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DWARFING OF *ACALYPHA WILKESIANA* var. HOFFMANII PLANT BY CYCOCEL AND PACLOBUTRAZOL

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ABSTRACT

This work was conducted at the Experimental Farm of Faculty of Agriculture, Kafr El-Sheikh University during the two successive seasons of 2005 and 2006 to study the effect of some growth retardants on the growth and chemical composition of *Acalypha wilkesiana* var. Hoffmanii shrub aiming to use it as indoor pot plants.

On April 1st rooted cuttings "one year old" were transplanted in plastic pots of 15 cm diameter filled with a mixture of peat moss, compost and sand "1:1:1 v:v:v" as every pot had one plant. The plants were fertilized with NPK at the ratio of 1:1:1 at the rate of 5g/pot.

The used growth retardants were paclobutrazol "PP-333" and cycocel "chloromequat" added twice at the rates of 0, 20, 40 and 60 ppm for PP-333 and 0, 1000, 1500 and 2000 ppm for cycocel. They were applied either as a soil drench or as a foliar spray beginning from May 1st with 4 weeks interval. Data were recorded on growth and some chemical constituents.

The results showed that the middle concentration of both growth retardants were the most effective in controlling plant growth thereby producing more compact and attractive plants suitable for used as pot plants. Paclobutrazol at 20 and 40 ppm as foliar spray or cycocel at 1000 and 1500 ppm as soil drench gave the best results compared to other treatments. The effects of both PP-333 and cycocel concentrations, application methods and their interaction treatments on growth characters and plant contents of chlorophylls and total carbohydrates were studied.

It can be recommended to apply both Paclobutrazol at 20 and 40 ppm as foliar spray or cycocel at 1000 and 1500 ppm as soil drench for *Acalypha wilkesiana* var. Hoffmanii shrub to obtain more compact and attractive plants suitable for used as pot plants.

Key words: *Acalypha wilkesiana* var. Hoffmanii, dwarfing, growth retardants, paclobutrazol, cycocel.

INTRODUCTION

Copperleaf *Acalypha wilkesiana* shrub belongs to Family Euphorbiaceae. It is a large, fast-growing evergreen shrub provides a continuous splash of color in the landscape. The bronze red to muted red 4 to 8 inch long, heart-shaped leaves are available in varying mottled combinations of green, purple, yellow, orange, pink, or white, depending upon cultivar. Their unusual color attracts attention and they could look gaudy.

The variety "Hoffmanii" has a dark green-crested leaves with narrow cream margins, often with only the very irregular teeth having the chimera. The dense, much-branched growth habit creates a full shape, but plants occasionally need shaping to maintain a neat appearance. It well-suited to use as hedge; mass planting; container or above-ground planter; screen accent in mixed shrubbery borders.

Treating plants with growth retardants would make them desirable pot plants with best quality. This investigation aimed to study the effect of some growth retardants on the growth of *Acalypha wilkesiana* "Hoffmanii". To accomplish the purpose of research, two-plant growth retardants were used i.e. paclobutrazol (PP-333) and cycocel (CCC) or chloromequat. In this concern, Kaminski (1989) stated that, rose plants treated with 150 ppm paclobutrazol had 6 shoots with total shoot length of 48.3 cm compared with 5 shoots with total length of 75 cm in the control. The plants had greener leaves and more mildew resistance. In addition, Porwal *et al.* (2002) found that, CCC application to *Rosa damascena* reduced plant height but increased number of shoots per plant.

Hashim *et al.* (1991) on *Hibiscus rosa-sinensis* found that spraying palobutrazol produced shorter plants. PP-333 at 250 ppm gave the lowest number of branches while PP-333 at 500 or 2000 ppm gave the lowest leaf area and, the lowest fresh and dry weights of roots and vegetative growth especially at 500 ppm. Total carbohydrates tended to decrease slightly as the concentration of PP-333 increased. Also, Abdella (2000) found that cycocel at the rates of 1000, 2000 and 3000 ppm decreased plant height, leaf area, chlorophyll in leaves and total carbohydrates in all organs but increased branching of *Hibiscus rosa-sinensis* and *H. mutabilis*. Likewise, Warner and Erwin (2003) showed that, one time spray application of CCC (1000 or 2000 ppm) on *Hibiscus coccineus, H. radiatus and H. trionum* inhibited stem elongation with a 2000 ppm by 87, 42 and 52%, respectively compared to untreated plants.

Helal (1993) stated that spraying poinsettia with PP-333 at the rates of .50,100 and 200 ppm decreased plant height, number of nodes/plant, leaf area, stem fresh and dry weights/plant. Likewise, Wilfret and Barrett (1994) reported that the single spray of PP-333 at 60 ppm reduced poinsettia height to 11.9-13.2inches while drenching 0.25mg PP-333 produced plants with 12.2-12.6inches tall. Also, Newman and Tant (1995) applied PP-333 to *Euphorbia pulcherrima* as impregnated spike or drench and found that, all treatments reduced shoot elongation.

Ruter (1996) found that PP-333 as soil drench at 0.5 or 1.0 mg/pot reduced *Lantana camara* root dry weight and plant biomass. It also reduced growth index, decreased shoots and roots dry weights more than spray application.

