GROWTH AND FLOWERING OF *Anisacanthus wrightii* PLANT AS AFFECTED BY CYCOCEL AND PACLOBUTRAZOL APPLICATION

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ABSTRACT

Anisacanthus wrightii (Torr) plant belongs to ornamental flowering shrubs (Fam. Acanthaceae).The effect of growth retardants on Anisacanthus have not been previously studied under the Egyptian condition. Therefore, the study was conducted in lath houses at Sakha Agricultural Research Station, Kafr El-Sheikh Governorate, Egypt, during two successive seasons of 2004/2005-2005/2006 to study the effect of two growth retardants i.e., cycocel at 500, 1000 and1500 ppm and paclobutrazol at 10, 20 and 30 ppm on some vegetative and roots growth, flowering and some chemical compositions of Anisacanthus wrightii, aiming to use it as a new flowering indoor pot plant. Three foliar sprays of cycocel and paclobutrazol at 3 weeks interval were applied to potted plants of Anisacanthus.

Results indicated that most of the studied characteristics (plant height, leaves number, fresh and dry weights of leaves, fresh and dry weights of vegetative parts, root length as well as fresh and dry weights of roots) were significantly decreased due to applications of the two used growth retardants. Only the application of high concentration in both growth retardants significantly delayed flowering time and decreased some of flowering traits (i.e. florets number, fresh and dry weights of florets) and chlorophyll (a) and (b).Also, total carbohydrates were linearly decreased with raising both cycocel and paclobutrazol concentrations. However phenols and indoles content in Anisacanthus leaves were increased due to the treatments.

In brief, to obtain new flowering indoor pot plants of Anisacanthus wrightii for long period with good vegetative and flowering traits, it is recommended to spray transplants (4-4.5 months old) with 1000 ppm of cycocel or paclobutrazol at 20 ppm three times at three weeks interval under similar conditions of this investigation.

INTRODUCTION

The technique of producing pot plants of some ornamental shrubs started since the sixties of the last century and especially for the flowering ones with the aim of obtaining colourful showy flowers for long period under indoor conditions.

Growth regulators may be useful in controlling growth and manipulating plants shape and size, producing short and attractive compact plants (Andersen and Andersen, 2000).

Anisacanthus plants are covered with long slender, orange blooms which bees and butterflies love them (Fig. 1).

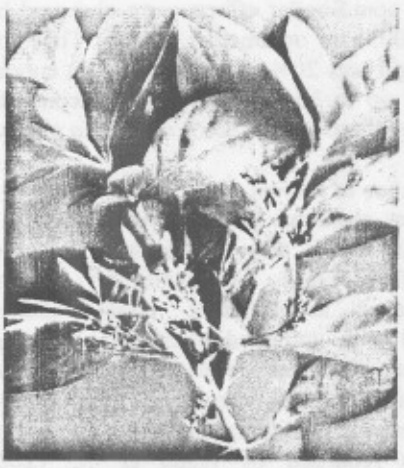

Fig. (1): *Aniscacanthus wrightii*, Family Acanthaceae.

Producing the pleasant compact *Anisacanthus* plants have not been investigated yet under our conditions. Anyway, many efforts were made to examine the influence of some growth retardants on growth control and flowering habit for some ornamental plants. Harry and Stephen (1990) found that, the application of PP-333 at 15 ppm and CCC at 1500 ppm was effective on height control of zonal geranium. Apholo *et al.*, (1997) mentioned that stem height and total dry weight of *Betula pendula* seedlings were decreased by using cycocel at 500 ppm.similar observations were also gained by Gent (1997) on *Rhodendron catawbiense* treated with Trizol at 25, 50 and 75 mg/L. Yoo *et al.*, (1999) and Anuraha *et al*,. (2000) found that the spray application of paclobutrazol reduced plant height of Chrysanthemum (*Dendranthema* × *grandiflora*).Emily *et al.*, (2001) found that three spray application of chloromequat (1500 mgL^{-1}) and paclobutrazol (30 mg L^{-1}) on *Oenothera fruticosa* reduced plant height and rooted stem length as compared with controls. Mi Young *et al.*, (2003) reported that the optimum concentration which reduced plant size, internodes length, and fresh and dry weights of leaves of *Kalanchoe blessfeldiana* was (10 ppm) of paclobutrazol

Regarding the effect of growth retardants on flowering, El-Maadawy *et al.*, (2001) stated that spraying *Begonia semperflorens* with cycocel at 1000-3000 ppm reduced number of flowers/ plant. Montasser (2004) recommended that to obtained high quality flowering pot plant of *Jacobinia carnea*, it should be sprayed with cycocel at 1000 ppm. Similar report was also obtained by Auda *et al.*, (2002) on *Barleria*. Moreover Shahine *et al.*, (2006) found that cycocel treatment delayed flowering time, and decreased number of flowers and flowering stalk of *Rudbeckia*.

