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STUDIES ON SEED GERMINATION OF SAUSAGE TREE (*KIGELIA PINNATA* (JACQ) D.C.)

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ABSTRACT: *The present study was conducted under the full sun at the nursery of Orman Botanic Garden, Hort. Res. Inst., Giza, Egypt during 2014 and 2015 seasons in order to reveal the response of Sausage tree (Kigelia pinnata (Jacq) D.C.) seeds to some pregermination treatments including, seeds without treatment (control), soaking in tap water for either 24 or 48 hours under room temperature, soaking in hot water (60-70 °C) for 24 h. and soaking in diluted sulphuric acid (50 %) for either 1 or 2 h. which followed by soaking in tap water for only 12 h. under room temperature in a complete randomized experiment, with 3 replicates of 10 seeds. The results of the study have shown that the maximal percent of germination was achieved in the two seasons by soaking the seeds in tap water for 48 h treatment which followed by soaking also in tap water, but only for 24 h, while the least germination % was attained in both seasons by soaking either in hot water (24 h) or in diluted H_2SO_4 (1 or 2 h.). The tap water soaking for 48 h treatment was also accelerated germination rate and velocity more than the control, but hot water and diluted H_2SO_4 treatments significantly delayed them. Most of the used treatments slightly improved the mean of germination rate index with non-significant differences in between, whereas the means of vigour index, seed viability, hypocotyl length of the germinated seeds, seedling and root lengths, No. leaves/seedling, fresh and dry weights of leaves and roots, as well as leaves content of chlorophyll a, b, carotenoids and total soluble sugars were only improved by soaking in tap water for 48 h treatment that recorded the highest averages compared to control in most cases of both seasons. The leaf content of total indoles was fluctuated in both seasons, while that of total phenols was markedly decreased only in the seedlings generated from the seeds soaked in tap water, especially for 48 h., as this treatment generally gave the best equilibrium between total indoles and total phenols content in the two seasons.*

Hence, it can be advised to soaking the seeds of Sausage tree in tap water for 48 h. before sowing under the ambient conditiops to get the best germination traits and highest quality of the seedlings.

Key words: *Ornamental trees, Sausage trees (Kigelia pinnata), seed germination, pregermination treatments.*

INTRODUCTION

The Sausage tree (*Kigelia pinnata* (Jacq) D.C. Syn. K. africana), a tree that belongs to Fam. Bignoniaceae, native to Tropical Africa, growing up to 20 m tall; the park is grey and smooth at first, peeling on older trees. The wood is pale brown or yellowish, undifferentiated and not prone to cracking (Roodt, 1992). It is evergreen where rainfall occurs throughout the year, but deciduous where there is a long dry season. The leaves are opposite or in whorls of 3, 30-50 cm, pinnate with 6-10 oral leaflets up to 20 cm long. The terminal leaflet can be either present or absent. The flowers (and later the fruits) hang down from branches on long flexible stems (2-6m long). Their scent is most notable at night. The fruit is woody berry from 30-100 cm long and up to 18 cm broad, it weights between 5-10 kg and hangs down on long, rope-like peduncles. Its pulp is fibrous and contains numerous seeds, it is eaten by several species of mammals (Huxley, 1992).

This tree is widely grown as an ornamental tree in tropical regions for its decorative flowers and unusual fruits. The fruit is believed to be a cure for a wide range of ailments, from rheumatism to syphilis and snake bites. An alcoholic peverage similar to beer is also made from it. The fresh fruits are prepared for consumption by drying, roasting or fermentation (Roodt, 1992).

The tree is mainly propagated from fresh seeds or from truncheons, seeds usually germinate through 25-30 days because they are parasitized in the velds by insects that make small holes in the exocarps, and that accelerates germination although the seeds are viable for one season only (Site1, 2012). However, information in the literature about seeds germination of Sausage tree are very limited, while several reports are available for other trees. In this regard, Scalon *et al.*, (2008) found that soaking the seeds of *Pyrostegia venusta* (Bignoniaceae) in tap water for 24 h led to higher germination percentage and velocity and higher seedling fresh and dry matter. Likewise, Trivedi and Joshi (2014) recorded that fresh seeds of *Stereospermum suaveolens* (Bignoniaceae) pre-soaked overnight in distilled water showed maximum percent of germination and higher seedling growth.