Ahmed (1997) on *Bougainvillea MrsButt* reported that PP-333 at a rate of 40 ppm as soil drench decreased plant height but increased the number of leaves, branches fresh and dry weights and increased carbohydrates and total chlorophyll contents in the leaves.

Manoly *et al.* (2001) found that CCC at 500,1000,1500 and 2000 ppm was effective especially at high concentration levels (1500 and 2000 ppm) in reducing the various vegetative growth parameters as these concentrations increased number of branches while decreased root dry weight of poinsettia.

Auda *et al.* (2002) studied the effect of PP-333 at 100,150 and 200 ppm and CCC at 1000, 2000 and 3000 ppm as foliar sprays on *Barleria cristata*,Linn. and mentioned that, plant height, number of lateral branches /plant, leaf area, number of leaves/ plant and aerial parts fresh and dry weights were significantly reduced, whereas stem diameter was significantly increased, the root fresh and dry weights were insignificantly decreased. Also, total carbohydrates as well as chlorophyll a and b contents of the leaves were increased.

Osman (2002) found that spraying *Nerium oleander*, L., with PP-333 at 80 ppm decreased plant height and branches number/pant. PP-333 at 20 ppm increased leaf area and root length and, the rates of 40 and 80 ppm increased fresh and dry weights of leaves, chlorophyll a and b in the leaves and total carbohydrates contents in all plant organs. Likewise, Banon *et al.* (2001) on the same plant, found that, the plants treated with 800 mg CCC were significantly shorter than the control plants. Cycocel at 100 mg reduced the aerial parts dry weight by 18.77- 23.66 % compared to control.

El-Sayed (2003) found that sprayed plants of *Cestrum aurantiacum, Murraya exotica* and *Cassia didymobotrya* with CCC at 1000, 200 and 3000 ppm gave the highest value of branches number/plant and fresh and dry weights of leaves, shoots and root as CCC at 3000 ppm gave the lowest plant height and leaf area. All treatments increased chlorophyll (a and b) and total carbohydrates.

Adam (2004) sprayed *Acacia saligna* twice with CCC at 0, 1000, 2000, 3000, and 4000 ppm and found that, plant height, stem diameter, shoots fresh and dry weights, leaf numbers, leaf area and leaves fresh and dry weights were progressively decreased when the CCC concentration was increased, while the number of lateral shoots was much higher than the control in different CCC treatments.

Montasser (2004) on *Lantana camara* and *Jacobinia carnea* reported that, all used concentrations of PP-333 (10, 15 and 20 ppm) and CCC (1000, 3000 and 5000 ppm) reduced plant height, leaf area, leaves fresh and dry weights,

branches and roots fresh and dry weights whereas, number of branches, chlorophyll contents and total carbohydrates were increased. Cycocel treatments gave higher number of branches than PP-333.

The present work aimed to using both paclobutrazol and cycocel treatments in controlling acalypha growth by producing more compact and attractive plants suitable for used as indoor potted plants.

MATERIALS AND METHODS

This work was carried out at the Experimental Farm of the Faculty of Agriculture at Kafr El-Sheikh, Kafr El-Sheikh University during the two seasons of 2005 and 2006 to study the effect of some growth retardants "paclobutrazol and cycocel" on the growth and chemical composition of *Acalypha wilksiana* var. Hoffmanii shrub aiming to use it as indoor pot plant.

One year old stem cuttings of 10 cm length were supplied from certain mother shrubs grown in Faculty of Agriculture at Kafr El-Sheikh and planted on February 1st in trays "84 cell" filled with a medium of peat moss and vermiculite "2:1 by volume" as were regularly irrigated till well rooted under a plastic house. On April 1st the rooted cuttings were transplanted to plastic pots of 15 cm diameter filled with a mixture of peat moss, compost and sand "1:1:1 v:v:v" as every pot had one plant. The plants were fertilized with NPK at the ratio of 1:1:1 at the rate of 5g/pot. The application started on May 1st and repeated every month till the termination of the experiment. The fertilizers used were ammonium sulphate "20% N", calcium super phosphate "15.5% P_2O_5" and potassium sulphate "48% K_2O".

The used growth retardants were paclobutrazol "PP-333" and cycocel "chloromequat" added twice at the rate of 20, 40 and 60 ppm for PP-333 and 1000, 1500 and 2000 ppm for cycocel, either as a soil drench or as a foliar spray. The plants were divided into 2 groups; each group was treated with both retardants at 3 levels each in addition to control treatment where plants were treated with a tap water only. This made 14 treatments and each treatment have 5 pots as every pot was considered as a replicate. The treatments were conducted as follows:-

* Fifty ml of each concentration of both retardants were added to each plant of the first group as a soil drench as the first one was on May 1st and the second was 4 week later.
* The second group applied with growth retardants as a foliar spray of the same concentrations of both retardants until the run off point.Tween-20 was used as a surfactant with these treatments at the rate of 0.1%, the soil surface was covered with polyethylene to protect it from the spray drips. The first application was started one month after transplanting on May 1st and the second was applied after 4 weeks later. Each plant received 25 ml of the solution, sprayed by a hand atomizer to assure complete coverage of foliage.
* Each concentration of the used two growth retardants was combined with each application method (soil drench or foliar spray) to form 14 interaction treatments.