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Most of chemical constituents of plants were invariably affected by using some growth retardants, thus the maximum chlorophyll contents in leaves were observed with the plants untreated by cycocel or paclobutrazol. Similar results were also obtained by Auda *et al.*, (2002) they indicated that chlorophyll contents (a+ b) were progressively decreased with increasing cycocel concentration (1000, 2000 or 3000 ppm). Mi young *et al*, (2003) on *Kalanchoe* reached similar conclusion. However Shahin *et al.*, (2006) found that, after the third spray, however, both indoles and phenols were increased, as well as total carbohydrates were decreased with raising cycocel concentration.

The aim of the present study was to study the effect of two growth retardants i.e., cycocel at 500, 1000 and1500 ppm and paclobutrazol at 10, 20 and 30 ppm on some vegetative and roots growth, flowering and some chemical composition of *Anisacanthus wrightii* aiming to use it as a new flowering indoor pot plants.

MATERIALS AND METHODS

The present work was conduced at Sakha Agricultural Research Station, Kafr El-Sheikh Governorate, Egypt during two successive seasons of 2004/2005 and 2005/2006.

Stem cuttings (semi-hard wood cuttings) with an average length of 15-17 cm were taken from certain mother shrubs grown in Faculty of Agriculture at Kafr El-Sheikh and planted in September 2nd in trays filled with a medium of peatmoss and vermiculite (3: 1 by volume). On October 12th, rooted cuttings were transplanted in 15 cm diameter plastic pots filled with peatmoss, sand and vermiculite (2: 1: 1 by volume). Every pot had one plant.The plants were pinched for about 5 cm from the shoot tip.cycocel (CCC) at 500, 1000, 1500 ppm and paclobutrazol (PP-333) at 10, 20 three times with three weeks intervals, 30 ppm) were sprayed three weeks on the foliage till runoff from mid February (i.e., 12 weeks after transplanting). Control plants, however, were sprayed with tap water.

The statistical design used was completely randomized block as seven treatments were replicated three times and distributed randomly within each block, each replicate contained 6 pots, (18 pots for each treatment)i.e. the experiment contained 126 pots for each season. Duncan's multiple range tests was used for the comparison among means of treatments according to Snedecor and Cochran (1972).

The following data were recorded : plant height (cm), number of leaves, fresh and dry weights of leaves (g), fresh and dry weights of vegetative parts (g), leaf area (cm2), longest root (cm), fresh and dry weights of roots (g), number of days from transplanting to flowering, number of florets, fresh and dry weights of florets (g), chlorophyll l (a) mg/g fresh weight, chlorophyll (b) mg/g fresh weight (Moran1982), total carbohydrates mg/g dry weight (Herbert *et al.*1971), phenols content (ppm) and indoles content (ppm) (A.O.A.C.1990).

RESULTS AND DISCUSSION

A-Effect of CCC and PP-333 on some vegetative growth characters:

A-1-Plant height:

The results regarding the effect of both growth retardants on *Anisacanthus* plants (Table 1) revealed that both cycocel and paclobutrazol were effective in controlling plant height, and at all levels had a pronounced effect on plant height Significantly shorter plants were attained in the treated plants as compared to the untreated plants. This reduction ranged from 29.7 % - 41.1 % and 33.4 % - 48.2 % in the first and second seasons respectively with using cycocel, while with paclobutrazol this reduction ranged from 24.0 % - 52.1 % and 38.3 % - 52.25%, in the first and second seasonsrespectively as compared to the control.

The best results, however, were obtained with the medium rates of both (CCC at 1000 ppm) and (PP-333 at 20 ppm.).The low rate of cycocel and paclobutrazol did not reduce plant height to optimal suitable height for marketing, at the same time the higher rates had resulted in excessive growth reduction coupled with some undesirable morphological shape as smaller, darker and crinkle leaves. Such results might be interpreted according to the direct role of some growth retardants in retarding stem elongation by reducing cell division and extension in the subapical meristematic zone of the stem (Huang, 1996). These results are in agreement with those obtained by, Emily *et al.*, (2001) on *Oenothera fruticosa*. Montasser (2004) reported that, to control the plant height of *Jacobinia carnea* and *Lantana camara*, it should be sprayed with cycocel at 1000 ppm and paclobutrazol at 15 or 20 ppm.Similar effects were observed by Paulo *et al.*, (2005) on ornamental tomato. They found the plant height was 20% shorter as PP-333 concentration increased up to 30 mg ai.L-1.Similar conclusion was reached by Pinto *et al.*, (2005) on *Zinnia* plants.