Similar observations were also revealed by Agba *et al.*, (2005) on *Mucuna flagellipes,* Uniyal *et al.*, (2007) on *Dalbergia sissoo*, Negi and Madwal (2008) on *Bauhinia variegata, Grewia disperma, Schleichera oleosa* and *Terminalia bellirica,* Merou *et al.*, (2011) on *Albizia julibrissin*, Azad *et al.*, (2013) on *Tamarindus indica*, Shahin *et al.*, (2015) on *Calliandra haematocephala* and Shahin *et al.*, (2015) whom declared that soaking seeds of *Dillenia indica* in tap water for 72 h greatly improved germination percentage and velocity, mean germination rate, germination rate index, vigour index, seeds viability, plumule length, growth and dry matter of the generated seedlings, as well as leaf content of pigments, total soluble sugars and indoles.

However, the purpose of this work is to find out the best suitable pre-sowing treatment for enhancing and accelerating germination of Sausage tree seeds plus improving growth and quality of the new formed seedlings.

MATERIALS AND METHODS

The current work was carried out under the full sun at the nursery of Orman Botanic Garden, Hort. Res. Inst., ARC, Giza, Egypt throughout the two successive seasons of 2014 and 2015 to study the response of Sausage tree seeds to some pre-sowing ordinary treatments.

Thus, the woody berry fruits of Sausage tree (*Kigelia pinnata* (Jacq) D.C.) were obtained from Giza Zoo on tenth of March for each season and fermented in stagnant water till the fibrous pulp rot and soften, then the seeds were gently get out, washed in running water and dried in the shade for 1 day. On the first of May in each season, the dried seeds (the mean weight of 10 seeds ranged between 1.12-1.16 g) were sterilized with sodium hydrochloride solution (10 %) for 10 minutes, next rinsed several times with sterile distilled water, then subjected to the following pre-sowing treatments.

1. Seeds without treatment (control).
2. Soaking in tap water for either 24 or 48 hours under ambient air conditions.
3. Soaking in hot water (60-70 °C) for 24 hours.
4. Soaking in diluted sulphuric acid (50 %) for either 1 or 2 hours, followed by soaking in tap water for 12 hours under ambient air conditions.

The treated seeds and those of control were sown directly after treatment in 16-cm-diameter plastic pots filled with about 1.5 kg of sand and Al-Obour compost mixture (2 : 1, by volume). The physical and chemical analyses of the sand and Al-Obour compost used in the two seasons are shown in Tables (1) and (2), respectively.

Table (1): The physical and chemical analyses of the sand used in both seasons.

Particle size distribution (%)				S.P.	E.C. (dS/m)	pH	Cations (meq/l)				Anions (Meq/l)		
Coarse sand	Fine sand	Silt	Clay				Ca^{++}	Mg^{++}	Na^{+}	K^{+}	HCO_3^-	Cl^-	SO_4^-
79.83	9.58	3.53	7.06	22.46	3.50	7.78	13.46	4.98	20.41	0.63	3.58	17.96	17.94

Table (2): The physical and chemical analyses of compost Al-Obour used in the two seasons.

Character	Content	Character	Content	Character	Content
Weight of/m^3 (kg)	500-550	Organic matter(%)	34-38	Fe (ppm)	1500-1800
Humidity (%)	25-30	Organic carbon(%)	19.8-22	Mn (ppm)	25-50
pH (1-2.5)	7.5-8.0	C/N ratio	1-14.2	Cu (ppm)	50-75
Ec (mmhos/cm^2)	3-3.5	NaCl (%)	1.1-1.25	Zn (ppm)	150-225
Water hold capacity (%)	250-300	Total P (%)	0.5-0.75	Weed seeds	00.00
Total N (%)	1-1.4	Total K (%)	1.25-1.75	Nematoda	00.00

- The used compost manufactured from plant residues and free from heavy metals and pollution. Analyses were done by: Producer Company.

