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EFFECT OF GA₃, PP₃₃₃ AND/OR PINCHING ON GROWTH AND FLOWERING OF *ASTER ERICOIDES* CV "MONTE CASINO" UNDER PROTECTED CULTIVATION

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ABSTRACT

This research was carried out at Ornamental farm, Department of Horticulture, Faculty of Agriculture, Ain Shams University, Shoubra El-Kheima, Cairo, Egypt. During two seasons (2017-2018 and 2018-2019) to study the effect of GA₃, PP₃₃₃ and/or Pinching treatments on vegetative growth and flowering of *Aster ericoides* cv "Monte Casino" plants. The treatments GA₃ at different concentrations (0, 100 and 200 ppm) and PP₃₃₃ at different concentrations (0, 50, 100 and 200 ppm) all the treatments were with pinching or without pinching of apical buds for each plant. GA₃ at 100 ppm gave highest value of flower stalk diameter (0.49 cm) in the two seasons under study. In case of flowering parameters such as No. of flowers (293), and fresh weights of plants (52.62 g) the best results were obtained when PP₃₃₃ at 50 ppm without pinching treatment were used. According to these results it was advisable to use PP₃₃₃ at 50 ppm without pinching and GA₃ at 100 ppm to increase flowering growth of *Aster* "Monte Casino" plants. The highest values of micro-elements in the plant composition were obtained with Fe, Zn, Mn and Cu, respectively. Also, there were no significant differences between all the treatments for much of the remaining parameters for the two seasons of the study.

Key words: *Aster ericoides* "Monte Casino", Gibberellin (GA₃), Paclobutrazol (PP₃₃₃), and Pinching.

INTRODUCTION

Effect of gibberellic acid:

1-Vegetative growth:

In *Aster ericoides* cv. *Monte casino* plants, **Farina et al (2000)** found that two sprays of GA₃ at 50 mg/l hastened stem growth. In another study GA₃ can be used to decrease the vegetative growth period under supplementary lighting but the response depends on the cultivar (**Farina et al., 2003**). For China Aster plants, **Shedeed et al., (1991)** found that GA₃ at 150 ppm increased plant height by 5-6 cm in *Callistephus chinensis*. Also, **Abou-Talib (1989)** mentioned that GA₃ at different concentrations increased plant height and the total number of branches/plant. The most effective treatment was 150 ppm GA₃ for *Callistephus chinensis*. The effects of gibberellic acid (0, 50, 100, 150 or 200 ppm) and pinching (at 35 or 45 days after transplanting or DAT) on the growth and yield of chrysanthemum cv. Flirt and Gauri were studied in Hisar, Haryana, India, during 1999 and 2000. Gibberellic acid was sprayed to plants at 30 and 40 DAT. Plant height, plant spread, number of branches per plant and yield per plant were increased with increasing rate of GA₃. Thus, in cvs Flirt and Gauri, plant height (48.00 and 70.54 cm), plant spread (32.05 and 37.55 cm), number of branches per plant (13.57 and 16.16) and flower yield per plant (117.76 and 84.069) were highest at 200 ppm GA₃. The interaction effects showed that the greatest plant spread (37.5 cm) and number of branches per plant (16.16) were recorded for cv Gauri treated with 200 ppm GA₃ (**Rakesh et al., 2003**). **Padmapriya and Chezhiyan (2003)** mentioned that for chrysanthemum cv. Chymal a 150 ppm of GA₃ treatment gave the highest plant height (67.88), while the highest number of branches per plant (15.75) was obtained when the cv. Red Gold was treated with 150 ppm of GA₃ and 100 ppm of salicylic acid. Also, **Belle et al., (2007)** suggested that GA₃ at 50, 100, 200, 300 and 500 improved plant height in cut chrysanthemum plants..