A-2 Number of leaves:

It was observed from data in (Table 1), that the number of leaves was significantly decreased as a result of spraying the plants by cycocel and paclobutrazol at different concentrations when compared with untreated plants in both seasons. A higher reduction was observed by using cycocel at 1500 ppm and paclobutrazol at 30 ppm in the first and second seasons. The reduction in the number of leaves was also recorded by Auda *et al.*, (2002).They indicated that the number of leaves were significantly reduced with applying cycocel at 1000, 2000or 3000 ppm and paclobutrazol at 100, 150 or 200 ppm on *Barleria*. A similar trend was obtained by Shahin *et al*, (2006) on *Rudbeckia* plants.

A-3 Fresh and dry weights of leaves:

Fresh and dry weights of leaves also showed a similar trend as the plant height and number of leaves in the two seasons. All treatments significantly decreased both fresh and dry weights of leaves as compared to the control. These results are parallel with those obtained by Mi Young *et al.*, (2003) who reported that the optimum paclobutrazol concentration which reduced the fresh and dry weights of leaves of *Kalanchoe blessfeldiana* was (10 mg L^{-1}). Shahin *et al.*, (2006) on *Rudbeckia* plants reached similar conclusion.

A-4. Fresh and dry weights of vegetative parts (shoots & leaves):

As for the effect of cycocel and paclobutrazol on fresh and dry weights of vegetative parts, data in (Table 1) showed that the different foliar spray application significantly decreased the fresh and dry weights of vegetative parts comparing with the control during both seasons. The greatest reduction was resulted in from the highest cycocel concentration (1500 ppm) and paclobutrazol at 30 ppm. The aforementioned results are in accordance with those of Apholo *et al.*, (1997) who recorded that total dry weight of *Betula pendula* seedlings were decreased by cycocel at 1500 ppm. Auda *et al.*, (2002) on *Barleria*, and Shahin *et al.*, (2006) on *Rudbeckia* reached similar conclusion.

Table (1): Effect of cycocel and paclobutrazol treatments on some vegetative growth traits of *Aniscacanthus wrightii* during two seasons (2004/2005-2005/2006).

Treatments	Concentration (ppm)	Plant height (cm)	No. of leaves/ plant	(F.W.) of leaves/ plant (g)	(D.W.) of leaves/ plant (g)	(F.W.) of vegetative parts/ plant (g)	(D.W.) of vegetative parts/ plant (g)	Leaf area $(cm)^2$/ plant
		First season						
Control	0	60.33 a	45.66 a	25.81 a	9.16 a	90.81 a	34.29 a	199.44 a
CCC	500	42.40 b	29.66 b	18.10 b	6.21 c	66.25 c	32.61 a	152.15 b
	1000	35.73 b	27.00 bc	12.97 d	6.16 cd	56.53 d	27.01 b	98.46 c
	1500	35.53 b	26.00 bc	11.55 cd	5.49 cd	46.79 e	22.67 c	94.64 c
PP-333	10	45.83 a	30.00 b	17.09 b	7.17 b	78.869 b	29.64 ab	91.83 c
	20	34.86 b	29.33 b	14.40 c	5.44 d	64.35 c	24.35 c	82.93 cd
	30	28.86 c	21.00 c	8.03 e	4.24 e	37.86 f	20.09 d	45.40 d
		Second season						
Control	0	65.06 a	46.00 a	27.22 a	9.88 a	82.89 a	32.82 a	221.95 a
CCC	500	43.30 b	25.33 bc	18.05 b	8.44 b	60.22 b	29.51 a	176.87 b
	1000	40.90 b	23.66 c	15.90 bc	7.64 c	51.37 c	25.23 b	128.50 c
	1500	33.66 b	22.33 c	14.63 c	6.69 d	48.20 cd	20.11 c	107.31 c
PP-333	10	40.13 b	30.33 b	14.75 c	6.60 de	64.82 b	23.52 bc	97.90 cd
	20	32.76 b	28.66 b	13.94 cd	6.18 de	53.17 bc	21.32 c	91.47 cd
	30	31.03 b	26.33 bc	11.05 d	5.91 e	42.90 d	19.92 c	69.78 d

(F.W) = Fresh weight. (D.W) = Dry weight.

Means within a column having the same letters are not significantly different according to Duncan's multiple range test.

A-5. Leaf area:

The data in Table (1) revealed that both cycocel and paclobutrazol had pronounced significant reducing effect on leaf area. The data also revealed that raising the cycocel or paclobutrazol concentrations resulted in a significant and steady reduction in the leaf area. This reduction ranged from 23.7 %-52.5 % and 20.3 %-51.6 % in the first and second seasons respectively when the plants were treating by cycocel, while with paclobutrazol gave a reduction ranged from 53.9 %-77.2 % and 55.8 %-68.5%, in the first and second seasonsrespectively when compared with untreated plants. Although both growth retardants induced reduction in the leaf area, the heights reduction was greater by PP-333 than by CCC. The reduction in the leaf area was also recorded by Joyce (1991) on *Zinnia elegance* and *Tagets erecta* and Auda *et al., (2002)* on *Barleria*. On ornamental tomato Paulo *et al.*, (2005) found that plants exhibited smaller leaf area as the paclobutrazol concentrations increased (15, 30, 45, 60 and 75 mg/L)