* Control treatment received the same quantity of tap water and the wetting agent only.
* All plants received normal agricultural practices as they needed.
* The lay out of the experimental work was factorial design in randomized complete blocks with five replicates.
* At the end of the experiment, the following data were recorded on September 1stas follows:

1- Growth:

1.1-Plant height (cm),
1.2-Leaves number and leaf area/ plant (dm^2),
1.3-Fresh and dry weights of leaves/plant (gm),
1.4-Branches diameter (cm),
1.5-Branches number/plant,
1.6-Fresh and dry weights of branches/plant (gm),
1.7-Root number and length (cm),
1.8-Fresh and dry weight of roots/plant (gm).

2-Chemical composition:

2.1- Chlorophyll a, b and total (mg/g leaf fresh weight) by the method of Moran (1982),
2.2- Total carbohydrates in plant leaves was determined according to Herbert *et al.* (1971).

* Means between treatments were compared with Duncan's Multiple Range Test according to Snedecor and Cochran (1982).

RESULTS AND DISCUSSIONS

1-Effect on growth of *Acalypha wilkesiana* var. Hoffmanii:-

1.1-Plant height:

Data presented in Table (1) showed that soil drench application method was more effective for shortening stem length than foliar spray method in both seasons as gave 38.71 and 35.86 cm for foliar spray method and 30.10 and 28.90 cm for the method of soil drench in the first and second seasons, respectively.

It was obvious that all used concentrations of both growth retardants significantly reduced plant height compared to the control in both seasons. The shortest plants resulted from the treatments of PP-333 at 60 ppm in the two methods of application for both seasons as gave 23.30 and 16.00; 19.70 and 18.70 cm, respectively against 60.00 and 60.00; 60.70 and 58.30 cm for control. This was followed by CCC at 2000 ppm as gave 28.70 and 18.30 cm in the first season and 22.00 and 17.30 in the second one. This may be due to that the growth retardants inhibit the sup-apical meristem. Also, inhibition of root formation and functioning as either antiauxins, antigibberellins or antimetabolities (Cathey, 1964). These results are in accordance with those of Helal (1993) and Wilfret and Barrett (1994) on poinsettia, Warner and Erwin (2003) on *Hibiscus* sp and Montasser (2004) on *Jacobinia carnea.*

Table (1): Effect of growth retardants on plant height and number of leaves/plant of *Acalypha wilkesiana* var. Hoffmanii in two seasons.

Growth retardants (ppm)		Plant height (cm)			Leaves number		
		Foliar spray	Soil drench	Mean	Foliar spray	Soil drench	Mean
First season							
Control PP-333	0	60.00a	60.00a	**60.00a**	16.30h	17.00h	**16.65f**
	20	39.30c	29.70d	**34.50c**	25.30fg	27.70cde	**26.50c**
	40	36.70c	20.70fg	**28.70e**	25.70ef	30.00b	**27.85b**
	60	23.30f	16.00h	**19.65g**	28.30bcd	35.30a	**31.80a**
CCC	1000	46.70b	39.30c	**43.00b**	23.30g	24.30fg	**23.80e**
	1500	36.30c	26.70e	**31.50d**	24.30fg	26.30def	**25.30d**
	2000	28.70de	18.30gh	**23.50f**	26.30def	29.00bc	**27.65b**
Mean		**38.71a**	**30.10b**			**24.21b**	**27.09a**
Second season							
Control PP-333	0	60.70a	58.30a	**59.50a**	17.30f	16.70f	**17.00bc**
	20	42.30b	29.70cd	**36.00c**	25.30e	26.00cde	**25.65d**
	40	34.00c	22.00ef	**28.00d**	26.30cde	28.30bc	**27.30bc**
	60	19.70efg	18.70fg	**19.20e**	28.00bcd	32.00a	**30.00a**
CCC	1000	44.00b	32.30cd	**38.15b**	23.70e	29.30b	**26.50c**
	1500	28.30d	24.00e	**26.15d**	24.70e	30.00ab	**27.35bc**
	2000	22.00ef	17.30g	**19.65e**	25.70de	30.30ab	**28.00b**
Mean		**35.86a**	**28.90b**		**24.43b**	**27.47a**	

Means within a column having the same letters are not significantly different according to Duncan,s Multiple Range Test.

1.2-Leaves number and leaf area:

Data presented in Table (1) show that foliar spray application gave significantly less number of leaves than soil drench method during the two seasons. The greatest number of leaves resulted from the treatments of PP-333 at 60 ppm for the two methods of application in both seasons as gave 28.30 and 35.30; 28.00 and 32.00 in the first and second season, respectively against 16.30 and 17.00; 17.30 and 16.70 for the control. This was followed by the treatment of CCC at 2000 ppm in the first season as gave 26.30 and 29.00 while in the second, one was followed by the treatments of PP-333 at 40 ppm for foliar spray method and CCC at 2000 for soil drench method as gave 26.30 and 30.30 against 17.30 and 16.70 for the control. This may be due to the increase in branches number as a result of application of growth retardants. This is in agreement with the results of Ahmed (1997) on *Bougainvilla* Mrs But, Auda *et al* (2002) on *Barleria cristata* and Adam (2004) on *Acacia saligna.*

