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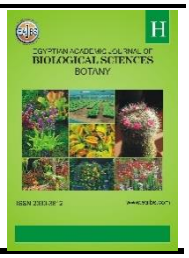

Effect of Microwave on Seed Germination and Growth Rate in Some Genera Fabaceae Trees in Antoniades Garden (A) *Sophora secundiflora* and *Bauhinia purpurea*

Nader A. El-Shanhorey
Botanical Gardens Research Department, Horticulture Research Institute, Agricultural Research Center, Alexandria, Egypt.
***E-Mail:** dr_shanhorey@yahoo.com

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ABSTRACT

This study was carried-out at Antoniadis Research Branch, Horticultural Research Institute, Agriculture Research Center (ARC), Alexandria, Egypt during the two successive seasons of 2019 and 2020. In this study, we aimed to test the effect of different exposure time from microwave on increasing seed germination, vegetative growth and chemical constituents in *Sophora secundiflora* and *Bauhinia purpurea* seedlings. The seeds of each treatment were subjected to a different time of exposure to the microwave radiation for 0s (control), 5s, 10s, 15s, 20s, 25s and 30s in the first and second seasons, respectively. Seedlings were planted individually in 20 cm diameter plastic pots filled with mixture of clay and sand at the ratio of (1:1) by volume. The obtained results revealed that the exposure time from microwave showed significant increase in vegetative growth and chemical constituents. From the obtained results, it could be concluded that the highest mean in *Sophora secundiflora* and *Bauhinia purpurea* plant was scored as a result of exposure time at 5 second in the first and second seasons, respectively.

INTRODUCTION

Fabaceae is the most diverse plant family in the world (Beech *et al.*, 2017) with a wide distribution of sorts, registering 770 genera and 19,500 sorts (LPWG., 2017), considered the third largest family of angiosperms in species numbers after Asteraceae and Orchidaceae in the global context (LPWG., 2017). The circumscribed family is in six subfamilies: Caesalpinioideae (146 genera and 4400 species); Cercidoideae (12 genera and 335 species); Detarioideae (84 genera and 760 species); Dialioideae (17 genera and 85 species); Duparquetioideae (1 genus and 1 specie) and Papilionoideae (503 genera and 14000 species) with the inclusion of the groups the previous subfamily Mimosoideae now in the subfamily Caesalpinioideae (LPWG., 2017).

The genus Sophora is by far the largest and most diverse genus of tribe Sophoreae of the sub-family Papilionoideae (Polhill 1981). Genus Sophora has an old history of traditional uses. The Arabian name is Sophera for a pea-flowered tree from which it derives its generic name (Gledhill 2008). This is a heterogeneous genus including 80 species of trees and herbs; that spread throughout much of the world, particularly the subtropics of the New World,

warmer temperate regions of North America and Asia, and many Pacific islands (Andrews 1914).

Bauhinia purpurea is a fast-growing tree and native to southern and southeastern Asia. The Flora of China Editorial Committee (2015) suggests that it is probably only native from Nepal through continental monsoon Asia, while Orwa *et al.* (2009) list it as also native to Indonesia, Japan and Taiwan. It has been planted as an ornamental in many tropical and subtropical regions of the world, now it can be found naturalized in North America, Central America, the West Indies, Africa, and on islands in the Indian and Pacific Ocean (Orwa *et al.*, 2009; ILDIS, 2015; PIER, 2015 and USDA-ARS, 2015).

A few studies have demonstrated that microwave radiation has a positive effect in accelerating seed germination (Rao *et al.*, 1989, Hu *et al*., 1996 and Chen *et al.*, 2005). However, regardless of the data concerning the effect of microwaves on plants that have been obtained, little is known as to whether pretreatment of seeds with microwave causes a change in the inner energy of seeds, stimulating enzyme activities, leading to an improvement of the metabolism, and enhancing the intensity of biophoton emission, which is regarded as an index of cell metabolism (Abeles, 1986 and Higeg and Inaba, 1991). Therefore, in the present study, we attempted to assess the effect of a microwave (12.5 cm, 1.26 mW/ mm^2) on the germinating of *Sophora secundiflora* and *Bauhinia purpurea* seeds. Therefore, the mechanism of action responsible for the effect of laser irradiation may be through its light and electromagnet effects (Xiang, 1995). To confirm this, we used microwaves (1.26 mW/mm^2) to pretreat seeds and compared their effect in *Isatis indigotica.*

These plant proteins receive special attention, found that the protein analysis of seedlings in *Sophora secundiflora* and *Bauhinia purpurea* (El-Akkad, 2004), ISSR analysis in *Sophora secundiflora* and *Bauhinia purpurea* (Rashmi *et al.*, 2004).

The present study aims at comparing the effect of short-wave treatments on seeds germination and vegetative growth in two *Sophora secundiflora* and *Bauhinia purpurea* grow in Egypt.

MATERIALS AND METHODS

The present study was carried-out at Antoniadis Research Branch, Horticultural Research Institute, Agriculture Research Center (ARC), Alexandria, Egypt during the two successive seasons of 2019 and 2020.

Microwaves used in this study were generated from a microwave oven Model-Mo6T, single phase, 220 V., 50 Hs., 1.3 Kw output at a frequency of 2450 MHz. Dry seeds were exposed to short waves from the microwave on the first of February, 2019 and 2020, respectively. 315 seeds were divided into 7 groups per plant (7 groups* 45 seeds per treatment) and each treatment was put in a bag. The seeds have been exposed to microwave radiation for 0s (control), 5s, 10s, 15s, 20s, 25s and 30s in the *Sophora secundiflora* and *Bauhinia purpurea* in the first and second seasons, respectively. Groups of 45 seeds were subjected to each microwave treatment, for chosen exposure time and analogous groups were used as control. The seeds were cultured in trays (50 eye/ tray), 45 seeds in each tray, on the mixture of peat moss and sand at a ratio of 1:1 (v/v). The trays were watered day after day. On 1st March 2019 and 2020 in the first and second seasons, respectively, the trays were gradually transferred from shade to sunny place within two weeks.

