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Effect of some natural extracts on growth and flowering of *Gardenia jasminoides* J. Ellis plant

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ABSTRACT

An experiment was undertaken at the nursery of Horticulture Research Institute, Agriculture Research Centre, Giza, Egypt during 2018 and 2019 seasons to examine the effect of moringa, thyme and marjoram natural leaf extracts on growth and flowering of *Gardenia jasminoides* J. Ellis transplants when applied as a foliar spray at concentrations of 0, 1.25 and 2.5% for each, twice every month, individually or in combination during the growing season. The results showed that all treatments caused significant increments in the means of plant height, stem diameter, number of branches and leaves/plant, leaf area, main root length and thickness, as well as number of leaves, stem and fresh and dry weights of roots with few exceptions in the two seasons. However, some treatments gave better results in some characters than others and vice-versa, but the dominance was for moringa + marjoram extracts combined treatment at 1.25 % rate for each. Increasing the rate of application from 1.25% to 2.5% induced an additional improvement in some traits. A similar response also occurred regarding flowering traits and concentration of some constituents determined in the leaves. Accordingly, it can be advised to spray the foliage of *Gardenia jasminoides* J. Ellis plants with moringa and marjoram leaf extracts in combination at 1.25 % rate for each during the growing season, once every 15 days to obtain a clean and safe product with better growth and flowering performance.

Keywords: *Gardenia jasminoides*, natural extracts of moringa, thyme and marjoram, vegetative growth, flowering, foliar spray.

Horticultural

INTRODUCTION

Gardenia jasminoides J. Ellis (syn. *Gardenia angustifolia* Lodd., *G. augusta* Merr. and *G. florida* L), common gardenia (Fam. Rubiaceae). It is an evergreen shrub Which grows up to 1.8 – 2 m in height with dark green, shiny, lanceolate, or obovate leaves and prominent veins. The white flowers have a matte texture in contrast to the glossy leaves. They can be quite large, up to 10 cm in diameter, loosely funnel-shaped and double in form. They are among the most strongly fragrant of all flowers. It is native to tropics and subtropics of old world. Gardenias were formerly very popular greenhouse plants and are now grown indoors for cut flowers and outdoors is mild climates. They require warm close house with a night temperature of about 20° C. They are propagated by cuttings with 3 or 4 buds kept over bottom-heat and with frequent syringing (Bailey, 1976).

Gardenias are considered among the plants that respond well to fertilization. This fact was documented by Gang *et al.,* (2010) on yellow gardenia, El-Sayed *et al.,* (2012) on *G. augusta* and Bayer *et al.,* (2015) and Badran *et al.,* (2017) on *Gardenia jasminoides*, as they all emphasized that using natural-, bio- or chemical-nutrition greatly enhanced growth and flowering of Gardenias giving good and healthy plants.

The use of natural extracts of certain plant leaves as a clean and safe way for improving growth and quality of various economic plants is well known nowadays to get better ornamentals without using chemical fertilizers or synthetic growth regulators that may harm our environment. Among these extracts,

moringa, thyme, and marjoram leaf extracts are rich in natural biostimulants, antioxidants, vitamins, amino acids and in nutrient naturally balanced levels necessary for the best growth. In this regard, Parabhu *et al.,* (2012) found that a combination of 2% panchakavya + 0.2% humic acid + 2% moringa leaf extract gave the greatest plant height, No. leaves/plant, leaf area, and herb fresh and dry weights of basil (*Ocimum basilicum*, L.). Likewise, Youssef and El-Sayed (2013) reported that spraying *Euonymus japonicus* cv. Aureus plants with 1 g/l of moringa leaves extract markedly improved vegetative and root growth plus increasing chlorophyll a, b, carotenoids, total indoles and phenols concentrations in the leaves. Khenizy *et al.,* (2014) postulated that a holding solution including 25% moringa extract+ 2% sucrose+ 150 ppm salicylic acid prolonged shelf life of *Gypsophila paniculata* cut flowers, which was coupled with increasing fresh weight %, total carbohydrates% and water uptake.

Similar observations were also detected by Younes *et al.,* (2012) on *Calendula officinalis*, Lobna *et al.,* (2015) on jojoba, Shahin *et al.,* (2015) on Seashore paspalum turf, Azra *et al.,* (2012) on wheat, Muhammed (2014) on cereals, oilseed, fibrous and sugar crops and Bashir *et al.,* (2014) on tomato. However, current work aims to examine the response of common gardenia plants to foliar spray with moringa, thyme and marjoram extracts, either alone or in combination under our local environment condition.

