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Response of Application Gibberellic acid (GA_3) and Benzyladenine (BA) to *Dizigotheeca elegantissima* Plants

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ABSTRACT

Field trials with *Dizigotheeca elegantissima* were conducted at the experimental farm of Faculty of Agriculture, Azad University Jiroft in growth seasons of 2012 year. The aim of this work was to study the effect of foliar application of gibberellic acid [GA_3] and benzyladenine [BA] at 0, 50, 100 and 150 mgL^{-1} on the vegetative growth and Photosynthetic pigments of *D. elegantissima* plants. Most of the vegetative growth characteristices like plant heights, number of leaves/plant, chlorophylle index and Photosynthetic pigments were significantly affected by application of the two factors which were used in this study. All foliar applications of BA and GA_3 separately promoted all the afore mentioned characters in this study, as well as Photosynthetic pigments i.e. Chl. [a and b], totol and sum pigments compared with control plants. The highest recorded data were obtained in plants treated with 200 mgL^{-1} GA_3+200 mgL^{-1} BA for plant height, number of leaves/plant and chlorophylle index, except with 200 mgL^{-1} GA_3+100 mgL^{-1} BA which gave the highest leaf area.

Key words: benzyl adenine, *Dizigotheeca elegantissima,* gibberellic acid, growth.

Abbreviations: GA_3, Gibberellic Acid; BA, Benzyl Adenine.

INTRODUCTION

It has been known that growth regulators among in the agriculture practices which is most favourable for promoting and improving plant-growth of different plants. The beneficial effect of gibberellic acid on different plants were recorded by Shedeed et al. [1991] on croton plant, Eraki [1994] on Quen Elizabeth rose plants, Bedour et al. [1994] on *Ocimum basillicum,* they concluded that gibberellic acid is used to regulating plant growth through increasing cell division and cell elongation. The effect of cytokinins especially benzyl adenine on the plant growth and chemical constituents of different plants have mentioned by Eraki et al. [1993] on salvia plants, Mazrou [1992] on Datura, Mazrou et al. [1994] on sweet basil, Mansoure et al. [1994] on soybean plants and Vijakumari [2003] on *Andrographis panculata*. Cytokinins are important plant hormones that regulate various processes of plant growth and development including cell division and differentiation, enhancement of leaf expansion and nutrient mobilization [Hassan and El-Quesni., 1989; Shudo.,1994]. The response of plants to cytokinins have been also discussed in more papers where Eraki [1994] on *Hibiscus sabdarijfa* L. plants mentioned that application of BA significantly increased plant height, number of branches as well as fresh and dry

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weights of leaves than the control. Hassanein [1985] on *Pelargonium graveolens*, El-Sayed et al. [1989] on *Polianthus tuberosa*, Menesi et al. [1991] on *Calendula officinalis* and Mazrou et al. [1994] on sweet basil, they found that foliar application of BA increased growth of different organs, active constituents production of these plants and increased total carbohydrates content on comparison to the untreated plants.

The main object of the present work is to study the effect of different regulators, Gibberellic acid and Benzyladenine on the growth and Photosynthetic pigments of *Dizigotheeca elegantissima* plants.

MATERIAL AND METHODS

The present work was conducted during the successive seasons of 2012 year at greenhouse of National Research Centre [Research and Production Station]. Plastic pots 30 cm in diameter were used for cultivation that were filled with media containing a mixture of sand, Rice husk, Leaf composts and peat as 1:1:1:1 [v/v]. The plants were fertilized with 3% liquid fertilizer in some doses after 4, 6 and 8 weeks from transplanting. In the application of gibberellic acid and benzyladenine [0, 100 and 200 mg L^{-1}] each containing 10 ml [0.l'%] Tween-20 surfactant. For each pot was used 40 cc of solution at each stage [three stages] with 15 days intervals [Carey et al., 2008].

Treatments to gibberellic acid and benzyladenine that the combination was as follows:

1- control
2- 0 mg L^{-1} GA_3+100 mg l^{-1} of BA
3- 0 mg L^{-1} GA_3+200 mg l^{-1} of BA
4- 100 mg L^{-1} GA_3+0 mg l^{-1} of BA
5- 100 mg L^{-1} GA_3+100 mg l^{-1} of BA
6- 100 mg L^{-1} GA_3+200 mg l^{-1} of BA
7- 200 mg L^{-1} GA_3+0 mg l^{-1} of BA
8- 200 mg L^{-1} GA_3+100 mg l^{-1} of BA
9- 200 mg L^{-1} GA_3+200 mg l^{-1} of BA

At the first week of October 2012, the following data were recorded: plant height [cm], stem diameter [mm], number of leaves/plant, leaf area [cm^2], chlorophyll index [SPAD] and photosynthetic pigments [$mg.ml^{-1}$] Lichtenthaler, [1987] were calculated.

