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European Journal of Experimental Biology, 2014, 4(2):311-318

ISSN: 2248 –9215
CODEN (USA): EJEBAU

Plant growth regulators effects on the growth and photosynthetic pigments on three indoor ornamental plants

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ABSTRACT

The effect of Gibberellic Acid and Benzyladenineon Ficus benjamina, Schefflera arboricola and Dizigotheeca elegantissima plants was evaluated at pot cultivation conditions. This study was performed in three factorial test based on completely randomized design and 4 repeats with 9 treatments. The aim of this work is to study the effect of foliar application with gibberellic acid (GA_3) at 0, 100 and 200 mg.$L^{-1}$and and benzyladenine (BA) at 0, 100 and 200 mg.L^{-1} levels. The results showed, The highest rate of Plant Height with 76.5, 52.5 and 36.25 cm belonged to 200 mg l^{-1} GA_3+200 mg l^{-1} BA, respectively between three indoor plants Ficus benjamina, Schefflera arboricola and Dizigotheeca elegantissima. The lowest rate of Plant Height with 57.5, 31 and 27 cm belonged to control treatment, respectively in three indoor plants Ficus benjamina, Schefflera arboricola and Dizigotheeca elegantissima. According to results, the highest rate of Plant Height in three indoor plants Ficus benjamina, Schefflera arboricola and Dizigotheeca elegantissima was related to Ficus benjamina plant that had higher Plant Height compared to two other plants. The highest rate of Number of leaves/plant with 133.25, 22.75 and 41.5 belonged to 200 mg l^{-1} GA_3+100 mg l^{-1} BA and 200 mg l^{-1} GA_3+200 mg l^{-1} BA for plants Ficus benjamina, Schefflera arboricola and Dizigotheeca elegantissima. The highest value of Ficus benjamina, Schefflera arboricola and Dizigotheeca elegantissima of sum pigments in level of 100 mg l^{-1} GA_3+200 mg l^{-1} BA and 200 mg l^{-1} GA_3+200 mg l^{-1} BA with average of 19.59, 21.65 and 21.88 mg.ml^{-1}.

Key words: Benzyladenine, *Dizigotheeca elegantissima*, *Ficus benjamina*, Gibberellic Acid, Leaf Area Index, Plant Height, *Schefflera arboricola.*

INTRODUCTION

Cytokinins are Plant growth regulators (Cytokinins and gibberellins) are used in agricultural industry for stimulation and synchronization of flowering and fruit setting, promotion of rooting, reduction of vegetative growth, reduction of lodging of agronomic crops, or defoliation [4]. important plant hormones that regulate various processes of plant growth and development including cell division and differentiation, enhancement of leaf expansion and nutrient mobilization [16, 35]. The response of plants to cytokinins have been also discussed in more papers where Eraki [11] on *Hibiscus sabdarijfa* L. plants mentioned that application of BA significantly increased plant height, number of branches as well as fresh and dry weights of leaves than the control. Hassanein [15] on *Pelargonium graveolens*, El-Sayed et al. [9] on *Polianthustuberosa*, Menesi et al. [31] on *Calendula officinalis* and Mazrou et al. [29] 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.

GAs form a large family of diterpenoid compounds, some of which are bioactive growth regulators, that control such diverse developmental processes as seed germination, stem elongation, leaf expansion, trichome development, and flower and fruit development [7]. In addition, GA_3, application increased petiole length, leaf area and delayed petal abscission and color fading (senescence) by the hydrolysis of starch and sucrose into fructose and glucose [8, 23]. It has been known that growth regulators among the agriculture practices which is most favorable for promoting and improving plant-growth of different plants [9]. The beneficial effect of gibberellic acid on different plants were recorded by Shedeed et al. [34] on *Croton* plant, Brooking and Cohen [5] on *Zantedeschia*, Al-khassawneh et al. [2] on Black Iris, they concluded that gibberellic acid is used to regulating plant growth through increasing cell division and cell elongation. GA_3 sprays enhanced plant dry mass, leaf area, plant growth rate and crop growth rate in Mustard [24].

