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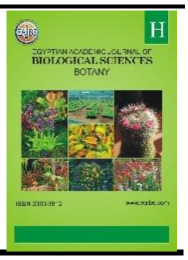

Effect of Microwave on Seed Germination and Growth Rate in Some Genera Fabaceae Trees in Antoniades Garden
(B) *Delonix regia* and *Albizzia julibrissin*

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ABSTRACT

The research was done in the Antoniadis Research Branch of the Agriculture Research Center (ARC), Alexandria, Egypt, over the course of the two succeeding growing seasons of 2019 and 2020. In this study, *Delonix regia* and *Albizzia julibrissin* seeds were exposed to microwaves for varying lengths of time in order to increase seed germination, vegetative development, and chemical components. The seeds of each treatment were exposed to microwave radiation for varying lengths of time: 0 seconds (control), 5 seconds, 10 seconds, 15 seconds, 20 seconds, 25 seconds, and 30 seconds in each of the two seasons. Individual seedlings were planted in 20 cm diameter plastic pots that were (1:1) by volume filled with a clay and sand mixture. From the obtained results, it could be concluded that the highest mean in *Delonix regia* and *Albizzia julibrissin* plants was scored as a result of exposure time at 5 seconds in both seasons, respectively.

INTRODUCTION

Fabaceae is the family with 770 genera and 19,500 species (LPWG., 2017), the Fabaceae plant family is the most diversified in the entire globe (Beech *et al.*, 2017). It is ranked third among the angiosperm families in terms of species numbers, after the Asteraceae and the Orchidaceae (LPWG., 2017). The circumscribed family is divided into six subfamilies, including 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). The former subfamily Mimoso (LPWG., 2017).

Delonix regia is a species of flowering tree native to Madagascar, *Delonix regia* is a species, native belonging to the Caesalpinioideae subfamily of the Fabaceae bean family. It is distinguished by its fern-like leaves and dramatic summertime display of red blooms. It is cultivated as an ornamental tree in many tropical regions of the world, and its English namesake is the flame tree or flame of the forest (Rivers, 2014). Delonixregia is indigenous to the dry deciduous forests of Madagascar, although it has been imported throughout the world to tropical and subtropical areas. Although it is at risk of extinction in the wild, it is commonly cultivated elsewhere and is often referred to as having naturalised there (Cowen, 1984).

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The Persian silk tree, also known as the pink silk tree, or *Albizia julibrissin*, is a species of tree in the Fabaceae family that is indigenous to southwestern and eastern Asia. The Italian nobleman Filippodegli Albizzi, who brought it to Europe in the middle of the 18th century, is honoured with the genus name. Sometimes, Albizzia is spelled improperly. The term "julibrissin" is a transliteration of the Persian word "gul-i abrisham," which means "silk blossom" (Juan-Alberto, 1990).

Microwave radiation has been shown in a few experiments to speed up the germination of seeds (Rao *et al.,* 1989, Hu *et al.,* 1996 and Chen *et al.,* 2005). Despite the information that has been gathered about the impact of microwaves on plants, it is unclear whether microwave pretreatment of seeds will alter their internal energy, stimulate their enzyme activity, improve their metabolism, or increase the intensity of biophoton emission, which is viewed as a marker of cell metabolism (Abeles, 1986 and Higeg and Inaba, 1991). Determining the impact of a microwave (12.5 cm, 1.26 mW/ mm2) on the germination of *Delonix regia* and *Albizzia julibrissin* seeds was our goal in the current investigation. Consequently, the light and magnetic actions of the laser may be the mechanism of action that causes the effect of laser irradiation (Xiang, 1995). In order to verify this, we pretreated seeds with microwaves (1.26 mW/mm2) and compared the results in Isatisindigotica.

According to El-Akkad (2004), these plant proteins attract particular attention. *Delonix regia* and *Albizzia julibrissin* seedling protein analyses and ISSR analyses were conducted (Rashmi *et al.*, 2004).

The present study aims at comparing the effect of short-wave treatments on seeds germination and vegetative growth in two *Delonix regia* and *Albizzia julibrissin* grown in Egypt.

MATERIALS AND METHODS

The current study was conducted over the course of the two succeeding growing seasons of 2019 and 2020 at Antoniadis Research Branch, Horticultural Research Institute, Agriculture Research Center (ARC), Alexandria, Egypt.

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 microwave on the first of February, 2019 and 2020 in both seasons, respectively. 315 seeds per genus were divided into 7 groups per specie (7groups* 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, the 20s, 25s and 30s in the *Delonix regia* and *Albizzia julibrissin* in the first and second seasons respectively. Groups of 45 seeds were subjected to each microwave treatment, for chosen exposure times and analogous groups were used as control. The seeds were cultured in trays (50eye/ tray), with 45 seeds in each tray, on a mixture of peat moss and sand at a ratio of 1:1 (v/v). The trays were watered daily. On 1st March 2019 and 2020 in the first and second seasons, respectively, the trays were gradually transferred from shade to a sunny place for two weeks. On the 15th of March, 2019 and 2020 (in the first and second seasons, respectively) homogeneous seedlings of *Delonix regia* and *Albizzia julibrissin* (15-20 cm height on average and Containing 4 leaves) 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 the 30th of October in both 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 1^{st} of March till the 30^{th} of October). In addition, weeds were removed manually upon emergence.