As for leaf area, data presented in Table (2) revealed that most concentrations of both growth retardants led to a significant decrease in leaf area compared to the control plants. There was a gradual decrease in leaf area as a result of increasing the concentration of both retardants with significant

differences between all concentrations, in both seasons. The smallest leaves were formed by the treatment of CCC at 2000 ppm for the method of foliar spray in the first season as gave 13.64 dm^2 while in the second one were the treatment of PP-333 at 60 ppm as gave 11.51 dm^2 against 16.74 and 15.85 dm^2 for the control in both seasons. Whereas, the smallest leaves were resulted from the treatment of PP-333 at 60 ppm for the soil drench application in both seasons as gave 11.35 and 12.76 dm^2 against 16.66 and 17.05 dm^2, respectively for the control.

Table (2): Effect of growth retardants on leaf area /plant (dm^2) and fresh weight of leaves /plant (gm) of *Acalypha wilkesiana* var. Hoffmanii in two seasons.

Growth retardants (ppm)		Leaf area/plant (dm^2)			Leaves fresh weight (gm)		
		Foliar spray	Soil drench	Mean	Foliar spray	Soil drench	Mean
First season							
Control PP-333	0	16.74a	16.66ab	**16.70a**	180.09b	184.33a	**182.21a**
	20	15.12cd	13.57e	**14.35d**	171.20ef	179.01bc	**175.11c**
	40	14.98d	13.07f	**14.03e**	167.38h	171.76e	**169.57e**
	60	13.77e	11.35g	**12.56g**	162.10j	165.58i	**163.84g**
CCC	1000	15.49c	16.29b	**15.89b**	167.99gh	163.84g	**168.42f**
	1500	15.41c	14.79d	**15.10c**	170.33f	171.98e	**171.16d**
	2000	13.64e	13.50e	**13.57f**	175.97d	177.89c	**176.93b**
Mean		**15.02a**	**12.06b**		**170.73b**	**174.20a**	
Second season							
Control PP-333	0	15.85b	17.05a	**16.45a**	175.21f	190.46a	**182.84a**
	20	13.91g	14.16f	**14.04c**	167.99h	187.92b	**177.96b**
	40	13.78h	13.95g	**13.87d**	164.96j	167.94h	**166.45f**
	60	11.51m	12.76k	**12.14g**	160.98l	159.87m	**160.43g**
CCC	1000	14.57d	14.96c	**14.77b**	167.06i	180.96d	**174.01e**
	1500	13.36i	14.26e	**13.81e**	169.99g	179.96e	**174.98d**
	2000	12.05l	12.84j	**12.45f**	164.85k	186.05c	**175.45c**
Mean		**13.58b**	**14.28a**		**167.29b**	**179.02a**	

Means within a column having the same letters are not significantly different according to Duncan,s Multiple Range Test.

This may be due to the role of such retardants in inhibiting cell elongation, which reflects on less leaf area (Cathey, 1964). This is in a harmony with the results of Auda *et al* (2002) on *Barleria cristata*, EL-Sayed (2003) on *Cestrum aurantiacum* and Adam (2004) on *Acacia saligna*.

1.3-Fresh and dry weights of leaves:

As shown in Table (2) the data revealed that, there was significant differences among the two ways of application in most cases in both seasons. The heaviest fresh leaves were those of the control plants during the two seasons as gave 180.09 and 184.33; 175.21 and 190.46 gm, respectively.

Meanwhile, the least fresh weight of leaves were produced due to the application of PP-333 at 60 ppm during the two seasons as gave 162.10 and 165.58; 160.98 and 159.87 gm, respectively. There was a gradual decrease in fresh weight of leaves as the of PP-333 and CCC rates were increased.

As for dry weight of leaves data presented in Table (3) showed that all used concentrations reduced leaves dry weight when compared to the control with significant differences in all cases in the first season, while in the second one there were non significant differences in most cases. The lightest leaves dry weight resulted from PP-333 at 60 ppm as gave 38.73 and 44.03 gm in the first season against 58.74 and 61.64 for the control and in the second one gave 45.60 and 45.07gm against 65.57 and 67.62 gm for the control in the second one. These results are in accordance with those of El-Sayed (2003) on *Murraya exotica* and Adam (2004) on *Acacia saligna.*

Table (3): Effect of growth retardants on leaves dry weight(gm) and branches diameter (cm) of *Acalypha wilkesiana* var. Hoffmanii in two seasons.