On 15th of March, 2019 and 2020 (in first and second seasons, respectively) homogeneous seedlings of *Sophora secundiflora* and *Bauhinia purpurea* (15-20 cm height) were planted individually in plastic pots (20 cm diameter) filled with 4 kg of a mixture of clay and sand at a ratio of 1:1 (v/v). The chemical constituents of the soil were measured as

described by Jackson (1973) as shown in Table (1). On 30th of October in first and second seasons, the plants were harvested.

Table 1: Chemical analyses of the used mixture of clay and sand (1:1) for the two successive seasons 2019 and 2020.

Season	pH	EC (dSm^{-1})	Soluble cations (meq/l)				Soluble anions (meq/l)		
			Ca^{++}	Mg^{++}	Na^{+}	K^{+}	HCO_3^-	Cl^-	SO_2^{--}
2019	7.98	1.53	3.3	3.4	6.7	1.2	3.6	6.9	2.4
2020	7.94	1.48	3.1	3.0	6.5	1.1	3.3	6.7	2.2

In the two seasons, all plants received NPK chemical fertilization using soluble fertilizer (Kristalon 19-19-19) at the rate of 1 g/ pot. Fertilization was repeated every 30 days throughout the growing season (from the 1st of March till the 30th of October). In addition, weeds were removed manually upon emergence.

Data Recorded :

Seed Germination (%):

On February 15, 2019 and 2020 in the first and second seasons, respectively, the seeds of every treatment were sown in a tray (45 seeds for each treatment/ tray). The seeds were sown in trays containing a soil mixture of 1 sand: 1 peat moss by volume. Seeds germination percentage of every treatment was calculated after 30 days from sowing according to the following formula:

$$\text{Seeds germination \%} = \frac{\text{Number of germinated seeds}}{\text{Number of total seeds}} \text{ X } 100$$

Vegetative Growth Parameters:

Sprouting date (day), plant height (cm), number of leaves per plant, leaves dry weight per plant (g), stem diameter (cm), stem dry weight (g), root length (cm) and root dry weight (g).

Chemical Analysis Determination:

-Pigments content: Chlorophyll a, b and carotenoids were determined in leaf samples (mg/g fresh matter) according to Nornai (1982).

-Total Soluble Phenols: phenols were determined by using Folin-Denis colorimetric method **(A.O.A.C., 1970)** and a standard curve of pyrogallol was used.

-Total Soluble Indoles: indoles were determined colorimetric according to the method described by Larson *et al.* (1962) and modified by Selim *et al.* (1978) using a standard curve of indole acetic acid (IAA).

-Peroxidase Activity: Peroxidase activity was prepared according to the methods described by **Howell *et al.* (2000).**

-Inter-Simple Sequence Repeat (ISSR) Technique: were as described by Cho *et al.*, (1996). Inter-Simple Sequence Repeat (ISSR) markers were applied as molecular fingerprint technique via four specific primers to evaluate exposure time from microwave on seven of *Sophora secundiflora* treatments and seven of *Bauhinia purpurea* treatments seedlings. Total DNA was extracted from young leaves in liquid nitrogen using a CTAB protocol (Doyle, 1991).

Electrophoresis has become a useful tool for the characterization of plant proteins. Protein profiles were studied by sodium-dodecyl sulphate polyacrylamide gel electrophoresis (Laemmli, 1970). A vertical slab gel apparatus was described by Studier (1973). Proteins are treated with sodium dodecyl sulfate (SDS) before electrophoresis so that the charge density of all proteins is made roughly equal. When these samples are

electrophoresed, proteins are separated according to mass. The protein bands were visualized by transilluminator and photographs were taken for comparison of results.

The experimental design was a randomized complete block design (RCBD) which contained 14 treatments with three replicates; each replicate contained three plants per treatment. Data were subjected to analysis of variance (ANOVA) using the SAS program (SAS Institute, 2002). The Means of the individual factors and their interactions were compared by L.S.D test at 5% level of probability according to Snedecor and Cochran (1989).

RESULTS AND DISCUSSION

Seed Germination (%):

Data outlined in Table (2) reveal the effect of different exposure times from microwave on seed germination. However, it could be concluded that the highest mean in *Sophora secundiflora* and *Bauhinia purpurea* plant was scored as a result of exposure time at 5 sec. (70.10 and 72.32 %) and (73.43 and 72.32 %) in the first and second seasons, respectively. On the other hand, the lowest means of germination in *Sophora secundiflora* and *Bauhinia purpurea* were in control plants (46.77 and 45.66 %) and (47.88 and 50.10 %) in the first and second seasons, respectively.

Table 2: Percentage of seeds germination of *Sophora secundiflora* and *Bauhinia purpurea* plants as influenced by different exposure times from microwave in the two seasons of 2019 and 2020

TREATMENTS		Seeds germination (%)	
Species	Exposure time	2019	2020
Sophora secundiflora	Control	46.77	45.66
	5 Sec.	70.10	72.32
	10 Sec.	68.99	70.10
	15 Sec.	61.21	63.44
	20 Sec.	55.66	56.77
	25 Sec.	48.99	50.10
	30 Sec.	46.88	47.99
L.S.D. at 0.05		3.40	1.65
Bauhinia purpurea	Control	47.88	50.10
	5 Sec.	73.43	72.32
	10 Sec.	66.77	66.77
	15 Sec.	58.99	62.32
	20 Sec.	52.32	56.77
	25 Sec.	52.32	52.32
	30 Sec.	50.21	50.21
L.S.D. at 0.05		3.66	2.29

Vegetative Growth:

1. Sprouting Date (day):

Data outlined in Table (3) reveal the effect of different exposure time from microwave on sprouting date. However, were observed different on sprouting date due to using exposure time. However, it could be concluded that the lowest mean in *Sophora secundiflora* and *Bauhinia purpurea* plant was scored as a result of exposure time of 5 sec. (14.50 and 14.50 day) and (14.33 and 14.50 day) in first and second seasons, respectively. On the other hand, the highest means of different exposure time from microwave on sprouting date in *Sophora secundiflora* and *Bauhinia purpurea* were in control plants (17.50 and 18.16 day) and (17.66 and 18.16 day) in the first and second seasons, respectively.