Experimental Design and Statistical Analysis: Experiment was arranged in a factorial test with complete randomized design with four replications. Analysis of variance was performed on the data collected using the general linear model (GLM) procedure of the SPSS software) Version 16, IBM Inc.). The mean separation was conducted by dancan analysis in the same software (p= 0.05).

RESULTS AND DISCUSSION

The Height number leaves was in a plant in applications of 200 mg l^{-1} GA_3 +200 mg l^{-1} BA , 200 mg l^{-1} GA_3+100 mg l^{-1} of BA with respectively, with average of 41.5 and 38 that which did not show statistically significant a meaniful diference [Table 1]. In a research, by Zieslin and Tsujita [1998] on *Lilium* and Hamano *et al* [2002] on Cabbage, using by of GA_3 on plants could cause to increase leaf than application that was seen. The effect of GA_3 on increasing rate of dry material of plant can attributed to its effect on increasing photosynthesis rate through increasing leaf surface [Lester et al, 2002].

The application Control treatment and 100 mg l^{-1} GA_3 with least number of leaf, with averages of 31.5 and 34.5 respectively that they showed a meaningful difference with application of 200 mg l^{-1} GA_3 +200 mg l^{-1} BA. Application of *Zantedeschia aethiopiea* caued to increase number of leaves by spraying solution of BA [Majidian et al, 2012].

In view of results of table [1], maximum Plant Height was obtained with applications of 200 mg l^{-1} GA_3 +200 mg l^{-1} BA , 200 mg l^{-1} GA_3+100 mg l^{-1} of BA with average of 36.25 and 33.25 cm . The results show, by increasing concentration of regulators of growth, Plant Height and Number of leaf/plant is increased, too. GA_3 by effecting cellular processes such as cellular division stimulation, lengthening cells caused to increase growing growth [Stuart and Jones, 1977]. GA_3 s by increasing tension of cellular wall, i.e. Wall extension though hydrolysis of starch to sugar that follows decrease of potential of cellular water, cause to enter water inside cell and lengthen cell [Arteca, 1996].

The maximum of Stem Diameter was in a plant in applications of 100 mg l^{-1} GA_3+200 mg l^{-1} BA and 100 mg l^{-1} BA, respectively, with average of 0.44 and 0.44 that they did not show a meaniful diference, statically [Table 1]. Leaf area was under a meaningful effect of regulators of growth, maximum leaf area was in application of 200 mg l^{-1} GA_3+100 mg l^{-1} BA and 100 mg l^{-1} GA_3+200 mg l^{-1} BA with averages of 16.79 and 16.11 cm^2, respectively. Results of table [1] showed, by increasing concentration of regulators of growth, leaf area increased as meaningful, too. Minimum value of leaf area in control application, was obtained as control and 100 mg l^{-1} GA_3, on average as 9.78 and 10.48 cm^2, respectively [Table 1].

Foliar sprays should be made in such a way as to contact the plant leaves, stems, and meristems as cytokinins will not travel very far in the plant from the point of contact [Fox and Weis, 1965; Zhu and Matsumoto, 1987]. In order for cytokinins to affect branching or flowering, they must be absorbed by the meristem or on the stem below it. Spray solutions should be pH adjusted to neutral pH levels to improve absorption. Foliar sprays may be made with hand sprayers, boom sprayers, and air blast sprayers.

Usually, the entire plant should be covered, but there are some applications where only certain parts of the plant should be targeted. In Easter lily, it is best to target only the lower leaves in order to prevent lower leaf yellowing [Whitman et al., 2001]. In watermelon, sprays should be limited to the ovaries in order to stimulate parthenocarpy [Maroto et al., 2005]. Lower stem sprays have been used to stimulate branching in *Monstera* and *Alocasia* [Henny and Fooshee, 1990a, 1990b]. Crown sprays have been used on *Hosta* [Keever and Warr, 2005].

In view of results of table (1), maximum index of chlorophyll was obtained in application of 200 mg l^{-1} GA_3, 100 mg l^{-1} GA_3 +200 mg l^{-1} BA and 200 mg l^{-1} GA_3+100 mg l^{-1} BA with average of 16.81, 16.76 and 16.28. By increasing concentration of regulators of growth, index of chlorophyll was increased, too. Using regulators of growth of GA_3 and BA, increased rate of chlorophyll in leaves of *Zantedeschia aethiopiea* plant [Majidian et al, 2011]. Minimum value of index of chlorophyll was obtained in control application. It seems, regulator of growth of BA has shown a better effect than GA_3 in index of chlorophyll content. GA_3 causes to stimulate sucrose synthesis and transfer it from leaf to filter vessel [Arteca, 1996]. may be, stimulation of sucrose synthesis and transfer of it to filter vessel in effect of applying application of GA_3 not only causes to increase growth in aerial parts of a plant that are discussed as consumption place, but another part are transferred from material inside underground limbs, too that causes to increase growth of root. In short, it can be said that variability of growth rate by GA_3 may be stimulation of photosynthesis rate, increase of activity of some enzyme or change in distribution of photosynthesis materials and or participative effect of these cases, due to increase in

effective level of leaf [Arteca, 1996; Aggarwal and Sachar., 1995]. on the one hand, GA_3s cause to transform proteins to amine acid such as tryptophan that is prerequisite of auxin, by stimulating activity of some enzyme of protease. Therefore, they apply some of their effects as indirect through auxin, too [Leshem, 1973].