The main objective of the present work was to study the effects of different plant growth regulators, gibberellic acid and benzyladenine on the Growth and Photosynthetic pigments of *Ficus benjamina*, *Schefflera arboricola* and *Dizigotheeca elegantissima* plants.

MATERIALS AND METHODS

These tests were done during the growing season of 2013 year at the greenhouse of the National Research Centre (Research and Production Station). *Ficus benjamina*, *Schefflera arboricola* and *Dizigotheeca elegantissima* pants were cultivated in plastic pots of 30 cm in diameter filled with media that constituted a mixture of sand, rice husk, leaf compost and peat as 1:1:1:1 [v/v]. The plants were fertilized with doses of 3% liquid fertilizer at intervals 4, 6 and 8 weeks from the time of transplanting. Pots were arranged as a factorial experiment based on a completely randomized design with 9 treatments and 4 replications. The treatment applications constituted benzyladenine [0, 100 and 200mg l^{-1}] and gibberellic acid [0, 100 and 200 mg l^{-1}], in which each treatment contained 10 ml [2013] (0.l'%) Tween-20 surfactant. For each pot, 40 cc of solution was applied at each stage [three stages] at 15-day intervals [6].

Treatments of gibberellic acid and benzyladenine combination were 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, evaluations were made for data on the following: plant height [cm], stem diameter [mm], number of leaves/plant, leaf area [cm^2], chlorophyll index [spad] and photosynthetic pigment [$mg.ml^{-1}$] Lichtenthaler, [26]. Data analysis was done using SPSS 16. Comparisons were made using one-way analysis of variance (ANOVA) and Duncan's Multiple Range Test. Difference was considered significant at $P < 0.05$.

RESULTS AND DISCUSSION

Ficus benjamina Test Results

The most number of produced leaves was in a plant in applications of 200 mg l^{-1} GA_3 +100 mg l^{-1} BA , 200 mg l^{-1} GA_3+200 mg l^{-1} of BA and respectively, with average of 133.25 and 130.5 that they did not show a significant diference, statically [Table 1]. The application control treatment, 100 mg l^{-1} GA_3 and 100 mg l^{-1} BA with least number of leaves, with averages of 97.25, 105 and 108.25 respectively that they showed a meaningful difference with application of 400 mg l^{-1} BA. In view of results of Table [1], maximum Length of lateral shoots and Number of shoot/plant was obtained in applications of 200 mg l^{-1} GA_3+200 mg l^{-1} BA with average of 30.74 cm and 21.75.

The results show, by increasing concentration of regulators of growth, Length of lateral shoots and Number of shoot/plant is increased, too. It seems regulators of growth of length GA_3 have shown better effect than BA in index of Length of lateral shoots and Number of shoot/plant. GA_3 by effecting cellular processes such as cellular division stimulation, lengthening cells caused to increase growing growth [37]. 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 [1]. The most number of Stem Diameter was in a plant in applications of 100 and 200 mg l^{-1} GA_3, control and respectively, with average of 0.45, 0.43and 0.43 that they did not show a significant diference, statically [Table 1]. Leaf surface was under a meaningful effect of regulators of growth, maximum leaf surface was in application of 400 mg l^{-1} GA_3+200 mg l^{-1} BA and 400 mg l^{-1} GA_3+100 mg l^{-1} BA with averages of 63.56 and 51.73 cm^2, respectively. Results of Table [1] showed, by increasing concentration of regulators of growth, leaf surface increased as significant, too. Minimum value of leaf surface in witness application, was obtained as 100 mg l^{-1} BA, control and 100 mg l^{-1} GA_3+100 mg l^{-1} BA, on average as 37.16, 37/58 and 40.96 cm^2, respectively. Levels of 400 mg l^{-1} BA had a significant difference to each other in comparison with control treatment [Table 1].

