percentage:

In leaves:

As shown in Table (8) pinching the plants significantly increased the nitrogen percentage in the leaves over those of control plants in the two seasons. In the first season, the greatest percentage of N (1. 41 %) resulted from pinching the plants once. However, in the second season, pinching the plants twice increased the nitrogen to the highest percentage (1.37 %).

Regarding the paclobutrazol treatments, the data indicate that, in the first season, the control plants had the greatest percentage of N (1.47 %). However, the least percentage (1.27 %) was found in the leaves of the plants received paclobutrazol at the rate of 100 ppm. In the second season, the two concentrations of paclobutrazol increased the N % than the control. The greatest percentage (1.41 %) was detected in the leaves of the plants treated with paclobutrazol at the rate of 100 ppm.

From the data in Table (8) it can be observed that, in both seasons, most of the interaction treatments caused a significant increase in N % in the leaves over the control. In the first season, the greatest percentage of the nitrogen (1.90 %) resulted from pinching the plants once only. Meanwhile, applying paclobutrazol at the rate of 200 ppm and pinching the plants once resulted in the least percentage of N (1.05 %). In the second season, treating the plants with paclobutrazol at the rate of 100 ppm and pinching them once led to the highest percentage of N (1.62 %). While, the concentration of paclobutrazol at 200 ppm alone caused the least percentage of N (0.74 %).

In branches:

From Table (8) it can be noticed that pinching the plants significantly increased the N % over the control in the two seasons, same as in the leaves. Pinching the plants once resulted in the highest percentage of N (1.33 %).

Also, the paclobutazol treatments significantly increased the N % over the control in both seasons. The highest percentage (1.20 and 1.14 %, respectively) was found in the branches of the plants treated with paclobutrazol at the rate of 200 ppm.

Concerning the effect of the interaction, the data reveal that all the treatments significantly increased the nitrogen percentage than the control in the two seasons. The highest percentage (1.43 and 1.51 %, respectively) was detected in the plants pinched once only.

Table (8): Effect of paclobutrazol and pinching on nitrogen percentage in the leaves and branches (g) of *Thevetia peruviana* plant during the two seasons of 2004/2005 and 2005/2006

Paclobutrazol (A) / Pinching (B)	Leaves				Branches			
	0	100	200	Mean	0	100	200	Mean
First season								
0	1.10	1.37	1.51	1.33	0.75	1.02	1.28	1.01
Once	1.90	1.29	1.05	1.41	1.43	1.31	1.24	1.33
Twice	1.42	1.61	1.62	1.40	1.11	1.17	1.10	1.13
Mean	1.47	1.27	1.40		1.10	1.17	1.20	
LSD at 0.05	A = 0.01 B = 0.01 A × B = 0.02				A = 0.04 B = 0.04 A × B = 0.06			
Second season								
0	0.94	1.12	0.74	0.93	0.64	0.99	1.17	0.93
Once	1.08	1.62	1.09	1.26	1.51	1.94	1.15	1.33
Twice	1.12	1.48	1.50	1.37	1.13	1.06	1.11	1.10
Mean	1.05	1.41	1.11		1.09	1.13	1.14	
LSD at 0.05	A = 0.03 B = 0.03 A × B = 0.04				A = 0.02 B = 0.02 A × B = 0.03			

Phosphorus percentage:

In leaves:

In Table (9) the data point out that, in the first season, pinching the plants increased the phosphorus percentage than the control. Pinching the plants once was the most effective treatment in increasing P % in the leaves in the two seasons. In the second season, the least percentage of P (0.18 %) was accumulated as a result of pinching the plants twice.

As for the effect of the paclobutrazol, the data show that the control plants had the highest percentage of P (0.33 %) in the first season. In the second one, the highest percentage (0.42 %) was detected as a result of trating the plants with paclobutrazol at the rate of 200 ppm. The least percentage (0.13 %) was found in the leaves of the plants received paclobutrazol at the rate of 100 ppm.

Concerning the combination treatments, the data reveal that most of the treatments increased the P % in the leaves than the control in the first season. Pinching the plants twice without supplying the paclobutrazol caused the accumulation of the highest percentage of P (0.65 %). Pinching the plants twice and supplying them with paclobutrazol at the rate of 200 ppm decreased the phosphorus to the lower percentage (0.11 %).