2-Flowering growth

In *Aster ericoides* cv. *Monte casino*, **Naranja and Balladares (2008)** found that in *Aster ericoides* des L., bolting was observed in plants sprayed with 100 ppm GA₃ 10.7 days from spraying. The plants that received 50, 30 and 10 ppm GA₃ bolted after 11.8, 16.5 and 25.8 days from spraying. The control bolted 53.5 days after spraying

although some plants in this group remained vegetative until the end of the experimental period. One hundred percent flowering was observed in plants sprayed with GA₃ and only 55.7% flowering in control plants. Harvesting was 48 days from bolting for the treated plants compared with 58 days for the control plants. Flower stalk weight was not affected by the treatments. Experimental trials on Aster Butterfly hybrids grown in the greenhouse for cut flower production have been carried out with the aim of obtaining contemporaneous flowering of cultivars with different growth rates using the same photoperiod treatment. The effects of pruning in different periods and of GA₃ applications on plants with flowering controlled by photoperiodic treatments were evaluated. The pruned plants were maintained in 16 h photoperiods until the stems reached a height of 60 cm. Afterwards the flowering was determined by the natural short day (SD) conditions on the whole, a good level of information regarding the bioorganic behavior of the cultivars is necessary to reach the objective of contemporaneous flowering with the same photoperiodic at the highest commercial quality (**Farina et al., 2003**). **Ben-Tal (2000)** suggested that in Aster, Phlox and Limonium, all quantitative LD plants, endo 16, 17-dihydro. GA₃ was able to enhance flowering. In China Aster plants, **Syamal et al., (1990)** found that the best results with regard to number of flowers/plant and yield of *Callistaphus chinensis* were obtained with GA₃ at 200 ppm. **Shedeed et al., (1991)** reported that both GA₃ and kinetin treatments generally reduced inflorescence DW and number of flowers per plant. **Geetha et al., (2000)** clarified that treatments with GA₃ advanced flowering; 250 ppm was the best concentration. The number of small or deformed flowers was reduced with GA₃ between 50 and 250 ppm, the latter concentration gave a 67% reduction compared with the control. Flower diameter, stem length and flowering period were all increased with GA₃, 50 ppm being the best treatment. In chrysanthemum cvs. Flirt and Gauhi, flower yield per plant (117.76 and 84.06 g) were highest at 200 ppm GA₃ (**Rakesh et al., 2003**). In another study by **Padmapriya and Chezhiyan (2003)**, the highest number of flower yield per plant (370.65) was produced when *chrysanthemum* cv. Red gold was treated with 150 ppm GA₃ and 100 ppm salicylic acid. Also, the length of flower stalk and spray were increased by GA₃ (100 and 150 ppm) treatment in all

cultivars. of *chrysanthemum morifolium* (Baggi, Indria, red Gold and Shymal) compared to the control.

Effect of Paclobutrazol (PP₃₃₃) on growth :

Mishra and Yadava (2011), found that, length of flower stalk and flower size significantly decreased with increased concentrations of Paclobutrazol except in case of flower size when applied as foliar spray. Plants treated with Paclobutrazol at 25 ppm as foliar spray proved to be superior over control and rest of the treatment combinations by increasing flower diameter and yield of cut flower as compared to control. Also, **Mishra et al., (2005)**, found that, Paclobutrazol at 200 ppm as soil drench was the most effective in retarding plant height, gave minimum No. of flowers and maximum delay in flowering. The highest No. of branches was observed with 25 ppm PP₃₃₃ as soil drench. Early flowering and maximum No. of flowers observed with 25 ppm of PP₃₃₃ as foliar spray in china aster plants.

The main aim of the research is to improve growth quality of flowering for *Aster ericoides* cv. " Monte Casino" using different growth regulators such as GA₃ and PP₃₃₃ with or without pinching.

MATERIALS AND METHODS

Location and duration:

This study was carried out during two seasons (2017-2018 and 2018-2019) under plastic house at ornamental farm of Department of Horticulture, Faculty of Agriculture, Ain shams University, Shoubra El-Kheima, Cairo, Egypt.

Plant Material:

Rooted cuttings of *Aster ericoides* cv. *Mont Casino* from the mother plants about 5-8 cm in length were used as plant material.

Media used and cultural procedure

pots about 25cm in diameter filled with washed sand, till the edge of the pots were used, the seedlings were cultured in the pots then irrigated immediately afterwards at 31st August. Pinching conducted after one month from culturing date. Irrigation was done every week according to plant requirement with tap water. Fertilization conducted with 500 ml/per pot with Harmful fertilizer

(19: 19: 19 N: P: K plus micro elements) from 30 September till 30 January every month.