Table 1- Effect of GA_3 and BA on plant growth parameters of *Ficus benjamina* Plant. 60 Day After Spray

GA_3	BA	leaf Chlorophyll Index (SPAD)	Plant Height (cm)	Length of lateral shoots (cm)	No. of shoot/plant	Stem Diameter (cm)	Leaf area (cm^2)	No. of leaves/plant
0	0	12.58b	57.5d	29.1b	12.25e	0.43a	37.58e	97.25d
	100	18.57ab	64.25bc	27.77bc	12.75de	0.4ab	37.16e	108.25cd
	200	16.49b	65.75bc	28.25bc	14.5cd	0.32c	44.39cd	126.75ab
100	0	12.78b	60.5cd	29.15b	15.25bc	0.45a	43.83cd	105cd
	100	13.48b	63bcd	27.75bc	17b	0.42ab	40.96de	117.5bc
	200	13.75b	64bc	28.3bc	20a	0.41ab	47.73bc	114.75bc
200	0	16.97b	63.75bcd	27.35c	14.25cde	0.43a	45.68cd	114c
	100	13.66b	69.25b	28.7bc	16.25bc	0.36bc	51.73b	133.25a
	200	23.66a	76.5a	30.74a	21.75a	0.39ab	63.56a	130.5a

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

In view of results of Table [1], maximum index of chlorophyll was obtained in application of 200 mg l^{-1} GA_3 +200 mg l^{-1} BA and 100 mg l^{-1} BA with average of 23.66 and 18.57. 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 [28]. Minimum value of index of chlorophyll was obtained in witness application. It seems, regulator of growth of BA has shown a better effect than GA_3 in index of chlorophyll content. The results [Table 2] of this test indicated this problem that regulators of BA and GA_3 were effective on photosynthesis pigments.

Table 2. Effect of foliar application of benzyladenine (BA) and gibberellic acid (GA_3) on the Photosynthetic pigments of *Ficus benjamina* Plant. 60 Day After Spray

GA_3	BA	(mg.ml^{-1} fresh weight)				
		Chl. (a)	Chl. (b)	Total Chl. a+b	Carotenoids	sum pigments
0	0	5d	4.09bc	9.09e	2.73c	11.82c
	100	5.38d	4.39b	9.77de	2.62c	12.39c
	200	7.91c	2.37d	10.29d	1.89d	12.18c
100	0	4.87d	3.49c	9.86de	2.74c	11.1c
	100	9.63ab	5.18a	14.81c	3.85a	18.66ab
	200	10.53a	5.81a	16.39a	3.19b	19.59a
200	0	10.56a	5.32a	15.88ab	2.92bc	18.8ab
	100	9.34b	5.39a	14.73c	2.18d	16.91b
	200	9.58ab	5.52a	15.11c	2.13d	17.24ab

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

The highest value of chlorophyll a, b was total and sum pigments in level of 200 mg l^{-1} GA_3, 100 mg l^{-1} GA_3+200 mg l^{-1} GA_3, 100 mg l^{-1} BA+200 mg l^{-1} GA_3 and 100 mg l^{-1} GA_3+200 mg l^{-1} BA with average of 10.56, 5.81, 16.39

and 19.59 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. [32] in *Freesia* and Yaghoubi et al [39] 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 [20]. Minimum value of chlorophyll of a, b and total was in 100 mg l^{-1} GA_3, 200 mg l^{-1} BA and control application with average of 4.87, 2.37 and 9.09 mg.ml^{-1} [Table 2].

The highest value of carotenoids was obtained in application of 100 mg l^{-1} GA_3+ 100 mg l^{-1} BA and 100 mg l^{-1} GA_3+ 200 mg l^{-1} BA with average of 3.85 and 3.19 mg.ml^{-1}. The done studies show in field of growth regulators such as GA_3 that they can cause to increase rate of dominant pigments like carotenoids [14; 17; 22]. Minimum value of carotenoids was in application 200 mg l^{-1} BA with average of 1.89 mg.ml^{-1} [Table 2]. Application of 100 mg l^{-1} GA_3 +200 mg l^{-1} BA, 200 mg l^{-1} GA_3 and 100 mg l^{-1} GA_3 +100 mg l^{-1} BA with averages of 19.59, 18.8 and 18.66 mg.ml^{-1} followed highest value of sum of pigments and its minimum was obtained in 100 mg l^{-1} GA_3 and control treatment application with average of 11.1 and 11.82 mg.ml^{-1} [Table 2].