MATERIALS AND METHODS

The current study was performed under a shade at the Experimental Farm of Hort. Res. Inst., Agric. Res. Center, Giza, Egypt, throughout 2018 and 2019 seasons in order to reveal the positive effect of some natural plant extracts on growth, flowering, and chemical composition of the common gardenia plant.

Thus, the five-months-old uniform transplants of *Gardenia jasminoides* J. Ellis at an initial height of 23± 0.3 cm carry about 12 -14 leaves were transplanted on May, 1st for each season in 20-cm-diameter plastic pots (one transplant/pot) filled with about 850 g of peat moss. The physical and chemical analysis of peatmoss used in both seasons were determined and illustrated in Table (a).

Table (a): The physical and chemical analysis of peat moss used in 2018 and 2019 seasons.

Variables	Value	Variables	Value	Variables	Value
Organic matter%	90-95	Salinity g/l	0.3	Fe ppm	421
Ash%	8-10	C/N ratio	10.75	Mn ppm	27
Density (vol.dry) mg/l	80-90	N%	1.09	Zn ppm	45
pH value	3.4	P%	0.23	Cu ppm	8.8
Water relation capacity	60-75	K%	1.77	Mg ppm	3.5

Preparation of the natural extracts used in the study:

A known weight of the fresh leaf samples (200 gm) was handly collected from mature plants of moringa (*Moringa oleifera*, Lam), thyme (*Thymus vulgaris*, L.) and (*Marjorana hortensis*, Moench.), cleaned well in distilled water and dried by strong shaking with hand. The leaves of every species were immersed in 2 L of warm water (35°C) inside a bowl tightly closed for 12 hours. The solution was then filtrated through two cheesecloth, and the resulted extract was used as a stock solution of 100% for each. plant species, where different levels of natural extracts employed in this trial (0, 1.25 and 2.5%) were prepared.

After one month from transplanting (on June, 1st), the foliage of plants was sprayed with the following solutions:

1) Tap water for control (untreated plants).

2) An aqueous solution of NPK (2: 1: 1)at 2 g/l + aqueous one of chelated Fe at 0.5 g/l. Ammonium sulfate (20.5%N), Ca-superphosphate (15.5% P_2O_5), and K-sulphate (48.5% K_2O) fertilizers were used to obtain the required ratio of the NPK mixture. Fe solution was sprayed after 2 days from spraying of the extract ones.
3) The aqueous solutions of moringa, thyme, and marjoram leaf extracts at the concentrations of 1.25 and 2.5% for each as an individual application.
4) The combinations of moringa+ thyme solutions, moringa+ marjoram solutions, and thyme+marjoram solutions at 1.25% concentration for each were also utilized.

The previous treatments were applied at 15 days intervals till the end of the experiment (on November, 30th). So, the plants received such treatments 12 times only till the solution was a run-off. All plants under the different treatments were subjected to the routine agricultural practices as usually grower did. The layout of the experiment was in a complete randomized design for each season (Mead *et al.,* 1993), with 3 replicates, as each replicate contained 5 plants.

At the terminate of both seasons, data were recorded as follows: plant height (cm.), number of branches and leaves per plant, leaf area (cm^2), stem diameter at the base (mm.), the longest root length (cm.), the main root thickness (mm), as well as fresh and dry weights of leaves, stem, and roots (g.).

At the beginning of this study (during May), all flowering buds that appeared were removed, and the plants left till flowering on the next spring, where the following data were registered: number of days from planting to flowering (days), flower diameter (cm.), number of petals/ flowers, pedicel length (cm.) and diameter (mm) and flower fresh and dry weights (g.).

In fresh leaf samples, photosynthetic pigments (chlorophyll a, b and carotenoids, mg/g f.w.) were determined according to the method of Sumanta *et al.,* (2014), while in dry ones, the percentages of total carbohydrates, nitrogen, phosphorus, and potassium were measured using the methods described by Herbert *et al.,* (1971), Blake (1956), John (1970) and Jackson (1973), respectively.

Data were then tabulated and statistically analyzed using the computer program of SAS Institute (2009), followed by Duncan's New Multiple Range Test (Steel and Torrie, 1980).

