Bionatura
Latin American Journal of Biotechnology and Life Sciences

Bionatura Issue 4 Vol 8 No 1 2023

Article

Influence of Corm Soaking in Epibrassinolide and Foliar Application of CPPU on Corms Production and Flowering of Gladiolus Plants

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Available from: http://dx.doi.org/10.21931/RB/CSS/2023.08.04.36

ABSTRACT

The study was carried out at Al-Zawraa park\Mayoralty of Baghdad on fall season 2016, to investigate the Influences of soaking gladiolus corms in Epibrassinolide (BRs) at three concentrations, and foliar application of CPPU at three concentrations, on flowering, corms, and cormels prodtion**.** The results could be summarized as follow**:** Soaking corms with 0.1 mg.l^{-1} of BRs was significantly increased the flowering characters**;** plants bloomed earlier, number of florets. flowering peduncle^{-1}, length of flowering peduncle, diameter of flowering peduncle, diameter of basal floret, while 0.05 mg**.**l^{-1} of BRs, was more effective on flowering period, vase life, number of corm**.**plant^{-1} , corm diameter, dry matter of corm, number of cormels**.**corm^{-1}, diameter of cormel and dry matter of cormel. Foliar application of gladiolus vegetative growth with CPPU at 20 mg**.**l^{-1}, increased plants boomed earlier, number of florets, Flowering peduncle^{-1} , length of flowering peduncle, diameter of flowering peduncle, diameter of basal floret, flowering period, and vase life, Number of corms**.**plant^{-1}, corm diameter, dry matter of corm, number of cormels**.**corm^{-1}, cormel diameter, and dry matter of cormel. The interactions between EP3 X CP3, was superior on improving all characters tasted except of flowering period and vase life which the treatment EP2 X CP3 was the most effective**.**

Keywords: Gladiolus, Epibrassinolide, CPPU, Soaking, Foliar

INTRODUCTION

Gladiolus is summer annual bulbs under the conditions of the Iraqi climate (it can be planted in two autumn and spring seasons, and throughout the year)-when cultivated under air-conditioned environmental conditions [1]. Belongs to Iridaceae family, and its original home is the countries of South Africa. The importance of plant due to its short growing season, the suitability of its flowers for commercial picking, its multiplicity of colors, and its long vase life, as well as the aromatic smell of the flowers of some of its varieties [2]. Cut flower producers have resorted to adopting modern techniques to improve plant growth and increase its productivity from commercial quality flowers (cut flowers). One of these agricultural techniques is using of growth regulators such as Brassinosteroids (BRs), which were extracted in 1970, which is a group of compounds steroid lactones that can be synthesized - including the compound Brassinolide (BRs), and its analogues - have multiple effects on the vital processes of plants, by inhibiting, activating or modifying these processes. And

they have an important role in regulating plant growth, ethylene gas production, and photosynthesis, stimulating the absorption of ions, encouraging nitrogen fixation increasing the transfer of materials resulting from the photosynthesis process, affecting the elongation and division of cells, specializing transport vessels, and helping to regulate many physiological processes that take place inside the plant cell, such as the manufacture of (RNA and DNA), and various other proteins, and stimulate the plant to flower, increase production, and other processes [3].

Among the research that was conducted to study effect of soaking, [4] found when soaking with Paclobutrazol, the amount of chlorophyll and diameter of flower stand increased and significantly decreased the height of the flower stalk and flower diameter in iris plant (Iris reticulatae). [5] mentioned that the effect of growth regulators (Salicylic acid and Brassinolide) on growth flowering of Dendranthena grandiflora (Yellow Erect), the effect of BL at 40 mg.L^{-1} gave the date of the appearance of first flower and increased in number of flowers, length of flower stem, floral stem diameter and flower age.

