

EFFECT OF SOME GROWTH SUBSTANCES ON GROWTH, FLOWERING AND CHEMICAL COMPOSITION OF *Rosa Polyantha* cv. CARRIERE.

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ABSTRACT

Two-years pot trials were conducted at Orman Botanical Garden, Giza, Egypt, throughout the 2000/2001 and 2001/2002 seasons, to find out the effect of foliar applications of cycocel ancymidol and paclobutrazol growth substances at three concentrations for each on growth, flowering and chemical constituents of *Rosa polyantha* cv. Carriere. Sprays were applied twice at April and July.

The results obtained revealed that the 100 ppm ancymidol and 200 ppm paclobutrazol treatments markedly reduced plant height, hastened flowering and increased number of flowers/plant and total chlorophylls. However, insignificant differences in dry weight, total carbohydrates, Fe, Mg and Ca contents in different parts of the plant.

INTRODUCTION

Several researchers workers observed that application of ancymidol, cycocel or paclobutrazol had marked reducing effect on height and growth of various plants, such as Maus (1987) and Andrasek (1989) on *Hibiscus rosa-sinensis*; Singh and Bist (2003) on rose cv. Gruss-an-Teplitz, Chen *et al* (2004) on *Ixora* plants. However, Maus (1987), Singh (2002) and Singh and Bist (2003) mentioned that shoot number of *Hibiscus rosa-sinensis*, rose cv. Black Nigrett and rose cv. Gruss-an-Teplitz, respectively, was increased due to paclobutrazol applications.

Regarding flowering characters, Andrasek (1989) on *Pelargonium hortorum* and *Hibiscus rosa-sinensis* and Chen *et al.* (2004) on *Ixora* noted that paclobutrazol reduced flowering date. Moreover, Kaminski (1989) and Singh and Bist (2003) on rose plants, Joustra (1989) on rhododendron and Muradi *et al.* (2003) on *Jasminum sambac*, pointed out that number of flowering buds were increased due to paclobutrazol or cycocel applications.

El-Ashry (1999) on *Dahlia pinnata*, observed that cycocel, paclobutrazol and ancymidol treatments increased chlorophyll content. However, Haggag (1997) using paclobutrazol on chrysanthemum and El-Ashry (1999) using ancymidol, cycocel and paclobutrazol on *Dahlia pinnata* mentioned that carbohydrates percentage was either decreased or not affected by such treatments.

The present investigation was carried out to study the effect of some growth substances (ancymidol, cycocel and paclobutrazol) on the growth, flowering and chemical composition of *Rosa polyantha* cv. Carriere, under the conditions of Giza, Egypt, to obtain more midget polyantha plants, to suit more tight offices and homes.

MATERIALS AND METHODS

The present study was conducted at Orman Botanical Gardens, during the two consecutive seasons 2000/2001 and 2001/2002.

Six-months old plants of *Rosa polyantha* cv. Carriere, 12 ± 1.5 cm height, were planted in 25cm diameter clay pots filled with sand loamy soil having the following characteristics: 16.85% coarse sand, 46.65% fine sand, 25.80% silt, 10.70% clay, 0.70 mmhos EC, 7.20 pH, 30.0 S.P., anions and cations (ppm): 2.0 HCO_3^- , 3.0 SO_4^{++} , 53.8 Ca^{++} , 31.9 Mg, 31.4 Na^+ , 40.0 N, 7.0 P and 3.2 K

The layout of the study was complete randomized blocks containing ten treatments, with three replicates. Each treatment had 12 pot, each contained one plant. The treatments were: Cycocel (CCC) at 2000, 4000 and 6000 ppm, ancymidol at 25,50 and 100 ppm and paclobutrazol at 50,100 and 200 ppm (PBZ), as well as, control which was sprayed with distilled water. All growth substances and distilled water were sprayed on all aerial parts until they were completely covered. Spraying was applied two times a year: at the first of April and July. The prevailing air temperature and relative humidity are shown in Table (A).