A-2. Root growth:

The application of cycocel and paclobutrazol especially at higher concentrations (1500 ppm and 30 ppm respectively) had significant effect for reducing some root growth traits (i.e. root length, fresh and dry weights of roots) as compared to untreated plants (Table2).This reduction in the root length ranged from 27.6 %-47.0 % and 28.2 %-36.0 % in the first and second seasonsrespectively with using cycocel, while

with paclobutrazol gave a reduction ranged from 18.1 %-23.3 % and 36.0 %-36.6% in the first and second seasons when compared with untreated plants.Similar results were attained by Gent (1997) when he treated *Rhodendron catawbiense* plants by Triazole at 25, 50, and 75 mg/L, Auda *et al.*, (2002) on *Barleria*, El-Maadawy *et al.*, (2001) on Begonia and Montasser (2004) on *Jacobinia carnea.*

B- Effect on some flowering traits

B-1 Flowering date (days):

Data in (Table3) indicated that using the two growth retardants at different rates increased the days from planting transplants to flowering with non-significant differences between the treatments of low and medium concentration of cycocel and paclobutrazol as compared to the control in both seasons. However the application of CCC at 1500 ppm significantly delayed the flowering time with 13 and 8 days, whereas PP-333 at 30 ppm delayed the flowering time with 12.4 and 11.4days as compared to the control in both seasons. The obtained results are in conformity with Yewale *et al.*, (1997) and Wei and Han (1997) on chrysanthemum. They reported that PP-333 at 25, 50, 75 and 100 ppm progressively delayed flowering as the concentration was increased. Also Starman and Williams (2000) on *Scaevola aemula* and Shahin *et al.*, (2006) on *Rudbeckia* reached similar conclusion.

Table (2): Effect of cycocel and paclobutrazol on some growth root traits of *Aniscacanthus wrightii* during two seasons (2004/2005-2005/2006).

Treatments	Concentration (ppm)	Longest root (cm)	(F.W.) of roots (g)	(D.W.) of roots (g)	Longest root (cm)	(F.W.) of roots (g)	(D.W.) of roots (g)
		First season			Second season		
Control	0	35.28 a	19.52 a	10.53 a	31.73 a	21.83 a	10.03 a
CCC	500	25.73 c	14.04 c	7.78 b	22.76 bc	12.91 b	6.24 c
	1000	25.09 c	13.94 c	6.62 c	22.54 bc	12.42 b	6.06 c
	1500	18.84 d	13.91 cd	6.38 cd	20.28 c	11.53 bc	6.03 c
PP-333	10	29.11 b	17.59 bc	9.89 a	24.39 b	13.58 b	6.68 b
	20	27.29 bc	10.52 d	5.67 cd	22.05 bc	11.64 bc	6.26 b
	30	27.27 bc	9.23 d	5.53 d	20.08 c	9.30 c	4.68 d

(F.W) = Fresh weight. (D.W) = Dry weight.

Means within a column having the same letters are not significantly different according to Duncan's multiple range tests.

Table (3): Effect of cycocel and paclobutrazol treatments on some flowering traits of *Aniscacanthus wrightii* during two seasons (2004/2005-2005/2006).

Treatments	Concentration (ppm)	No. of days from transplanting to flowering	No. of florets/plant	(F.W.) of florets (g/pl)	(D.W.) of florets (g/pl)	No. of days from transplanting to flowering	No. of florets/plant	(F.W.) of florets (g/pl)	(D.W.) of florets (g/pl)
		First season				Second season			
Control	0	126.3 b	129.3 a	7.01 a	2.21 a	121.3 c	113.0 a	5.55 a	1.49 a
CCC	500	127.3 b	121.0 b	6.18 b	1.96 b	125.0 bc	101.6 b	5.22 ab	1.39 ab
	1000	130.3 b	115.0 bc	6.11 bc	1.61 bc	126.3 b	93.5 c	5.13 ab	1.33 ab
	1500	139.3 a	90.0 cd	6.00 c	1.39 c	129.3 ab	85.6 d	5.01 b	1.11 b
PP-333	10	127.0 b	114.7 bc	5.88 cd	1.33 c	125.3 bc	102.2 b	5.22 ab	1.30 b
	20	129.7 b	110.7 bc	5.52 cd	1.41 c	128.3 b	95.7 c	5.20 ab	1.27 b
	30	138.7 a	80.3 d	3.65 d	1.01 d	132.7 a	91.2 c	5.04 b	1.12 b

(F.W) = Fresh weight. (D.W) = Dry weight.

Means within a column having the same letters are not significantly different according to Duncan's multiple range tests.