In branches:

The data show that the highest percentage of P (0.31 and 0.38 %, in the first and second season respectively) was found in the branches of the plants pinched twice. The least P % (0.23 and 0.27 %, respectively) was determined in the branches of the plants pinched once in the two seasons.

Regarding the data shown in Table (9) it may be noticed that the paclobutrazol treatments increased the P % than the control in the two seasons. The highest percentage (0.29 and 0.34 %, respectively) was detected in the branches of the plants treated with paclobutrazol at the rate of 100 ppm.

As for the interaction between paclobutrazol and pinching, the data indicate that most of the treatments increased the P % over the control in both seasons. The highest percentage (0.34 and 0.41 %, respectively) was detected in the branches of the plants received paclobutrazol at the rate of 100 ppm and pinched twice. Pinching the plants once without paclobutrazol resulted in the least percentage of P (0.17 and 0.20 %, respectively) in the two seasons.

Potassium percentage:

In leaves:

As shown in Table (10) the data reveal that pinching the plants increased K % than the control in the two seasons. The plants pinched twice had the highest percentage of K in the leaves (2.24 and 2.35 %, in the first and second season, respectively).

The two concentrations of paclobutrazol increased K % in the leaves in both seasons. The highest percentage (2.30 and 2.36 %, respectively) was determined in the plants received paclobutrazol at the rate of 100 ppm. Increasing the concentration of paclobutrazol up to 200 ppm decreased the K %.

All the interaction treatments significantly increased the potassium percentage in the two seasons. Applying paclobutrazol at the rate of 100 ppm to the plants and pinching them twice led to the highest K % (2.36 and 2.63 %, respectively).

In branches:

From the data in Table (10) it can be noticed that, same as in the leaves, pinching the plants increased K % over the control in the two seasons. The highest percentage (1.97 and 2.02 %, respectively) was found in the plants pinched twice.

Also, treating the plants with paclobutrazol significantly increased the K % in the branches than the control in both seasons. Supplying the plants with paclobutrazol at the rate of 200 ppm caused the accumulation of the highest K % (2.12 and 2.18 %, respectively).

All the combination treatments significantly increased the potassium percentage. The highest K % (2.19 and 2.23 %, respectively) was determined in the branches of the plants treated with paclobutrazol at the rate of 200 ppm and pinched twice in the two seasons.

Table (9): Effect of paclobutrazol and pinching on phosphorus percentage in the leaves and branches (g) of *Thevetia peruviana* plant during the two seasons of 2004/2005 and 2005/2006

Paclobutrazol (A) / Pinching (B)	First season							
	Leaves				Branches			
	0	100	200	Mean	0	100	200	Mean
0	0.19	0.21	0.24	0.21	0.21	0.32	0.24	0.26
Once	0.15	0.44	0.47	0.35	0.17	0.20	0.32	0.23
Twice	0.65	0.18	0.11	0.31	0.31	0.34	0.29	0.31
Mean	0.33	0.28	0.27		0.23	0.29	0.28	
LSD at 0.05	A = 0.01 B = 0.01 A × B = 0.02				A = 0.02 B = 0.02 A × B = 0.03			
Second season								
0	0.49	0.09	0.40	0.33	0.24	0.36	0.26	0.29
Once	0.19	0.14	0.74	0.36	0.20	0.24	0.36	0.27
Twice	0.26	0.15	0.13	0.18	0,39	0.41	0.33	0.38
Mean	0.31	0.13	0.42		0.28	0.34	0.32	
LSD at 0.05	A = 0.02 B = 0.02 A × B = 0.03				A = 0.03 B = 0.03 A × B = 0.05			

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. Abou Dahab and Habib (2005) on *Barleria cristata* showed that the contents of N, P and K in the leaves were increased by pinching and paclobutrazol treatments as well as the interaction between them.