Table (A): Monthly mean air temperature ($^{\circ}\text{C}$) and relative humidity (%) at El-Kanater, during the period of the experiments in 2000/2001/2002 seasons:

Year Month	2000			2001			2002		
	Max temp.	Min. temp.	Relat. humid.	Max temp.	Min. temp.	Relat. humid.	Max temp.	Min. temp.	Relat. humid.
1	19.6	8.4	39.1	19.7	9.0	38.0	17.2	5.3	63.0
2	21.6	9.4	37.2	22.8	11.1	28.3	22.2	10.5	59.0
3	18.8	10.6	41.2	30.5	18.3	31.3	26.3	11.8	55.0
4	31.2	15.7	30.8	25.4	15.6	41.9	28.6	14.6	58.0
5	31.6	16.2	25.3	32.9	18.8	34.1	32.5	17.6	52.0
6	35.8	20.1	29.9	38.4	23.3	30.8	36.1	19.6	56.0
7	36.3	20.7	35.7	35.6	25.3	41.0	40.7	33.6	57.0
8	35.9	20.7	37.6	35.9	26.3	41.0	35.4	25.7	65.0
9	34.7	23.7	32.9	35.6	25.7	35.3	34.3	21.2	57.0
10	29.2	21.0	44.9	30.2	21.9	42.2	29.2	17.8	34.0
11	25.2	15.9	45.3	27.2	12.2	45.0	28.3	14.9	53.0
12	20.6	12.4	41.9	20.5	7.0	42.7	20.8	7.2	44.0

The plants were fertilized bimonthly with 4g, 1:2:1 NPK mixture provided from ammonium nitrate (33.5%N), calcium superphosphate (15.5% P_2O_5) and potassium sulphate (48% K_2O). Other routine agricultural practices as weeding, watering ... etc were done whenever needed.

The following data were recorded:

- * Plant height in centimeters, from the top of the pot to plant apex.
- * Number of branches/plant,
- * Time to flowering in days,
- * Total number of flowers/plant,
- * Dry weights (g) of leaves, flowers and roots/plant.

* Photosynthetic pigments in leaves were assessed as described by Moran (1982).

At the end of the second season, the following chemical determinations were carried out in dry samples:

* Total carbohydrates (%) in leaves, flowers and roots, as suggested by A.O.A.C (1990).

* Mineral status: N% using micro-Kjeldahl method mentioned by A.O.A.C (1990); P and K% as described by Chapman and Pratt (1978) and Cotton *et al.* (1982), respectively. Fe, Mn and Zn were determined by atomic absorption spectrophotometry using a Perkin Elmer Model 370 A.A. (A.O.A.C., 1990).

Data were averaged and the means were subjected to statistical analysis, and L.S.D. values at 5% level were calculated whenever F. values were significant as reported by Gomez and Gomez (1984).

RESULTS AND DISCUSSION

Vegetative growth parameters :

It appears from Table (1) that most treatments, significantly reduced plant height when compared to the control except the low and medium concentrations of cycocel. The largest reduction than the control (30.5 and 31.7% in both seasons) occurred by the high level (100 ppm) of arcymidol. Whereas the 4000 ppm cycocel significantly increased plant height by about 12.9 and 16.9% in both seasons, successively. In this concern, Maus (1987) and Andrasek (1989) on *Hibiscus rosa-sinensis*, Singh and Bist (2003) on rose cv. Gruss-an-Teplitz and Chen *et al.* (2004) on *Ixora* "King ixora" claimed that application of paclobutrazol reduced plant height. They added that such reduction was due to shortening internodes' length.

Table (1): Effect of some growth substances on some vegetative growth characters of *Rosa poliantha* cv. Carriers, during the two seasons of 2000/2001 and 2001/2002:

Treatments		Plant height (cm)		Number of branches/plant	
Gr. Sub.	Conc. ppm	F.S	S.S	F.S	S.S
Control	00	37.3	39.1	7.6	7.1
	2000	39.0	42.3	9.6	9.8
Cycocel	4000	42.1	45.7	9.7	9.9
	6000	35.3	37.8	10.8	10.7
	25	35.0	36.6	9.2	9.3
Ancymidol	50	33.1	36.3	9.3	9.7
	100	25.9	26.7	9.9	9.9
Paclobutrazole	50	35.1	36.7	9.3	9.2
	100	33.2	34.3	9.5	9.4
	200	26.2	27.5	9.9	9.8
L.S.D. at 0.05		2.14	2.23	1.53	1.35

Gr. Sub. = Growth substances; Conc. = Concentrations; F.S = First season; S.S = Second season.

All growth substances treatments significantly raised number of branches as compared to the control in both seasons, however, the differences among most treatments did not reach the level of significance. This result agreed with results obtained by Maus (1987) on *Hibiscus rosa – sinensis*, Singh (2002) on rose cv. Black Nigrett and Singh and Bist (2003) on rose cv. Gruss-an-Teplitz observed that paclobutrazol applications increased number of shoots. Also, Muradi *et al.* (2003) mentioned that cycocel increased number of shoots on *Jasminum sambac*.