Data Recorded :

1-Seed Germination (%):

On February 15, 2019 and2020 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. The germination percentage of every treatment was calculated after 30 days from sowing according to the following formula:

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

2-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).

3-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:** As described by Cho *et al.*, (1996). Inter-Simple Sequence Repeat (ISSR) markers were applied as a molecular fingerprinting technique via four specific primers to evaluate different exposure times from microwave influence on seven *Delonix regia* treatments and seven *Albizzia julibrissin* 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 a transilluminator and photographs were taken for comparison of the results.

The experimental design was a randomized complete block design (RCBD) that 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 the L.S.D test at a 5% level of probability according to Snedecor and Cochran (1989).

RESULTS AND DISCUSSION

1-Seed Germination (%):

Data outlined in Table (2) reveal the effect of different exposure times from microwave radiation on seed germination (%). However, it could be concluded that the highest mean in *Delonix regia* and *Albizzia julibrissin* plant was scored as a result of exposure time at 10 sec. (72.55 and 74.80%) and (75.90 and 74.80 %) in the first and second seasons, respectively. On the other hand, the lowest means of germination in *Delonix regia* and *Albizzia julibrissin* were in control plants (58,12 and 59.24 %) and (54.7979 and 59.26 %) in both seasons.

Table 2: Percentage of seeds germination of *Delonix regia* and *Albizzia julibrissin* 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**
Delonix regia	**Control**	51.45	52.58
	5 Sec.	71.44	72.58
	10 Sec.	72.55	74.80
	15 Sec.	63.69	65.92
	20 Sec.	58.12	59.24
	25 Sec.	49.35	50.46
	30 Sec.	49.24	48.13
L.S.D. at 0.05		**03.40**	**01.65**
Albizzia julibrissin	**Control**	54.79	54.80
	5 Sec.	69.23	69.24
	10 Sec.	75.90	74.80
	15 Sec.	54.79	59.26
	20 Sec.	61.44	64.80
	25 Sec.	52.68	52.64
	30 Sec.	50.35	52.57
L.S.D. at 0.05		**03.66**	**02.30**

2-Vegetative Growth:

2.1. Sprouting Date (day):

Data outlined in Table (3) reveal the effect of different exposure times from microwave radiation on the sprouting date. In most cases, were observed on the sprouting date due to using the different exposure times. However, it could be concluded that the lowest mean in *Delonix regia* and *Albizzia julibrissin* plant was scored as a result of exposure time of15 sec. (12.50 and 12.50day) and (12.83 and 13.00 days) in the first and second seasons, respectively. On the other hand, the highest means of different exposure times from microwave radiation on sprouting date in *Delonix regia* and *Albizzia julibrissin* were in plants was scored as a result of exposure time of 30 sec. (16.50 and 17.16 day) and (16.66 and 17.16 day) in both seasons, respectively.

2.2. **Plant Height (cm):**

Data obtained on the effect of different exposure times on plant height were averaged in Table (3). A clear effect on plant height was noticed as a result of different exposure times. In this connection, it could be concluded that the highest means in *Delonix regia* and *Albizzia julibrissin* plant were scored as a result of exposure time of 5 sec. it was (88.00 and 87.83 cm) and (89. 58 and 90.91 cm) in the first and second seasons, respectively. On the other hand, the lowest mean of different exposure times on plant height in *Delonix regia* and *Albizzia julibrissin* were at the time of 30 sec.(73.41 and 75.75 cm) and (75. 75 and 78.41 cm) in both seasons, respectively.

2.3. Number of Leaves Per Plant:

Data obtained on the effect of different exposure times from microwave radiation 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. A clear effect 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 *Delonix regia* and *Albizzia julibrissin* plant were scored as a result of an exposure time of 5 sec. They were (28.83 and 28.66) and (28.00 and 28.33) in the first and second seasons, respectively. On the other hand, the lowest means of the number of leaves per plant in *Delonix regia* and *Albizzia julibrissin* were observed at an exposure time of 30 sec.(24.00 and 24.66) and (23.83 and 24.50) in both seasons, respectively.

2.4. Leaf Dry Weight (g):

Data presented in Table (3) reveal the effect of different exposure times from microwave radiation on leaf dry weight. However, it could be concluded that the highest means in *Delonix regia* and *Albizzia julibrissin* plant were scored as a result of an exposure time of 5 sec. and they were (18.60 and 18.85 g) and (18.22 and 18.17 g) in the first and second seasons, respectively. On the other hand, the lowest means of leaf dry weight in *Delonix regia* and *Albizzia julibrissin* were at an exposure time of 30 sec. were (15.20 and 15.94 g) and (14.86 and 15.33 g) in both seasons, respectively.