B-2 Effect on florets number:

It was obvious from the data in (Table3) that, the number of florets/ plant was significantly decreased as a result of spraying the plants by both growth retardants at the different concentrations as compared with untreated plants in the two seasons. The reduction in the number of florets was also recorded by El-Maadawy *et al.*, (2001) on Begonia. Similar results were observed by Montasser (2004) on *Jacobinia carnea* with using cycocel, and Shahin *et al.*, (2006) on *Rudbeckia.*

B-3 Fresh weight of florets:

Data in (Table3) indicated that fresh weight of florets was negatively influenced by all treatments of

cycocel, in the first season the decrement that significantly was the highest for the treatment at 1500 ppm. There were no significant difference between the 1000 and 1500 ppm treatments in this concern. However in the second season the decrement was the highest for the treatment of cycocel 1500 ppm, treating plants by all concentrations of paclobutrazol significantly decreased the fresh weight of florets in the first season as compared to the control.Meanwhile in the second one only paclobutrazol at 30 ppm significantly decreased the fresh weight of florets as compared to the control.

B-4 Dry weight of florets:

A somewhat similar trend as the previous parameter as shown in (Table 3) was detected. Dry weight of florets was significantly decreased with increasing the concentration of cycocel and paclobutrazol.The lowest record was resulted in from plants treated with the highest rates of both growth retardants.In the first season all treatments significantly decreased the dry weight of florets. However in the second season the high rate of cycocel and all rates of paclobutrazol significantly decreased the dry weight of florets as compared to the control.

In general, although there was a reduction in the number of florets as well as fresh and dry weights of florets on treated plants, the corresponding reduction in plant height and vegetative parts improved the appearance of the compact *Anisacanthus wrightii* as a flowering indoor pot plant, especially those treated with CCC at 1000 ppm and PP-333 at 20 ppm (Fig. 2).

Fig. (2): *Aniscacanthus wrightii* after treatments.

C - Effect of CCC and PP-333 on chemical composition:

C-1 Chlorophyll (a) (mg/g fresh weight):

Results in Table (4) indicated that gradually decreases in chlorophyll a content in the leaves were observed with increasing the concentration of cycocel and paclobutrazol in both seasons as compared to the control. The aforementioned results are in accordance with those of Abdella (2000) who studied the effect of PP-333 on *Hibiscus rosa-sinensis* and stated that it reduced chlorophyll (a) in leaves.

C-2 Chlorophyll (b) (mg/g fresh weight):

Data in (Table 4) revealed that all growth retardants treatments significantly decreased chlorophyll (b) content in *Anisacanthus* leaves in the first season as compared to the control. On the other hand, in the second season, data in the same Table indicated that, the application of cycocel just at 500 and 1000 ppm insignificantly decreased chlorophyll (b) as compared to the control. However all the other treatments significantly decreased the leaves content of chlorophyll (b) as compared to the control, the maximum chlorophyll contents in leaves were observed in the control plants. Plants typically appeared darker green which might be due to reduced leaf expansion (Davis *et al.*, (1988)

The growth retardants treatments reduced thick and dark green leaves (Fletcher and Hofstra 1985 b). It causes the change in cell size as well as the change in the form of the plant (Thetford *et al.*, 1995a). This result was in agreement with, Mi Young *et al.*, (2003) on *Kalanchoe* who found that chlorophyll concentration was decreased with using plant growth regulators.

Table (4): Effect of cycocel and paclobutrazol treatments on some chemical constituents of *Aniscacanthus wrightii* during two seasons (2004/2005-2005/2006).

Treatments	Conc. ppm	Chl. (a) (mg/g F.W.)	Chl. (b) (mg/g F.W.)	Total carbohyd rates (mg/g D.W.)	Phenols content (ppm)	Indoles content (ppm)	Chl. (a) (mg/g F.W.)	Chl. (b) (mg/g F.W.)	Total carbohydra tes (mg/g D.W.)	Phenols content (ppm)	Indoles content (ppm)
	First season						Second season				
Control	0	1.80 a	1.04 a	8.80 a	5.71 d	12.00 c	1.96 a	1.09 a	6.80 a	6.53 d	12.03 f
CCC	500	1.24 ab	0.95 b	6.56 b	12.33 cd	12.42 bc	1.68 ab	1.01 b	6.43 a	13.70 c	12.41 e
	1000	1.08 b	0.78 d	6.13 bc	15.17 c	13.00 ab	1.59 b	0.97 bc	5.62 ab	15.97 b	12.72 d
	1500	0.97 b	0.73 de	5.54 cd	19.23 a	13.52 a	1.57 b	0.86 bc	4.87 b	17.77 a	13.22 c
PP-333	10	1.75 a	0.86 c	5.96 c	14.10 c	13.06 ab	1.70 ab	0.85 b	3.64 b	12.67 c	12.91 d
	20	1.50 ab	0.76 de	4.73 d	17.00 b	13.09 ab	1.53 b	1.67 bc	2.48 c	16.07 ab	13.82 b
	30	1.27 ab	0.79 e	2.90 e	18.20 ab	13.50 a	1.40 b	0.61 c	2.07 c	17.07 a	14.11 a

(F.W) = Fresh weight. (D.W) = Dry weight.
Chl (a) =Chlorophyll (a) Chl (b) =Chlorophyll (b)
Means within a column having the same letters are not significantly different according to Duncan's multiple range tests.