2. Plant Height (cm):

Data obtained on the effect of different exposure time on plant height were averaged in Table (3). Influence on plant height was noticed as a result of different exposure time. In this connection, it could be concluded that the highest means in *Sophora secundiflora* and *Bauhinia purpurea* plant were scored as a result of exposure time of 5 sec. it were (86.58 and 86.33 cm) and (88. 33 and 89.50 cm) in first and second seasons, respectively. On the other hand, the lowest mean of different exposure time on plant height in *Sophora secundiflora* and *Bauhinia purpurea* were at a time of 30 sec. (72.00 and 74.25 cm) and (74. 25 and 76.91 cm) in the first and second seasons, respectively.

3. Number of Leaves Per Plant:

Data obtained on the effect of different exposure times from microwave on the number of leaves per plant were averaged in Table (3). The microwave treatments used revealed clear differences in the number of leaves per plant. Influence on the number of leaves per plant was noticed as a result of different exposure times. In this connection, it could be concluded that the highest means in *Sophora secundiflora* and *Bauhinia purpurea* plant were scored as a result of exposure time of 5 sec. it was (25.83 and 25.66) and (25.00 and 25.33) in the first and second seasons, respectively. On the other hand, the lowest means of the number of leaves per plant in *Sophora secundiflora* and *Bauhinia purpurea* were observed at an exposure time of 30 sec. (21.00 and 21.66) and (20.83 and 21.50) in the first and second seasons, respectively.

4. Leaf Dry Weight (g):

Data presented in Table (3) reveal the effect of different exposure times from microwave on leaf dry weight. However, it could be concluded that the highest means in *Sophora secundiflora* and *Bauhinia purpurea* plant were scored as a result of exposure time of 5 sec. and they were (18.06 and 18.32 g) and (17.69 and 17.63 g) in the first and second seasons, respectively. On the other hand, the lowest means of leaf dry weight in *Sophora secundiflora* and *Bauhinia purpurea* were at an exposure time of 30 sec. were (14.67 and 15.40 g) and (14.33 and 14.80 g) in first and second seasons, respectively.

Table 3: Means of sprouting date (day), plant height (cm), number of leaves per plant and leaves dry weight (g) of *Sophora secundiflora* and *Bauhinia purpurea* plants as influenced by different exposure times from microwave in the two seasons of 2019 and 2020

TREATMENTS		Sprouting date (day)		Plant height (cm)		Number of leaves per plant		Leaf dry weight (g)	
Species	Exposure time	2019	2020	2019	2020	2019	2020	2019	2020
Sophora secundiflora	Control	17.50	18.16	79.25	82.50	24.50	24.66	17.35	17.53
	5 Sec.	14.50	14.50	86.58	86.33	25.83	25.66	18.06	18.32
	10 Sec.	15.33	15.33	83.08	84.50	25.00	25.00	17.64	17.81
	15 Sec.	16.00	16.33	80.08	81.66	24.00	24.33	16.89	17.24
	20 Sec.	16.66	17.00	76.91	79.00	23.00	23.33	16.04	16.43
	25 Sec.	17.00	17.50	73.08	75.33	22.00	22.66	15.33	15.90
	30 Sec.	17.50	18.16	72.00	74.25	21.00	21.66	14.67	15.40
L.S.D. at 0.05		**0.29**	**0.29**	**0.88**	**0.45**	**0.69**	**0.40**	**0.44**	**0.16**
Bauhinia purpurea	Control	17.66	18.16	85.00	85.83	22.66	24.00	16.13	16.82
	5 Sec.	14.33	14.50	88.33	89.50	25.00	25.33	17.69	17.63
	10 Sec.	15.33	15.33	86.33	87.16	24.00	24.16	16.94	17.25
	15 Sec.	15.66	16.00	82.83	84.50	23.33	24.00	16.30	16.64
	20 Sec.	16.33	16.83	78.83	80.66	22.33	23.00	15.63	16.08
	25 Sec.	17.33	17.16	75.50	78.16	21.33	22.00	14.82	15.30
	30 Sec.	17.66	18.16	74.25	76.91	20.83	21.50	14.33	14.80
L.S.D. at 0.05		**0.50**	**0.53**	**2.03**	**0.78**	**0.38**	**0.26**	**0.17**	**0.09**

5-Stem Diameter (cm):

Data obtained on the effect of different exposure time on stem diameter were averaged in Table (4). Influence on stem diameter was noticed as a result of different exposure times. In this connection, it could be concluded that the highest means in *Sophora secundiflora* and *Bauhinia purpurea* plant were scored as a result of exposure time of 5 sec., where the stem diameter was (0.83 and 0.84 cm) and (0.82 and 0.81 cm) in the first and second seasons, respectively. On the other hand, the lowest means of stem diameter in *Sophora secundiflora* and *Bauhinia purpurea* were recorded at an exposure time of 30 sec. (0.68 and 0.71 cm) and (0.65 and 0.67 cm), respectively, in first and second seasons.

