

THE EFFECT OF THE LIGHT SELECTIVE COVER AND SPRAYING WITH PACLOBUTRAZOL ON THE VEGETATIVE GROWTH OF *ANTIRRHINUM MAJUS* PLANTS

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ABSTRACT

This study was conducted on *Antirrhinum majus* plant to investigate the effect of the light selective and colored covers red, yellow and control with spraying by paclobutrazol in three concentrations (0,50 and 100 mg.L⁻¹) on some vegetative growth. The factorial experiment was carried out within Randomized Complete Block design using three replicates with six plants for each replicate. Results indicated that there was a significant decrease in the plant characters grown under the red and yellow polyethylene covers in comparison with the plants grown under the control cover. These characters were the plants height, number of the internodes, number of branches, diameter of the crown area, number of leaves, leaf area and the total carbohydrate in the leaves the mean values were: 14.84, 17.31 cm, 7.66, 7.11 internode per plant⁻¹, 8.55, 7.77 branch per plant⁻¹, 15.33, 15.44cm, 112.66, 108.55 leaf per plant⁻¹, 1861.6, 1458.7 cm², 43.74, 51.11 % respectively. Also, there was a significant increase in the ratio of chlorophyll in the leaves which was 40.33 and 39.11Spad unit, respectively. Spraying with paclobutrazol at 50 and 100 mlg.L⁻¹ led to a significant decrease in the plant height 18.46 and 18.80cm and number of leaves 110.33 and 111.55 leaf per plant⁻¹ respectively, whereas there was no significant effect on the other characters of the plants sprayed with both concentrations of paclobutrazol.

Key words: Ornamental plants, selective covers, plant growth Retardants.

Part of M.Sc. Thesis of the 3rd author

المهداوي وآخرون

مجلة العلوم الزراعية العراقية -2018: 49(2): 243-250

تأثير الغطاء الانتقائي للضوء والرش بالباكلوبترازول في صفات النمو الخضري لنبات حنك السبع *Antirrhinum majus*

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باحثة

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المستخلص

اجريت الدراسة على نباتات حنك السبع *Antirrhinum majus* بهدف المقارنة بين الاغطية الملونة والانتقائية للضوء ذات الالوان الاحمر والاصفر وغطاء المقارنة، والرش بالباكلوبترازول بتركيز صفر و 50 و 100 ملغم.لتر⁻¹ في بعض صفات النمو الخضري. نفذت التجربة العملية بتصميم القطاعات العشوائية الكاملة بثلاث مكررات وست نباتات لكل مكرر. اشارت النتائج الى انخفاض معنوي في صفات النباتات النامية تحت غطاء البولي اثيلين الاحمر والاصفر ومنها صفة ارتفاع النبات وعدد السلاميات وعدد الافرع وقطر منطقة التاج وعدد الاوراق والمساحة الورقية وتقدير الكربوهيدرات في الاوراق إذ سجلت قيم بلغت 14.84 و 17.31 سم و 7.66 و 7.11 سلامة.نبات⁻¹ و 8.55 و 7.77 فرع.نبات⁻¹ و 15.33 و 15.44 سم و 112.66 و 108.55 ورقة.نبات⁻¹ و 1861.6 و 1458.7 سم² و 43.74 و 51.11 % بالتتابع، بالمقارنة مع النباتات النامية تحت غطاء المقارنة، وفي المقابل سجلت ارتفاع معنوي في نسبة الكلوروفيل في الاوراق بلغت قيمته 40.33 و 39.11 Spad unit على الترتيب، وادى الرش بالباكلوبترازول بتركيز 50 و 100 ملغم.لتر⁻¹ الى انخفاض معنوي في ارتفاع النبات 18.46 و 18.80 سم وعدد الاوراق 110.33 و 111.55 ورقة.نبات⁻¹ بالتتابع، في حين لم تظهر الصفات الاخرى تأثيراً معنوياً للنباتات التي رشت بكلا تركيزي الباكلوبترازول.