The growth regulators treatments:

The treatments used were, GA₃ at 0, 100 and 200 ppm levels. PP₃₃₃ (Paclobutrazol) (RS,3RS)-1-(4-Chlorophenyl)-4,4 dimethyl-2,1,2,4-triazol-1-yl)Pentan-3-ol at 0,50, 100 and 200 ppm levels. All treatments were pinched or not pinched which were done at 14 October for the two seasons 2017 to 2019 under study.

Data recorded

A- Vegetative parameters:

1. Plant height (cm).
2. No. of branches.
3. No. of Nodes.
4. No. of suckers.
5. Number of lateral branches.

B- Flowering parameters:

1. No. of flowers/pot.
2. Flower stalk diameter (cm).
3. No. of ray florets/flower.

C- Fresh and dry weights of plants and root length.

D- Chemical composition of plants (ppm).

E- Experimental design and statistical analysis.

All trails were arranged in completely randomized design where five plants per each treatment.

To statistically test the results one or two ways analysis of variance as required was carried out as described by **Sendecor and Cochran (1989)**.

RESULTS AND DISCUSSION

For the first season of the research, all parameters such as plant height, No. of branches, No. of suckers, No. of lateral branches, fresh weight of plants and root length were give no significant differences for all treatments under study of *Aster ericoides* plants except that for flower stalk diameter, No. of Nodes, No. of flowers per pot, No. of ray florets/flower and dry weights of plants there were more differnces between treatments .Also, It was found that, GA₃ at 100 ppm without pinching treatment gave best results (0.49 cm) for flower stalk

diameter in the two seasons of the study, the 200 ppm treatment of PP₃₃₃ without pinching gave the best result for No. of nodes per stem (37.0) and the 50 ppm of PP₃₃₃ without pinching treatment gave best results for no. of flowers/pot (293). Meanwhile, the best results for No. of ray florets were obtained with 50 ppm PP₃₃₃ with pinching treatment. For dry weights of the plants, the best results obtained with 200 ppm PP₃₃₃ without pinching treatments as shown in **Tables (1 and 3).**

Table (1): Effect of GA₃ and PP₃₃₃ with or without pinching treatments on some growth parameters of *Aster ericoides* cv. "Monte Casino" during first season (2017/2018) of the research.

Parameters Treatments	Plant height (cm)	No. of Branches	No. of Nods	No. of suckers	No. of lateral branches	No. flowers/pot	Flower stalk diameter	No. of ray florets/flower
With Pinching								
Zero control	55.2	3	29	6	22	161	0.31	20
GA ₃ 100 ppm	55	4	30	4	23	226	0.35	20
GA ₃ 200 ppm	58.8	4	34	5	24	205	0.35	19
PP ₃₃₃ 50 ppm	54.4	3	27	5	26	62	0.32	22
PP ₃₃₃ 100 ppm	56.4	3	35	5	26	159	0.28	21
PP ₃₃₃ 200 ppm	57.4	4	29	6	19	118	0.36	20
Without Pinching								
Zero	57	5	32	5	23	174	0.33	21
GA ₃ 100 ppm	56.4	5	33	6	21	198	0.49	21
GA ₃ 200 ppm	59	4	30	5	22	207	0.32	21
PP ₃₃₃ 50 ppm	60.4	5	36	5	22	293	0.35	21
PP ₃₃₃ 100 ppm	60.4	4	31	6	22	152	0.46	21
PP ₃₃₃ 200 ppm	57.4	4	37	6	25	214	0.35	21
L.S.D 5%	11.2	2.63	6.5	3.02	10.79	172.3	0.17	1.5

Table (2): Effect of GA₃ and PP₃₃₃ with or without pinching treatments on some growth parameters of *Aster ericoides* cv. "Monte Casino" during second season (2018/2019) of the research.