A completely randomized design was used in the two seasons with three replicates as each pot contained 10 seeds stands for one replicate (Mead *et al.*, 1993). Clearly visible hypocotyls protrusion was used as a criterion for germination. All agricultural practices needed for seeds care were carried out on the proper time. Number of germinated seeds was daily counted. At the end of each season (on June, 30th), data were recorded as follows:

1. Germination characteristics:-

1) Germination percentage (G %) from the following equation:
   G. % = No. germinated seeds/ Total No. sown seeds x 100
2) Germination velocity (G.V.) in days, which equal average number of days from sowing till emergence of the final hypovotyl.
3) Mean germination rate (MGR) in days = mean number of days till 50 % germination (Odetola, 1987).
4) Germination rate index (GRI), which calculated from Bartled equation indicated by Hartmann and Kester (1983). GRI = A + (A + B) + (A + B + C) + ... /N (A + B + C ....).
   - Where: A, B, C, ... etc. are number of germinated seeds counted at different times, and N is number of times at which the germinated seeds were counted.
5) Vigour index (VI) = G % x mean length of hypovotyl (Selvaraju and Selvaraj, 1994)
6) Seed viability (SV) = number of survived seedlings in each treatment after excluding the deteriorated and dead ones (Odetola, 1987).
7) Hypocotyl length of the germinated seeds (cm).

2. Seedling growth characters:-

Samples from the produced seedlings under the different used treatments were gently lifted to measure: seedling length (cm), number of leaves/seedling, root length (cm) and leaves and roots fresh and dry weights (g).

3. Chemical determinations:-

In fresh leaf samples, the photosynthetic pigments (chlorophyll a, b and carotenoids, mg/g. f.w.), the percent of total soluble sugars, as well as total indoles and total

phenols (mg/100 g f.w.) were measured according to the methods described by Yadava (1986), Dubois *et al.*, (1966), A.O.A.C (1990) and William *et al.*, (1965), respectively.

Data were then tabulated and statistically analyzed using SAS (2009) program, which was followed by Duncan's New Multiple Range Test (Steel and Torrie, 1980) to verify the significancy between the means of various treatments.

RESULTS AND DISCUSSION

Effect of pre-germination treatments on:

1- Germination characteristics:

It is obvious from data averaged in Table (3) that the maximal percent of germination (100 %) was achieved in the two seasons by soaking the seeds in tap water for 48 h treatment and was followed by soaking in tap water for 24 h treatment, which raised the mean of this parameter to 80 % with significant differences compared to control treatment that gave 65.83 % germination in the first season and 67.33 % in the second one. This may indicate the ability of the seeds to absorb tap water well, especially when they immersed in it for longer period, and that of course activates hydrolysis enzymes which decompose the complex food reserves to simple sugars supply the embryo with energy necessary for its growth (Agba, *et al.*, 2005). In this regard, Uniyal *et al.*, (2007) noticed that soaking of *Dalbergia sissoo* seeds in tap water for 24 h. favoured germination up to 96.84 % against 68.42 % for control.

On the other side, the least percent of germination was attained in both seasons by soaking either in hot water for 24 h or in diluted sulphuric acid (50 %) for 1 or 2 h., as these 3 treatments reduced germination % to 50.47, 50.00 and 41.67 % in the first season and to 52.50, 50.16 and 40.83 % in the second one compared to control (Photo, 1).

This may be attributed to subjecting the embryo to deterioration by either sulphuric acid or hot water. In this concern, Chikumba *et al.*, (2006) stated that the 10-min sulphuric acid treatment increased germination of *Macrotyloma daltonii* seeds from 21 to 38 %, but 20-min treatment reduced germination and increased the number of dead seeds. Souza *et al.*, (2012) found that after treatment of *Cassia tora* seeds with hot water, the lens detached from the coat, and that prevented the water from contacting the lens inhibited water absorption in hot-water-treated seeds. Thus, hot water had no effect on seed germination. This result was emphasized by Pant and Chauhan (2013) who revealed that hot water treatment increased germination % of *C. tora* seeds at 50 °C (44.54 %), while further increase in temperature drastically reduced the germination. Likewise, Kavita and Kumar (2014), reported that seeds of *Stylosanthes guianensis* cv. Cook treated with hot water showed maximum death compared to other treatments.