Cytokinins represent the third group of plant growth - promoting hormones after auxins and gibberellins, and they play a role in stimulating plant cell division and specialization, in association with the auxin group, as well as their role in many other physiological processes of plants, such as the phenomenon of apical dominance. CPPU or KT-30, which is the trade name for N - (2- chloro - 4 - pyridyl -N- phenylurea), is one of the synthetic compounds of the phenylurea group that has a urea base
[3]. Among the research that was conducted to study the effect of adding cytokines, [6] reported that spraying the vegetative growth of (narcissus poeticus) with the growth regulator CPPU at a concentration of 9 mg.l^{-1} was the most effective in increasing the rates of the following traits: date of first flower appearance, number of flowers.$Plant^{-1}$, flower diameter, flower stem length and diameter, and vase life. This study aims to know the effects of soaking the corms of gladiolus with the growth regulator BRs and then spraying the vegetative growth of the plant with the growth regulator CPPU, and the interactions of the two factors, on the characteristics of floral growth and indicators of corms and cormels of the gladiolus plant

MATERIALS AND METHODS

The research was conducted in Al-Zawra Park [inside a greenhouse (with an area of 50 x 9 m)], affiliated to the Department of Parks and Afforestation / Department of Parks and Afforestation / Municipality of Baghdad, in the autumn season of 2016.The corms of gladiolus (White Prosperity cv.) were planted in 162 pots with a diameter of 25 cm with one corm in each pot. The pots were filled with an agricultural medium consisting of 3 volumes of soil taken from the edge of the river, and one volume of peat moss- table1 shows the components of house moss - at a rate of 6 kg for each pot, soil sterilization was carried out with pentanol 50%, at a concentration 0.5 ml l^{-1}, to avoid infection with fungi, and insecticide sevin 85%, to avoid infection with insects. The process of taking soil samples (the mixture), before mixing it with the middle of the house moss, was chemically and physically analyzed in the laboratory belonging to the Department of the National Center for Organic Agriculture/General Authority for the Protection of Plants (table 3 shows the results of this analysis)

C:N	moisture	pH	O.M.	Cl	Na	K_2O	P_2O_5	N	ingredients
16:1	13.5	6.1	65	0.8 >	0.01 >	1.7	1	2.5	%

Table 1. Components of house moss* its physical and chemical properties.* The peat moss is produced by the German Company Sab-Germany.

All agricultural operations, including irrigation, weeding, and insects control, were carried out completely and for all experimental units as needed. As for the fertilization process, the plants were sprayed with liquid fertilizer (Grow more) only - its components are shown in table 2- at a concentration of ml l^{-1} with a difference of 10 days, between one spray and another, and it continued until the end of the experiment**.**

Mo	B	Cu	Fe	Mn	Mg	S	K	P	N
0.0005	0.02	0.05	0.10	0.05	0.10	0.20	20	20	**20**

Table 2. Components of liquid fertilizer grow more than Mineral elements (%).

measuring unit	value		Analysis type
—	7.74		**PH**
DS. m^{-1}	2.95		**EC 1:1**
Mg. kg^{-1}	25.9		**O.M.**
	223		**carbon minerals**
	9		**gypsum**
	42.1		**N availaBRse**
	29		**P availaBRse**
	189		**K availaBRse**
Gm. Kg^{-1}	721	sand	**Soil Separators**
	192	silt	
	87	Clay	
Loamy Sand			**texture**

Table 3. Some physical and chemical properties of the Mixture type of analysis value unit of measure.

The factorial experiment was carried out with two factors (each factor has three concentrations), and the first factor represented by soaking with the growth regulator BRs, at concentrations**:** 0, 0.05, and 0.1 mg**.**l^{-1} as EP1, EP2, and EP3 respectively - and the second factor represented, foliar spraying with CPPU at concentrations 0, 10, and 20 mg.l^{-1} as CP1, CP2, and CP3, the interactions between factors were studied in a (R.C.B.D.) with three replicates, and one replicate included 6 experimental units (pot), with one corm / pot. The results were analyzed according to the statistical program [16], as well as means of traits measured using the (L.S.D.) test, and at a probability level of 5% [7]**.** The solutions were prepared by dissolving 0.05, and 0.1 mg, from 24-epiBL, to obtain At concentrations 0.05and 0.1 mg.l^{-1}, and in the same way, concentrations of CPPU were prepared by dissolving 1and 2 mg], to obtain the two concentrations 10, and