C-3 Total carbohydrates:

Reduction of total carbohydrates (Table 4) is considered reasonable because they took a parallel line to that of pigments content which is responsible of biosynthesis processes in the plant. The aforementioned results are in accordance with those of Auda *et al.*, (2002) on *Barleria* and Shahin *et al.*, (2006) on *Rudbeckia*, and Kwack and Lee (1997) on *Epipremnum aureum, Plantago asiatica* and *Lonicera japonica*. They noticed that at the dose of 10 mg/l unicnazole increased the carbohydrates content. Several records were also indicated by Starman and Williams (2000) on *Scaevola aemula*.

C-4 Indoles and Phenols content:

A somewhat different trend in indoles and phenols content was (Table 4). Both growth retardants at all concentration increased gradually indoles and phenols contents as compared with the control in both seasons. Similar results were attained by Shahin *el al.*, (2006) on *Rudbeckia* plants.

Equations [1], [3], [5], [7], [9], [11], and [13] showed that each one part per million of cycocel application decreased plant height, no. of leaves, dry weight of vegetative parts, leaf area, longest root, dry weight of roots, and total carbohydrates by 0.02 cm, 0.01, 0.01g, 0.07cm^2, 0.01cm, 0.003 g, and 0.002 mg/g D.W.respectively, as shown in Table 5. On the other hand, application of 1ppm of aclobutrazol decreased plant height, no. of leaves, dry weight of vegetative parts, leaf area, longest root, dry weight of roots, and total carbohydrates by 1.1 cm, 0.72, 0.50g,.4.8cm^2, 0.30 cm, 0.20 g, and 0.20 mm/g D.W. respectively, (Equations [2], [4], [6], [8], [10], [12], and [14]). It means that application of paclobutrazol on *Anisacanthus* plants was more efficient on reduction of all parameters under study compared with application of cycocel (Table 5) and the reduction in all traits under study was linearly decreased with increasing the concentration of growth retardants. In general both cycocel and paclobutrazol were effectiveness in controlling plant growth. The difference in effective between the two compounds could be due to different modes of action. paclobutrazol blocks an early step in the gibberellin biosynthetic pathway (Coolbaugh and Hamilton.1976)), thus reducing the gibberlic acid content in the treated plant whereas cycocel reducing cell division and extensions in the subapical meristematic Zone stem (Huang 1996) or by inhibition of cytokinin and gibberellin biosynthesis (Million *et al.*, 1999)

The reduction in all traits under study was linearly decreased with increasing the rate of growth retardants i.e. cycocel and paclobutrazol as shown in Table (1, 2, 3, and 4).

It could be concluded that the production of controlled size of *Anisacanthus wrightii* pot plants is possible through the use of growth retardants especially PP-333 at 20 ppm or CCC at 1000 ppm.

Regression:

Table (5): Regression equations adjusted to evaluate parameters [$\hat{Y}$] of *Anisacanthus wrightii* as variables of growth regulators concentration (X)

Evaluated parameter [$\hat{Y}$]	Growth retardants [X]	Regression equation	R^2
Plant height (cm)	Cycocel	$\hat{Y}$ = 56- 0.02X....[1]	0.86**
	Paclobutrazol	$\hat{Y}$ = 58- 1.10X....[2]	0.96**
No. of leaves	Cycocel	$\hat{Y}$ = 41- 0.01 X....[3]	0.70**
	Paclobutrazol	$\hat{Y}$ = 42- 0.72 X....[4]	0.79**
Dry weight of vegetative parts (g)	Cycocel	$\hat{Y}$ = 35- 0.01X....[5]	0.86**
	Paclobutrazol	$\hat{Y}$ = 34- 0.50X....[6]	0.84**
Leaf area (cm^2)	Cycocel	$\hat{Y}$ = 190- 0.07X...[7]	0.79**
	Paclobutrazol	$\hat{Y}$ = 174- 4.80X...[8]	0.84**
Longest root (cm)	Cycocel	$\hat{Y}$ = 33- 0.01X....[9]	0.84**
	Paclobutrazol	$\hat{Y}$ = 33- 0.30X....[10]	0.78**
Dry weight of roots (g)	Cycocel	$\hat{Y}$ = 9.8- 0.003X..[11]	0.81**
	Paclobutrazol	$\hat{Y}$ = 10.9- 0.2X...[12]	0.86**
Total carbohydrates (mg/g D.W)	Cycocel	$\hat{Y}$ = 8.2- 0.002X..[13]	0.81**
	Paclobutrazol	$\hat{Y}$ = 8.4- 0.2X.....[14]	0.98**

** Significant at $p<0.01$; R^2 coefficient of determination

REFERENCES

Abdella, Ebtessam, M. M. (2000). Effect of some growth regulators on some flowering shrubs. Ph. D. Thesis, Fac. Agric., Cairo Unvi., El Fayoum.