The least number of days passed to score either 100 % germination (G.V.) or 50 % germination (MGR) was also recorded by soaking in tap water treatment for 48 h was and followed directly by soaking treatment for only 24 h. On the contrary, soaking the seeds in either hot water or diluted H_2SO_4 significantly elongated these two parameters relative to control in most cases of both seasons. The mean of germination rate index (GRI) was slightly increased over control by the accomplished treatments with few exceptions in the two seasons, while the means of vigour index (VI), seed viability (S.V.) and hypocotyl length of the germinated seeds (cm) were improved only by soaking treatments in tap water, especially for 48 h one which gave the highest records in the two seasons. This may be ascribed to that prolonging soaking time to 48 h. gave a chance for tap water to penetrate the hard seeds in amount sufficient to activate germination more than the other treatments.

Table (3): Effect of pregermination treatments on germination traits of *Kigelia pinnata* (Jacq.) D.C. tree seeds during 2014 and 2015 seasons.

Pre-germination treatments	Germination percentage (G. %)	Germination velocity (G.V., day)	Mean germination rate (MGR, day)	Germination rate index (GRI)	Vigour index (VI)	Seed viability (S.V.)	Hypocotyl length (cm)
First season: 2014							
Control	65.83c	30.14b	27.21b	0.57a	5.00c	67.81c	1.03b
Soaking in tap water (24 h.)	80.00b	27.57c	23.20c	0.56a	7.33b	88.00b	1.10b
Soaking in tap water (48 h.)	100.00a	25.30d	14.40d	0.60a	10.00a	133.00a	1.33a
Soaking in hot water (24 h)	50.47d	32.25a	32.25a	0.60a	3.10d	41.89d	0.83c
Soaking in diluted H_2SO_4 (1 h.)+ soaking in tap water (12 h.)	50.00d	30.63b	30.63a	0.60a	3.18d	35.50d	0.71d
Soaking in diluted H_2SO_4 (2 h.)+ soaking in tap water (12 h.)	41.67e	33.25a	-	0.63a	2.50d	37.50d	0.90c
Second season: 2015							
Control	67.33c	31.28bc	28.00b	0.57a	4.67c	67.33c	1.00bc
Soaking in tap water (24 h.)	80.00b	29.56c	24.79c	0.58a	7.00b	89.60b	1.12b
Soaking in tap water (48 h.)	100.00a	26.00d	15.08d	0.60a	10.00a	131.00a	1.31a
Soaking in hot water (24 h)	52.50d	34.60a	34.50a	0.61a	3.00d	44.63d	0.85c
Soaking in diluted H_2SO_4 (1 h.)+ soaking in tap water (12 h.)	50.16d	32.78b	32.71a	0.61a	3.00d	35.11de	0.70d
Soaking in diluted H_2SO_4 (2 h.)+ soaking in tap water (12 h.)	40.83e	35.67a	-	0.63a	2.50d	34.30e	0.84c