الكلمات المفتاحية: نباتات الزينة، الاغطية الانتقائية، معوقات النمو النباتية.

البحث مستل من رسالة ماجستير للباحث الثالث

*Received:12/10/2017, Accepted:2/1/2018

INTRODUCTION

Antirrhinum majus plant is one of the member of Scrophulariaceae family which its plants are characterized by its beauty (5, 12) and their heights are varied according to their cultivars some are tall and their flowers are used as acut flower, while the short ones are used as limitation plants. The physiological response of *Antirrhinum majus* is depend on light intensity making alert to different vegetation and flower features of the plant (24). The production of commercialized pot flowers is considered one of the remarkable operations spread worldly and the demand is required certain conditions such as colorful and fragrance flowers. Therefore, it is necessary to understand the physiology of this plant in order to get the desirable characters (23). The light selective polyethylene covers are considered as non-chemical growth organizers of the plant production with desirable characters. Kawabata (18) study The effect of covering with light selective shading cloths in various colored such as red, gray, blue, and black which has the ratios of transmittance of electromagnetic spectrum of the selective covers were (32%, 24%, 21%, and 20%) respectively in the greenhouse on the growth of *Dracaena deremensis* plant c.v. Engl. Jin (17) studying the effect of three types of colored polyethylene covers (blue, red, and yellow) on *Chrysanthemum morifolium* plant C.V chuju, indicate that there obvious differences in the plant height under the colored covers. The plant heights grown under the blue, red, blue, and transparent polyethylene were (70.23, 60.92, 52.67 cm) respectively. When studying the effect of the colors of polyethylene blue and control covers on the characters of vegetative growth of *Pelargonium X domesticum*, a significant increase in height was found in plants covered with blue polyethylene in comparison with those covered with control cover (7). Growth retardant were used to get the desired characters of vegetative growth and to get pot plant flowers which are attractive and easy handle during marketing (26). The paclobutrazol is considered one of the trading growth characters belonging to Tarzol group (22) inhibiting the construction of Gibbrellin acid (15). Al-Bakkar (3) shows that

paclobutrazol spraying in concentrations 0.2, 0.4, 0.6, and 0.8 mg.l⁻¹ on the *Chrysanthemum morifolium* plants reduced plants night at 0.4 mg.l⁻¹ (18.25 cm) in comparison with the control plants (26.29 cm) Spraying paclobutrazol in at 0, 5, 10, and 15 mg.l⁻¹ on *Arundina graminifolia* plant, noticed that there was a noticeable decrease in the plant height in all concentrations (27). Ahmad and whipker (1) mentioned that the effect of paclobutrazol is not limited in decreasing the plant height, but it decreases the diameter of the vegetative group. When spraying in concentrations (0, 1, 2, and 4 mg.l⁻¹) on *Petunia x hybrida* Vilm plants, is decreased stem diameter with the increase of the paclobutrazol concentration.

MATERIALS AND METHODS

The experiment was conducted in the greenhouse related to Baqubah nursery- Diyala Agriculture Directorate during October 2016 to April 2017 on the *Antirrhinum majus* plants, cultivar Palette White. It was carried out as the factorial experiment with Randomized Complete Block Design with three replicates and six plants for each replicated. The experiment was 1st February, 2017 by selecting the homogeneous plants in the height 8-10cm produced from sowing the seeds in cork plates containing peat. Then those plants were transplanted when the plants had 3-4 leaves transferred to pots 25 cm diameter containing 5 kg – volumetric ratio 2 loams: 1 peat moos which their physical and chemical characteristics mentioned in Table 1. The plants were put under Structures from wood 2×1×1.25 cm. The factors involved studying the effect of using two colors of polyethylene : red, yellow, and control (transparent) with the thickness (0.12, 0.10, 0.13 ml) respectively and the measured transmittance by UV .Visible 1800 Double beam spectrophotometer in the labs (College of Science/ Department of Physics) Figure 1. Whereas the second factor involved spraying the plants with paclobutrazol supplied from Technogen corp. with three concentrations 0, 50, and 100 mg.l⁻¹. The plants were sprayed at one time after three days of covering plants in the early morning to the full wetting by using manual sprayer, while the control plant were sprayed with distilled water. The Beltanol pesticide at 5% (1 ml.l⁻¹) concentration was used. It was