Table 3: Means of sprouting date (day), plant height (cm), number of leaves per plant and leaves dry weight (g) of *Delonix regia* and *Albizzia julibrissin* 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
Delonix regia	Control	15.00	15.33	80.75	83.33	27.00	27.33	17.42	17.77
	5 Sec.	13.50	13.50	88.00	87.83	28.83	28.66	18.60	18.85
	10 Sec.	14.33	14.33	84.75	86.00	28.00	28.00	18.17	18.34
	15 Sec.	12.50	12.50	81.58	84.00	27.50	27.66	17.88	18.06
	20 Sec.	15.66	16.00	78.33	80.50	26.00	26.33	16.57	16.96
	25 Sec.	16.00	16.50	74.58	76.83	25.00	25.66	15.86	16.43
	30 Sec.	16.50	17.16	73.41	75.75	24.00	24.66	15.20	15.94
L.S.D. at 0.05		0.29	0.29	0.88	0.46	0.69	0.40	0.44	0.17
Albizzia julibrissin	Control	14.66	15.00	84.33	86.00	25.66	27.00	16.66	17.17
	5 Sec.	13.33	13.50	89.58	90.91	28.00	28.33	18.22	18.17
	10 Sec.	14.33	14.33	87.83	88.75	27.00	27.16	17.47	17.78
	15 Sec.	12.83	13.00	86.50	87.25	26.33	27.00	16.83	17.35
	20 Sec.	15.33	15.83	80.25	82.16	25.33	26.00	16.16	16.61
	25 Sec.	16.33	16.16	77.00	79.66	24.33	25.00	15.35	15.83
	30 Sec.	16.66	17.16	75.75	78.41	23.83	24.50	14.86	15.33
L.S.D. at 0.05		0.50	0.53	2.06	0.79	0.38	0.26	0.17	0.09

2.5. Stem Diameter (cm):

Data obtained on the effect of different exposure times on stem diameter were averaged in Table (4). A clear effect on stem diameter was noticed as a result of different exposure times. In this connection, it could be concluded that the highest means in *Delonix regia* and *Albizzia julibrissin* plant were scored as a result of exposure time of 5 sec., where the stem diameter was (0.70 and 0.70 cm) and (0.68 and 0.67 cm) in the first and second seasons, respectively. On the other hand, the lowest means of stem diameter in *Delonix regia* and *Albizzia julibrissin* were recorded at an exposure time of 30 sec. (0.54 and 0.57 cm) and (0.51 and 0.53 cm), respectively, in the both seasons.

2.6. Stem Dry Weight (g):

Data presented in Table (4) reveal the effect of different exposure times from microwave radiation on stem dry weight. However, it could be concluded that the highest mean in *Delonix regia* and *Albizzia julibrissin* plant was scored as a result of an exposure time of 5 sec. and they were (8.00 and 8.14 g) and (7.82 and 7.79 g) in the first and second seasons, respectively. On the other hand, the lowest means of stem dry weights in *Delonix regia* and *Albizzia julibrissin* were observed at exposure times of 30 sec. (6.16 and 6.37 g) and (5.91 and 6.14 g) in both seasons, respectively.

2.7. Root Length (cm):

Data obtained on the effect of different exposure times on root length were averaged in Table (4). A clear effect on root length was noticed as a result of different exposure times. In this connection, it could be concluded that the highest mean in *Delonix regia* and *Albizzia julibrissin* plant were scored as a result of exposure time of 5 sec. and they were (30.73 and 31.09 cm) and (30.20 and 30.13 cm) in the first and second seasons, respectively. On the other hand, the lowest means of root length in *Delonix regia* and *Albizzia julibrissin* were seen at exposure times of 30 sec. (26.35 and 27.17 cm) and (25.63 and 26.29 cm) in both seasons, respectively.

2.8. Root Dry Weight (g):

Data presented in Table (4) reveal the effect of different exposure times from microwave radiation on root dry weight. However, it could be concluded that the highest means in *Delonix regia* and *Albizzia julibrissin* plant was scored as a result of an exposure time of 5 sec. and they were (5.99 and 6.09 g) and (5.87 and 5.86 g) in the first and second seasons, respectively. On the other hand, the lowest means of root dry weight in *Delonix regia* and *Albizzia julibrissin* were scored at exposure times of 30 sec.(4.61 and 4,79 g) and (4.43 and 4.59 g) in both seasons, respectively.

