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EFFECT OF PUTRESCINE AND ALPHA - TOCOPHEROL ON THE VEGETATIVE GROWTH AND FLOWERING OF *Celosia argentea* var. *Cristata* L. PLANTS

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ABSTRACT

A pot experiment was conducted in the greenhouse of the National Research Centre, Dokki, Giza, Egypt during two successive seasons (2009-2010) and (2010-2011) to study the effect of putrescine (50,100 and 200 ppm), alpha- tocopherol (200, 400 and 600 ppm) on the vegetative growth and flowering of *Celosia argentea* var. *Cristata* L. plants. The data indicated that most criteria of vegetative growth were expressed as plant height, No. of leaves, fresh and dry weight of leaves, stem diameter and fresh and dry weight of the stem as well as inflorescence characters, which are expressed as inflorescence length, inflorescence diameter, fresh and dry weight of inflorescence which were significantly affected by the application of putrescine and alpha- tocopherol compared with the control plants. Foliar application of putrescine at the concentration of 200 ppm gave the highest increase values in the vegetative growth and inflorescence characters as compared with the other treatments and untreated plants in the two seasons of study. Spraying with alpha- tocopherol at the concentration of 400 ppm gave the highest values in the vegetative growth and flowering except for fresh and dry weight of the inflorescence, which gave the highest increase values when the plants were treated with 200 ppm alpha- tocopherol as compared with the control plants.

Key words: *alpha-tocopherol, celosia cristata, flowering characters , growth, putrescine.*

1. INTRODUCTION

Celosia argentea var. *cristata* L. (Cocks comb) is an herbaceous plant of the family Amaranthaceae. It has distinctive characteristic inflorescence which looks like the crest of a rooster or convoluted brain after its full development (Bojian *et al.,* 2003). The attractive inflorescences are usually brightly colored in, red, yellow, pink, or orange though other colors can be present. It is a popular ornamental plant and has some medical purposes such as antiviral proteins, betalains, and anthocyanin (Balasubrahmanyam *et al.*, 2000).

Polyamines are beneficial subgroups of amines, divided into aliphatic di- amine putrescine, tri- amine spermidine, and tetra amine spermine. These compounds have diverse biological functions and are formed during metabolic processes in the living organisms. Polyamines in plants are involved in many steps of protein synthesis, embryogenesis, transcription of genes, cell division, organ development, fruit ripening, leaf senescence, tuber dormancy and stress minimization. Moreover, there is a strong association between polyamine metabolism in plants and environmental stress, *e.g.* nutrient deficiency, drought soil salinity or temperature (Kosson and Prange., 2005).

Vitamins could be considered as bio-regulators compounds which in relatively low concentrations exert profound influence on many physiological processes, such as synthesis of enzymes, act as co-enzymes and affect plant growth (Reda *et al*., 2005). Alpha-tocopherol (Vitamin E) is a low molecular weight lipophilic antioxidant, which mainly protect membranes from oxidative damage (Asada, 1999). Zhang *et al*. (2000) reported a positive correlation between alpha-tocopherol and

shoot or root growth in two grass species grown under drought. Tocopherols were proposed to function in relation to their antioxidant properties being prominent in the protection of poly unsaturated fatty acids from lipid peroxidation by quenching and scavenging various reactive oxygen radicals. Also, in plants tocopherol levels vary in different tissues and fluctuate during its development and in response to abiotic stresses (Munne-Bosch, 2005).

Therefore, the aim of this investigation was to study the influence of putrescine and alpha-tocopherol application on the growth and flowering of *Celosia argentea* var. *cristata* L. plants, in order to obtain high quality of Celosia cut flowers, especially to be used for flower arrangements and interior decoration.

2. MATERIALS AND METHODS

A pot experiment was carried out during two successive seasons of (2009-2010) and (2010-2011) in the greenhouse of the National Research Centre, Dokki, Giza, Egypt to investigate the influence of putrescine (Put.) and alpha-tocopherol (V.E) application on the growth and flowering of *Celosia argentea* var. *cristata* L. plant.