20 mg.l^{-1}, with the addition of drops of bubblegum solution (as a diffuser), and before planting the corms, they were soaked for two hours with the concentrations of the growth regulator 24-epiBL, (the control plants were soaked with distilled water). The concentrations of the growth regulator CPPU were sprayed three times**:** the first**:** when 2-3 pairs of leaves appear, the second**:** after the vegetative growth is completed and the first flower bud begins to form, and the third**:** after the end of the flowering period

RESULTS

Effects of soaking gladiolus corms in BRs and foliar spraying with CPPU on flower growth:

It is clear from the statistical data of table no.4 the significant effects of soaking the gladiolus corms in most indicators adjectives floral growth of gladiolus plants, and the treatment EP3 gave the best results, as the flowering date took 66.50 days, and the number of florets**.** Flowering *peduncle*$^{-1}$ is12.07, the length of the flowering *peduncle* is 190.64 cm, the diameter of the flowering *peduncle* is 1.05 cm, and the diameter of the basal flower is 14.10 cm, while the soaking treatment with the concentration EP2 gave the longest flowering period of 14**.**67 days, and vase life 13.23 days**.**

The interactions between two factors showed a significant effect on flowering and treatment EP3 X CP3 gave the best results for most of the traits except for the flowering period and vase life, where the treatment outperformed the treatment EP2 X CP3, compared to the untreated plants**.**

3.2. Effects of soaking gladiolus corms in BRs and foliar spraying with CPPU on corms and cormels characteristics:

It is clear from the statistical data of table 5 that soaking the gladiolus corms with concentration EP3 significantly increased all indicators of corms and cormels, as number of corms**.**plant^{-1} 3.06, diameter of the corm 11.56 cm, dry matter for corm 86.84%, number of cormels**.**corm^{-1} 85.18, diameter of cormels 1.55cm, and cormels dry matter 61**.**25%**.** From the same table, the moral effect of the process of spraying with CP3,which produced number of corms**.**plant^{-1} 3**.**12, diameter of corms 10.88 cm, dry matter of corms 87**.**13%, number of cormels**.**corms^{-1} 94**.**28, cormel diameter1.49cm, and cormel dry matter 63**.**24%**.**

DISCUSSION

It is possible to explain the response of gladiolus plants to soaking in BRs as follows**:** the early flowering date, and the increase in the number of florets**.***peduncle*$^{-1}$ is possibly due to a change in the photosynthesis process from the vegetative stage to the stage of floral growth (flower production), after adding the BRs, due to the severity of the effects of the latter in increasing the rates of vegetative growth indicators, which hastened and helped the plant enter the flowering stage, or it may return to the increase in the rates of vegetative growth indicators causing in increasing the production of sugars, proteins, and starch in the leaves, and consequently to the accumulation of these biochemical materials in places of consumption, and improving the proportion of proteins and total carbohydrates in the leaves, and then using them in the formation of flower buds [8]**.** The increase in the length and diameter of the flowering *peduncle*, and the diameter of the basal flower may be due to the role of BRs in encouraging many cellular and physiological processes that occur in plants such as cell division elongation, biosynthesis of cell wall components, DNA and RNA synthesis, nitrogen fixation, and the distribution of representative substances to the plant organs, stimulating the processes responsible for cell elongation and division, or it may be to increase the accumulation of carbohydrates in leaves ,

As for the shortening of the flowering period and vase life, it may be due to increase in ethylene release, as it was found that BRs helps the biosynthesis of ethylene, which accelerates flower senescence [9].