Table 4: Means of stem diameter (cm), stem dry weight (g), root length (cm) and root dry weight (g) of *Delonix regia* and *Albizzia julibrissin* 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
Delonix regia	Control	0.64	0.66	7.44	7.61	29.07	29.68	5.60	5.74
	5 Sec.	0.70	0.70	8.00	8.14	30.73	31.09	5.99	6.09
	10 Sec.	0.67	0.68	7.80	7.88	30.13	30.38	5.85	5.90
	15 Sec.	0.67	0.67	7.65	7.75	29.72	29.98	5.76	5.82
	20 Sec.	0.59	0.61	7.01	7.22	27.86	28.41	5.33	5.45
	25 Sec.	0.56	0.59	6.66	6.94	26.85	27.66	5.10	5.28
	30 Sec.	0.54	0.57	6.16	6.37	26.35	27.17	4.61	4.79
L.S.D. at 0.05		**0.02**	**0.01**	**0.21**	**0.09**	**0.61**	**0.25**	**0.13**	**0.07**
Albizzia julibrissin	Control	0.60	0.63	7.15	7.32	27.98	28.71	5.35	5.54
	5 Sec.	0.68	0.67	7.82	7.79	30.20	30.13	5.87	5.86
	10 Sec.	0.65	0.67	7.45	7.62	29.15	29.58	5.63	5.77
	15 Sec.	0.61	0.63	7.05	7.41	28.24	29.00	5.42	5.59
	20 Sec.	0.57	0.60	6.81	7.05	27.28	27.91	5.20	5.34
	25 Sec.	0.53	0.56	6.41	6.64	26.11	26.79	4.94	5.09
	30 Sec.	0.51	0.53	5.91	6.14	25.63	26.29	4.43	4.59
L.S.D. at 0.05		**0.012**	**0.006**	**0.08**	**0.06**	**0.25**	**0.14**	**0.05**	**0.04**

3. Chemical Constituents:

3.1. Chlorophyll(a)Content In Fresh Weight Of Leaves (mg/g):

Data presented in Table (5) reveal the effect of different exposure times from microwave radiation on chlorophyll (a)content in fresh leaves. However, it could be concluded that the highest means in *Delonix regia* and *Albizzia julibrissin* plant were scored as a result of exposure time of 10 sec., where chlorophyll (a) contents were (0.664 and 0.648 mg/g) and (0.598 and 0.613 mg/g) in the first and second seasons, respectively. On the other hand, the lowest means in *Delonix regia* and *Albizzia julibrissin* were observed at exposure times of 30 sec. (0.520 and 0.540 mg/g) and (0.504 and 0.519 mg/g) in both seasons, respectively.

3.2. Chlorophyll (b) Content In Fresh Weight Of Leaves (mg/g):

Data outlined in Table (5) reveal the effect of different exposure times from microwave radiation on chlorophyll (b) content in fresh leaves. However, it could be concluded that the highest means in *Delonix regia* and *Albizzia julibrissin* plant were scored as a result of exposure time of 10 sec. and they were (0.439 and 0.429 mg/g) and (0.414 and 0.443 mg/g) in the first and second seasons, respectively. On the other hand, the lowest mean in *Delonix regia* and *Albizzia julibrissin* were noticed at exposure times of 30 sec. (0.344 and 0.356 mg/g) and (0.335 and 0.346 mg/g) in the both seasons, respectively.

3.3. Carotenoids Content In Fresh Weight Of Leaves (mg/g):

Data obtained on the effect of different exposure times on carotenoid content in fresh leaves were averaged in Table (5). In this connection, it could be concluded that the highest means in *Delonix regia* and *Albizzia julibrissin* plant were scored as a result of an exposure time of 5 sec. and they were (0.471 and 0.460 mg/g) and (0.443 and 0.446 mg/g) in the first and second seasons, respectively. On the other hand, the lowest mean in *Delon ixregia* and *Albizzia julibrissin* were observed at exposure times of 30 sec. (0.373 and 0.384 mg/g) and (0.359 and 0.372 mg/g) in both seasons, respectively.

Table 5: Means of chlorophylls and carotene content of *Delonix regia* and *Albizzia julibrissin* 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**
Delonix regia	**Control**	0.612	0.612	0.407	0.405	0.434	0.434
	5 Sec.	0.616	0.632	0.419	0.417	0.471	0.460
	10 Sec.	0.664	0.648	0.439	0.429	0.448	0.448
	15 Sec.	0.632	0.619	0.409	0.410	0.438	0.439
	20 Sec.	0.566	0.580	0.376	0.383	0.402	0.411
	25 Sec.	0.541	0.560	0.359	0.373	0.384	0.398
	30 Sec.	0.520	0.540	0.344	0.356	0.373	0.384
L.S.D. at 0.05		**0.020**	**0.007**	**0.014**	**0.005**	**0.014**	**0.005**
Albizzia julibrissin	**Control**	0.568	0.588	0.376	0.391	0.403	0.417
	5 Sec.	0.625	0.624	0.396	0.406	0.443	0.446
	10 Sec.	0.598	0.613	0.416	0.414	0.425	0.435
	15 Sec.	0.576	0.595	0.383	0.393	0.408	0.422
	20 Sec.	0.551	0.567	0.365	0.375	0.391	0.402
	25 Sec.	0.523	0.540	0.346	0.358	0.370	0.382
	30 Sec.	0.504	0.519	0.335	0.346	0.359	0.372
L.S.D. at 0.05		**0.006**	**0.004**	**0.004**	**0.002**	**0.005**	**0.004**

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

Data obtained on the effect of exposure times from microwave radiation 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 *Delonix regia* and *Albizzia julibrissin* plant were scored as a result of an exposure time of 5 sec. and they were (3.455 and 3.509 mg/g) and(3.386 and 3.375 mg/g) in the first and second seasons, respectively. On the other hand, the lowest means in *Delonix regia* and *Albizzia julibrissin* were noticed at exposure times of 30 sec.(2.929 and 3.035 mg/g) and (2.830 and 2.923 mg/g) in both seasons, respectively.