Celosia seedlings were obtained from a commercial private farm for flower production (at Kafr Hakim, Giza). The seedlings were selected in similar shape and size. (Seedlings were 7 cm in length, with 4 pairs of leaves). The seedlings were individually transplanted on the 15th of June for both seasons in 30cm diameter clay pots, filled with 8 kg growing media consist of loamy clay and sand at the ratio of 1:1 (v/v). After two weeks from transplanting all seedlings received equal dose (4gm/pot) of N.P.K fertilizer (19:19:19) from ammonium nitrate, tri phosphates and potassium sulphate, respectively and were irrigated regularly with tap water. On the 15th of July for both seasons, the plants were sprayed till run off point with two growth regulators namely putrescine: (Put.) at the concentrations of (0, 50, 100 and 200ppm) and alpha-tocopherol (V.E) at the concentrations of (0, 200, 400 and 600 ppm), while the control plants were sprayed with tap water. The second spray was carried out after two weeks from the 1st spraying. Thus, seven treatments were carried out, with each treatment replicated three times, each replicate consisted of three plants. The layout of the experiment was completely randomized design. The following data were recorded: plant height (cm), No. of leaves; fresh and dry weight of leaves (g), stem diameter (cm), fresh and dry weight of stem (g), inflorescence length (cm), fresh and dry weight of inflorescence (g) and inflorescence diameter (cm). The data were subjected to statistical analysis of variance according to Snedecor and Cochran (1980).

3. RESULTS AND DISCUSSION

3.1. Vegetative growth characters

The data presented in Table (1) showed that foliar application of putrescine (Put.) at rate of 50, 100 and 200 ppm and alpha-tocopherol (V.E) at the concentration of 200, 400 and 600 ppm significantly increased vegetative growth of *Celosia* plants as compared with the control plants. Application of putrescine at 200 ppm, significantly increased plant height with (35.4%), the number of leaves (38.2%), fresh (132.6%) and dry weight (166.3%) of leaves, stem diameter (25.7%) and fresh (102.6%) and dry weight of stem (129.9%) over the control plants, in the first season. Similar results were obtained in the 2nd season. In this connection, similar results were reported by Youssef *et al*. (2004b) on *Matthiola incana*, Youssef *et al.*, (2004a) on datura plants, Abd-El Wahed and Gamal El-Din (2005) on chamomile plants , Talaat and Gamal El-Din (2005) on *Nigella sativa*, Talaat *et al.* (2005) on *Dianthus caryophyllus* plants, Abdel-Aziz *et al.* (2009) on galdiolus plants, El-Sayed (2009) on chrysanthemum plants, Mahgoub *et al*. (2011) *on Dahlia pinnata* plants,and Youssef (2011) on populous species. The obtained results may be attributed to that polyamines had been implicated in a wide range of biological processes including growth development , abiotic stress responses, cell division and differentiation as mentioned by Kuchen and Phillips (2005). Also, Galston (1983) mentioned that polyamines had been considered as regulators for plant growth and development.

Regarding, the effect of alpha-tocopherol on *Celosia* plants, the data in Table (1) emphasized that all concentrations significantly increased plant growth characters as compared with the control plants, and the application of 400 ppm alpha-tocopherol resulted in the highest value of all growth parameters. The increments, due to the application ed of 400 ppm putrescine, were (76.44,

53.44, 30.42, 4.89,0.70, 42.89 and 13.68 %), for plant height, No. of the leaves, F.W. of the leaves, D.W. of the leaves, stem diameter, F.W. of stem and D.W. of stem, respectively, over the untreated plants in the 1st season. Similar results were found in the 2nd season. These results are in agreement with those obtained by El-Liethy *et al.* (2010) on *Linum usitatissimum* L. plants, El-Bassiouny *et al.* (2005) on *Vicia faba* plants. Plant cells could be protected against oxidant stress by various radical – scavenging systems, including low – molecular- weight antioxidants such as ascorbate, glutathione, alpha-tocopherol and carotenoids, as well as by antioxidant enzymes such as superoxide dismutases, peroxidase and glutathione reductase (Foyer *et al.,* 1994b). Protection against phytotoxic peroxidation processes; halophilic environments may be achieved by antioxidants, like alpha-tocopherol (V. E), which is assumed to be the most effective radical – chain- breaking substance in the membranes. Therefore, many attempts had been made to reduce oxidative stress in plants by exogenous application of this vitamin (Foyer *et al.,* 1994a).