6-Stem Dry Weight (g):

Data presented in Table (4) reveal the effect of different exposure times from microwave on stem dry weight. However, it could be concluded that the highest mean in *Sophora secundiflora* and *Bauhinia purpurea* plant was scored as a result of exposure time of 5 sec. and they were (8.51 and 8.65 g) and (8.33 and 8.30 g) in the first and second seasons, respectively. On the other hand, the lowest means of stem dry weights in *Sophora secundiflora* and *Bauhinia purpurea* were observed at exposure times of 30 sec. (6.67 and 6.88 g) and (6.42 and 6.65 g) in the first and second seasons, respectively.

7-Root Length (cm):

Data obtained on the effect of different exposure times on root length were averaged in Table (4). Influence on root length was noticed as a result of different exposure times. In this connection, it could be concluded that the highest mean in *Sophora secundiflora* and *Bauhinia purpurea* plant was scored as a result of exposure time of 5 sec. and they were (28.47 and 28.83 cm) and (27.94 and 27.87 cm) in first and second seasons, respectively. On the other hand, the lowest means of root length in *Sophora secundiflora* and *Bauhinia purpurea* were seen at exposure times of 30 sec. (24.09 and 24.91 cm) and (23.37 and 24.03 cm) in the first and second seasons, respectively.

8-Root Dry Weight (g):

Data presented in Table (4) reveal the effect of different exposure times from microwave on root dry weight. However, it could be concluded that the highest means in *Sophora secundiflora* and *Bauhinia purpurea* plant was scored as a result of exposure time of 5 sec. and they were (6.52 and 6.62 g) and (6.41 and 6.40 g) in the first and second seasons, respectively. On the other hand, the lowest means of root dry weight in *Sophora secundiflora* and *Bauhinia purpurea* were scored at exposure times of 30 sec. (5.14 and 5.33 g) and (4.97 and 5.13 g) in the first and second seasons, respectively.

Chemical constituents

1. Chlorophyll (a) Content in Fresh Weight of Leaves (mg/g):

Data presented in Table (5) reveal the effect of different exposure times from microwave on chlorophyll (a) content in fresh leaves. However, it could be concluded that the highest means in *Sophora secundiflora* and *Bauhinia purpurea* plant were scored as a result of exposure time of 5 sec., where chlorophyll (a) contents were (0.675 and 0.659 mg/g) and (0.636 and 0.635 mg/g) in the first and second seasons, respectively. On the other hand, the lowest means in *Sophora secundiflora* and *Bauhinia purpurea* were observed at exposure times of 30 sec. (0.531 and 0.551 mg/g) and (0.513 and 0.530 mg/g) in first and second seasons, respectively.

2. Chlorophyll (b) Content in Fresh Weight of Leaves (mg/g):

Data outlined in Table (5) reveal the effect of different exposure times from microwave on chlorophyll (b) content in fresh leaves. However, it could be concluded that the highest means in *Sophora secundiflora* and *Bauhinia purpurea* plant were scored as a result of exposure time of 5 sec. and they were (0.418 and 0.440 mg/g) and (0.427 and 0.425 mg/g) in the first and second seasons, respectively. On the other hand, the lowest mean in

Sophora secundiflora and *Bauhinia purpurea* were noticed at exposure time of 30 sec. (0.355 and 0.367 mg/g) and (0.346 and 0.357 mg/g) in first and second seasons, respectively.

Table 4: Means of stem diameter (cm), stem dry weight (g), root length (cm) and root dry weight (g) of *Sophora secundiflora* and *Bauhinia purpurea* plants as influenced by different exposure times from microwave in the two seasons of 2019 and 2020.

TREATMENTS		Stem diameter (cm)		Stem dry weight (g)		Root length (cm)		Root dry weight (g)	
Species	**Exposure time**	**2019**	**2020**	**2019**	**2020**	**2019**	**2020**	**2019**	**2020**
Sophora secundiflora	**Control**	0.81	0.81	8.16	8.26	27.46	27.72	6.30	6.35
	5 Sec.	0.83	0.84	8.51	8.65	28.47	28.83	6.52	6.62
	10 Sec.	0.81	0.82	8.31	8.39	27.87	28.12	6.39	6.44
	15 Sec.	0.78	0.80	7.94	8.11	26.81	27.42	6.14	6.28
	20 Sec.	0.73	0.75	7.52	7.72	25.60	26.15	5.87	5.99
	25 Sec.	0.70	0.73	7.17	7.45	24.59	25.40	5.64	5.82
	30 Sec.	0.68	0.71	6.67	6.88	24.09	24.91	5.14	5.33
L.S.D. at 0.05		**0.01**	**0.01**	**0.21**	**0.09**	**0.61**	**0.25**	**0.13**	**0.07**
Bauhinia purpurea	**Control**	0.74	0.77	7.56	7.91	25.72	26.74	5.89	6.13
	5 Sec.	0.82	0.81	8.33	8.30	27.94	27.87	6.41	6.40
	10 Sec.	0.79	0.81	7.96	8.13	26.89	27.32	6.17	6.31
	15 Sec.	0.75	0.77	7.66	7.83	25.98	26.45	5.96	6.08
	20 Sec.	0.71	0.74	7.32	7.55	25.02	25.65	5.74	5.88
	25 Sec.	0.67	0.70	6.92	7.15	23.85	24.53	5.48	5.63
	30 Sec.	0.65	0.67	6.42	6.65	23.37	24.03	4.97	5.13
L.S.D. at 0.05		**0.01**	**0.006**	**0.08**	**0.06**	**0.25**	**0.14**	**0.05**	**0.04**

Table 5: Means of chlorophylls and carotene content of *Sophora secundiflora* and *Bauhinia purpurea* plants as influenced by different exposure times from microwave in the two seasons of 2019 and 2020**.**