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

Data presented in Table (6) reveal the effect of different exposure times from microwave radiation on indolecontents in fresh leaves. However, it could be concluded that the highest means in *Delonix regia* and *Albizzia julibrissin* plant were scored as a result of an exposure time of 5 sec. and they were (0.912 and 0.898 mg/g) and (0.866 and 0.868 mg/g) in the first and second seasons, respectively. On the other hand, the lowest means in *Delonix regia* and *Albizzia julibrissin* were observed at exposure times of 30 sec. (0.740 and 0.773 mg/g) and (0.728 and 0.744 mg/g) in the both seasons, respectively.

3.6. 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 *Delonix regia* and *Albizzia julibrissin* plant were scored as a result of exposure time of 30 sec. and they were (1.859 and 1.843min/g) and (1.807 and 1.814 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 *Delonix regia* and *Albizzia julibrissin* were observed in control plants (1.260 and 1.251 mg/g) and (1.304 and 1.281 mg/g) in both seasons, respectively.

Table 6: Means of phenol and indole content and peroxidase activity of *Delonix regia* and *Albizzia julibrissin* 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**
Delonix regia	**Control**	3.072	3.147	0.850	0.859	1.260	1.251
	5 Sec.	3.455	3.509	0.917	0.898	1.327	1.308
	10 Sec.	3.376	3.409	0.876	0.874	1.433	1.425
	15 Sec.	3.321	3.358	0.855	0.849	1.530	1.521
	20 Sec.	3.234	3.301	0.790	0.807	1.659	1.644
	25 Sec.	2.938	3.046	0.757	0.783	1.770	1.749
	30 Sec.	2.929	3.035	0.740	0.773	1.859	1.843
L.S.D. at 0.05		**0.082**	**0.037**	0.024	**0.011**	**0.031**	**0.070**
Albizzia julibrissin	**Control**	3.088	3.086	0.792	0.827	1.304	1.281
	5 Sec.	3.386	3.375	0.866	0.868	1.341	1.334
	10 Sec.	3.244	3.307	0.832	0.853	1.397	1.396
	15 Sec.	3.123	3.219	0.802	0.818	1.468	1.450
	20 Sec.	2.995	3.188	0.770	0.791	1.612	1.581
	25 Sec.	2.842	2.932	0.734	0.756	1.740	1.715
	30 Sec.	2.830	2.923	0.728	0.744	1.807	1.814
L.S.D. at 0.05		**0.031**	**0.024**	**0.009**	**0.006**	**0.075**	**0.094**

4.Inter-Simple Sequence Repeat (ISSR) Fingerprinting Technique: in *Delonix regia* and *Albizzia julibrissin* Plant:

The Inter Simple Sequence Repeat (ISSR) represents genomic areas in the plants *Delonix regia* and *Albizzia julibrissin.* Species boundaries can be established using sequences amplified by ISSR-PCR. A simple, low-cost, reliable multilocus marker system called ISSR-PCR has been utilised to analyse genetic variation among various microwave exposure time treatments. The ensuing PCR reaction enhances the relationship between the two ISSR, resulting in a multilocus marker framework useful for genome mapping and fingerprinting. The ISSR-PCR method is utilised in this study to identify the genetic diversity among various microwave exposure time treatments.

For their capacity to amplify the genomic DNA of the *Delonix regia* and *Albizzia julibrissin* and its variations, four primers were tested. With a mean value of 10.5 bands per primer in the two plants, respectively, the number of DNA fragments amplified varied from 6 to 36 depending on the primer and the DNA sample. (Table: 7).