A. O. A. C. (1990). The Association of official Agricultural Chemists. 15 th Ed., Arilington, Virginia. 22201: 877-878.

Andesen, A. S. and Andersen, L. (2000). Growth regulators as a necessary prerequisite for introduction of new plants. Acta Hort. 541: 183-192.

Anuradha, T.; Nihal C. Rajapakse, R. Thomas, Fernandez, and James R. Rieck (2000). Effectiveness of plants growth regulators under

Photo selective greenhouse covers. J. Amer. Soc. Hort. Sci. 125 (6): 673-678.

Apholo, P. J; R. Rikala and R. A. Sancher (1997). Effect of CCC on the morphology and growth potential of containerized sliver birch seedlings. New Frosts, 14 (3): 167-177.

Auda, M. S.; S. M. Shahin and M. H. El Shakhs (2002). The dwarf *Barleria* a new pot plant product. Arab. Univ. J. Agric. Sci, Ain Shams Univ., Cairo, 10 (1), 319-333.

Coolbaugh, R. C. and R. Hamilton. (1976). Inhibition of ent-kaurene oxidation and growth by α-cyclopropyl-α-(p-methoxy-phenyl)-5-pyrimidine methyl alcohol. Plant Physiol. 57: 245-248.

Davis, T. D., Steffens, G. L. and Sankhla, N. (1988). Triazol plant growth regulators. Hort. Rev. 10: 63-105.

El–Maadawy, El., Mohamed, T. A. and Ahmed, M. A. (2001). Effect of GA3 and CCC on growth, flowering and chemical composition of *Begonia semperflorens* L. plants. Bull. Faculty Agri. Cairo Univ. 52: 279-296.

Emily, A., Arthur, C. Cameron, Royal D. Heins, and William H. Carlson (. 2001). Growth and development of *Oenothera fruticosa* is influenced by vernalization duration, photoperiod, forcing temperature and plant growth regulators. J. Amer. Soc. Hort. Sci. 126 (3): 269-274.

Fletcher, R. A. and Hofstra, G. (1985). Trimefon –A plant multiprotectant. Plant Cell Physiol. 26 775-780.

Gent, M. P. N. (1997). Persistence of triazole growth retardants on stem elongation of Rhododendron and Kalmia. J. plant Growth Regulation, 16 (4): 197-203.

Harry, K. Tayama and Stephen A. Carver (1990). Zonal geramium growth and flowering to six growth regulators. Hort Sci 25 (1): 82-83.

Herbert, D.; J. Philipps and R. E. Strange (1971). Determination of total carbohydrates. Methods in Microbiology, 5 (8): 290-344.

Hung, Q. (1996). Effect of plant growth regulators on endogenous hormones and bud differentiation of longan. Acta Botanica Yunnanica, 18 (2): 145-150.

Joyce G. Latimer (1991). Growth retardants affect landscape performance of *Zinnia impatiens*, and marigold. Hort Science 26 (5): 557-560.

Kwack, H and Lee (1997). Effect of uniconazole and gibberellin on leaf variegation of ornamental plants under different light condition. J. Kor. Soc. for Hort. Sci., 38 (6): 754-760.

Mi Young Lee, Nam Hee Choi and Byoung Ryong Jeong (2003). Growth and flowering of *Kalanchoe* (Rako) as affected by concentration of Paclobutrazol and uniconazole. Acta. Hort. 624,. 287-296.

Million, J. B., J. E. Barrett, T. A. Nell and D. G. Clark (1999). Inhibition growth of flowering crops with ancymidol and paclobutrazol in sub irrigation water Hort Sci, 34 (6): 1103-1105.

Montasser. H. M. (2004). Physiological studies on *Jacobinia carnea* Lindl and *Lantana camara* L. shrubs M. Sc Thesis, Fac. Agric., Kafr El-Sheik Tanta univ.

Moran, R. (. 1982).. Formula for determination of chlorophyllous pigment extracted with N. N dimethyl formamide. Plant Physiol., 69: 1376-1381.

Paulo Jose de Moraes, Jose Antonio Saraiva Grossi, Sabrina de Araujo Tinoco, DerlyJose, Henriques da Silva, Paulo Roberto Cecon and Jose Geraldo Barbosa (2005). Ornamental Tomato growth and fruiting response to paclobutrazol. Acta Hort 683, 327-330.