TREATMENTS		Chlorophyll (A) content (mg/g fw)		Chlorophyll (B) content (mg/g fw)		Carotene content (mg/g fw)	
Species	**Exposure time**	**2019**	**2020**	**2019**	**2020**	**2019**	**2020**
Sophora secundiflora	**Control**	0.623	0.630	0.418	0.421	0.440	0.445
	5 Sec.	0.675	0.659	0.450	0.440	0.477	0.466
	10 Sec.	0.643	0.642	0.430	0.428	0.454	0.454
	15 Sec.	0.627	0.622	0.419	0.416	0.443	0.440
	20 Sec.	0.577	0.590	0.387	0.394	0.408	0.417
	25 Sec.	0.552	0.571	0.370	0.383	0.390	0.404
	30 Sec.	0.531	0.551	0.355	0.367	0.379	0.390
L.S.D. at 0.05		**0.020**	**0.007**	**0.013**	**0.006**	**0.014**	**0.005**
Bauhinia purpurea	**Control**	0.579	0.605	0.387	0.404	0.409	0.428
	5 Sec.	0.636	0.635	0.427	0.425	0.449	0.451
	10 Sec.	0.609	0.624	0.407	0.417	0.430	0.441
	15 Sec.	0.586	0.599	0.394	0.401	0.414	0.423
	20 Sec.	0.562	0.577	0.376	0.386	0.397	0.408
	25 Sec.	0.533	0.550	0.357	0.369	0.376	0.388
	30 Sec.	0.513	0.530	0.346	0.357	0.365	0.377
L.S.D. at 0.05		**0.006**	**0.004**	**0.004**	**0.002**	**0.005**	**0.003**

3. Carotenoids Content in Fresh Weight of Leaves (mg/g):

Data obtained on the effect of different exposure time on carotenoids content in fresh leaves were averaged in Table (5). In this connection, it could be concluded that the highest means in *Sophora secundiflora* and *Bauhinia purpurea* plant were scored as a result of exposure time of 5 sec. and they were (0.477 and 0.466 mg/g) and (0.449 and 0.451 mg/g) in the first and second seasons, respectively. On the other hand, the lowest mean in *Sophora secundiflora* and *Bauhinia purpurea* were observed at exposure times of 30 sec. (0.379 and 0.390 mg/g) and (0.365 and 0.377 mg/g) in first and second seasons, respectively.

4. Phenol Contents in Fresh Leave (mg/g):

Data obtained on the effect of exposure time from microwave on phenol contents in leaves were averaged in Table (6). The microwave treatments used revealed clear differences in phenol contents in fresh leaves. In this connection, it could be concluded that the highest means in *Sophora secundiflora* and *Bauhinia purpurea* plant were scored as a result of exposure time of 5 sec. and they were (3.498 and 3.551 mg/g) and (3.429 and 3.418 mg/g) in the first and second seasons, respectively. On the other hand, the lowest means in *Sophora secundiflora* and *Bauhinia purpurea* were noticed at exposure times of 30 sec. (2.972 and 3.078 mg/g) and (2.873 and 2.966 mg/g) in the first and second seasons, respectively.

5. Indole Contents in Fresh Leaves (mg/g):

Data presented in Table (6) reveal the effect of different exposure times from microwave on indole contents in fresh leaves. However, it could be concluded that the highest means in *Sophora secundiflora* and *Bauhinia purpurea* plant were scored as a result of exposure time of 5 sec. and they were (0.902 and 0.882 mg/g) and (0.851 and 0.853 mg/g) in the first and second seasons, respectively. On the other hand, the lowest means in *Sophora secundiflora* and *Bauhinia purpurea* were observed at exposure times of 30 sec. (0.724 and 0.757 mg/g) and (0.713 and 0.729 mg/g) in the both seasons, respectively.

6. Peroxidase Activity (min/g FW):

Data outlined in Table (6) reveal the effect of different exposure times from microwave on peroxidase activity. However, it could be concluded that the highest mean in *Sophora secundiflora* and *Bauhinia purpurea* plant was scored as a result of exposure time of 30 sec. and they were (1.739 and 1.723 min/g) and (1.687 and 1.694 min/g) in the first and second seasons, respectively. On the other hand, the lowest means of different exposure times from microwave on peroxidase activity in *Sophora secundiflora* and *Bauhinia purpurea* were observed in control plants in the first and second seasons, respectively.

Inter-Simple Sequence Repeat (ISSR) Fingerprinting Technique: in *Sophora secundiflora* and *Bauhinia purpurea* plant:

The Inter Simple Sequence Repeat (ISSR) represents genome regions. Sequences amplified by ISSR-PCR can be used for delimiting species. ISSR-PCR is a simple, inexpensive, robust, multilocus marker system that has been used to examine genetic variability among different microwave exposure time treatments. The resultant PCR response intensifies the arrangement between two ISSR, yielding a multilocus marker framework helpful for fingerprinting and genome mapping. In this study, the ISSR-PCR technique is used to reveal the genetic diversity for different microwave exposure time treatments.

Four primers were screened for their ability to amplify the genomic DNA of the *Sophora secundiflora* and *Bauhinia purpurea* and its variants. The number of DNA fragments amplified ranged from 6 to 36 depending on the primer and the DNA sample with a mean value of 10.5 bands per primer in *Sophora secundiflora* and *Bauhinia purpurea* plants, respectively (Table 7).

Table 6: Means of phenol and indole content and peroxidase activity of *Sophora secundiflora* and *Bauhinia purpurea* plants as influenced by different exposure times from microwave in the two seasons of 2019 and 2020.