***Schefflera arboricola* Test Results**

The top leaves produced by plants were treated with applications of 200 mg l^{-1} GA_3 +100 mg l^{-1} BA, 200 mg l^{-1} GA_3+200 mg l^{-1} of BA with respectively, (22.75 and 22.5) and results showed no statistically significant difference [Table 3]. The control treatment and 100 mg l^{-1} BA had lower evaluations for number of leaves with averages of 15.75and 16.75 respectively and comparison of results for applications of 200 mg l^{-1} GA_3 +100 mg l^{-1} BA showed significant difference. Results shown in Table [1] demonstrate higher evaluations for plant height from applications of 200 mg l^{-1} GA_3 +100 mg l^{-1} BA, 200 mg l^{-1} GA_3+200 mg l^{-1} of BA with averages of 28.55 and 27.95 cm. Also, results showed evaluations for plant height and number of leaf/plant increased under treatments of increasing concentrations of plant growth regulators.

The highest stem diameter was recorded in plants treated with applications of 200 mg l^{-1} GA_3+100 mg l^{-1} BA and 100 mg l^{-1} GA_3+100 mg l^{-1} BA, respectively, with averages of 0.79 and 0.78 mg.ml^{-1} data statistics showed no significant difference, [Table 3]. Leaf area was significantly affected by plant growth regulators; the highest evaluation for leaf area was recorded in the treatment of 100 mg l^{-1} GA_3+100 mg l^{-1} BA with an average of 48.34 cm^2. Results of Table [3] showed, that under increasing concentrations of growth regulators, leaf area increase was evaluated as significant. The lowest value for leaf area was recorded from the application of 100 mg l^{-1} GA_3, 100 mg l^{-1} BA and the control, with evaluations of averages as 38.6, 38/85 and 38.91cm^2, respectively [Table 3].

Table 3. Effect of foliar application of of GA_3 and BA on plant growth parameters of *Schefflera arboricola* L Plant. 60 Day After Spray

GA_3	BA	leaf Chlorophyll Index (spad)	Plant Height (cm)	Stem Diameter (cm)	Leaf area (cm^2)	No. of leaves/plant
0	0	4.62abc	31.5d	0.71ab	38.91b	15.75c
	100	17.3d	42.25c	0.75ab	38.85b	16.75bc
	200	24.35abc	46abc	0.73ab	44.77ab	18.5ab
100	0	27.35ab	39.5c	0.71ab	38.6b	18.75ab
	100	23.6bc	43.25bc	0.78a	48.34a	18.25ab
	200	28.45a	49.75ab	0.74ab	44.76ab	19.75ab
200	0	20.97cd	51.5a	0.64ab	45.97ab	20ab
	100	28.55a	52.5a	0.79a	43.25ab	22.75a
	200	27.95ab	52.25a	0.61b	42.78ab	22.5a

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

In view of the results shown on Table [3], the highest evaluation on the chlorophyll index was recorded in the 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 28.55 and 28.45. Increasing concentrations of growth regulators, resulted in increased evaluations on the chlorophyll index. Application of the growth regulators GA_3 and BA, increased evaluations on the chlorophyll index in leaves of *Zantedeschia aethiopiea* plants [28]. The lowest evaluation on the chlorophyll was recorded in the control. It seems that the BA growth regulator had a better effect than GA_3 in terms of the chlorophyll index.

Table 4. Effect of foliar application of GA_3 and BA on the Photosynthetic pigments of *Schefflera arboricola* L. Plant. 60 day after spray

GA_3	BA	(mg.ml^{-1} fresh weight)				
		Chl. (a)	Chl. (b)	Total Chl. a+b	Carotenoids	sum pigments
0	0	9.4c	4.28b	13.68c	2.59ab	16.27ef
	100	9.72bc	4.22b	14.44bc	2.63ab	16.57def
	200	10.34b	4.88ab	15.22b	2.52ab	17.75bcd
100	0	9.29c	4.29b	14.09bc	2.07b	15.66f
	100	9.76bc	4.87ab	14.63bc	2.48ab	17.11cde
	200	10.61b	5.72a	15.34b	2.53ab	18.87b
200	0	9.84bc	3.93b	13.77c	2.91a	16.68cdef
	100	10.38b	5.05ab	15.43b	2.49ab	17.92bc
	200	13.17a	6.22a	19.39a	2.26ab	21.65a