Table (1): Influence of putrescine and alpha-tocopherol (V.E) on the vegetative growth characters of *Celosia argentea* **var.***Cristata* **L. plant during the first and second seasons.**

Treatments / Season	Plant height (cm)		No. of leaves		F.W leaves (g)		D.W leaves (g)		Stem diameter (cm)		F.W stem (g)		D.W stem (g)	
	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd
Control	60.11	82.83	42.44	46.00	15.26	29.74	2.85	7.25	0.66	0.70	22.98	40.61	5.67	10.88
50ppm Put.	62.33	88.58	45.56	49.00	17.67	32.98	3.35	8.14	0.70	0.84	27.69	43.00	9.95	11.86
100 ppm Put.	73.72	96.00	54.33	57.00	24.27	37.82	4.99	9.87	0.80	0.92	40.77	50.6	10.92	14.59
200 ppm Put.	81.39	101.67	58.67	60.00	35.51	52.35	7.59	14.13	0.83	0.97	46.58	63.42	13.04	19.02
200 ppm V.E	70.67	94.00	50.22	52.67	22.75	35.32	4.55	9.04	0.76	0.88	37.05	49.79	9.70	14.28
400 ppm V.E	76.44	98.67	53.44	54.00	30.42	41.44	4.89	10.98	0.70	0.77	42.89	55.74	13.68	16.38
600 ppm V.E	67.66	91.05	46.56	51.00	19.41	33.98	3.78	8.56	0.74	0.82	31.75	46.24	8.19	13.03
LSD at 5%	2.4	2.97	2.62	2.94	2.41	3.57	1.23	1.4	0.03	0.04	3.49	3.54	1.00	1.45

Put. = Putrescine **V.E= Alpha-tocopherol**

3.2. Flowering characters

The data presented in Table (2) indicated that both putrescine and alpha-tocopherol treatments significantly increased the mean values of all inflorescence characters as compared with the control treatment.

It was found that foliar application of putrescines at the concentrations of 50, 100 and 200 ppm significantly increased length of the inflorescence, inflorescence diameter and the fresh and dry weights of the inflorescence in the 1st and the 2nd seasons as compared with the control plants. Foliar application of putrescine at 200 ppm gave the highest significant increase in inflorescence characters which recorded (155, 91, 217.9 and 290.9 %) compared with the untreated

Table (2): Influence of putrescine and alpha-tocopherol (V.E) on inflorescence of *Celosia argentea* **var.***Cristata* **L. plant during the first and second seasons.**

Treatments / season	Inflorescence length (cm)		Inflorescence diameter (cm)		F.W Inflorescence (g)		D.W Inflorescence (g)	
	1st	2nd	1st	2nd	1st	2nd	1st	2nd
Control	3.07	3.50	3.00	5.33	8.28	10.37	1.21	1.72
50 ppm Put.	3.83	4.25	3.45	6.66	12.56	15.07	1.98	2.70
100 ppm Put.	6.67	7.25	4.75	7.37	21.00	27.97	3.52	5.45
200 ppm Put.	7.83	8.15	5.73	8.67	26.33	31.10	4.73	6.22
200 ppm V.E	5.28	6.55	4.22	7.33	17.90	18.13	2.91	2.99
400 ppm V.E	7.09	7.75	5.11	7.67	15.50	16.63	2.41	2.62
600 ppm V.E	4.62	5.85	3.85	6.67	10.28	15.36	1.65	2.50
LSD at 5%	0.55	0.60	0.39	0.47	1.96	2.15	0.24	0.32

Put. = Putrescine **V.E= Alpha-tocopherol**

plants in the 1st season. Also, a similar trend was found in the 2nd one. These results are supported by El-Quesni *et al.* (2007) on *Bougainvillea galbra* plants who obtained a significant influence of putrescine on increasing the flower length, flower diameter, fresh and dry weight of the flower. Also, El-Sayed (2009) on chrysanthemum, Mahgoub *et al.* (2011) on dahlia plants and El-Sabwa (2012) on *Salvia splendens*, obtained similar results. This may be explained as putrescine enhance the accumulation of the production in the plant tissues, *i.e* flowers. The conjugated polyamines were known to be associated with the physiology of flowering, (Slocum and Glaston 1985).