added to the soil periodically for two weeks in an average of 100 ml. flower pot⁻¹ and the plants were sprayed by Super Cyren pesticide which consists of two active materials: Chlorpyrifos 500 g.l⁻¹ and Cypermethrin 50 g.l⁻¹ when the insect inflection appeared according. The plants were fertilized by the chemical manure King Life fruit made by the Italian Green company. This manure composed of NPK concentrations 6, 9.5, and 18 % respectively with 4% Mg, 2% B and 0.08% Fe, Mn, Mo, and Zn. The plants were irrigated manually when the soil surface of the pot was dry in addition to weeping and

plowing of the surface soil to get rid of the grown weeds. The studied characters of the vegetative growth were: the plant height (cm), the number of internodes in the main stem (internode.plant⁻¹), number of branches (branch.plant⁻¹), diameter of the crown area (cm), number of leaves (leaf.plant⁻¹), leaves area of the plant (cm²), the content of chlorophyll ratio in the leaves (Spad unit), and the total Carbohydrates value in the leaves(%).The data was analyzed using analysis of variance and the means were compared with Duncan Multiple Range.

Table 1. Some physical and chemical characteristics of planting mixture

Organic matter (%)	EC ds.m ⁻¹	Soil pH	Soil texture	Separates soil (g.kg ⁻¹)		
				clay	silt	sand
0.552	1.314	7.634	Sandy silt	81.6	45.1	873.3
CaCO3 g.kg ⁻¹	Content macro nutrients available					
161.74	K		P		N	
	196.8		11.291		7.62	