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

ISSR Primers	Samples Polymorphism (%)													
	Delonix regia							*Albizzia julibrissin*						
	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**	**0.0**	**0.0**	**16.7**	**0,0**	**16.7**	**30.8**	**0.0**	**0.0**	**6.7**	**18.2**	**20.0**	**7.1**	**31.3**
Second	**25.0**	**8.3**	**0.0**	**0.0**	**18.2**	**18.2**	**9.1**	**21.4**	**0.0**	**0.0**	**11.1**	**11.1**	**20.0**	**11.1**
Third	**11.1**	**0.0**	**0.0**	**11.1**	**11.1**	**0.0**	**0.0**	**0.0**	**10.0**	**0.0**	**11.1**	**0.0**	**0.0**	**0.0**
Fourth	**12.5**	**14.3**	**0.0**	**0.0**	**0.0**	**12.5**	**14.3**	**22.2**	**0.0**	**0.0**	**0.0**	**10.0**	**9.1**	**0.0**
Average	**12.5**	**5.6**	**0.0**	**6.9**	**7.3**	**11.8**	**13.5**	**10.9**	**2.5**	**1,7**	**10.1**	**10.7**	**9.0**	**10.6**

Fragments ranged in size from 100 to 1000 bp. The four primers generated 105 fragments in total. Of these, 105 amplified (61.9%) were polymorphic in at least one often genotype (one cultivar and eight somaclones). Figures 1a and 1b, however, display the amplification profiles produced by primer 14 across the *Albizzia julibrissin* and its somaclones as well as *the Delonix regia.* The primer 14's 8 Scandinavian bands varied between the *Delonix regia* and *Albizzia julibrissin* genotypes.

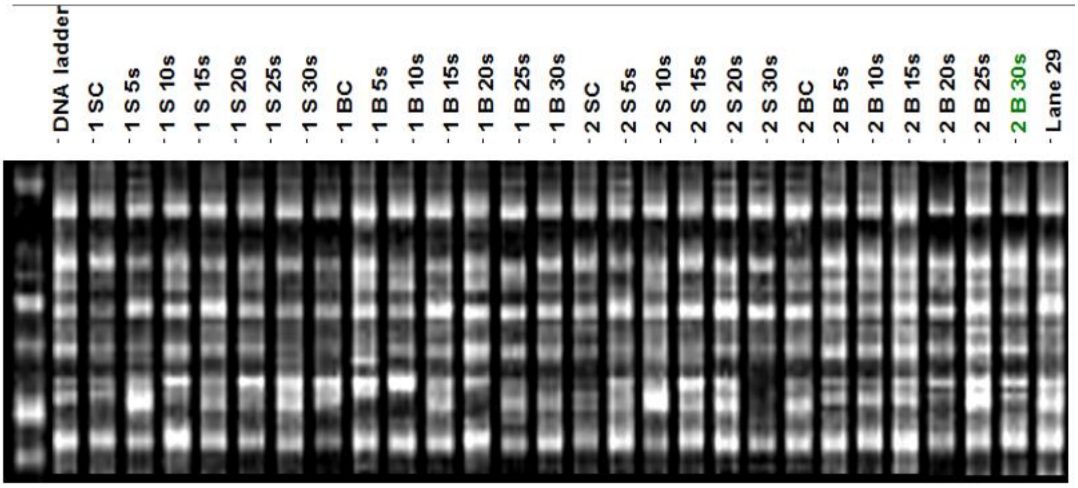

Fig. 1a.: the finger printing technique of first and second primers for seven *Delonix regia* treatments and seven *Albizzia julibrissin* treatments.

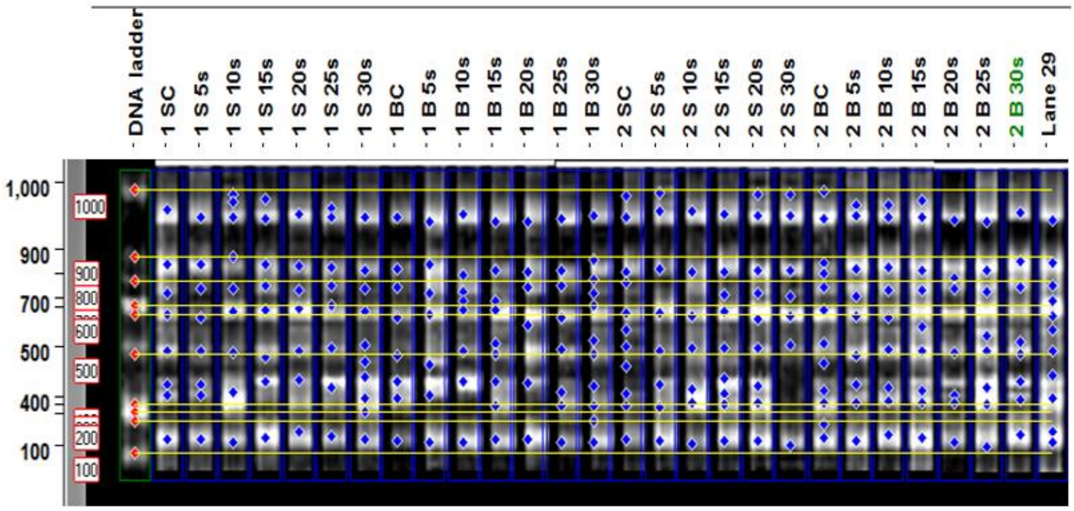

Fig.1b.: Computerized fragments length calculation of Inter-Simple Sequence Repeat (ISSR) fingerprinting technique of first and second primers for seven *Delonix regia* and *Albizzia julibrissin* samples.