Pinto A. C. R, Rodrigues, T. J. D., Leite I. C. and J. C. Barbosa (2005). Effect of daminozid, paclobutrazol and chloromequat on development and quality of potted Persian carpet (*Zinnia*). Acta Hort 683: 399-406.

Shahin S. M., Manoly N. d. and Samira S. Ahmed (2006). Production of the stunted Ruodbeckia. Minufia J. Agric. Res. vol. 31 No. 1: 89-106.

Snedecor, G. W. and W. G. Cochran (1972). "Statistical Methods" 6th ed., Iowa Univ. Press. Ames. Iowa, U. S. A.

Starman, T. W. and M. S. Williams (2000). Growth retardants affect growth and flowering of Scaevola. Hort. Sci. 35 (1): 36-38.

Thetford, M.; Stuart, L.W., Frank, A. B. and Judith, F. T. (1995). Response of *Forsythia* x *Intermedia spectabilis* to uniconazole II. leaf and stem anatomy, chlorophyll, and photosynthesis J. Amr. Soc. Hort. Sci. 120: 983-988

Wei, S and B. Han (1997). Studies on production of desk chrysanthemum by applying B9 as dwarfing agent. J. Chi. Agric. Unvi. 2 (3): 101-105.

Yewale, A. K., P. V. Belorkar, M. A. Chanekar, T. R. Padgilwar and B. S. Chimurkar (1997). Effect of growth retardants paclobutrazolon flowering of chrysanthemum. J. Soil and Crops 7 (2): 175-177.

Yoo, Y.; K. Sangwook and K. Hyunkyung (1990). Effects of pinching and daminozide treatments on growth and flowering of *Chrysanthemum zawadskii* ssp. *Naktongense*. J Korean Soc. Hort. Sci. 40 (5): 598-602.

الملخص العربى

نمو وإزهار نباتات الأنيس اكانسس وتأثير السيكوسيل والباكلوبترازول عليها

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يتبع نبات الأنيس اكانسس شجيرات الزينة المزهره وينتمي للعائلة (Acanthaceae)ولم يتم من قبل دراسة تاثير مثبطات النمـــوعلي هذا النبات تحت الظروف المصرية. لذا اجريت هذه الدراسة في صوب خشبية فى محطة البحوث الزراعية بسخا بمحافظة كفر الشيخ بمصرفي الموسمين المتعاقبين (٢٠٠٤/٢٠٠٥-٢٠٠٥/٢٠٠٦) وذلك لدراسة تأثير نوعين من مثبطات النمو وهما السيكوسيل (بتركيزات ٥٠٠، ١٠٠٠ ، ١٥٠٠جزء في المليون)والباكلوبترازول (بتركيزات ١٠،٢٠،٣٠ جزء في المليون) علي كل من بعض صفات النمو الخضرية والجذرية وكـــذا بعض الصفات الزهرية بالإضافة إلي بعض المكونات الكيميائية لنبات الأنيس اكانسس بهدف الحصول علي نبات اصص جديد مزهر جذاب من اجل التنسيق الداخلي. ولقد تم رش النباتات بالسيكوسيل والباكلوبترازول ثلاث مرات بفاصل ثلاثة أسابيع بين الرشات

وقد أوضحت النتائج نقصا معنويا في معظم الصفات التي تم دراستها (ارتفاع النبات والوزن الطازج والجاف للأوراق وكذا الـــوزن الطـــازج والجاف للأجزاء الخضرية وطول الجذور وكذا وزن الجذور الطازج والجاف نتيجة للإستخدام المادتين).

وقد أدي استخدام التركيز المرتفع من السيكوسيل (١٥٠٠ جزء في المليون) وايضا التركيز المرتفع من الباكلوباترازول (٣٠ جـــزء في المليون إلي تأخير معنوي في موعد الإزهار في الموسمين كما حدث نقص في بعض الصفات الزهرية مثل عدد الزهيـــرات وكـــذا وزنهـــا الطازج والجاف وقد إزداد النقص في كلا من كلوروفيل (أ) وكلوروفيل (ب) و محتوي الكربوهيدرات الكلية في الأوراق وذلك مـــع زيـــادة التركيزات المستخدمة من كلا من السيكوسيل والباكلوبترازول وكان العكس صحيحا مع محتوي الأوراق من الفينولات والاندولات

وعليه فإنه يوصي للحصول علي نبا ت الأنيساكانسس كنبات اصص مزهر جديد ذو صفات خضرية وزهريةجيده للتنسيق الـــداخلي بمعاملة الشتلات عمر (٤-٤,٥ شهر) بالرش بالسيكوسيل بتركيز ١٠٠٠ جزء في المليون أو الرش بإستخدام الباكلوبترازول بتركيز ٢٠ جزء في المليون ثلاث مرات بفاصل ثلاث اسابيع بين الرشات وتحت ظروف مناسبه لظروف البحث المستخدم.