TREATMENTS		Phenol content (mg/g fw)		Indol content (mg/g fw)		Peroxidase activity (min/g fw)	
Species	**Exposure time**	**2019**	**2020**	**2019**	**2020**	**2019**	**2020**
Sophora secundiflora	**Control**	3.364	3.401	0.834	0.844	1.140	1.131
	5 Sec.	3.498	3.551	0.902	0.882	1.207	1.188
	10 Sec.	3.419	3.452	0.861	0.859	1.313	1.305
	15 Sec.	3.277	3.343	0.839	0.834	1.410	1.401
	20 Sec.	3.115	3.189	0.775	0.792	1.539	1.524
	25 Sec.	2.981	3.088	0.742	0.768	1.650	1.629
	30 Sec.	2.972	3.078	0.724	0.757	1.739	1.723
L.S.D. at 0.05		**0.082**	**0.037**	**0.024**	**0.010**	**0.031**	**0.070**
Bauhinia purpurea	**Control**	3.131	3.262	0.777	0.812	1.184	1.161
	5 Sec.	3.429	3.418	0.851	0.853	1.221	1.214
	10 Sec.	3.287	3.35	0.817	0.837	1.277	1.276
	15 Sec.	3.165	3.231	0.787	0.803	1.348	1.330
	20 Sec.	3.038	3.129	0.755	0.776	1.492	1.461
	25 Sec.	2.884	2.975	0.718	0.741	1.620	1.595
	30 Sec.	2.873	2.966	0.713	0.729	1.687	1.694
L.S.D. at 0.05		**0.032**	**0.024**	**0.009**	**0.006**	**0.075**	**0.094**

Table 7: Average of polymorphism (%) among each sample for four ISSR primer

ISSR Primers	Samples Polymorphism (%)													
	Sophora secundiflora							*Bauhinia purpurea*						
	0 Sec.	5 Sec.	10 Sec.	15 Sec.	20 Sec.	25 Sec.	30 Sec.	0 Sec.	5 Sec.	10 Sec.	15 Sec.	20 Sec.	25 Sec.	30 Sec.
First	0	0	11	0	0	13	10	0	0	0	0	17	0	9
Second	36	0	0	0	0	0	0	8	11	0	22	0	0	25
Third	0	0	0	0	0	0	0	0	0	9	0	0	0	8
Fourth	0	0	0	0	0	10	0	0	0	0	0	0	0	6
Average	9	0	2.7	0	0	5.7	2.5	2	2.7	2.2	5.5	4.2	0	12

The sizes of fragments ranged from 100 to 1000 bp. A total of 105 fragments were produced by the four primers. Of these 105 amplified (61.9%) were polymorphic in one or other often genotypes (one cultivar and eight somaclones). However, figures (1a and 1b) show the amplification profiles, generated by primer 14 across the *Sophora secundiflora* and *Bauhinia purpurea* and its somaclones. The 8 scroble bands of the primer 14 were polymorphic across the *Sophora secundiflora* and *Bauhinia purpurea* genotypes.

During the experiment, the fingerprinting was estimated in *Sophora secundiflora* and *Bauhinia purpurea* seedlings, all treatments gave similar results in most of the studied traits from microwave exposure time in *Sophora secundiflora* and *Bauhinia purpurea* seedlings Compared to the control treatment, while all treatments did not have any genetic mutation, which means that microwave irradiation does not affect the genetic structure (Figs**.** 1 and 2).

The results of this study confirm the importance of using molecular methods To ensure that microwave treatments, as well as the length of exposure to radiation, affected the genetic composition of the seeds, as shown in (Figs. 1&2).

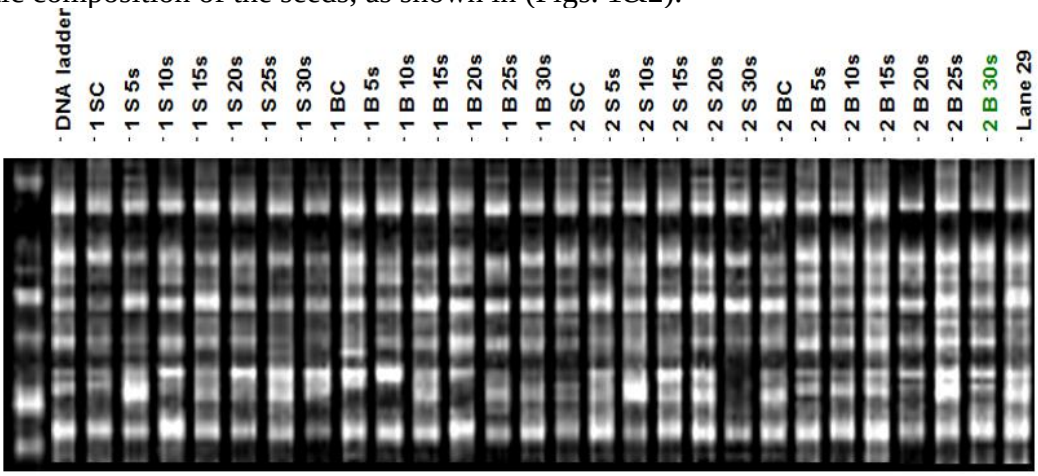

Fig. 1a.: Fingerprinting technique of first and second primers for seven *Sophora secundiflora* treatments and seven *Bauhinia purpurea* treatments.