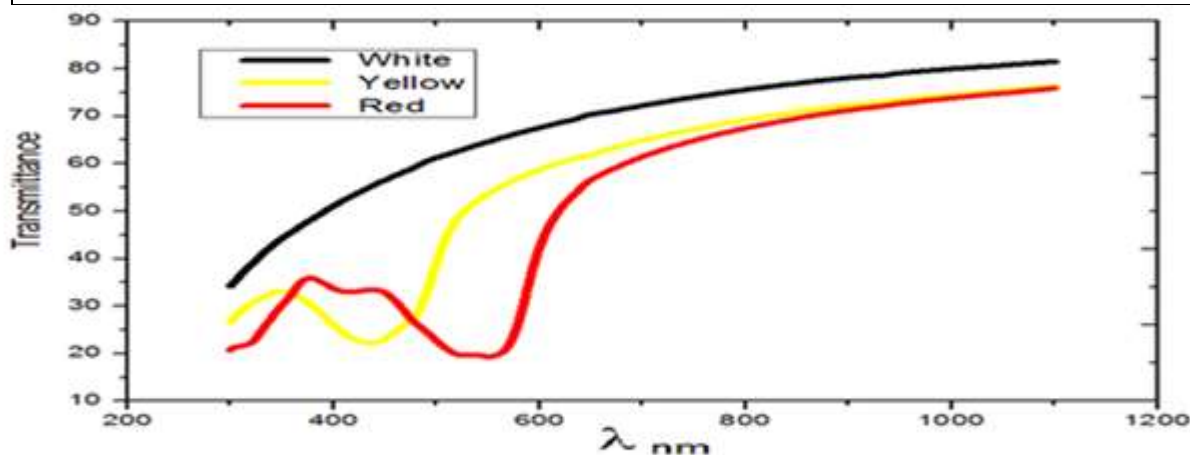


Figure 1. shows the transmittance of plant cover used in the study

RESULT AND DISCUSSION

Plant height (cm): The results in Table 2 indicat that the lowest plant height was found from the plant under the red and yellow covers. The height of these plants were 14.84 and 17.31cm, respectively in comparison with the tallest plants grown under the control cover which was 26.64 cm. These results were in agreement with the results of other researchers (13), when the *Antirrhinum majus* plants were grown under the red cover. This result may be due to the role of colored covers in controlling the permeability of the electromagnetic spectrum which was received by photochromic receptors in plant which turn the light signals to biochemical signals (11). Figure 1 show the electromagnetic spectrum transmitted through

the red, yellow, and control polyethylene covers used in this study. The lowest transmittance was with the wave length 730 nm of the red polyethylene cover and often that the yellow covers. The results of spraying with paclobutarzol 50 and 100 mg.l⁻¹ concentrations indicated to the decrease of the plant heights which were 18.46 and 18.80 cm and they exceeded significantly on the plants of the control group which their height was 21.54 cm. These results in agreement with the results of other researchers (27) and (6). This may be a result of role of Paclobutarzol in inhibiting the synthesis of Gibbrellin acid which is responsible of elongation of plant stem and thus leads to reduce the height of the plants (15).

Table 2. Effect of the cover color and paclobutrazol spraying and their interactions on the height (cm) of *Antirrhinum majus*

cover color	Paclobutrazol concentration (mg.L ⁻¹)			Mean
	0	50	100	
Control	a 28.67	b 23.71	a 27.54	a 26.64
yellow cover	b 21.36	c 15.51	c 15.08	b 17.31
Red cover	c 14.58	c 16.16	c 13.79	c 14.84
Mean	a 21.54	b 18.46	b 18.80	

Number of internodes (internode.plant⁻¹)

Results of Table 3 shows significant differences in of internodes number of the plants grown under the red and yellow covers in comparison with the plants grown under the control cove 7.66, 7.11 and 8.88 internodes plant⁻¹ respectively. These results were in agreement with results of Crowley (14). The decrease in internode numbers may due to photochromic effect especially that the number

of internods relate with genetic control as Hilali (16) mentioned, so the spraying with paclobutarzol did not show a significant difference in both concentrations 50 and 100 mg.l⁻¹ (their values were 7.77 and 7.88 internode.plant⁻¹, respectively) in comparison with its value in the control plants (8.00 internode.plant⁻¹). These results were in agreement with the others (25) when spraying *Zinnia elegans* plants.

Table 3. Effect of the cover color and paclobutarzol spraying and their interactions on the number of internodes (internode.plant⁻¹) of *Antirrhinum majus*

cover color	Paclobutrazol concentration (mg.L ⁻¹)			Mean
	0	50	100	
Control	ab 9.00	ab 8.33	a 9.33	a 8.88
yellow cover	bc 7.33	bc 7.33	c 6.66	b 7.11
Red cover	a-c 7.66	a-c 7.66	a-c 7.66	b 7.66
Mean	a 8.00	a 7.77	a 7.88	

Number of branches on the plants (branch.plant⁻¹)

The results in Table 4 show that the color of the polyethylene cover had significant effect on the number of the branch.plant⁻¹. The highest value was 12.88 branch.plant⁻¹ with a significant difference under the control cover and the lowest was 7.77 branch.plant⁻¹ under the yellow cover. Results of the correlation analysis shows that there was positive between

the number of branches, the number of internodes and 0.659. The factor of paclobutarzol spraying did not show any significant differences and the value of the control plants was 10.00 branch.plant⁻¹, while they were 9.55 and 9.66 branch.plant⁻¹ in each of the two concentrations 50 and 100 mg.l⁻¹. These were in agreement with the results of Ameen and Jasim (10).