Table (10): Effect of paclobutrazol and pinching on potassium percentage in the leaves and branches (g) of *Thevetia peruviana* plant during the two seasons of 2004/2005 and 2005/2006

Paclobutrazol (A) / Pinching (B)	First season							
	Leaves				Branches			
	0	100	200	Mean	0	100	200	Mean
0	1.89	2.21	2.33	2.14	1.72	2.03	2.09	1.95
Once	1.96	2.33	2.14	2.14	1.82	1.95	2.09	1.95
Twice	2.32	2.36	2.03	2.24	1.79	1.93	2.19	1.97
Mean	2.06	2.30	2.17		1.78	1.97	2.12	
LSD at 0.05	A = 0.03 B = 0.03 A × B = 0.04				A = 0,02 B = 0,02 A × B = 0.04			
Second season								
0	1.94	2.13	2.39	2.16	1.67	2.08	2,18	1.98
Once	2.33	2.31	2.29	2.31	1.87	2.03	2.14	2.01
Twice	2.20	2.63	2.21	2.35	1.83	1.99	2.23	2.02
Mean	2.16	2.36	2.30		1.79	2.04	2.18	
LSD at 0.05	A = 0.02 B = 0.02 A × B = 0.03				A = 0.01 B = 0.01 A × B = 0.02			

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تقزيم شجيرة التيفيتيا

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أجرى هذا البحث فى مشتل قسم بساتين الزينة بكلية الزراعة – جامعة القاهرة خلال الموسمين ٢٠٠٤/٢٠٠٥ و ٢٠٠٥/٢٠٠٦ فى أصص بلاستيك (قطر ٢٠ سم) مملوءة بخليط من الطمى والرمل بنسبة ١:١ حجما بغرض دراسة تأثير الباكلوبيوترازول بتركيز ١٠٠ أو ٢٠٠ جزء فى المليون والتطويش مرة أو مرتين على تقزيم نباتات التيفيتيا حتى يمكن استعمالها كنباتات أصص . وقد أوضحت النتائج الآتى:

- أدى تطويش النباتات مرة واحدة إلى نقص فى الوزن الطازج للأفرع ، إلا أنه أدى إلى زيادة محتوى الأفرع من الكربوهيدرات الكلية والنتروجين ومحتوى الأوراق من الفوسفور .
- تطويش النباتات مرتين أدى إلى نقص فى الطول والوزن الجاف للأفرع مع زيادة كل من قطر الساق والأفرع، عدد الأوراق/نبات ، الوزن الطازج والجاف للأوراق ، محتوى الأوراق من كلوروفيل ا والكاروتينويدات ، ومحتوى الأفرع من الفوسفور وأيضا محتوى الأفرع والأوراق من البوتاسيوم .
- أدت معاملة النباتات بالباكلوبيوترازول بتركيز ١٠٠ جزء فى المليون إضافه إلى التربة إلى زيادة فى قطر الساق والأفرع ، عدد الأوراق/النبات بالإضافة إلى محتوى الأفرع من الفوسفور ومحتوى الأوراق من البوتاسيوم مع النقص فى محتوى الأوراق من الكربوهيدرات الكلية .
- معاملة النباتات بالباكلوبيوترازول بتركيز ٢٠٠ جزء فى المليون أدت إلى زيادة عدد الأفرع/نبات ، الوزن الطازج والجاف للأوراق ، بالإضافة إلى زيادة محتوى الأوراق من كلوروفيل ا ، ب والكاروتينويدات وأيضا محتوى الأفرع من النتروجين والبوتاسيوم . إلا أنها أدت إلى نقص فى الوزن الطازج والجاف للأفرع .
- معاملة النباتات بالباكلوبيوترازول بتركيز ٢٠٠ جزء فى المليون مع التطويش مرتين أدى إلى نقص طول الأفرع مع زيادة قطر الساق والأفرع ، عدد الأفرع والأوراق/النبات، الوزن الطازج والجاف للأوراق ، مع زيادة محتواها من الكاروتينويدات

ولذلك يوصى بتطويش النباتات مرتين فقط أو مرتين مع إضافة الباكلوبيوترازول بتركيز ٢٠٠ جزء فى المليون للحصول على نباتات متقزمة من التيفتيا ذات نمو خضرى جيد صالحة للإستخدام كنباتات أصص.