Parameters Treatments	Plant height (cm)	No. of Branches	No. of Nods	No. of suckers	No. of lateral branches	No. flowers/pot	Flower stalk diameter	No. of ray florets/flower
With Pinching								
Zero control	48.6	7.0	7.0	3.0	22	323	0.31	21
GA ₃ 100 ppm	49.6	6.0	6.0	3.0	23	204	0.35	21
GA ₃ 200 ppm	52.6	4.0	4.0	3.0	24	437	0.35	20
PP ₃₃₃ 50 ppm	53	7.0	7.0	2.0	26	183	0.32	21
PP ₃₃₃ 100 ppm	50.4	8.0	8.0	2.0	26	317	0.28	21
PP ₃₃₃ 200 ppm	46.6	6.0	6.0	3.0	19	309	0.36	21
Without Pinching								
Zero	45	7.0	7.0	4.0	23	305	0.33	21
GA ₃ 100 ppm	44.6	6.0	6.0	3.0	21	383	0.49	22
GA ₃ 200 ppm	47.8	7.0	7.0	3.0	22	222	0.32	21
PP ₃₃₃ 50 ppm	59.4	6.0	6.0	2.0	24	325	0.35	21
PP ₃₃₃ 100 ppm	55.4	5.0	5.0	3.0	22	295	0.46	22
PP ₃₃₃ 200 ppm	46.4	7.0	7.0	3.0	25	383	0.35	21
L.S.D 5 %	20.06	3.59	3.59	2.45	10.82	281.44	0.17	1.16

Table (3): Effect of GA₃ and PP₃₃₃ with or without pinching treatments on fresh, dry weight and root length of *Aster ericoides* cv. "Monte Casino" during the first season (2017/2018)

Parameters Treatments	Fresh weight of plants (g)	Dry weights of plants (g)	Root length (cm)
With Pinching			
Zero control	38.87	10.78	32.4
GA ₃ 100 ppm	27.22	9.41	30.2
GA ₃ 200 ppm	35.74	15.46	28.4
PP ₃₃₃ 50 ppm	30.68	12.17	30.0
PP ₃₃₃ 100 ppm	33.82	10.74	30.2
PP ₃₃₃ 200 ppm	29.6	14.46	29.0
Without Pinching			
Zero	39.9	11.40	31.4
GA ₃ 100 ppm	36.41	9.71	31.6
GA ₃ 200 ppm	25.76	12.22	31.2
PP ₃₃₃ 50 ppm	24.27	11.81	29.8
PP ₃₃₃ 100 ppm	41.58	12.12	30.8
PP ₃₃₃ 200 ppm	27.6	20.1	31.0
L.S.D 5 %	17.34	7.95	5.52

For second season (2018-2019), there were no significant differences in between most parameters such as, plant height, No. of branches, No. of nodes, No. of suckers, No. of lateral branches, No. of flowers and root length. Although, there were more differences between the treatments for flower stalk diameter, GA₃ at 100 ppm without pinching gave the best result was (0.49). The best result for fresh weight of plants obtained with 50 ppm PP₃₃₃ without pinching treatments (52.62 g). But for the dry weights of the plants the best results with the control (Zero level of Hormones with pinching) treatment was (21.45 g) as shown in **Tables (2 and 4 and 5).**

In conclusion, GA₃ at 100 ppm without pinching treatment gave the best result for flower stalk diameter in the two seasons was (0.49 cm). The best results for *Aster ericoides* cv. “*Monte Casino*” plants were with 50 ppm of puclobtrazol (PP₃₃₃) without pinching treatments during the first season of the research. The higher results of flower stalk diameter was (0.49 cm), No. of flowers/pots was (293). For this reason, it was recommended to use 50 ppm of PP₃₃₃ without pinching and GA₃ at 100 ppm without pinching treatments to increase flower growth of the plant under study. The results obtained for flower stalk diameter were in harmony with **Farina *et al.*, (2000, 2003)** for Aster plants. Also, **Ben *et al.*, (2000)** suggested to use GA₃ to enhance flowering of Aster, phlox and Limonium plants. PP₃₃₃ at 50 ppm gave the best results for No. of flowers/pot and flower stalk diameter these results were in harmony with **Mishra *et. al.*,(2005)** and **Mishra & Yadava (2011)** in china aster plants.