Table 4. Effect of the cover color and paclobutarzol spraying and their interactions on the number of branches of *Antirrhinum majus*

cover color	Paclobutrazol concentration (mg.L ⁻¹)			Mean
	0	50	100	
Control	ab 13.00	a -c 11.66	a 14.00	a 12.88
yellow cover	cd 8.66	cd 7.66	d 7.00	b 7.77
Red cover	cd 8.33	bc 9.33	cd 8.00	b 8.55
Mean	a 10.00	a 9.55	a 9.66	

Diameter of the crown area (cm)

The results in Table 5 shows the diameter of the crown which significantly differed yellow and red polyethylene 15.44 and 15.33cm respectively compared with the control plants which was 21.00 cm. These agreed with results of others (20). These results may explain by the significant correlation with the number of plant branches characters as shown in Table 6. The effect of infrared decrease in the growth environment was not limited on

inhibiting the plant height only but its role was appeared in this study on decreasing the diameter area of the crown. The paclobutrazol spraying didn't differ significantly of this character and these were in agreement with those arrived at by others (25).

Table 5. Effect of cover color and paclobutrazol spraying and their interactions on the diameter of crown area (cm) of *Antirrhinum majus*

cover color	Paclobutrazol concentration (mg.L ⁻¹)			Mean
	0	50	100	
Control	a 22.00	ab 21.00	ab 20.00	a 21.00
yellow cover	bc 17.33	c 14.00	c 15.00	b 15.44
Red cover	c 14.33	c 14.66	bc 17.00	b 15.33
Mean	a 17.88	a 16.55	a 17.33	

Table 6. The correlation analysis among the vegetative features

Character	Number of internods	Number of branches	Crown area	Number of leaves	Leaf area	Chlorophyll	carbohydrate
Height plant	0.642**	0.763**	0.746**	0.605**	0.572**	- 0.872**	0.419*
Number of internods		0.659**	0.704**	0.574**	0.494**	- 0.598**	0.377
Number of branches			0.640**	0.573**	0.501**	- 0.664**	0.241
Crown area				0.644**	0.490**	- 0.656**	0.367
Number of leaves					0.518**	- 0.552**	0.128
Leaf area						- 0.611**	0.356
Chlorophyll							- 0.356

The number of leaves on the plant (leaf .plant⁻¹)

Results in Table 7 shows significant difference is the effect of covering plants with red, yellow, and control polyethylene covers on the number of the leaves on the *Antirrhinum majus* plant. The highest value of leaves under the control cover was 132.66 leaf.plant⁻¹ with a significant difference from the numbers under the yellow and red covers which were 108.66 and 112.66 leaf.plant⁻¹ respectively and there significant differences between them. These results were in agreement with what was mentioned by others (21). The paclobutrazol spraying treatment showed a significant effect on the leaves number feature in comparison with the control treatment. The number of

leaves was decreased at 50 and 100 mg.l⁻¹ concentrations and they were 110.33 and 111.55 leaf.plant⁻¹ respectively in comparison with the control plants 132.00 leaf.plant⁻¹. These results were in agreement with the results of others (8) when spraying *Iris nigricans* plant c.v Dinsm and with Ahmade (2) when spraying *Gerbera jamesonil L* plant. The decrease in the number of leaves was attributed to the decrease of the number of branches and this matter was explained in the correlation. The correlation analysis results showed that there is significantly high positive relationship between leaves number with the branches number and it was 0.573 at 0.01 level of probability

Table 7. Effect of cover color and paclobutrazol spraying and their interactions on the leaves number (leaf.plant⁻¹) in *Antirrhinum majus*

cover color	Paclobutrazol concentration (mg.L ⁻¹)			Mean
	0	50	100	
Control	a 144.00	a -c 123.67	ab 130.33	a 132.66
yellow cover	a-c 126.00	c 97.33	bc 102.33	b 108.55
Red cover	a -c 126.00	bc 110.00	bc 102.00	b 112.66
Mean	a 132.00	b 110.33	b 111.55	

Leaf area (cm²)