Growth retardants (ppm)		Leaves dry weight(gm)			Branches diameter (cm)		
		Foliar spray	Soil drench	Mean	Foliar spray	Soil drench	Mean
First season							
Control PP-333	0	58.74b	61.64a	**60.19a**	0.72a	0.48c	**0.60a**
	20	47.42h	55.09d	**51.26b**	0.50b	0.30i	**0.40d**
	40	40.33l	51.56e	**45.95e**	0.44e	0.22k	**0.33e**
	60	38.73m	44.03i	**41.38f**	0.25j	0.18l	**0.22g**
CCC	1000	42.00k	50.22f	**46.11de**	0.48c	0.41f	**0.45b**
	1500	43.00j	49.36g	**46.18d**	0.46d	0.36g	**0.41c**
	2000	43.89i	55.95c	**49.92c**	0.33h	0.21k	**0.27f**
Mean		**44.87b**	**52.55a**		**0.45a**	**0.31b**	
Second season							
Control PP-333	0	65.57ab	67.62a	**66.60a**	0.55b	0.58a	**0.57a**
	20	56.77bcd	60.96abc	**58.86b**	0.35f	0.25i	**0.30d**
	40	49.07de	48.13de	**48.60d**	0.27h	0.23j	**0.25f**
	60	45.60e	45.07e	**45.33d**	0.30g	0.16l	**0.23g**
CCC	1000	51.23cde	56.03bcd	**66.59a**	0.42c	0.31g	**0.37b**
	1500	54.40cde	54.20cde	**53.63c**	0.40d	0.23j	**0.32c**
	2000	51.77cde	60.53abc	**54.30dc**	0.37e	0.19k	**0.28e**
Mean		**53.48b**	**56.08a**		**0.38a**	**0.28b**	

Means within a column having the same letters are not significantly different according to Duncan,s Multiple Range Test.

1.4-Branches diameter:

From Table (3) it may be observed that, the thickest branches in the two seasons were those of the control plants as gave 0.72 and 0.48 cm; 0.55 and 0.58 cm respectively. Whereas, the thinnest branches resulted from the plants treated

with PP-333 at 60 ppm followed by CCC at 2000 ppm in both seasons as gave 0.25 and 0.18 cm; 0.33 and 0.21 cm, respectively in the first season and in the second one gave 0.30 and 0.16; 0.37 and 0.19 cm, respectively.

A gradual decrease in branches diameter was observed as a result of raising the concentration of both retardants. There were significant differences among the application methods as the soil drench method gave the thinnest branches compared to foliar spray method in both season as gave 0.45 and 0.31; 0.38 and 0.28 cm, respectively. These results are in harmony with those of Adam (2004) on *Acacia saligna*.

1.5-Branches number:

It is evident from data in Table (4) that there were non-significant differences among the methods of application in both seasons. There was a gradual increase in branches number/plant as a result of increasing the rate of both growth retardants. Control plants had the least number of branches /plant. The greatest number of branches /plant resulted from treating plants with the highest concentrations of PP-333 and CCC as gave 4.70 and 5.30; 4.00 and 4.70, respectively in the first season and 4.30 and 5.70; 4.00 and 4.70, respectively in the second one.

Table (4): Effect of growth retardants on branches number and branches fresh weight (gm) of *Acalypha wilkesiana* var. Hoffmanii in two seasons.

Growth retardants (ppm)		Branches number			Branches fresh weight (gm)		
		Foliar spray	Soil drench	Mean	Foliar spray	Soil drench	Mean
First season							
Control PP-333	0	1.30f	1.30f	**1.30f**	85.04d	91.89a	**88.47a**
	20	2.30ef	2.70de	**2.50e**	79.23h	57.89l	**68.58f**
	40	4.00bc	4.30ab	**4.15c**	82.91e	74.81j	**78.86d**
	60	4.70ab	5.30a	**5.00b**	78.29h	86.99c	**82.64c**
CCC	1000	2.00af	2.30af	**2.15e**	74.52j	65.93k	**70.23e**
	1500	3.00cde	3.70bcd	**3.35d**	75.96	80.96f	**78.46d**
	2000	4.00bc	5.30a	**4.65a**	79.49g	89.89b	**84.69b**
Mean		**3.04b**	**3.56a**		**79.35a**	**78.34b**	
Second season							
Control PP-333	0	1.00g	1.00g	**1.00f**	80.72a	76.97b	**78.85a**
	20	2.30f	2.70def	**2.50e**	63.20g	56.69h	**55.95e**
	40	3.70bcd	4.00bc	**3.85c**	74.83c	62.81g	**68.45d**
	60	4.30be	5.70a	**5.00a**	74.08bc	75.05bc	**74.94b**
CCC	1000	2.00f	2.30ef	**2.15e**	69.95d	65.05fg	**67.50d**
	1500	2.70b	3.30cde	**3.00d**	74.90bc	66.29ef	**70.60c**
	2000	4.00bc	4.70b	**4.35b**	81.98a	68.47de	**75.23b**
Mean		**2.86b**	**3.39a**		**74.24a**	**67.33b**	

Means within a column having the same letters are not significantly different according to Duncan,s Multiple Range Test.

This may be due to the inhibition of cell division and elongation of sub-apical meristem may overcome the apical dominance of the plant by interruption either basipetal auxin transport which may give an advantage to buds to grow and give branches (Philip, 1975). These results are in agreement with those of Abdella (2000) on *Hibiscus* sp, El-Sayed (2003) on *Cassia didymobotrya* and Montasser (2004) on *Lantana camara.*

1.6-Fresh and dry weights of branches:

It is obvious from data in Tables (4) and (5) that, the results of fresh and dry weights of branches in the two ways of application take the same trend with non-significant differences between them in most cases in the two seasons. Most of the used concentrations of both retardants significantly reduced branches fresh and dry weights when compared to the control. There was a gradual increase in the fresh and dry weights of branches as a result of increasing growth retardants rate. The lighter branches fresh and dry weights resulted from the least concentrations of both retardants. These results confirm those of Ahmed (1997) on *Bougainvillea* Mrs Butt, Banon *et al.*(2001) on *Nerium oleander* and Auda *et al* (2002) on *Barleria cristata.*

Table (5): Effect of growth retardants on branches dry weight (gm) and root number of *Acalypha wilkesiana* var. Hoffmanii in two seasons.