Delonix regia and Albizzia julibrissin seedlings were used in the experiment to estimate fingerprinting, and all treatments produced results that were similar for the majority of the features that were being evaluated from the microwave exposure period. While none of the treatments had any genetic mutations compared to the control treatment, this indicates that microwave irradiation has no effect on the genetic makeup (Figure 1and2).

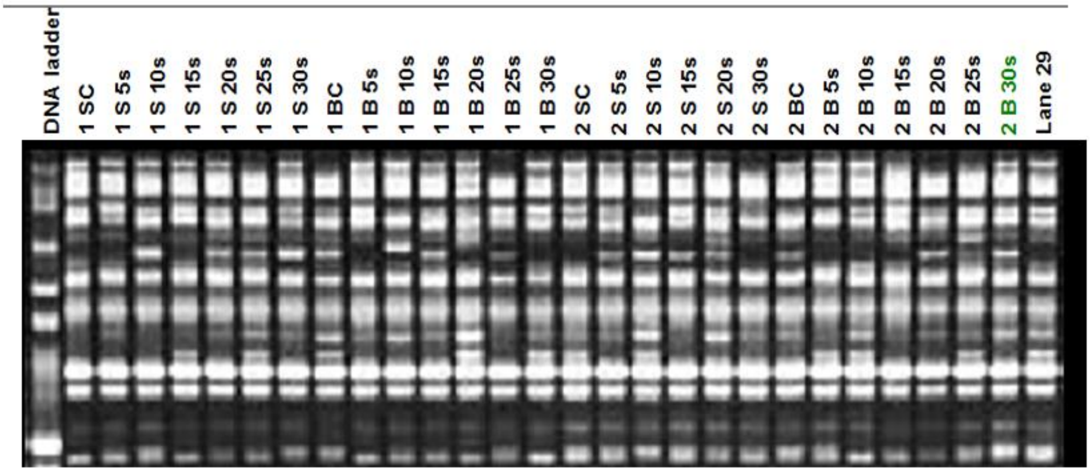

Fig. 2a.: the fingerprinting technique of third and fourth primers for seven *Delonix regia* treatments and seven *Albizzia julibrissin* treatments.

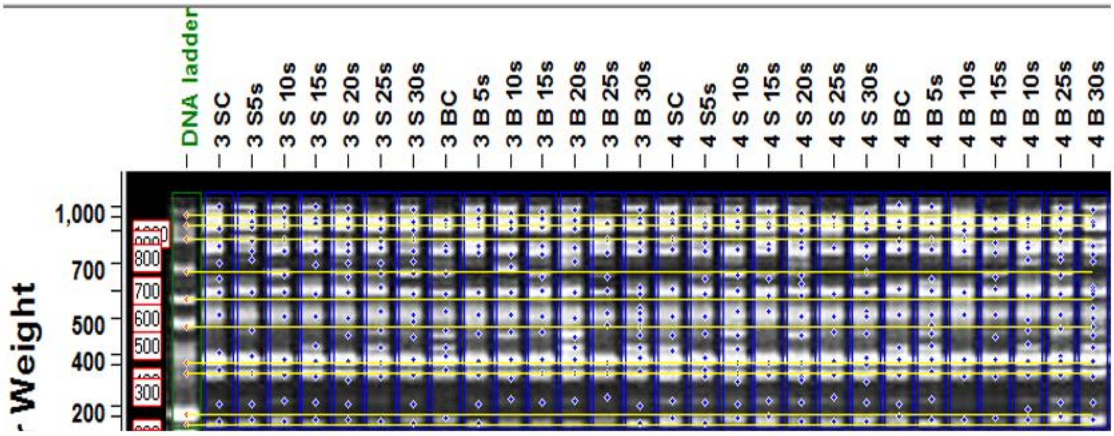

Fig 2b.: Computerized fragments length calculation of Inter-Simple Sequence Repeat (ISSR) fingerprinting technique of third and fourth primers for seven *Delonix regia* and *Albizzia julibrissin* samples.

The findings of this study support the value of utilising molecular techniques. To confirm that microwave treatments and the duration of radiation exposure had an impact on the genetic makeup of the seeds, as demonstrated in (Figs. 1&2).

DISCUSSION

Because plants are highly sensitive to external environmental influences, both internal cues and exterior environmental factors can affect a plant's growth. The impact of microwave radiation on plants depends on how temperature and electromagnetism affect them. The effects of different microwave exposure times on seed germination, vegetative growth, and chemical components are the results covered in this section. With an increase in exposure time from 5 seconds to 30 seconds in *Delonix regia* and *Albizzia julibrissin,* compared to control treatment, a decrease in seed germination is seen in all seed samples.