Dry weight of aerial parts was significantly improved by different treatments, except the high concentrations of ancymidol (100 ppm) and paclobutrazol (200 ppm). Similar trend was attained during both seasons (Table 2). Such finding would be reasonable, since number of branches/plant attained similar trend. However, insignificant effect was found due to different treatments on dry weights of both total flowers and roots, in both seasons.

Table (2): Effect of some growth substances on dry weight (gm/plant) of different parts of *Rosa poliantha* cv. Carriers, during the two seasons of 2000/2001 and 2001/2002:

Treatments Gr.Sub.	Conc. ppm	Aerial Parts		Flowers		Roots	
		F.S	S.S	F.S	S.S	F.S	S.S
Control	00	15.53	17.45	47.1	49.3	8.63	8.73
	2000	20.17	21.30	48.2	51.0	8.93	8.51
Cycocel	4000	21.10	22.30	47.1	48.8	7.90	8.03
	6000	18.00	20.10	45.5	45.9	7.66	7.80
	25	21.06	22.90	48.3	50.1	8.01	8.01
Ancymidol	50	18.90	20.50	45.4	47.7	7.91	7.89
	100	16.61	17.90	43.7	45.1	7.65	7.66
	50	19.90	21.31	48.2	51.0	8.13	8.30
Paclobutrazole	100	18.70	20.40	45.3	48.1	7.86	7.91
	200	16.62	18.10	43.0	45.9	7.76	7.77
L.S.D. at 0.05		1.93	2.01	N.S	N.S	N.S	N.S

Gr. Sub. = Growth substances; Conc. = Concentrations; F.S = First season; S.S = Second season.

Flowering parameters:

Data in Table (3) exhibits the results on the effect of some growth substances on time-to-flowering in days and flowers number per plant during the two seasons of the investigation.

It is clear that growth substances at any concentration significantly advanced flowering date than the control by time ranging between 4.3 and 12.1days caused by paclobutrazol at 50 ppm and ancymidol at 100 ppm in the first season, but in the second one the advance ranged between 3.6 and 7.0 days due to the 2000 ppm cycocel and 100 ppm ancymidol. In brief, the high level of ancymidol resulted the quickest flowering date, however, the low levels of the three substances delayed flowering. This result agreed with the findings of several researchers, such as Andrsek (1989) on *Hibiscus-rosa-sinensis*, and *Pelargonium hortorum* and Chen *et al.* (2004) on *Ixora* who stated they paclobtrazol treatments reduced flowering date.

Table (3): Effect of some growth substances on some flowering characters of *Rosa poliantha* cv. Carriers, during the two seasons of 2000/2001 and 2001/2002:

Treatments		Time-to-flowering (days)		Flowers number/plant	
Gr. Sub.	Conc. ppm	F.S	S.S	F.S	S.S
Control	00	66.0	62.5	46.9	50.1
	2000	60.0	59.0	56.1	59.3
Cycocel	4000	58.7	57.7	57.3	59.9
	6000	55.5	56.3	59.3	61.7
Ancymidol	25	60.3	57.1	50.1	53.0
	50	56.1	56.3	54.7	57.2
Paclobutrazole	100	53.9	55.6	60.1	63.2
	50	61.7	58.3	52.3	54.2
L.S.D. at 0.05	100	57.3	56.7	55.6	58.7
	200	54.1	55.9	59.7	62.9
		3.91	3.33	3.10	3.99

Gr. Sub. = Growth substances; Conc. = Concentrations; F.S = First season; S.S = Second season.

Application of the three growth substances caused significant increment in number of flowers/plant in comparison to the control. Increasing growth substances concentration resulted gradual increase in number of flowers/plant. The highest number of flowers/plant (60.1 and 63.2 flowers, in both seasons, respectively) was produced by 100 ppm ancymidol treatment. Such finding coincides with that obtained by many researchers on different plants; Andrsek (1989), Kaminski (1989) and Singh and Bist (2003) using paclobutrazol on *Pelargonium hortorum* cv. Springtime, rose cv. Paprika and rose cv. Gruss-an-Taplitz, respectively as well as Joustra (1989) on two cultivars of *Rhododendron* and Muradi *et al.* (2003) on *Jasminum sambac*. They claimed that paclobutrazol or cycocel application increased the number of flower buds/plant.

Chemical constituents:

Table (4) presents the data on photosynthetic pigments in leaves, during the two seasons.