Growth retardants (ppm)		Branches dry weight (gm)			Root number		
		Foliar spray	Soil drench	Mean	Foliar spray	Soil drench	Mean
First season							
Control	0	25.08d	26.46a	**25.77a**	10.70bcde	10.00cde	**10.35bc**
PP-333	20	18.91g	14.91j	**16.91g**	6.70f	11.00bcd	**8.85d**
	40	23.37c	18.08h	**20.73d**	9.00def	12.00bc	**10.50bc**
	60	21.11e	23.03cd	**22.07b**	11.00bcd	15.00a	**13.00a**
CCC	1000	19.86f	16.65i	**18.26f**	8.00ef	11.00bcd	**9.50cd**
	1500	18.32h	19.81f	**19.07e**	9.00def	10.00cde	**9.50cd**
	2000	19.73f	22.95d	**21.34c**	10.00cde	13.00ab	**11.50b**
Mean		**20.91a**	**20.27b**		**9.20b**	**11.71a**	
Second season							
Control	0	20.18a	16.96e	**18.57a**	9.00ef	8.00f	**8.50d**
PP-333	20	15.35f	11.39h	**13.37d**	10.00cde	10.00cde	**10.00c**
	40	17.32de	15.16f	**16.24c**	9.30de	10.30cd	**9.80c**
	60	19.03b	17.36de	**18.20a**	10.00cde	12.00ab	**11.00b**
CCC	1000	17.99cb	14.04g	**16.02c**	9.00ef	9.00ef	**9.00d**
	1500	18.33bc	16.66e	**17.50b**	10.30cd	11.00bc	**10.65b**
	2000	18.96b	18.16bcd	**18.56a**	11.00bc	12.70a	**11.85a**
Mean		**18.17a**	**15.68b**		**9.80b**	**10.43a**	

Means within a column having the same letters are not significantly different according to Duncan,s Multiple Range Test.

1.7-Root number and length:

As shown in Table (5) the data reveal that, there were significant differences among the two ways of application. The highest number of roots/plant resulted from the highest rates of both retardants compared to the control plants for the two ways of application. The results of the second season take the same trend of the first season. As for the effect of the application method on root length, data presented in Table (6) showed that, there were significant differences among the two application methods. All used concentrations of both growth retardants reduced root length compared to control plants. The shortest roots resulted from the lowest rates of both retardants in both seasons. There was a gradual increase in root length with increasing the rate of the retardants. These results are in agreement with those of Osman (2002) on *Nerium oleander*.

Table (6): Effect of growth retardants on root length (cm) and roots fresh weight (gm) of *Acalypha wilkesiana* var. Hoffmanii in two seasons.

Growth retardants (ppm)		Root length (cm)			Roots fresh weight (gm)		
		Foliar spray	Soil drench	Mean	Foliar spray	Soil drench	Mean
First season							
Control PP-333	0	25.00a	22.00b	**23.50a**	51.00a	50.00ab	**50.50a**
	20	20.00c	15.30e	**17.65bc**	42.18f	50.72a	**46.45c**
	40	19.70c	12.70f	**16.20d**	39.30g	48.60bc	**43.95e**
	60	15.70e	10.30g	**13.00f**	46.81d	46.00d	**46.41c**
CCC	1000	19.70c	16.70de	**18.20b**	41.30f	49.00b	**45.15d**
	1500	17.70d	16.30de	**17.00c**	44.40e	47.32cd	**45.86cd**
	2000	15.30e	15.30e	**15.30e**	46.30d	51.05a	**48.68b**
Mean			**19.01a**	**15.51b**	**44.47b**	**48.96a**	
Second season							
Control PP-333	0	20.00a	17.70b	**18.85a**	42.67bc	41.00d	**41.84b**
	20	16.70cd	11.70g	**14.20c**	42.40bc	36.02f	**3921c**
	40	15.30e	10.70h	**13.00d**	43.27b	34.20g	**38.74c**
	60	16.70cd	8.30j	**12.50e**	40.81d	41.90cd	**41.36b**
CCC	1000	17.30bc	13.70f	**15.50b**	30.88h	39.48e	**35.18e**
	1500	18.00b	10.30h	**14.15c**	35.30fg	36.35f	**35.83d**
	2000	16.30d	9.30i	**12.80de**	40.67d	45.46a	**43.07a**
Mean		**17.19a**	**11.67b**		**39.43a**	**39.20a**	

Means within a column having the same letters are not significantly different according to Duncan,s Multiple Range Test.

1.8-Roots fresh and dry weights:

Data of the effect of growth retardants on root fresh and dry weights in the two seasons are presented in Tables (6) and (7). It is obvious from data that there were a significant differences among the two methods of application for fresh weight of roots in the first season and dry weight of roots in both seasons, but there were no significant differences among them for fresh weight of roots in the second season.