GA_3 causes to increase plasticity of cellular wall, too. This problem can be due to acidification of cellular wall or as a result of absorption of calcium ion inside cytoplasm [Baninasab and Rahemi., 1994]. it has been proved that GA_3 increases activity of oxigenase carboxilase non phosphate ribolose [Rabisco] enzyme that is a main photosynthesis enzyme in plants.

The results [Table 2] of this test indicated this problem that regulators of BA and GA_3 were effective on photosynthesis pigments. The highest value of chlorophyll of a, b was total and sum pigments in level of 200 mg l^{-1} GA_3+200 mg l^{-1} BA, with average of 12.19, 7.55, 19.74 and 21.88 mg ml^{-1}. By increasing concentration of GA_3 and BA, value of chlorophyll a is increased. Results related to attribution, showed chlorophyll of leaf that application of GA_3 has a meaningful difference with control application that these results adapted with results of Mynett et al [2001] in Freesia and Yaghoubi et al [2013] in Bellis perennis about effect of GA_3 on increase of greenness index. GA_3 has structural role in membrane of chloroplast and causes to stimulate photosynthesis [Janowsk and Jerzy., 2003]. Minimum value of chlorophyll of Chl. (b), total, Carotenoids and sum pigments was treatment control with average of 1.51, 4.08 and 1.95 and 6.03 mg.ml^{-1} [Table 2]. Minimum value of chlorophyll of Chl. (a) treatment 100 mg l^{-1} BA and control with average of 2.5 and 2.56 mg.ml^{-1} [Table 2]. Chlorophyll has primary basic role from view of absorption and use of light energy in photosynthesis. So, effect of regulators of plant growth are effective on biosynthesis and decomposition of chlorophyll on photosynthesis, directly [Arteca., 1996]. The highest value of carotenoids 100 mg l^{-1} GA_3+200 mg l^{-1} BA and 200 mg l^{-1} BA with average of 2.53 and 2.39 mg.ml^{-1} that which did not show statistically significant a meaniful diference [Table 2].

Conclusion

In view of the obtained results, growing growth of a plant *Dizigotheeca elegantissima* can be stimulated through increase of synthesis of photosynthesis pigments by GA_3 and BA.

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Tab 1- Effect of GA_3 and BA on Plant Growth Parameters of *Dizigotheeca elegantissima* 60 Day After Spray (DAS)

GA_3	BA	leaf Chlorophyll Index (SPAD)	Plant Height (cm)	Stem Diameter (cm)	Leaf area (cm^2)	No. of leaves/plant
0	0	8.35d	27.25c	0.24c	9.78c	31.5c
	100	9.03cd	28.5c	0.33b	11.13b	37abc
	200	9.03cd	29.25c	0.44a	11.16c	39.25ab
100	0	10.21cd	29.5c	0.32b	10.48b	34.5bc
	100	11.76cd	30bc	0.34b	13.19b	36.75abc
	200	16.76a	30.25bc	0.44a	16.11a	37abc
200	0	16.81a	30bc	0.31b	13.36b	35.75abc
	100	16.28ab	33.25ab	0.33b	16.79a	38abc
	200	17.03a	36.25a	0.34b	13.14b	41.5a

Means followed by same letter are not significantly different at P< 0.05 probability using Duncan's test.

Tab 2- Effect of Foliar Application of GA_3 and BA on the Photosynthetic Pigments of *Dizigotheeca elegantissima* Plant 60 Day After Spray (DAS)

GA_3	BA	(mg.ml^{-1} fresh weight)				
		Chl. (a)	Chl. (b)	Total Chl. a+b	Carotenoids	sum pigments
0	0	2.56d	1.51f	4.08e	1.95c	6.03e
	100	2.5d	1.68f	4.19e	1.97c	6.16e
	200	6.52c	3.22de	9.74d	2.39ab	12.14d
100	0	6.3c	2.64ef	8.94d	2.31abc	11.25d
	100	8.8b	4.24cd	13.04c	2.25bc	15.29c
	200	9.49b	3.57cde	13.06c	2.53a	15.59c
200	0	9.21b	4.48c	13.69c	2.2bc	15.89c
	100	10.66ab	6.37b	17.03b	2.3abc	19.34b
	200	12.19a	7.55a	19.74a	2.14c	21.88a

Means followed by same letter are not significantly different at P< 0.05 probability using Duncan's test.