Bulletin of Environment, Pharmacology and Life Sciences
Bull. Env. Pharmacol. Life Sci., Vol 2 (10) September 2013: 118-122

Online ISSN 2277-1808
Journal's URL:http://www.bepls.com

ORIGINAL ARTICLE

Effects of Putrescine on Morphological and Physiological Characteristics of Ornamental plant African violet (*Saintpaulia ionantha*)

Razieh Nanvakenary, Hossein Moradi , Somayeh Ghasemiomran
Department of Horticulture, College of Agriculture and Natural resources Sciences, University of Sari, Sari, Iran. P.O.Box 578
[1] **Corresponding author**: s.ghasemiomran@yahoo.com

ABSTRACT
A pot experiment was conducted in a completely randomized design, to study the effect of putrescine application (50, 75, and 100 ppm) on vegetative growth (diameter of rosette, number of leaves, leaf area, stomatal index, and dry weight), reproductive growth (number of florets and diameter of flower) and some physiological compounds (a, b, and total chlorophyll, petiole's carbohydrate) in African violet (Saintpaulia ionantha). Results were analyzed by SAS software and Duncan test. Results showed that putrescine did not have any significant effect on rosette diameter, but there was significant difference in other factors. According to the findings, the most increase in number of leaves, flower diameter, leaf area, and dry weight belonged to the 75 ppm putrescine treatment. besides, the number of flowers and the amount of a, b, and total chlorophyll were maximum in putrescine concentration of 50 ppm. Although the putrescine concentration of 100 ppm led to decrease in the number of leaves, but it caused carbohydrate increase in petioles of African violet. The results showed that the effectiveness of putrescine plant growth regulator on African violet can differ depending on the concentration of plant growth regulator and type of the studied characteristic.
Key words: *African violet, morphology, ornamental plants, physiology, putrescine*

Received 09.07.2013 Accepted 02.09.2013

INTRODUCTION

African violet (*saintpaulia ionantha*) is a pot plant, rosette, native to northern African tropical forest; it belongs to Gesneriaceae family, and is famous all around the world [1]. Diverse colors [2], shadow resistance, the ability of flowering under artificial light, and easy multiplication over the year make this plant popular [1]. Putrescine, Spermine, and Spermidine are polyamine compounds playing role in different stages of growth cycle, such as cell division, differentiation, flowering, fruit ripening, embryogenesis, aging and rooting. Besides, the above mentioned compounds are considered as secondary messengers, carbon and nitrogen resources in culture medium [3]. Using different concentrations of Putrescine on leaves increased the height, fresh and dry weight of *Plargunium graveolense* L**.** [4]. Also, spraying Putrescine on *Chrysanthemum indicum* L. leaves increased number and diameter of its flowers, fresh and dry weight, and carbohydrate [5]. Spraying the solution of Putrescine and Thiamine on Dahlia plant (*Dahlia pinnata* L.) increased the plant's height, number of branches, number of leaves, fresh and dry weight of leaves, stem diameter, and fresh and dry weight of stem [6]. Besides, using Putrescine and Glutamine on leaves, separately or together, increased the height, number and weight of leaves, fresh and dry weight of plant, leaf area, and length of bulbs, weight and diameter of bulbs, and fruiting and quality of bulbs [7]. Using Putrescine and Tryptophan on leaves of Vinca (*Catharanthus roseus* L.) increased the growth, photosynthetic pigments (chlorophyll a, b and Carotenoids), soluble and insoluble sugars, protein, and total alkaloids [8]. Using Putrescine on the leaves of Egyptian Paper Flower (*Bougainvilla glabra* L.) led to increase in plant height, number of leaves and branches, diameter, fresh and dry weight of stem, leaf and root. Also, application of Putrescine and Puclobutrazol on the leaves increased the number of flowers, fresh and dry weight of flower, and its chemical compounds [9]. Since characteristics like increase of flowering period, emerge of florets, number of florets and some photosynthetic characteristics are considered as quality improvement and commercialization factors in African Violet ornamental plant, and also regarding the direct and indirect role of Putrescine on in forming and

emerging of the flowers and vegetative parts of other ornamental plants, different concentrations of Putrescine was tested in the form of spraying on the plant to approach the mentioned aims.