RESULTS AND DISCUSSION

Effect of the foliar spraying with moringa, thyme and marjoram leaf extracts on:

a.Vegetative and root growth parameters:

It is obvious from data presented in Tables (1) and (2) that all-natural extract treatments significantly increased the means of various vegetative and root growth characters, expressed as plant height (cm.), No. branches and leaves/ plant, stem diameter (mm), leaf area (cm2), main root length (cm) and thickness (mm), as well as fresh and dry weights of leaves, stem, and roots (g), with few exceptions in the two seasons. Some treatments were dominant in improving some traits than others, while these others were excellent in improving the remaining traits. The upper hand, however, was for the combination of moringa+ marjoram leaf extract at 1.25% concentration for each, which gave the highest records in most growth attributes over the other sole and combined treatments in both seasons. Increasing the rate of application from 1.25 to 2.5% caused an additional improvement in most cases of the two seasons, but in a few other cases, the opposite was the right.

This may indicate the role of natural extracts in enhancing the growth of plants due to containing some natural biostimulants and activators, minerals, vitamins, amino acids, and antioxidants (Price, 2007). In this concern, Azra *et al.,* (2012) concluded that *Moringa oliefera*, Lam. leaves are rich in zeatin, so it can be used as a natural source of cytokinins that play a vital role in cell division and delaying leaf senescence. Amini *et al.,* (2013) mentioned that leaf extract of thyme contains volatile essences with antibacterial activity against fungi that are considered aflatoxins producers, virus, helminths, Gram-positive, and Gram-negative bacteria. So, successfully used for healthy plant production and elongating the life of cut flowers. Moreover, a-tocopherol, as the main component of thyme extract plays a great role in increasing plant growth, delaying senescence, preventing lipid peroxidation, and interacting with the signal cascade that conveys abiotic and biotic signals (Baffel and Ibrahim, 2008).

The previous gains are in harmony with those discovered by Gang *et al.,* (2010) on yellow gardenia, and Badran *et al.,* (2017) on *Gardenia jasminoides*. On other ornamentals, Younes *et al.,* (2012) stated that foliar spray with thyme extract at 100 ppm concentration maximized growth, fresh and dry weights of *Calendula officinalis* aerial parts. Youssef

and El-Sayed (2013) noticed that spraying the foliage of *Euonymus japonicus* cv. Aureus plant with 1 g/l moringa extract solution greatly raised plant height, stem diameter, No. shoots and leaves per plant, leaf area, root length and aerial parts and roots fresh and dry weights. Similarly, Lobna *et al.,* (2015) elicited that plant height, No. branches/ plant, root length, and fresh and dry weights of branches and roots of jojoba plants were improved in response to applying moringa leaf extract at 10% level.

Table (1): Effect of natural extracts on some vegetative and root growth traits of *Gardenia jasminoides* J. Ellis plant during 2018 and 2019 seasons.

Treatments	Plant height (cm.)	No. branches per plant	No. leaves per plant	Leaf area (cm^2)	Stem diameter (mm.)	Root length (cm)	Main root thickness (mm)
	First season: 2018						
Control	34.33e	8.00c	98.50d	13.46c	2.27d	29.63c	1.87d
NPK (2g/l)+ Fe(0.5g/l)	44.17c	8.33c	112.67c	15.83bc	3.88a	34.57b	2.90b
Moringa extract 1.25% (A)	51.50b	10.17ab	123.33b	14.50c	3.78a	30.86c	2.38c
Moringa extract 2.5%	42.67c	10.65ab	127.50b	20.38b	3.37ab	31.22c	2.99ab
Thyme extract 1.25% (B)	38.08d	11.83a	129.67b	16.20bc	2.55c	32.67bc	1.76d
Thyme extract 2.5%	57.50a	11.83a	149.83a	18.00bc	3.27ab	30.25c	2.65b
Marjoram extract 1.25% (C)	55.67a	9.90b	129.66b	18.50bc	2.52c	35.50ab	2.35c
Marjoram extract 2.5 %	51.50b	9.83b	151.60a	19.25b	2.93b	34.63b	2.33c
A+B	48.25bc	10.00b	118.00bc	26.27a	3.07ab	34.68b	1.90d
A+C	57.83a	9.50b	136.71ab	22.41ab	3.58a	39.50a	3.40a
B+C	40.67cd	9.17bc	105.20cd	20.17b	2.45c	36.33ab	1.76d
	Second seasons: 2019						
Control	31.83d	12.50d	140.15bc	14.00c	2.27e	22.83d	1.92d
NPK (2g/l)+ Fe(0.5g/l)	53.56b	19.83a	171.33a	17.25bc	4.83a	38.40b	3.21b
Moringa extract 1.25% (A)	49.75bc	13.50cd	135.83bc	15.23c	3.89bc	35.85bc	3.00bc
Moringa extract 2.5%	68.50a	13.75cd	166.20a	20.67b	4.32b	48.33a	3.99a
Thyme extract 1.25% (B)	44.17c	16.00bc	96.50d	21.00b	3.07d	31.67c	2.65c
Thyme extract 2.5%	54.00b	17.67b	147.00b	24.63a	4.73a	38.72b	3.25b
Marjoram extract 1.25% (C)	50.67bc	16.50bc	152.50b	15.98bc	3.97bc	36.25b	3.04b
Marjoram extract 2.5 %	51.20bc	15.33c	148.33b	16.00bc	4.50ab	36.61b	3.05b
A+B	45.92c	14.50cd	149.90b	15.73c	3.65c	32.83c	2.78c
A+C	68.50a	15.33c	166.17a	20.67b	3.75c	48.61a	4.08a
B+C	51.50bc	13.70cd	123.20c	17.38bc	4.78a	37.00b	3.10b