Table (7): Effect of growth retardants on roots dry weight (gm) of *Acalypha wilksiana* var. Hoffmanii in two seasons.

Growth retardants (ppm)		Roots dry weight (gm)					
		First season			Second season		
		Foliar spray	Soil drench	Mean	Foliar spray	Soil drench	Mean
Control PP-333	0	15.00a	14.00ab	14.50a	13.00a	11.44cde	12.22a
	20	12.23def	14.83a	13.53b	11.52cd	9.66g	10.59c
	40	11.72ef	12.96bcd	12.34c	11.66c	7.86h	9.76d
	60	13.23bcd	11.69ef	12.46c	11.34cde	10.82cdef	11.08b
CCC	1000	11.10f	13.82abc	12.46c	9.54g	10.52defg	10.03d
	1500	12.73cde	12.60cde	12.67c	10.43efg	9.97fg	10.20cd
	2000	14.57a	14.72a	14.65a	11.83bc	12.73ab	12.28a
Mean			12.94b	13.52a		11.33a	10.43b

Means within a column having the same letters are not significantly different according to Duncan,s Multiple Range Test.

All concentrations of both retardants reduced the fresh and dry weights of roots compared to control in both seasons. The heaviest fresh and dry weights of roots for the foliar spray method resulted from the treatment of CCC at 2000 ppm as gave 46.30 and 14.57 gm/plant in the first season and 40.67 and 11.83 gm/plant in the second one compared to the other treatments. While this treatment gave 51.02 and 14.72 gm/plant against 50.00 and 14.00 gm/plant for the control plants when applied as soil drench in the first season and in the second one gave 45.46 and 12.73 gm/plant against 41.00 and 11.44 gm/plant for the control. Auda et al (2002) obtained similar results on *Barleria cristata* and Montasser (2004) on *Lantana camara*.

2- Effect of growth retardants on chemical compostion of *Acalypha wilkesiana* var. Hoffmanii:-

2.1- Chlorophyll a, b and total contents:

The data in Table (8) show that, there are no significant differences in chlorophyll a contents in most cases among the two methods of application in both seasons. All used concentrations of both retardants increased chlorophyll a contents over control. The highest chlorophyll a contents resulted from the highest concentrations of PP-333 and CCC as gave 1.91 and 1.91; 1.83 and 1.92 mg/g F.W. against 1.72 and 1.80 mg/g F.W. for the control in the first season, while, in the second one gave 1.65 and 1.82; 1.62 and 1.83 mg/g F.W against 1.58 and 1.71 mg/g F.W for the control. There was a gradual increase in chlorophyll a contents with increasing the concentration of both retardants in both seasons.

As for chlorophyll b it is obvious from data presented in Table (8) that there were significant differences among the two methods of application in both seasons. Soil drench application gave the highest results when compared to foliar spray application. There was a gradual increase in chlorophyll b contents with increasing the rate of both retardants. The lowest contents resulted from control plants in both seasons.

Table (8): Effect of growth retardants on chlorophyll a (mg/g F.W.) and chlorophyll b (mg/g F.W.) of *Acalypha wilksiana* var. Hoffmanii in two seasons.

Growth retardants (ppm)		Chlorophyll a (mg/g F.W.)			Chlorophyll b (mg/g F.W.)		
		Foliar spray	Soil drench	Mean	Foliar spray	Soil drench	Mean
First season							
Control	0	1.72g	1.80f	1.76e	0.699l	0.715i	0.707g
PP-333	20	1.82e	1.89c	1.86d	0.708k	0.787f	0.748f
	40	1.83d	1.91b	1.87c	0.714a	0.820c	0.767b
	60	1.91b	1.91b	1.91a	0.727g	0.834b	0.781a
CCC	1000	1.82e	1.89c	1.86d	0.710j	0.788f	0.749e
	1500	1.83d	1.92a	1.88b	0.715i	0.803e	0.759d
	2000	1.83d	1.92a	1.88b	0.722h	0.809d	0.766c
Mean		1.82b	1.89a		0.71b	0.79a	
Second season							
Control	0	1.58l	1.71e	1.65e	0.675k	0.678j	0.677g
PP-333	20	1.59k	1.80d	1.69d	0.685i	0.711f	0.698e
	40	1.63g	1.81c	1.72b	0.731b	0.724c	0.728b
	60	1.65f	1.82b	1.73a	0.744a	0.731b	0.738a
CCC	1000	1.60j	1.81c	1.71c	0.671l	0.698g	0.685f
	1500	1.61i	1.83a	1.72b	0.695h	0.713e	0.704d
	2000	1.62h	1.83a	1.73a	0.711f	0.716d	0.714c
Mean		1.61b	1.80a		0.702b	0.710a	

Means within a column having the same letters are not significantly different according to Duncan's Multiple Range Test.