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

The results [Table 4] of these tests indicate that the plant regulators BA and GA_3 were effective on production of photosynthetic pigments. Higher values of chlorophyll a, b were total and sum pigments in levels of 200 mg l^{-1} GA_3+200 mg l^{-1} BA, with averages of 13.17, 6.22, 19.39 and 21.65 mg.ml^{-1}. Increasing concentrations of GA_3 and BA, determined increased values for chlorophyll a. Results for evaluations of chlorophyll of leaf showed that application of GA_3 had a significant difference compared to the control application, and these results suitable with results of Mynett et al. [32] in *Freesia* and Yaghoubi et al. [39] in *Bellis perennis* about the effect of GA_3 that showed an increased greenness. GA_3 has a structural role in the membrane of chloroplast and stimulates photosynthesis [20]. Minimum values of chlorophyll a, b and total chlorophyll were recorded in the treatment control, 200 mg l^{-1} GA_3, control and 100 mg l^{-1} GA_3 with averages of 9.4, 3.93 and 13.68 and 15.66 mg.ml^{-1}. The highest value of carotenoids was determined from the BA application of 200 mg l^{-1} with an average of 2.91 mg.ml^{-1}. The minimum value of carotenoids was determined from the GA_3 application of 100 mg l^{-1} with an average of 1.89 mg.ml^{-1} [Table 4].

***Dizigotheeca elegantissima* Test Results**

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 significant diference These results are consistent with the results of other investigators [33, 34]. In a research, by Zieslin and Tsujita [39] on *Lilium*, 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 [25].

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 significant 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 [28].

Tab 5- Effect of GA_3 and BA on Plant Growth Parameters of *Dizigotheeca elegantissima* Plant. 60 Day After Spray

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.

In view of results of Table [5], 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 These results are consistent with the results of other investigators [33, 34], too. GA_3 by effecting cellular processes such as cellular division stimulation, lengthening cells caused to increase growing growth [37]. GA_3 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 [1].

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 significant diference, statically [Table 5]. Leaf area was under a significant 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 [5] showed, by increasing concentration of regulators of growth, leaf area increased as significant, too. lowest 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 5].

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 [13, 40]. 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 [38]. In watermelon, sprays should be limited to the ovaries in order to stimulate parthenocarpy [30]. Lower stem sprays have been used to stimulate branching in *Monstera* and *Alocasia* [18, 19]. Crown sprays have been used on *Hosta* [21].

In view of results of Table (5), 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 [33, 34], too. Using regulators of growth of GA_3 and BA, increased rate of chlorophyll in leaves of *Zantedeschia aethiopiea* plant [28]. lowest 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 [1]. 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 [1]. on the one hand, GA_3 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 [27].

Tab 6- Effect of Foliar Application of GA_3 and BA on the Photosynthetic Pigments of *Dizigotheeca elegantissima* Plant. 60 Day After Spray

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.

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 [3]. 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 6] 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 These results are consistent with the results of other investigators [33, 34]. Results related to attribution, showed chlorophyll of leaf that application of GA_3 has a significant difference with control application that these results adapted with results of Mynett et al. [32] in Freesia and Yaghoubi et al [39] 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 [20]. lowest 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 6]. Minimum value of chlorophyll of Chl. (a) treatment 100 mg l^{-1} BA and control treatment with average of 2.5 and 2.56 mg.ml^{-1}, These results are consistent with the results of other investigators. 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 or non significant diference [Table 6].

CONCLUSION

In view of the obtained results, the growth rate of *Ficus benjamina*, *Schefflera arboricola* and *Dizigotheeca elegantissima* plants can be stimulated through increasing synthesis of photosynthetic pigments by applications of GA_3 and BA.

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