All growth substances treatments caused significant increments in total chlorophylls content and total carotenoides in leaves, as compared to the control (Table 4). The largest increases in chlorophylls occurred due to the high levels of the three growth substances, as it attained the following pattern : 100 ppm ancymidol > 200 ppm paclobutrazol > 6000 ppm cycocel, without significant differences among them. Regarding total carotenoides, it appears that all treatments raised this parameter when compared to the control. However, the significant increments occurred only by the high concentrations of the three growth substances, without significant variations among them. These results are in agreement with those of many researchers. Maus (1987) on *Hibiscus-rosa-sinencis*, mentioned that paclobutrazol application intensified leaf color. Kaminski (1989) and Lee and Lee (1990) noticed that paclobutrazol markedly increased chlorophyll content in rose cv.

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Paprika and gerbera leaves, respectively. El-Ashry (1999) observed that applications of cycocel, paclobutrazol, ancymidol and GA₃ increased total chlorophyll content in the leaves of *Dahlia pinnata*, Cav.

Table (4): Effect of some growth regulators on pigments content (mg/gm F.W) in the leaves of *Rosa poliantha* cv. Carriere, during the 2000/2001 and 2001/2002 seasons:

Treatments		Total Chlorophyll content		Total carotencids	
Gr. Sub.	Conc. ppm	F.S	S.S	F.S	S.S
Control	00	5.43	2.05	5.19	1.90
	2000	6.33	2.50	6.71	2.65
Cycocel	4000	6.87	2.71	6.91	2.69
	6000	7.41	3.27	7.14	2.99
	25	6.59	2.57	6.11	2.42
Ancymidol	50	7.11	2.98	7.32	2.76
	100	8.23	3.39	8.13	3.36
Paclobutrazole	50	6.46	2.20	6.09	2.41
	100	6.78	2.80	7.13	2.79
	200	7.99	3.35	8.01	3.31
L.S.D. 0.05		0.69	1.09	0.69	0.91

Gr. Sub. = Growth substances; Conc. = Concentrations; F.S = First season; S.S = Second season.

Data on total carbohydrates (%) in leaves, flowers and roots as affected by different growth substances rates in the second (2001/2002) season are presented in Table (5). Data revealed that most treatments significantly improved total carbohydrates (%) in the aerial parts compared to the control, but without significant variations among them.

Table (5): Effect of some growth regulators on total carbohydrates (%) in different parts of *Rosa poliantha* cv. Carriers, during the 2001/2002 season:

Treatments		Leaves	Flowers	Roots
Gr. Sub.	Conc. ppm			
Control	0	10.62	11.79	11.01
	2000	13.01	11.80	11.03
Cycocel	4000	10.71	12.03	11.70
	6000	13.71	12.27	11.81
	25	12.61	11.70	11.10
Ancymidol	50	13.01	12.10	11.60
	100	13.91	12.27	11.77
Paclobutrazol	50	12.07	11.70	11.00
	100	12.97	12.11	11.35
	200	13.63	12.21	11.51
L.S.D. at 0.05		12.81	N.S	N.S

Gr. Sub. = Growth substances; Conc. = Concentrations.

However, total carbohydrates (%) in flowers and roots did not reach to the level of significance as affected application of deferent growth regulators. In this concern, Haggag (1997) on chrysanthemum observed that paclobutrazol treatments decreased carbohydrates content in the leaves. El-Ashry (1999) mentioned that carbohydrates (%) in leaves and tubers of *Dahlia pinnata*, Cav. were not affected by CCC, PBZ or ancymidol treatments.

Minerals content :

It appears from Tables (6 and 7) that the various parts of *Rosa polyantha* showed different responses to the growth substances.

Table (6): Effect of some growth regulators on N,P and K% in different parts of *Rosa poliantha* cv. Carriere, during the 2001/2002 season:

Treatments Gr. Sub.	Conc. ppm	N%			P%			K%		
		L	F	R	L	F	R	L	F	R
Control	0	1.69	1.72	0.99	0.30	0.29	0.30	1.79	2.01	1.90
	2000	2.82	1.72	1.10	0.33	0.31	0.30	1.78	1.98	1.99
Cycocel	4000	1.79	1.07	1.03	0.35	0.33	0.31	1.73	1.97	2.00
	6000	2.19	1.20	1.10	0.39	0.33	0.32	1.76	2.06	2.10
Ancymidol	25	2.02	1.11	0.99	0.39	0.32	0.32	1.80	2.01	2.10
	50	2.82	1.69	1.11	0.40	0.35	0.32	1.85	2.03	2.12
	100	2.23	1.13	1.00	0.43	0.37	0.33	1.81	2.05	2.06
Paclobutrazol	50	1.93	1.00	1.03	0.36	0.33	0.31	1.81	1.99	1.98
	100	2.08	1.01	1.01	0.38	0.34	0.32	1.82	2.02	2.01
	200	2.18	1.17	1.03	0.41	0.37	0.33	1.80	2.00	2.05
L.S.D. at 0.05		0.73	0.59	N.S	0.09	0.07	N.S	N.S	N.S	N.S