As for total chlorophyll contents it is obvious from data presented in Table (9) that the results take the same trend of both chlorophyll a and b in both seasons as the lowest contents resulted from the control plants. There was a gradual increase in total chlorophyll contents with increasing the rate of both retardants. There are no significant differences among the methods of application in both seasons. These results are in harmony with those of Ahmed (1997) on *Bougainvillea* Mrs Butt, Auda *et al.* (2002) on *Barleria cristata*, Osman (2002) on *Nerium oleander* and Montasser (2004) on *Jacobinia carnea.*

2.2-Total carbohydrates contents:

Data presented in Table (9) showed that there was a significant difference in total carbohydrates contents among the two methods of application in both seasons. All used concentrations of both retardants increased total carbohydrates contents over control. The highest concentrations of both growth retardants gave the best results of total carbohydrates contents in the two seasons. These results are in accordance with those of Abdella (2000) on *Hibiscus* sp and EL-Sayed (2003) on *Murraya exotica.*

Table (9): Effect of growth retardants on total chlorophyll (mg/g.F.W.) and total carbohydrates (mg/g D.W.) of *Acalypha wilkesiana* var. Hoffmanii in two seasons.

Growth retardants (ppm)		Total chlorophyll (mg/g F.W.)			Total carbohydrates (mg/g D.W.)		
		Foliar spray	Soil drench	Mean	Foliar spray	Soil drench	Mean
First season							
Control	0	2.418e	2.513d	2.466e	32.60j	33.27hi	32.94e
PP-333	20	2.528d	2.674abc	2.601cd	35.63f	37.54bc	36.59b
	40	2.544d	2.729ab	2.637bc	36.73d	37.89ab	37.31a
	60	2.636c	2.748a	2.692a	37.18cd	38.37a	37.78a
CCC	1000	2.532d	2.683abc	2.608bcd	33.55h	36.22e	34.89d
	1500	2.543d	2.624bc	2.584d	34.26g	36.84d	35.55c
	2000	2.555d	2.733ab	2.644b	35.77ef	37.18cd	36.48b
Mean		2.537b	2.672a		35.10b	36.76a	
Second season							
Control	0	2.237m	2.389g	2.313g	24.19h	22.63i	23.41e
PP-333	20	2.278k	2.513d	2.396e	27.75d	25.61g	26.68d
	40	2.364h	2.536c	2.450b	28.50c	26.64f	27.57c
	60	2.394f	2.549a	2.472a	30.26a	27.88d	29.07a
CCC	1000	2.272l	2.510e	2.391f	27.67d	25.72g	26.69d
	1500	2.307j	2.542b	2.425d	28.06d	26.86ef	27.46c
	2000	2.336i	2.548a	2.442c	29.39b	27.22e	28.31b
Mean		2.313b	2.512a		27.97a	26.08b	

Means within a column having the same letters are not significantly different according to Duncan,s Multiple Range Test.

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تقزيم نبات الاكاليفا باستخدام السيكوسيل والباكلوبترازول.

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اجري هذا البحث بالمزرعة البحثية بكلية الزراعة جامعة كفر الشيخ خلال موسمي ٢٠٠٥، ٢٠٠٦ لدراسة تأثير بعض معوقات النمو على النمو والتركيب الكيماوي لشجيرة الاكاليفا بهدف استخدامها كنبات أصص في التنسيق الداخلي.

- تم زراعة العقل الناجحة عمر سنة أول ابريل في أصص بلاستيك قطر ١٥سم في مخلوط من البيت موس، الكمبوست، الرمل بنسبة (١:١:١بالحجم) وتم تسميد النباتات بسماد يحتوى على NPK (١:١:١) بمعدل ٥جم /أصيص.
- استخدم كل من الباكلوبترازول و السيكوسيل كمعوقات نمو، حيث أضيفت مرتين بتركيزات صفر، ٢٠، ٤٠، ٦٠ جزء في المليون بالنسبة للباكلوبترازول، صفر، ١٠٠٠، ١٥٠٠، ٢٠٠٠ جزء في المليون بالنسبة للسيكوسيل عن طريق الإضافة إلى التربة أو رشا على المجموع الخضري، حيث كانت الإضافة الأولى في أول مايو والثانية بعد شهر من الأولى وتم اخذ بيانات على النمو وبعض المكونات الكيماوية.
- أوضحت النتائج أن التركيزات المتوسطة من كلا المعوقين كانت أكثر تأثيرا في إعطاء نباتات متقزمة وأكثر جاذبية ومناسبة كنباتات أصص.
- أعطت كل من معاملة الرش الباكلوبترازول بتركيز ٢٠، ٤٠ جزء في المليون أو السيكوسيل بتركيز ١٠٠٠، ١٥٠٠ جزء في المليون عن طريق التربة أفضل النتائج مقارنة بالمعاملات الأخرى.
- تم دراسة تأثيرات معاملات التركيزات وطرق الإضافة لكل من الباكلوبترازول و السيكوسيل والتفاعل بينهما على صفات النمو ومحتوى النبات من الكلوروفيللات والكربوهيدرات الكلية.
- **التوصية:** يوصى بإضافة كل من الباكلوبترازول بتركيز ٢٠، ٤٠ جزء في المليون أو السيكوسيل بتركيز ١٠٠٠، ١٥٠٠ جزء في المليون عن طريق التربة إلى شجيرة الاكاليفا للحصول على نباتات متقزمة وأكثر جاذبية ومناسبة للاستخدام كنباتات أصص.