Means within a column having the same letters are not significantly different according to Duncan's New Multiple Ranget-Test at 5% level.

Table (2): Effect of natural extracts on leaves, stem, and roots fresh and dry weights of *Gardenia jasminoides* J. Ellis plant during 2018 and 2019 seasons.

Treatments	Fresh weight (g)			Dry weight (g)		
	Leaves	Stem	Roots	Leaves	Stem	Roots
	First season: 2018					
Control	13.45d	9.40d	23.09f	3.69d	3.45d	9.91d
NPK (2g/l)+ Fe(0.5g/l)	19.82b	16.66c	55.48e	6.73b	7.59bc	18.96c
Moringa extract 1.25% (A)	19.17bc	23.55a	84.30a	6.78b	10.06a	31.93a
Moringa extract 2.5%	20.81b	19.00b	77.09b	6.76b	8.43b	25.33b
Thyme extract 1.25% (B)	20.98b	16.93c	64.43d	7.09ab	8.25b	23.53bc
thyme extract 2.5%	23.31a	18.75bc	53.46e	7.15ab	7.21c	17.86c
Marjoram extract 1.25% (C)	21.69b	18.76bc	52.83e	7.04ab	8.33b	18.33c
Marjoram extract 2.5 %	20.93b	17.78bc	68.71cd	7.46a	6.89c	23.97bc
A+B	24.63a	19.53b	60.18de	7.79a	8.85b	18.63c
A+C	25.00a	19.73b	84.43a	7.85a	8.65b	31.50a
B+C	18.31c	16.54c	71.03c	5.73c	7.14c	23.76bc
	Second seasons: 2019					
Control	15.31d	13.80c	36.57d	4.58c	6.03d	13.86d
NPK (2g/l)+ Fe(0.5g/l)	24.81a	23.21b	60.33b	7.62a	10.15b	22.73b
Moringa extract 1.25% (A)	19.71c	21.58bc	55.81bc	6.05b	9.43bc	21.10bc
Moringa extract 2.5%	24.08a	29.76a	71.67a	7.38a	13.00a	26.91a
Thyme extract 1.25% (B)	17.07d	19.20bc	50.43c	6.23b	8.40c	19.13c
Thyme extract 2.5%	21.35b	23.46b	56.96bc	6.55ab	10.27b	21.60bc
Marjoram extract 1.25% (C)	22.14ab	21.72c	52.78c	6.81ab	9.48bc	20.00c
Marjoram extract 2.5 %	21.52b	22.25bc	52.33c	6.63ab	9.75bc	19.71c
A+B	21.76b	19.93bc	51.50c	6.70ab	8.71c	19.50c
A+C	24.08a	29.50a	71.38a	7.41a	12.79a	26.33a
B+C	17.60d	22.17bc	56.00bc	5.31bc	9.70bc	21.20bc

Means within a column having the same letters are not significantly different according to Duncan's New Multiple Range t-Test at 5% level.

Table (3): Effect of natural extracts on flowering traits of *Gardenia jasminoides* J. Ellis plant during 2018 and 2019 seasons.