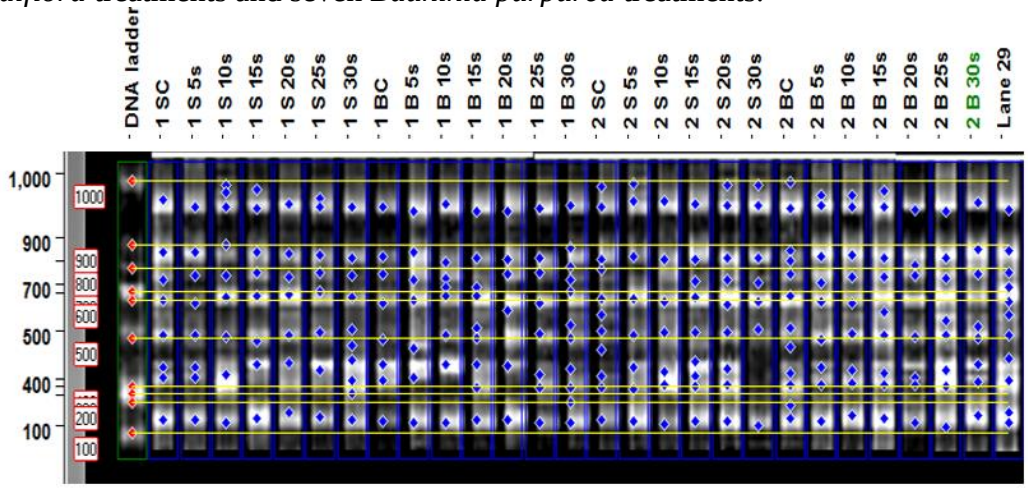

Fig. 1b.: Computerized fragments length calculation of Inter-Simple Sequence Repeat (ISSR) fingerprinting technique of first and second primers for seven *Sophora secundiflora* and *Bauhinia purpurea* samples.

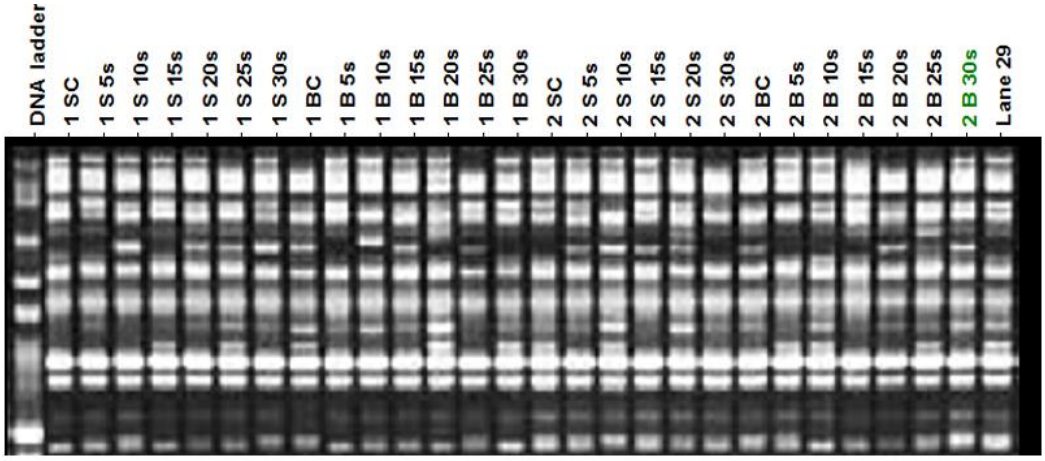

Fig. 2a.: Fingerprinting technique of third and fourth primers for seven *Sophora secundiflora* treatments and seven *Bauhinia purpurea* treatments.

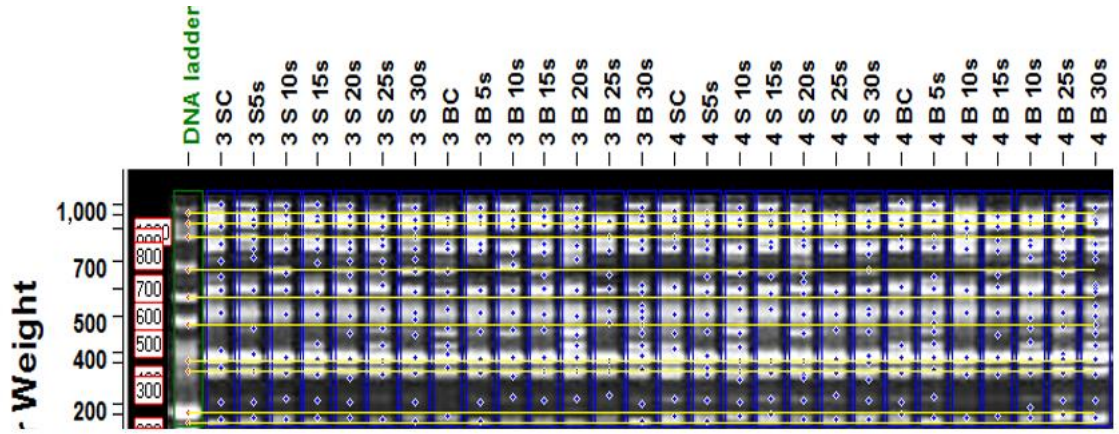

Fig. 2b.: Computerized fragments length calculation of Inter-Simple Sequence Repeat (ISSR) fingerprinting technique of third and fourth primers for seven *Sophora secundiflora* and *Bauhinia purpurea* samples.

DISCUSSION

Plant growth is modulated by internal cues and external environmental factors because plants are particularly sensitive to external environmental factors. The effects of microwave irradiation are based on the effects of temperature and electromagnetism on plants. The results discussed in this section are the effects of various microwave exposure time on seed germination, vegetative growth and chemical constituents. A decrease in seed germination is observed in all seed samples with an increase in exposure time from 5 seconds to 30 seconds in *Sophora secundiflora* and *Bauhinia purpurea* as compared to the control treatment.

Previous studies have illustrated that certain doses of microwave irradiation notably improve the activities of the germination rate of lentil (*Lens culinaris*) seeds exposed to the microwave power of 450–730 W for 30 S. however, this rate was inhibited for longer exposure times (60 and 90 S.) (Aladjadjiyan, 2010). The results indicated that microwave pretreatment increased some enzyme activities, germination rate and growth vigor) Chen *et al*., 2009). In the case of wheat, green gram and bengal gram, decrease in trend was observed for vegetative growth and chemical constituents with increase in microwave exposure time as compared to control treatment (Ragha *et al.*, 2011).