Gr. Sub.=Growth substances; Conc.= Concentrations. L = Leaves, F = Flowers, R = Roots

In leaves, N,P and Ca were increased than the control in response to all treatments. But, the significant increment in N occurred by both the 2000 ppm cycocel and 50 ppm ancymidol treatments. The significant increase in P and Ca resulted by the 50 and 100 ppm ancymidol and 200 ppm paclobutrazol. Most treatments improved Zn in leaves than the control but all ancymidol concentrations only caused the significant increments. However, K, Fe and Mg ppm showed insignificant response.

In flowers, N was significantly increased by the 2000 ppm cycocel treatment only, however, other treatments showed various response. The significant increment in P resulted due to the high levels of ancymidol (100 ppm) and paclobutrazol (200 ppm). K, Fe, Zn, Mg and Ca variations did not reach the level of significancy.

All minerals contents (N, P, K, Fe, Mg and Ca) in root, except zinc, showed non-significant differences due to various treatments. Zinc in root was significantly reduced by all levels of paclobutrazol.

Table (7): Effect of some growth regulators on Fe,Zn,Mg and Ca content in different parts of *Rosa poliantha* cv. Carriere, during the 2001/2002 season:

Treatments	Gr.Sub.	Conc. ppm	Fe			Zn			Mg			Ca		
			Los	Fl	R	Los	Fl	R	Los	Fl	R			
Control	0		0.42	0.27	1.07	5.11	6.81	7.31	0.35	0.25	0.30	0.21	0.13	0.12
	2000		0.45	0.28	1.10	5.62	6.90	8.35	0.36	0.24	0.32	0.22	0.14	0.13
Cycocel	4000		0.41	0.25	1.11	5.73	7.10	8.01	0.34	0.24	0.31	0.23	0.14	0.13
	6000		0.42	0.26	1.11	6.07	7.01	8.99	0.38	0.25	0.32	0.28	0.15	0.14
Ancymidol	25		0.44	0.28	1.09	3.69	7.35	8.90	0.36	0.23	0.30	0.28	0.14	0.13
	50		0.41	0.27	1.10	3.66	7.15	8.95	0.37	0.25	0.31	0.39	0.15	0.15
	100		0.40	0.27	1.09	3.37	7.31	8.94	0.39	0.24	0.25	0.31	0.17	0.17
Paclobutrazol	50		0.44	0.28	1.10	5.04	6.79	5.23	0.35	0.25	0.31	0.23	0.14	0.13
	100		0.42	0.28	1.11	5.13	6.98	5.21	0.36	0.24	0.33	0.24	0.14	0.12
	200		0.41	0.27	1.09	5.21	6.85	5.10	0.38	0.24	0.29	0.25	0.13	0.12
L.S.D. at 0.05			N.S	N.S	N.S	1.19	N.S	0.81	N.S	N.S	N.S	0.09	N.S	N.S

Gr. Sub.=Growth substances;Conc.= Concentrations; L.=Leaves; F1.= Flowers;R.= Roots.

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تأثير بعض منظمات النمو على نمو وإزهار والتركيب الكيماوي لورد البوليانثا
صنف كاريير *Rosa polyantha* cv. Carriere
عزة أحمد طه الملط
قسم بحوث الزينة ، معهد بحوث البساتين ، مركز البحوث الزراعية

أجريت تجربة أعص خلال سنتين في حدائق الأورمان النباتية بالجيزة ، مصر ، خلال موسمي ٢٠٠١/٢٠٠٠ ، ٢٠٠٢/٢٠٠١ ، لبحث أثر المعاملة بالرش لمواد النمو : سيكوسيل ، أنسيميدول ، باكوتبرازول بثلاثة تركيزات لكل منها على النمو ، الإزهار المحتوى الكيماوي لنبات *Rosa polyantha* var. Carriere . تم الرش مرتين في إبريل ويوليو . أوضحت النتائج التي تم التوصل إليها أن المعاملة بالأنسيميدول بتركيز ١٠٠ جزء في المليون والباكوتبرازول بتركيز ٢٠٠ جزء في المليون قللت بوضوح بارتفاع النبات ، أسرعت التزهير ، وزادت عدد الأزهار على النبات والكلوروفيللات الكلية . إلا أن فروقا غير معنوية كانت في الوزن الجاف ، محتوى الكربوهيدرات والكالسيوم والحديد والماغنسيوم في مختلف أجزاء النبات .