Treatments	No. of days from planting to flowering (day)	Flower diameter (cm)	No. petals per flower	Pedicel length (cm)	Pedicel diameter (mm)	Flower F.W. (g)	Flower D.W. (g)
	First season: 2018						
Control	379.67a	4.92d	17.33d	2.07c	1.98b	1.87c	0.23b
NPK (2g/l)+ Fe(0.5g/l)	368.00c	6.72bc	21.17c	2.72b	2.45ab	2.51bc	0.27b
Moringa extract 1.25% (A)	376.50b	7.00b	22.83ab	3.25a	2.48ab	2.24bc	0.42ab
Moringa extract 2.5%	376.17b	5.82cd	23.00ab	2.46bc	1.98b	1.88c	0.27b
Thyme extract 1.25% (B)	363.82d	7.00b	22.89ab	2.45bc	2.29ab	3.97a	0.55a
thyme extract 2.5%	360.33de	7.13b	20.67c	2.77b	2.30ab	2.51bc	0.43ab
Marjoram extract 1.25% (C)	361.89d	8.57a	24.11a	3.22a	2.95a	3.91a	0.51a
Marjoram extract 2.5 %	359.78e	8.23a	24.28a	3.06ab	2.63a	3.86a	0.51a
A+B	365.39cd	7.74ab	21.63bc	3.29a	1.99b	2.79b	0.38ab
A+C	360.67de	8.86a	24.33a	3.30a	2.79a	3.35ab	0.48a
B+C	366.11cd	6.38c	22.18b	3.10ab	2.80a	2.93b	0.31b
	Second seasons: 2019						
Control	376.67a	5.18c	19.67c	2.27c	2.04c	1.94c	0.26b
NPK (2g/l)+ Fe(0.5g/l)	354.00b	7.89ab	24.56ab	3.16ab	2.86ab	3.89a	0.43a
Moringa extract 1.25% (A)	346.67d	7.50ab	24.89ab	3.17ab	2.34bc	3.58ab	0.44a
Moringa extract 2.5%	353.56b	7.15b	24.50ab	3.02b	2.59b	3.15b	0.38ab
Thyme extract 1.25% (B)	354.48b	7.15b	24.17ab	2.88bc	2.48b	3.37ab	0.41a
Thyme extract 2.5%	349.79c	7.73ab	25.44a	3.02b	2.69ab	3.76a	0.42a
Marjoram extract 1.25% (C)	349.50c	8.50a	26.78a	3.44a	3.07a	3.91a	0.49a
Marjoram extract 2.5 %	346.50d	8.39a	26.45a	3.35a	3.08a	3.93a	0.50a
A+B	352.39b	7.78ab	24.39ab	3.19ab	2.58b	3.25ab	0.39ab
A+C	346.37d	8.50a	26.55a	3.48a	3.08a	3.99a	0.48a
B+C	352.00b	7.24b	24.10b	3.29a	3.05a	3.81a	0.45a

Means within a column having the same letters are not significantly different according to Duncan's New Multiple Range t-Test at 5% level.

b. flowering characteristics:

Data presented in Table (3) show that all treatments caused a precocity in flowering date, but the least No. days from planting to flowering in the first season was achieved by spraying 2.5% marjoram extract (359.78 days), followed by 2.5% thyme extract (360.33 days) and the combination of moringa+ marjoram (1.25% for each) extract (360.67 days) against 379.67 days for control, but in the second one that was attained by the combination of moringa+ marjoram extract (1.25% for each), that shortened this period up to (346.37 days), followed by 2.5% marjoram extract and 1.25% moringa extract treatments that diminished such period to 346.50 and 346.67 days, respectively versus 376.67 days for control. Hence, the combination of moringa and marjoram extracts is the only treatment that induced the greatest precocity in the first and second seasons. This combination, also acquired the utmost high averages in all the

other flowering traits, i.e. flower diameter (cm), No. petals/ flower, pedicel length (cm.) and diameter (mm) and flower fresh and dry weights (g), with few exceptions as compared to other treatments in both seasons. The second rank, however, was occupied by 2.5% marjoram extract treatment, and then marjoram extract one at 1.25% concentration, as these two treatments gave means closely near to those of the superior combination mentioned before in most instances of the two seasons.