Conc. mg.L^{-1}		Flowering date (day)	No. of florets. flowering peduncle^{-1}	flowering peduncle length (cm)	flowering peduncle Diameter (cm)	Basal flower Diameter (cm)	flowering period (day)	vase life (day)
(A) effects of EP								
1EP		85.83	9.33	71.72	0.81	9.69	11.24	**10.02**
EP2		72.25	10.17	82.24	0.98	12.23	14.67	**13.23**
EP$_3$		66.50	12.07	90.64	1.05	14.10	13.87	**12.76**
LSD 0.05		0.71	0.26	1.58	0.02	0.26	0.45	**0.19**
(B) effects of CPPU								
CP1		89.17	8.27	75.67	0.83	9.65	10.97	**9.67**
CP2		70.62	11.17	84.25	1.06	11.82	14.98	**13.71**
CP3		61.42	13.74	88.31	1.54	13.90	16.85	**14.24**
LSD 0.05		0.71	0.26	1.58	0.02	0.26	0.45	**0.19**
(C) effects of interactions between EP and CP								
EP1	**CP1**	97.00	6.94	68.93	0.79	8.89	9.63	**10.33**
	CP2	77.32	8.63	79.57	1.09	10.32	13.86	**13.89**
	CP3	71.83	10.33	87.83	1.56	12.97	15.66	**14.09**
EP2	**CP1**	73.63	10.42	86.01	1.16	12.31	13.89	**12.54**
	CP2	66.81	13.73	91.14	1.37	13.32	16.33	**13.81**
	CP3	64.33	14.57	92.83	1.59	15.18	19.15	**16.86**
EP3	**CP1**	66.57	11.12	88.03	0.95	13.92	13.33	**10.95**
	CP2	64.83	14.73	93.64	1.57	15.35	15.15	**14.23**
	CP3	60.53	15.81	97.05	1.74	16.56	17.33	**15.33**
LSD 0.05		1.45	0.52	3.21	0.03	0.53	0.95	**0.38**

Table 4. effects of soaking gladiolus corms with BRs and foliar spraying with CPPU and their interactions on of flower growth.

It can also be seen from table 4 the moral effect of spraying CPPU on all indicators of flowering growth of gladiolus plants, and the treatment CP3 gave the best results, as the flowering date took 61.42 days, the number of florets.flowering peduncle^{-1} 13.74, the length of the flowering peduncle is 88.31 cm, the diameter of the flowering peduncle is 1.54 cm, the diameter of the basal flower is 13.90 cm, the flowering period is 16.85 days, and the vase life is 14.24 days, the reason for the early flowering date- after spraying the CPPU - may be due to its role in increasing the vegetative growth, which caused an increase in the amount of processed carbohydrates - from the photosynthesis process - which

plays an important role in the emergence of flowers [15], as for the reason for the increase in the number of florets.flowering peduncle^{-1} after spraying with CPPU, it may be attributed to the biological effect of cytokinins in inhibiting apical dominance, and then stimulating lateral buds to grow, or the increase may be due to the cytokinins being one of the important internal factors to drive the vegetative growth stage. to the stage of flowering growth [15], as well as its role in increasing carbohydrates in the plant, which plays an important role in the emergence of flowers, as the increase of carbohydrates in the leaves has an important effect on the formation of flower buds through the development of the beginnings of the emergence of leaves to form flowers, as well as its role in controlling the amount of sugars appropriate to the meristem areas, which are capable of forming the primary floral facilities flower primordial [10], as for the increase in the length of the flowering peduncle after adding CPPU, it may be due to the latter's role in increasing cell division in the apical meristems and cambium, and adding new cells to the plant, which caused an increase in these traits [11].

The reason for increase in flowering peduncle diameter after spraying with CPPU it may be due to its work on increasing cell size by elongating their width and not their length, whether they are for the vegetative or root parts [15]. The increase in florets diameter after spraying with CPPU may be attributed to the vital role of cytokinins in stimulating growth through its effect on encouraging DNA formation and its replication, encouraging cell division and elongation, increasing cell expansion, and plasticity of the cell wall, which leads to an increase in the diameter of the florets [12], while increasing the duration of flowering, this may be due to the increase in the food stock resulting from the increase in the photosynthesis process, which caused the availability of carbohydrates necessary for the continued opening of the florets on the plant [13], and the increase in vase life after spraying CPPU may be due to its role in the transfer of soluble compounds (including carbohydrates) from old leaves to active tissues such as new leaves, flowers and growing tops - that is it works to create a mechanism for attracting [sink] nutrients - which in turn works to prolong the life of the leaf by delaying its aging, which An increase in leaf area, an increase in processed carbohydrates, and a rapid transfer of nutrients that include other growth hormones, vitamins and nutrients that promote increased growth [10].