Table (4): Effect of GA₃ and PP₃₃₃ with or without pinching treatments on fresh, dry weight and root length of *Aster ericoides* cv. " Monte Casino" during the second season (2018/2019)

Parameters Treatments	Fresh weight of plants (g)	Dry weights of plants (g)	Root length (cm)
With Pinching			
Zero control	34.4	21.45	32.4
GA ₃ 100 ppm	27.63	11.59	30.2
GA ₃ 200 ppm	48.25	19.91	28.4
PP ₃₃₃ 50 ppm	39.9	14.6	30.0
PP ₃₃₃ 100 ppm	36.52	16.05	30.2
PP ₃₃₃ 200 ppm	39.89	19.08	29.0
Without Pinching			
Zero	41.8	15.2	31.4
GA ₃ 100 ppm	49.32	14.88	31.6
GA ₃ 200 ppm	36.35	14.85	31.2
PP ₃₃₃ 50 ppm	52.62	15.43	29.8
PP ₃₃₃ 100 ppm	33.18	13.73	30.8
PP ₃₃₃ 200 ppm	51.34	17.63	31.00
L.S.D 5%	12.76	7.54	5.52

Table (5): Effect of GA₃ and PP₃₃₃ with or without pinching treatments with or without pinching on some mineral content of *Aster ericoides* cv. plants

Mineral contents ppm Treatments	Cu	Zn	Mn	Fe
Zero control	20.5	95	43	1637
GA ₃ 100 ppm	23	70	65.5	2521.5
GA ₃ 200 ppm	14	78.5	54.5	1841.5
PP ₃₃₃ 50 ppm	16	72.5	51	1703
PP ₃₃₃ 100 ppm	17.5	87.5	65	2398.5
PP ₃₃₃ 200 ppm	19.5	54	54.5	1746.5
Zero	17	44.5	73	2079
GA ₃ 100 ppm	30	76	61	2358
GA ₃ 200 ppm	9	58	45	1585
PP ₃₃₃ 50 ppm	15	70	43	1630
PP ₃₃₃ 100 ppm	13.5	83	55	2125.5
PP ₃₃₃ 200 ppm	26.5	77	69	2092.5

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تأثير الرش بمنظمات النمو GA₃ PP₃₃₃ والتطوئيش على نمو وازهار نبات الاستر مونت كازينو تحت ظروف الزراعة المحمية "

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اجريت الدراسة فى موسمين متتاليين هما: 2017-2018 و 2018-2019 فى حقل مزرعة الزينة التابعة لقسم البساتين - كلية الزراعة جامعة عين شمس - شبرا الخيمة - القاهرة - مصر وتم اجراء التجربة على نبات الاستر مونت كازينو وكانت المعاملات المستخدمة الرش للمنظمات النمو هى صفر، 100، 200 جزء فى المليون من مادة الجبرلين، واستخدمت كذلك تركيزات من مادة البكلوبترازول وهى صفر، 50 ، 100 ، 200 جزء فى المليون بكلوبترازول مع اجراء التطوئيش أو عدم اجراء التطوئيش لجميع المعاملات السابقة وذلك فى تصميم عشوائى كامل للتجربة خمس نباتات للمعاملة، وتم أخذ قياسات خضرية (طول النبات - عدد الافرع الرئيسية - عدد السلاميات - عدد الخلفات - عدد الافرع الجانبية)، كما وقد أخذت قياسات زهرية (عدد الازهار الكلى/ القصيرية - قطر الساق الزهرية - عدد الازهار الشعاعية)، وأخذت قياسات الوزن الطازج والجاف للنمو الخضرى والزهرى وطول الجذور. وكانت أفضل النتائج المتحصل عليها بالنسبة لعدد الازهار الكلى/ قصيرية، هو مع استعمال البكلوبترازول بتركيز 50 جزء فى المليون (293)، وكذلك باستخدام الجبرلين بدون تطوئيش عند تركيز 100 جزء فى المليون حيث زود قطر الساق الزهرية (0.49سم) ولذا يوصى بصفة عامة باستخدام تركيزة 50 جزء فى المليون من مادة بكلوبترازول PP₃₃₃ الرش على نبات الاستر صنف مونت كازينو للحصول على صفات زهرية جيدة على الاخص مع عدم تطوئيش النباتات وكذلك تركيز 100 جزء فى المليون من الجبرلين. ولم تتضح فروق معنوية فى معظم الصفات الاخرى لجميع المعاملات.