The prevalence of moringa+ marjoram extracts treatment may be attributed to that moringa leaves is rich in zeatin, which acts as cytokinins that promote flower bud initiation (Azra *et al.,*., 2012) and supplying the moringa and marjoram extracts buds with sufficient amounts of minerals, vitamins and amino acids necessary for accelerating flower bud development and opening. Besides, marjoram extract usually contains considerable concentrations of carvacrol, linalool, caffeic and rosmarinic acids, flavonoids, triterpenoids, sabinen and sabinen hydrate (InterNet Site T, 2011), which may improve flower characteristics. In this respect. Khenizy *et al.,* (2014) decided that holding a solution containing natural extract of either moringa or thyme at 25% concentration increased vase life of *Gypsophyila paniculata* "Perfecta" cut flowers, with increasing percentages of fresh weigh, total carbohydrates, and water uptake relative to distilled water. Badran *et al.,* (2017) found that NPK fertilizer amended with biostimulant (EM) advanced flowering of *Gardenia jasminoides* plants and increased No. flowers/ plant and flower f.w. compared to unfertilized ones.

The aforestated findings showed a similar trend to those revealed by Younes *et al.,*(2012) on *Calendula officinalis*, Noor (2014) on wheat, and Bashir *et al.,* (2014) who noticed that moringa leaf extract at 20% concentration improved No. flowers/ plant of tomato.

c.Chemical composition of the leaves:

From data listed in Table (4), it can be concluded that chlorophyll a, b and carotenoids concentrations (mg/g f.w.) in the leaves of fertilized plants was markedly increased over control, in various proportions by all the applied treatments without notable differences among themselves. However, the highest records were found due to 2.5% marjoram extract treatment that scored 0.942, 0.643, and 0.631 mg/g f.w. for the three pigments mentioned above, consequently. This may be ascribed to that such extracts contain some substances like growth regulators, which may promote stroma lamella formation and grana and chlorophyll appearance during normal leaf growth. In this connection, Shahin *et al.,* (2015) observed that adding moringa leaf powder at 1 g/l to humic acid at 20 ml/l significantly increased chlorophyll a, b, and carotenoids in the leaves of seashore paspalum. Likewise, Lobna *et al.,* (2015) claimed that moringa leaf extract at 3.5, 7, and 10% caused a progressive increment in pigments content in jojoba plant leaves.

Similarly, the percentages of total carbohydrates, nitrogen, phosphorus, and potassium were also raised in response to the different individual or combined treatments utilized in such trial. Means of most treatments were clearly at par with each other for the various constituents measured except for the treatments of 2.5% moringa extract that recorded the highest percentage of total carbohydrates, NPK+ Fe, 2.5% moringa extract, 1.25% thyme extract, and A+B combination treatments that gave the highest N%, as well as 2.5% of either thyme or marjoram extracts that resulted in the highest percent of P and K exhibiting their prevalence over control and all other treatments. This may be reasonable because natural extracts are usually rich in various minerals necessary for plant growth. In this regard, Makkar *et al.,* (2007) demonstrated that moringa leaf extract is rich in ascorbate, Ca, K, Mg, S, and Fe. Shahin *et al.,* (2015) noticed that involving moringa leaf powder at 1 g/l with humic acid at 20 ml/l increased total soluble sugars, N, P, K, and indoles in the herb of seashore paspalum.

These results could be supported by those of Gang *et al.,* (2010) on yellow gardenia, Badran *et al.,* (2017) on *Gardenia jaminodes*, Muhammed (2014) on cereals, and Sakr *et al.,* (2018) who affirmed that NPK at the full recommended dose connected with moringa leaf extract at 6 g/l greatly increased chlorophyll a, b and carotenoids concentrations in the leaves, as well as total carbohydrates, N, P and K percentages in herb of *Pelargonium graveolens*.

Table (4): Effect of natural extracts on the chemical composition of *Gardenia jasminoides* J. Ellis leaves during 2018 and 2019 seasons.

	Pigment (mg/gf.w.)			Total carbohydrates (%)	Macro-elements (%)		
	Chlo.a	Chlo.b	carotenoids		N	P	K
Control	0.571	0.255	0.269	18.924	1.227	0.288	7.901
NPK (2g/l)+Fe (0.5g/l)	0.721	0.525	0.414	26.115	2.509	0.470	9.508
Moringa extract 1.25% (A)	0.801	0.488	0.399	28.062	1.999	0.378	8.029
Moringa extract 2.5%	0.738	0.591	0.472	49.038	2.148	0.321	9.438
Moringa extract 1.25% (B)	0.706	0.494	0.396	21.971	2.898	0.401	9.537
Thyme extract 2.5%	0.778	0.636	0.513	28.317	1.887	0.554	9.948
Marjoram extract 1.25% (C)	0.725	0.435	0.389	23.735	1.723	0.369	9.356
Marjoram extract 2.5 %	0.942	0.643	0.631	24.126	1.905	0.618	9.429
A+B	0.698	0.489	0.401	24.658	2.203	0.397	8.987
A+C	0.697	0.521	0.412	31.785	1.888	0.495	9.291
B+C	0.757	0.633	0.488	31.178	1.985	0.470	8.683