Concerning the effect of alpha-tocopherol on the inflorescence characters, the data presented in Table (2) indicated that the concentrations of 200, 400 and 600 ppm significantly increased inflorescence length, diameter as well as, fresh and dry weights, in both seasons as compared with the untreated plants. Spraying the plants with alpha-to alpha-tocopherol copherol at the concentration of 400 ppm gave the highest significant increase in length and diameter of the inflorescence, which recorded (130.9, 121.4 %) and (70.3, 43.9 %) in the 1st and the 2nd season, respectively, compared with the untreated plants, while alpha-tocopherol at the concentration of 200 ppm gave the highest significant increase for fresh and dry weight of the inflorescence, giving (116.1 and 14.4%) in the 1st season as compared with the untreated plants. Similar trend was found in the 2nd season. These results are in harmony with those obtained by El-Quesni *et al.*, 2009 on *Hibiscus rosa sinenses* L. plants, El-Liethy*et al.*(2010) on Falx plant, Eid *et al.* (2010) on *Jasminum grandiflorum* plants. Alpha-tocopherol are considered as a group of compounds synthesized only by photosynthetic organisms. Plants treated with alpha- tocopherol are believed to protect chloroplast membranes from photooxidation and help to provide an optimal environment for photosynthetic machinery; Munne-Bosch and Alegre (2002).

From the above mentioned results, it could be concluded that spraying *Celosia argentea* var.*cristata* L. plants with 200 ppm of putrescine and 400 ppm of alpha- tocopherol were the most favorable concentrations to give the highest values of growth and flowering characters.

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تأثير البتروسين والألفا توكوفيرول على النمو الخضري والزهري
لنباتات السيلوزيا.L *Celosia argentea* **var.** *Cristata*

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ملخص

أجريت هذه التجربة في الصوبة السلكية بالمركز القومي للبحوث- الدقي- الجيزة- مصر خلال موسمي الزراعة (٢٠٠٩-٢٠١٠) و(٢٠١٠-٢٠١١) لدراسة تأثير الرش بالبتروسين بتركيز (٥٠و١٠٠و٢٠٠) جزء في المليون والألفا توكوفيرول بتركيز(٢٠٠و ٤٠٠ و٦٠٠) جزء في المليون على كل من صفات النمو الخضري والزهري لنباتات عرف الديك (السيلوزيا).

أظهرت النتائج أن معظم صفات النمو الخضري مثل (ارتفاع النبات وعدد الأوراق وقطر الساق والوزن الطازج والجاف والصفات الزهرية مثل طول النورة وقطر النورة والوزن الطازج و الجاف للنورة قد زادت بدرجة معنوية عند معاملتها بالبتروسين والالفاتوكوفيرول مقارنة بالنباتات غير المعاملة (الكنترول). كذلك أشارت النتائج إلى أن استخدام البتروسين بتركيز ٢٠٠ جزء في المليون أعطى أعلى القيم لصفات النمو الخضري وصفات النورة خلال موسمي النمو مقارنة بنباتات الكنترول.

كما أدى رش النباتات بالألفاتوكوفيرول بتركيز ٤٠٠ جزء في المليون إلى الحصول على أعلى القيم في كل صفات النمو الخضري والزهري عدا الوزن الطازج والجاف للنورة والذي أعطى أعلى القيم وذلك عند معاملة النباتات بالألفاتوكوفيرول بتركيز ٢٠٠جزء في المليون مقارنة بنباتات الكنترول.

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