MATERIAL AND METHODS

This research is a pot experiment in the framework of completely randomized design with four treatments of Putrescine concentrations of 0, 50, 75, and 100 ppm, and six repeats in the research greenhouse of the Agricultural and Natural Resources University of Sari in 2013 year. Uniform plants with 7-8 leaves from tissue culture of Atropis spices of African Violet were put in plastic pot with the diameter of 7 centimeters and the height of 8.5 centimeters, filled with Peat moss and Perlite sterile in 1:3 proportion. Then the pots were kept in 23±2 centigrade degrees and relative humidity of 70 % ± 5%. Two weeks after putting plants in the greenhouse, first stage of plant growth regulator spray was carried out. plant growth regulator was sprayed as a solution on the aerial parts of the plant in three stages, in duration of 10 days. In the measurement stage, morphological factors like number of leaves, number of florets, and longevity of flower on plant (number of days between half opening until complete wilting) are studied by counting and diameter of rosette and flower are measured in millimeters by ruler. physiological factors such as petiole carbohydrate and stomatal index calculate by refrectometer device (ANTAGO PR-32) in percent and Gozareh light microscope (Sa Iran Optic Industry) with digital camera respectively. leaf area was measured by Leaf Area Meter Software in square centimeters, and dry weight by digital balance (A&D company, Limiled FX-300 GD) in grams. Total chlorophyll was determined by Chlorophyll meter device (KONICA MINOLTA 9229-A1RT-12) in spad and also chlorophyll a and b [10] by spectrophotometer device (MAPADA UV-1800) in microgram per millimeters. The results were analyzed by SAS Software and Mean comparisons to identify significant differences between treatments were performed using Duncan test.

RESULT AND DISCUSSION

Results from variance analyze of studied characteristics, shown in table 1, declares that under treatment all characteristics are significant ($p< 0.05$), except for rosette diameter Putrescine effect according to the average comparison in table 2, although there is no significant difference between rosette diameter in different Putrescine concentrations, the largest rosette diameter (177.5 millimeters) was observed in 50 ppm concentration, and the smallest one (165 millimeters) in 100 ppm concentration. Maximum number of leaves (27) was in 75 ppm concentration and the minimum number (18) was in 100 ppm concentration (Figure 1-a). Besides, the maximum number of florets (13.3) occurred in 50 ppm concentration and the minimum number of florets (8) occurred in 75 ppm concentration (Figure 1-b).The maximum and minimum diameter of floret was respectively observed in concentrations of 75 ppm (3 millimeters) and 50 ppm (24.5 millimeters) (Figure 1-c). On the other hand according to the table of regression (Table 3), the regression coefficients showed that there is a negative regression between floret diameter and number of florets (r=-0.75*), which means that by increase in number of florets, the diameter of floret decreases (Table 3). Regarding the average comparison table, the maximum amount of leaf area (520.4 square centimeters) was in 75 ppm concentration and the minimum amount (287.7 square centimeters) was in 100 ppm concentration (Table 2). The maximum (8.6) and minimum (6.36) stomatal index were resulted from 75 ppm and 100 ppm concentration, respectively (Figure 1-d). According to the average comparison table, the maximum dry weight (2.6 grams) was related to 75 ppm concentration and the minimum one (1.24 grams) was from 100 ppm concentration (Table 2). Regarding the average comparison table the maximum petiole soluble solids (carbohydrate) (1.1%) was observed in concentration of 100 ppm and the minimum petiole soluble solids (0.16%) was observed in control (Table 2). In comparison of the average, the maximum and minimum amount of total chlorophyll was observed respectively, in concentrations of 50 ppm (41.05 micrograms per millimeters) and 100 ppm (25.3 micrograms per millimeters) and the maximum and minimum amount of chlorophyll a in concentrations of 50 ppm (5.85 micrograms per millimeters) and 100 ppm (2.32 micrograms per millimeters), and also the maximum and minimum amount of chlorophyll b in concentrations of 50 ppm (2.92 micrograms per millimeters) and 100 ppm (0.78 micrograms per millimeters) (Table 2).

Table 1: Results of variance analyze of morphological Characteristics of African Violet under different putrescine concentrations.