In the case of radish seedlings, the microwave may reduce the water passage across the cell membrane, closing the aquaporins and causing a reduction of growth. As the increase of growth rate upon irradiation removal was seen during the elongation growth and the cell can partially repair damages that occur at the membrane level. There was a general consensus of opinion about the fact that microwave irradiation induces a thermal detrimental effect on the biological system. We assume that the damage induced by the low power microwave exposure is non-thermal because a slight increase in temperature (up to 25 ºC) with radish seeds has been demonstrated to induce increases in germination and growth (Scialabba and Melati, 1995).

The subsequent seedling growth involves the establishment of the root and shoots systems. The hypocotyl growth is caused principally by cell expansion and/or by elongation. The low power 0.5 GHz irradiation reduces the rate and percentage of germination in radish seeds and increases germination, thus impairing seed germination. The reduction of hypocotyl growth (which occurs gradually when the power increases) and growth delay show the effect of microwave on seed germination performance (D'Inzeo *et al.*, 1988).

Peroxides in higher plants could be classified two major groups, according to their functions and specificity of substrate. The guaiacol peroxides have low specificity of substrate, it seems to have different peroxidative functions in the cell. The other peroxides as glutation peroxidase (Beeor-Tzahar *et al.*, 1995) and ascorbat peroxides (Asada, 1992) are crucial for neutralization of H_2O_2, organic hydroperoxides and lipid peroxides. Up to now, guaiacol peroxides have been found in the vacuoles, cell wall, cytosol, extracellular space and corn mitochondria (Asada, 1992 and Prasad *et al.*, 1995), whereas ascorbat peroxides are present mainly in chloroplast and partially in cytosol and glyoxisomes (Asada, 1992; Asada *et al.*, 1993; Mittler and Zillinskas, 1993 and Bunkelmann and Trelease, 1996).

Peroxides modify the redox equilibrium of the cell being involved in plant development (Broin *et al.*, 2002) and the signal transduction mediated by calcium is necessary for induction of plant response against stress factors (Kawano, 2003). Moreover, it was already demonstrated that ascorbate peroxides, one of the peroxides from *Arabidopsis* is the central component in the complex of the enzymes involved in the neutralization of free radicals (Davletova *et al.*, 2005). It has been demonstrated that ascorbate peroxides, peroxides from mitochondria is essential for homeostasis and root growth in *Arabidopsis* under different stress conditions (Finkemeier *et al.*, 2005).

No similar and contrary results were available in *Acacia species*, but in other plants, analogous results were reported in *Artemisia vulgaris* (Kumar and Ranjitha, 2009), *Glycine max* L. (Radhakrishnan and Ranjitha, 2009), and *Plumbago zeylanica* L. (Rout *et al.*, 2010). No research has been done contrary to these results. This paper presents and sheds light on the *Sophora secundiflora* and *Bauhinia purpurea* proteins which grow on Antoniades Garden and in arid regions. Therefore, very much attention should be given to arid species since these valuable showed plants some signs as an important resource for desert ecosystems and arid environments.

These results indicated that ISSR technique could be successfully applied to ornamental crops. ISSR analysis in the characterization of the *Sophora secundiflora* and *Bauhinia purpurea* and their some clones allows the detection of changes produced during culture and also, with samples taken subsequently through the entire process, to detect at which time the alteration has been produced (Martin *et al*., 2002).

CONCLUSION

The results obtained from this experiment emphasized the necessity of exposing *Sophora secundiflora* and *Bauhinia purpurea* seeds to the lowest microwave exposure time (5 and10 Sec.) of the microwave before sowing in seeds bed to promote a high germination percentage and to produce uniform seedlings.

Generally, it was found that the use of microwave has an effect on the revitalization of seed germination of *Sophora secundiflora* and *Bauhinia purpurea* under different doses. As demonstrated by genetic analysis of *Sophora secundiflora* and *Bauhinia purpurea* seedlings, was found not that there is no genetic difference, which means that the microwave radiation dose was the revitalization for seed germination. Therefore, it can be used as a non-traditional means of seed germination besides traditional methods.

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ARABIC SUMMARY

تأثير الموجات القصيرة على إنبات البذور ومعدل النمو فى بعض أجناس أشجار العائلة البقولية فى حديقة أنطونيادس (أ) صافورا الزرقاء و بوهينيا بنفسجية

نادر أحمد الشنهورى

قسم بحوث الحدائق النباتية – معهد بحوث البساتين – مركز البحوث الزراعية – الإسكندرية – مصر

أجريت هذه الدراسة خلال موسمى 2019 و2020 فى فرع بحوث الحدائق النباتية – معهد بحوث البساتين – مركز البحوث الزراعية -. الإسكندرية- مصر. كان الهدف من هذه الدراسة هو تحديد تأثير زمن التعرض لأشعة المايكروويف على إنبات البذور والنمو الخضرى والمكونات الكيماوية لنوعى *Sophora secundiflora* *Bauhinia purpurea*. تم تعريض بذور *Sophora* و *Bauhinia* لأشعة المكيروويف لمدة صفر (مقارنة), 5 ,10 , 15, 20, 30,25 ثانية فى كلا الموسمين على التوالى. تم زراعة الشتلات بشكل فردى كل فى أصيص بلاستيك قطرة 20 سم مملوء بخليط من الطين والرمل بنسبة (1:1) من حيث الحجم.

أظهرت النتائج المتحصل عليها زيادة معنوية فى النمو الخضرى والمكونات الكيميائية عند التعريض لوقت قليل من أشعة الميكروويف. يمكن تلخيص النتائج إلى أن أفضل النتائج المتحصل عليها سجلت عند تعريض بذور *Sophora secundiflora* و *Bauhinia purpurea* لمدة خمس ثوانى من أشعة الميكروويف فى كلا الموسمين على التوالى.