The reason for the increase in the indicators of the corms and cormels as result of soaking the corms with EP3 from the increase in the number, diameter, and percentage of dry matter, may be due to the role of BRs in improving the vegetative growth of plants, which in turn caused the increase in the content of the leaves from sugars and carbohydrates, and then their transfer to the rootstock -for storage-at the end of the growing season, this means improving all indicators of corms and cormels [14]. As for the reason for the significant increase in corms and cormels charcters after spraying CPPU, it may be due to the direct role of cytokinins in increasing the growth and improving vegetative growth characters, and the indirect role in improving the root growth (corms and cormels), as well as the effect of CPPU in stimulating the two processes of splitting and the expansion of cells laterally, which caused an improvement and increase in the growth of the root system (corms and cormels) and its dry weight, and the cytokinin works to increase the size of the cell and its elongation transversely rather than longitudinally [15].

The reason for the improvement of the aforementioned indicators may also be attributed to the combined effect of BRs and CPPU in increasing the susceptibility of the root system of treated plants to increasing the absorption of mineral elements and increasing their concentration in the leaves, including phosphorous (which works to form a strong root system), which increased the

plant's ability to absorb the rest of the nutrients, and this in turn caused an increase in nutrients resulting from the photosynthesis process, and the transfer of its products to other parts of the plant, including the root growth [17,18.19].

CONCLUSION

BRs at concentration EP_3, and CPPU at concentration CP3 showed a significant difference in all of flowering and corm characters. These results confirmed the role of the plant and improved the yield of the gladiolus plant. The treatment EP3 X CP3 gave the best results for all traits.

Conc. $mg.L^{-1}$		No. of corms. $plant^{-1}$	corm diame-ter (cm)	D.M. of corm (%)	No. of cor-mels.cor m^{-1}	diame-ter of cormel (cm)	D.M. of cormel (%)
(A) effects of EP							
1EP		2.06	8.14	72.69	56.41	0.94	**39.66**
EP2		2.66	10.18	84.95	76.93	1.33	**54.90**
EP_3		3.06	11.56	86.84	85.18	1.55	**61.25**
LSD 0.05		0.28	0.12	1.81	1.41	0.01	**2.20**
(B) effects of CPPU							
CP1		2.15	7.98	81.07	67.48	1.02	**40.24**
CP2		3.02	9.74	85.75	82.93	1.29	**55.63**
CP3		3.12	10.88	87.13	94.28	1.49	**63.24**
LSD 0.05		0.28	0.12	1.81	1.41	0.01	**2.20**
(C) effects of interactions between EP and CP							
EP1	**CP1**	1.02	7.36	69.93	60.01	1.11	**38.09**
	CP2	2.69	9.69	85.97	84.19	1.31	**57.27**
	CP3	3.15	10.79	87.94	98.24	1.52	**66.81**
EP2	**CP1**	2.76	9.93	85.08	81.35	1.35	**58.09**
	CP2	3.19	11.25	86.63	86.25	1.44	**60.24**
	CP3	3.25	11.68	87.53	98.12	1.72	**65.16**
EP3	**CP1**	2.95	11.21	86.91	87.83	1.57	**62.03**
	CP2	3.09	11.40	87.69	93.25	1.93	**64.12**
	CP3	3.18	11.84	88.14	101.36	2.10	**70.05**
LSD 0.05		0.86	0.22	2.30	3.24	0.02	**2.41**

Table 5. Effects of soaking gladiolus corms with BRs and foliar spraying with CPPU and their interactions on corms and cormels characters.

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Received: May 15, 2023/ Accepted: June 10, 2023 / Published: June 15, 2023
Citation: Salih, S.M. Influence of Corm Soaking in Epibrassinolide and Foliar Application of CPPU on Corms Production and Flowering of Gladiolus Plants. Revista Bionatura 2023;8 (4) 63. http://dx.doi.org/10.21931/RB/CSS/2023.08.04.36