The data of leaf areas Table 8 shows a significant decrease in the leaf area of the plants grown under the yellow and red covers 1458.7 and 1861.6 cm² respectively in comparison with the plants grown under the control cover 2379.8 cm². These results in

agreement with those of a study conducted on *Orthosiphon stamineus* plants which were grown under infrared filters (28a) and (19) on *Salvias x Indigo* (21), when they studied the effect of filtered infrared covers on *Antirrhinum majus*. These results were attributed to the decrease of the total leaves

number. The correlation analysis showed that there was positive relationship at the significant level 0.01 which was 0.518. Paclobutrazol concentrations did not show any significant effect on the values of this character. While in the concentrations 50 and

100 mg.L⁻¹, the values were 1821.1 and 2030.3 mg.L⁻¹ respectively. This was in agreement with results of others (6). The physiological effect of paclobutrazol was obvious in inhibiting the stem growth without affecting the other structural parts of the plants (16).

Table 8. Effect of cover color and paclobutrazol spraying and their interactions on the leaf area (cm²) in *Antirrhinum majus*

cover color	Paclobutrazol concentration (mg.L ⁻¹)			Mean
	0	50	100	
Control	ab 2323.8	ab 2271.3	a 2544.3	a 2379.8
yellow cover	b 1052.5	ab 1751.0	ab 1572.7	b 1458.7
Red cover	ab 2169.7	ab 1441.0	ab 1974.0	b 1861.6
Mean	a 1848.6	a 1821.1	a 2030.3	

Chlorophyll content in the leaves (Spad unit)

Data in Table 9 shows that the cover color had a significant effect on increasing the chlorophyll content. The ratio of this pigment was increased under the red and yellow covers and they were 40.3 and 39.11 Spad unit in comparison with its value 29.11 Spad units under the control cover. These results were asserted by others (29b). The reason of increasing this chlorophyll content was attributed to the inhabitation of Gibbrellin acid

resulted from exposing to the red light. Mentioned that the Gibbrellin acid has an effective role in decreasing the average of producing chlorophyll which in turn leads to decrease the ratio of chlorophyll within an area unit (16). On the other hand, spraying with paclobutrazol in 50 and 100 mg.L⁻¹ did not show a significant effect in comparison with the control plants and these results were not in agreement with Al-Mukhtar (9) when spraying *Nephrolepis exaltata* plants.

Table 9. Effect of cover color and paclobutrazol spraying and their interactions on the ratio of chlorophyll content (Spad unit) in *Antirrhinum majus*

cover color	Paclobutrazol concentration (mg.L ⁻¹)			Mean
	0	50	100	
Control	bc 28.33	b 32.00	c 27.00	b 29.11
yellow cover	a 39.00	a 39.66	a 38.66	a 39.11
Red cover	a 40.33	a 40.00	a 40.66	a 40.33
Mean	a 35.88	a 37.22	a 35.44	

Total carbohydrate in the leaves (%)

Results in Table 10 shows that the color of polyethylene cover used in the recent study had a significant effect on the decrease of the ratio of carbohydrate in the leaves in comparison with the control plants. The values of the plants grown under the yellow and red

covers were 51.11 and 43.75% respectively. Whereas this percentage exceeded in the control plants and 56.36 %. This can be attributed to the decrease in the average of the leaves number and leaves area Tables 7,8. This reserved on the average of producing the photosynthesis

Table 10. Effect of cover color and paclobutrazol spraying and their interactions on the assessment of carbohydrate (%) in *Antirrhinum majus*

cover color	Paclobutrazol concentration (mg.L ⁻¹)			Mean
	0	50	100	
Control	ab 53.20	a 60.93	ab 54.96	a 56.36
yellow cover	ab 48.96	a 55.10	ab 49.26	ab 51.11
Red cover	b 42.50	b 41.90	ab 46.86	b 43.75
Mean	a 48.22	a 52.64	a 50.36	

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