S.V	df	Rosset diameter (mm)	Leaf number	Leaf area (cm^2)	Stomata index	D.weight (gr)	floret number	Flower diameter (mm)	Charbohydrate (%)	Chl .b (µgr/ml)	Chl. b (µgr/ml)	Total.Chl (µgr/ml)
Treat	3	79.1^{ns}	17.07*	13214.8*	1.6*	0.3*	27.4*	8.7*	0.24*	3.3*	1.1*	59.7*
Error	3	120.8	2.8	3300.8	0.16	0.02	2.6	0.2	0.002	0.35	0.12	13.3
c.v		6.46	8.18	14.7	5.6	7.6	15.2	1.7	4.9	14.5	17.08	10.5

Significant at* $P \leq 0.05$.

Table 2: Mean comparison of putrescine treatment on different factors at African violet

Treatments	Rosset diameter (mm)	Leaf area (cm^2)	Charbohydrate (%)	Chl. a (µgr/ml)	Chl. b (µgr/ml)	Total.Chl (µgr/ml)	D. weight (gr)
Control	165 a	423 ab	0.16 b	3.57 b	1.99 ab	32.9 ab	1.91 b
50ppm	177.5 a	323.3 ab	0.2 b	5.85 a	2.92 a	41.05 a	1.84 b
75ppm	175 a	520.4 a	0.2 b	3.87 ab	1.62 ab	35.6 ab	2.6 a
100ppm	165 a	287.7 b	1.1 a	2.32 b	0.78 b	25.3 b	1.24 c

Table 3: Correlation coefficients between different characteristics

	Rosset diameter (mm)	Leaf number	floret number	Flower diameter (mm)	Charbohydrate (%)	Stomatal index	Total.Chl (µgr/ml)	Chl.a (µgr/ml)	Chl. b (µgr/ml)	Leaf area (cm^2)	.Dry weight (gr)
Rosset diameter	1										
Leaf number	0.31^{ns}	1									
floret number	0.31^{ns}	-0.21^{ns}	1								
Flower diameter	0.81^{ns}	0.94*	-0.75*	1							
Charbohydrate	-0.23^{ns}	-0.34^{ns}	-0.28^{ns}	-0.81^{ns}	1						
Stomatal index	0.56^{ns}	0.54^{ns}	-0.15^{ns}	0.54^{ns}	-0.05^{ns}	1					
Total.Chl	0.78*	0.28^{ns}	0.6^{ns}	0.85^{ns}	-0.66^{ns}	0.43^{ns}	1				
Chl. a	0.008^{ns}	0.2^{ns}	-0.02^{ns}	0.15^{ns}	-0.15^{ns}	-0.36^{ns}	0.04^{ns}	1			
Chl.b	0.52^{ns}	0.02^{ns}	0.57^{ns}	0.59^{ns}	-0.68^{ns}	0.21^{ns}	0.9**	0.24^{ns}	1		
Leaf area	0.19^{ns}	0.58*	-0.24^{ns}	0.96^{ns}	-0.49^{ns}	0.08^{ns}	0.14^{ns}	0.5^{ns}	0.01^{ns}	1	
Dry weight	0.02^{ns}	0.25^{ns}	-0.03^{ns}	0.21^{ns}	-0.18^{ns}	-0.34^{ns}	0.06^{ns}	0.99**	0.24^{ns}	0.55^{ns}	**1**

Significant at* $P \leq 0.05$ and ** $P \leq 0.01$.