The germination rate of lentil (Lens culinaris) seeds exposed to microwave power of 450–730 W for 30 S is shown to be significantly improved by certain dosages of microwave irradiation in previous investigations. However, for longer exposure times (60 and 90 S.)(Aladjadjiyan, 2010), this rate was inhibited. The outcomes showed that pretreatment with microwaves improved several enzyme activities, germination rate, and growth vigor(Chen *et al.,* 2009). Increased microwave exposure time resulted in a decrease in the trend for vegetative growth and chemical components in wheat, green gramme, and Bengal gramme compared to the control (Ragha *et al.,* 2011).

Microwave exposure to radish seedlings may restrict water flow across the cell membrane, shutting the aquaporins and slowing growth. Because the cell can only partially repair damages done at the membrane level, the growth rate increased after the radiation was removed. There is widespread agreement that exposure to microwave radiation has a negative thermal impact on biological systems. Because a small temperature increase (up to 25 oC) has been shown to promote germination and growth in radish seeds, we assume that the damage caused by the low power microwave exposure, in this case, is non-thermal (Scialabba and Melati, 1995)

The establishment of the root and shoot systems is a part of the subsequent seedling growth. The primary causes of hypocotyl growth are cell elongation and/or expansion. The low power 0.5 GHz irradiation hinders seed germination by decreasing the rate and percentage of germination in radish seeds and lengthening the germination meantime. The influence of microwave on seed germination performance can be seen in the reduction of hypocotyl growth (which gradually decreases as power is increased) and growth delay (D'Inzeo *et al.*, 1988).

According to their activities and substrate specificity, peroxides in higher plants can be divided into two main categories. Guaiacol peroxides appear to have a variety of peroxidative roles in cells despite their limited substrate specificity. For the neutralisation of H_2O_2, organic hydroperoxides, and lipid peroxides, additional peroxides such as glutation peroxidase (Beeor-Tzahar *et al.,* 1995) and ascorbat peroxides (Asada, 1992) are essential. Guaiacol peroxides have so far been discovered in maize mitochondria, cell walls, cytosol, extracellular space, and vacuoles (Asada, 1992; Prasad *et al.,* 1995); in contrast, ascorbat peroxides are primarily detected in chloroplast and only slightly in cytosol and glyoxisomes (Asada, 1992; Asada *et al*., 1993; Mittler and Zillinskas, 1993 and Bunkelmann and Trelease, 1996).

Peroxides alter the redox equilibrium of the cell involved in plant development (Broin*et al.,* 2002), as well as the calcium-mediated signal transduction required for the stimulation of a plant's response to stress stimuli (Kawano, 2003). Additionally, it has been established that ascorbat peroxides, one of the peroxides from Arabidopsis, are the key enzyme in the complex responsible for neutralising free radicals (Davletova *et al.,* 2005). Ascorbate peroxides, a type of peroxide produced by mitochondria, have been shown to be crucial for maintaining homeostasis and promoting root growth in Arabidopsis under various stress situations (Finkemeier *et al.,* 2005).

The *Acacia species* did not yield any comparable or contradictory results, while Artemisia vulgaris (Kumar and Ranjitha, 2009), Glycine max L. (Radhakrishnan and Ranjitha, 2009), and *Plumbago zeylanica* L. did (Rout *et al.,* 2010). No research has been conducted to refute these findings. The *Delonix regia* and *Albizzia julibrissin* proteins, which are found in arid locations and in Antoniades Garden, are discussed in this research. Due to the severe challenges facing these priceless plants, which have shown some evidence of being a useful resource for the desert ecosystem and arid environment, much attention needs to be paid to dry species.

These findings suggested that attractive crops could benefit from the application of the ISSR approach. When *Delonix regia* and *Albizzia julibrissin* and their somaclones are characterised using ISSR analysis, alterations created during culture can be detected, and samples taken later on in the process can be used to determine when the modification was produced (Martin *et al.,* 2002).

CONCLUSION

The findings of this study highlighted the need for *Delonix regia* and *Albizzia julibrissin* seeds to be exposed to the shortest possible microwave exposure duration (5 and 10 seconds) prior to sowing in seed beds in order to encourage a high germination rate and create uniform seedlings.

In general, it was discovered that microwave use, at various doses, had an impact on the rejuvenation of seed germination of *Delonix regia* and *Albizzia julibrissin*. Since there are no genetic differences between *Delonix regia* and *Albizzia julibrissin* seedlings according to protein analysis, the microwave radiation dose served as a refresher for seed germination. Therefore, in addition to conventional ways, it can be employed as a non-traditional method of seed germination.

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ARABIC SUMMARY

تأثير الموجات القصيرة على إنبات البذور ومعدل النمو فى بعض أجناس أشجار العائلة البقولية فى حديقة أنطونيادس (ب) البوانسيانا واللبخ الأحمر

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أجريت هذه الدراسة خلال موسمى 2019 و 2020 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 *Delonix regia* و *Albizzia julibrissin* . تم تعريض البذور 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 أفضلالنتائج المتحصل عليها سجلت عند تعريض بذور و, *Delonix regia* و *Albizzia julibrissin* لمدة 5 و10 ثوانى من أشعة الميكروويف فى كلا الموسمين على التوالى.