According to the results of the present study, it is preferable to spray the foliage of *Gardenia jasminoides* plants with moringa extract and marjoram one in combination at 1.25% concentration for each during the active growing period, once every 15 days to get the best growth, flowering, and chemical constituents.

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الملخص العربي

تأثير بعض المستخلصات الطبيعية على نمو و إزهار نبات الجاردينيا

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أجريت تجربة أصص تحت الظل بالمزرعة التجريبية لمعهد بحوث البساتين، مركز البحوث الزراعية، الجيزة، مصر خلال موسمي 2018، 2019 بقصد معرفة التأثير النافع و المفيد للرش بمحاليل بعض المستخلصات الطبيعية لأوراق المورينجا، الزعتر، البردقوش على النمو، الإزهار و التركيب الكيماوي لشتلات الجاردينيا (*Gardenia jasminoides* J. Ellis) النامية في أصص بلاستيك قطرها 20 سم مملوءة بحوالي 850 جم بيتموس، عند إضافتها رشاً على الأوراق بتركيزات: صفر، 1,25 ، 2,5 % لكل مستخلص، مرتين في الشهر، فردياً أو في توليفات خلال فترة النمو النشط للنبات. أوضحت النتائج المتحصل عليها أن جميع معاملات المستخلصات الطبيعية (المورينجا، الزعتر و البردقوش) الفردية و المشتركة أحدثت زيادة معنوية في متوسطات طول النبات، قطر الساق، عدد الأفرع و الأوراق/نبات، مساحة الورقة، طول و سمك الجذر الرئيسي، و كذلك الأوزان الطازجة و الجافة للأوراق، الساق و الجذور مع قليل من الأستثناءات في كلا الموسمين. إلا أن بعض المعاملات أعطت نتائج أفضل في بعض الصفات عن المعاملات الآخرى، لكن السيادة كانت لتوليفة مستخلصات المورينجا و البردقوش بمعدل 1,25% لكل منهما و التي أحرزت أعلى المتوسطات على الإطلاق في معظم قياسات النمو الخضري و الجذري. و لقد أحدثت زيادة معدل الإضافة من 1,25% إلى 2,5% تحسناً إضافياً في بعض الصفات، بينما كان العكس صحيحاً في الصفات الآخرى. أيضاً، أحدثت جميع المعاملات تبكيراً في موعد الإزهار، و الذي بلغ أقصاه نتيجة الرش بالمعاملة المشتركةبين مستخلص المورينجا و البردقوش. هذه التوليفة سجلت أيضاً أعلى القيم لصفات قطر الزهرة، عدد البتلات/زهرة، طول و قطر عنق الزهرة و الوزن الطازجو الجاف للزهرة، مع بعض الأستثناءات القليلة بكلا الموسمين. بالمثل، فإن تركيزات كلوروفيللي أ، ب، الكاروتينويدات، و النسبة المئوية للكربوهيدرات الكلية ، النتروجين، الفوسفور و البوتاسيوم في أوراق النباتات المعاملة قد تحسنت بشكل ملحوظ إستجابة لمختلف المعاملات الفردية و المشتركة المطبقة بهذه الدراسة، إلا أن متوسطات معظم المعاملات كانت متقاربة فيما بينها، دون تفوق معاملة على آخرى بإستثناء القليل منها. طبقا لهذه النتائج، فإنه ينصح برش أوراق نباتات الجاردينيا (*Gardenia jasminoides* J. Ellis) بمحلول المستخلص الورقي للمورينجا و البردقوش، بتركيز 1,25% لكل منهما أثناء موسم النمو، مرة كل 15 يوم للحصول على منتج نظيف و آمن مع أفضل مظهر للنمو و الإزهار.

الكلمات المفتاحية:*Gardenia jasminoides* ، مستخلصات طبيعية من المورينجا و الزعتر و العتر، المجموع الخضري ، التزهير، الرش الورقي.