Results showed that this plant growth regulator can be applied as an effective plant growth regulator on African Violet, so that its amount of effectiveness varies depended on the type of characteristics and applied concentration. The purescine was most effective in 75 ppm concentration on factors such as number of leaves, diameter of floret, stomatal index, leaf area, and dry weight, so that the results matched with the results of Talaat *et al* on Vinca flower [8] with high concentration, as well as the results of Mahgoub *et al* experiment [6] on Dahlia Flower with high concentration. One of the cases of studying the effect of high concentrations of the plant growth regulator on mentioned factors is its direct effect on cell division and growth, followed by differentiation [8,6], so that cell division and growth effects the morphological and physiological characteristics of the plant and lead to increase in vegetative characteristics such as number of leaves and leaf area. With the increase in the vegetative characteristics, the active photosynthesis with stimulation of protein synthesis, and metabolism of nitrogen components [8,6], the amount of dry weight also increased in this treatment in comparison to other ones. The considerable point about African Violet is the variable relation between concentration and number of leaves, which means that the number of leaves had a significant increase in comparison with the control in concentrations up to 75 ppm, but in concentration of 100 ppm the number of them decreased. Which unlike the experiments of Mahgoub *et al* [6] on Dahlia Flower, in which the number of leaves increased by increasing the concentration up to 150 ppm, without any decrease in number of leaves. The difference between two plants can be studied from different viewpoints; one of these possibilities is the sensitivity of African Violet's tissue in high concentrations of Putrescine. Despite the decrease of leaves' number in high concentration, the sources of petiole carbohydrate increased significantly in leaves in comparison with other concentrations and control. Consequently, required storage for generation of vegetative parts were produced and increased gradually by concentration, but it seems that differentiation of some parts was more sensitive to high concentration, and had an inverse relation with that. In flowering stage, considering the direct effect of this plant growth regulator on cells differentiation and direct and indirect relation of flowering physiology with polyamines [6], different concentrations of Putrescine changed the flowering in a way that its lower concentrations produced the maximum number of florets and its higher concentrations produced less florets comparing to the control. Thus even if Putrescine treatment in African Violet can directly affect flowering, but in high concentrations, depending on sensitivity of the differentiating part of the plant it can have inverse effect. While the flower diameter had a negative and significant regression with the number of florets (r = -0.75*), in the end the treatment with 50 ppm concentration, producing more florets, had the minimum flower diameter, and the treatment with 75 ppm concentration and minimum number of florets produced maximum diameter of flower. Considering the experiment of Abdel Aziz Nahed *et al* [3], increasing the concentration of Putrescine up to 200 ppm caused the increase in the amount of a, b, and total chlorophyll, as well as soluble solids in Gladiolus; while in this research, the low concentrations showed the same results, the higher ones did not showed this effect. In the case of its positive effect, since application of polyamines increase some nutrients,

especially potassium, which directly increases the plant's growth and number of pigments by affecting photosynthesis [3].So, treatment of Putrescine affects pigments directly, but considering other vegetative and reproductive characteristics of African Violet, the increase in concentration might change the type of its effects. Consequent results of this research showed that concentration of Putrescine and the type of characteristic are considered as the two important factors for application of Putrescine on African Violet.

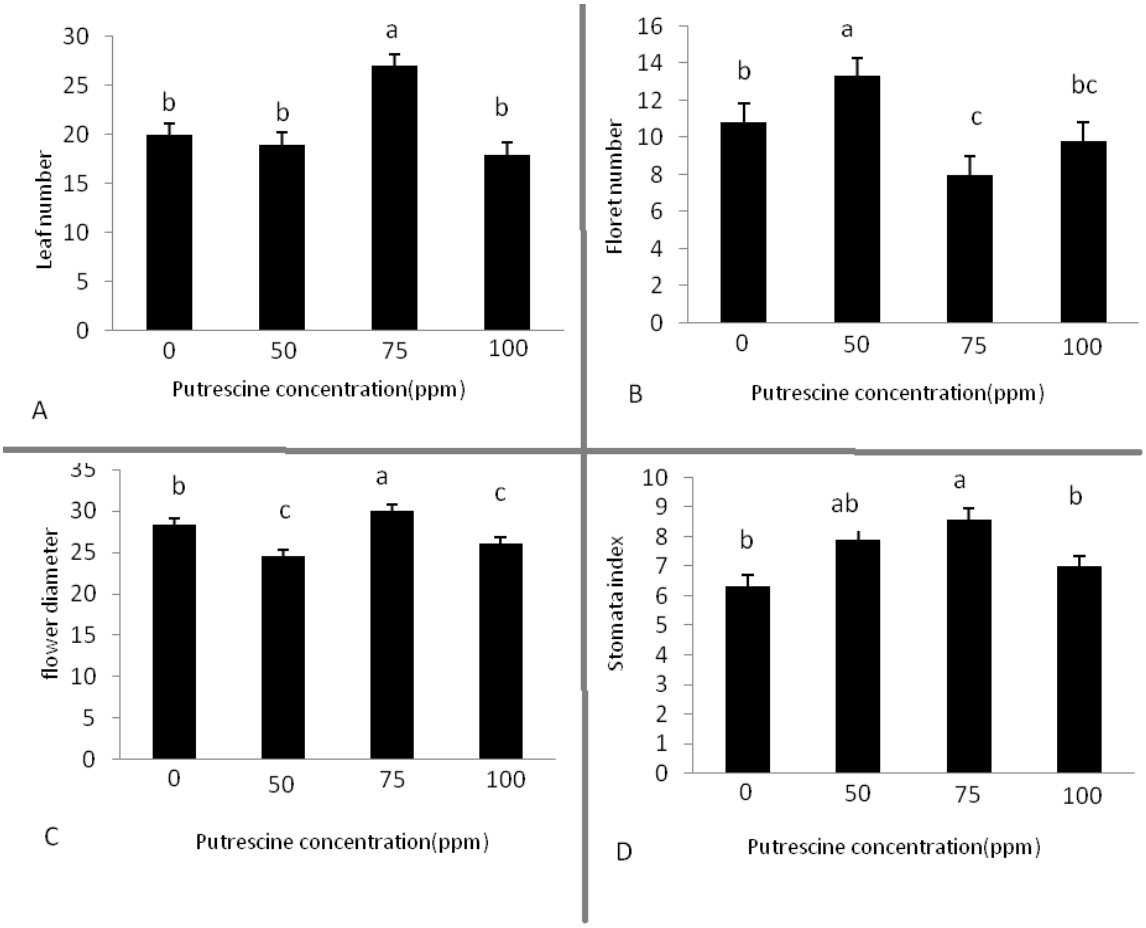

Fig 1: Changes in Number of Leaves(A), Number of Florets(B), Flower Diameter(C), and Stomatal Index(D) in Different Concentrations of Putrescine.

REFERENCE

1. Khan, S., S. Nasseb and K. Ali. (2007). Callus induction, plant regeneration and acclimatization of African violet (*saintpauia ionantha*) using leaves as explants. *Pak. J. Bot.* **39**(4):1263-1268.
2. Chen, J. and Henny, R.J. (2012). Cultural guidelines for commercials production of African violet (*saintpaulia ionantha*), University of Florida IFAS Extension. 1-4 p.
3. Abdel aziz nahed, G., Tahalobna, S. and Ibrahim soad, M.M. 2009. Some studies on the effect of putrescine, ascorbic acid and thiamine on growth, flowering and some chemical consistuents of gladiolus plants at nubaria. Ozeam Journal of Applied Sciences. **2**(2): 169-179.
4. Ayad, H.S., Read, F. and. Abdalla, M.S.A.(2010). Effect of putrescine and zinc on vegetative growth, photosynthetic pigments lipid proxidation and essential oil content of (*geranium pelargonium* L). *World journal of agricultural sciences*. **6** (5): 601-608.
5. Mahros, K. M., Badawy, E. M., Mahgoub, M.H., Habib, A.M. and Sayed, I.M. E. (2011). Effect of putrescine and uniconazole treatments on flower characters and photosynthetic pigments of *chrysanthemum indicum* L. plant. *Journal of American Science*. **7**(3): 399-408
6. Mahgoub, M.H., Abdel Aziz Nahed, G. and Mazhar, A.M.A. (2011). Response of *Dahlia pinnata* L. plant to foliar spray with putrescine and thiamine on growth, flowering and photosynthetic pigments. *American-Eurasian J. Agric & Environ Sci*. **10** (5):769-775.
7. Amin, A.A., Fatma, A. E., Ghrib. M., El-awadi, M. and Rashed, E. S. M. (2011). physiological response of onion plants to foliar application of putrescine and glutamine. Scientia Horticulturea. **129** (3): 353-360.

8. Talaat, I.M., Bekheta. M.A. and Mahgoub. M.M.H.. (2005). Physiological response of Periwinkle plants (*Cataranthus roseus* L.) to tryptophan and putrescine. *International Journal Of Agriculture & Biology.* **7**(2): 210-213.
9. Fatma, E.M., Quesni, E., Magda, M.K. and Mahgoub, M.H. (2007). Some studies on the effect of putrescine and paclobutrazol on the chemical composition of *bougainvillea glabra* L. at Nubaria. *American-Eurasian J. Agric & Environ*. **2**(5): 552-558
10. Porra, R.J. (2002). the chequred history of the development and use of simulanouse equations for the accurate determination of chlorophyll a and b. *photosynthesis Research*. **73**: 149-156.

How to cite this article
Razieh Nanvakenary, Hossein Moradi , Somayeh Ghasemiomran . Effects of Putrescine on Morphological and Physiological Characteristics of Ornamental plant African violet (*Saintpaulia ionantha*). Bull. Env. Pharmacol. Life Sci., Vol 2 (10) September 2013: 118-122