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

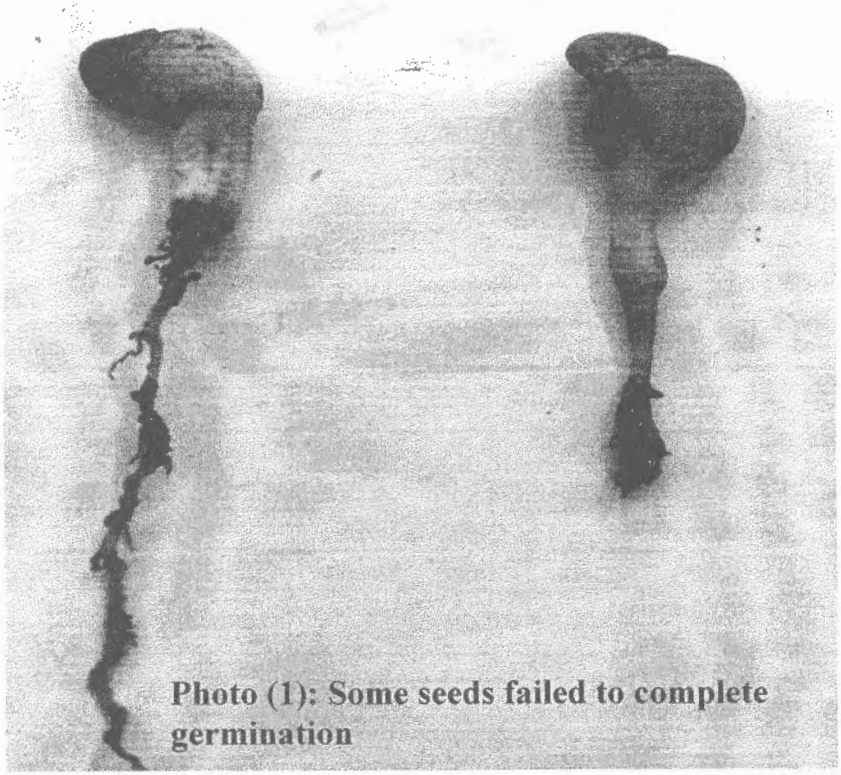

Photo (1): Some seeds failed to complete germination

The present findings conform with previous ones mentioned by Scalon *et al.*, (2008) on *Pyrostegia venusta* and Agba *et al.*, (2005) whom postulated that soaking *Mucuna flagellipes* seeds in water at room temperature for 36-48 h resulted in significantly higher cumulative germination over planting of seeds without pre-soaking. On seeds of *Bauhinia variegata, Grewia disperma, Schleichera oleosa* and *Terminalia bellirica*, Negi and Madwal (2008) claimed that the highest germination % was observed when the seeds were soaked in cold water under normal temperature up to 24 h followed by soaking in hot water up to 12 h > soaking in hot water up to 24 h > soaking in diluted H_2SO_4 up to 10 min., and that depend upon the nature of seed coat.

2- Seedling growth parameters:

Similarly, were those results of vegetative and root growth traits of the seedlings resulted from the germinated seeds (Table, 4), as the means of seedling and root lengths (cm), number of the leaves/seedling and the leaves and roots fresh and dry weights (g) were markedly improved by soaking in tap water treatment for either 24 or 48 h comparing with control treatment, but were decreased by soaking in either hot water or diluted sulphuric acid for any time. However, the superiority in all previous characters was also found due to soaking in tap water for 48 h., which gave the longest length of seedling and root, higher No. of leaves and the heaviest fresh and dry weights of leaves and roots over the control and all other treatments, (Photo, 2) but the inferiority was ascribed to soaking in diluted H_2SO_4 for 2 h + soaking in tap water for 12 h treatment which recorded the least means at all.

Table (4): Effect of pregermination treatments on growth traits of *Kigelia pinnata* (Jacq.) D.C. seedlings during 2014 and 2015 seasons.

Pre-germination treatments	Seedling length (cm)	No. leaves per seedling	Root length (cm.)	Leaves		Roots	
				F.W. (g)	D.W. (g)	F.W.(g)	D.W.(g)
First season: 2014							
Control	6.87b	3.67b	5.10b	0.811c	0.101b	0.088c	0.051bc
Soaking in tap water (24 h.)	8.90ab	4.00b	6.21a	0.989b	0.118ab	0.123b	0.067b
Soaking in tap water (48 h.)	9.51a	5.33a	6.80a	1.215a	0.137a	0.190a	0.089a
Soaking in hot water (24 h)	5.90bc	3.31b	5.40b	0.742d	0.083bc	0.091c	0.046bc
Soaking in diluted H_2SO_4(1h.) + soaking in tap water (12 h.)	5.78bc	3.40b	4.96bc	0.637e	0.071c	0.079cd	0.044bc
Soaking in diluted H_2SO_4(2h.) + soaking in tap water (12 h.)	4.33c	2.38c	2.87c	0.533f	0.058c	0.058d	0.031c
Second season: 2015							
Control	7.03b	3.80b	5.20b	0.842c	0.105b	0.090c	0.052bc
Soaking in tap water (24 h.)	9.13ab	4.21b	6.67a	1.041b	0.126ab	0.133b	0.073b
Soaking in tap water (48 h.)	10.00a	5.61a	7.30a	1.279a	0.145a	0.204a	0.097a
Soaking in hot water (24 h)	6.24bc	3.38b	4.63b	0.758d	0.085bc	0.079cd	0.050c
Soaking in diluted H_2SO_4(1h.) + soaking in tap water (12 h.)	6.15bc	3.60b	4.70b	0.676e	0.076c	0.071c	0.041c
Soaking in diluted H_2SO_4(2h.) + soaking in tap water (12 h.)	5.11c	2.57c	3.75c	0.583f	0.066c	0.076c	0.041c

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

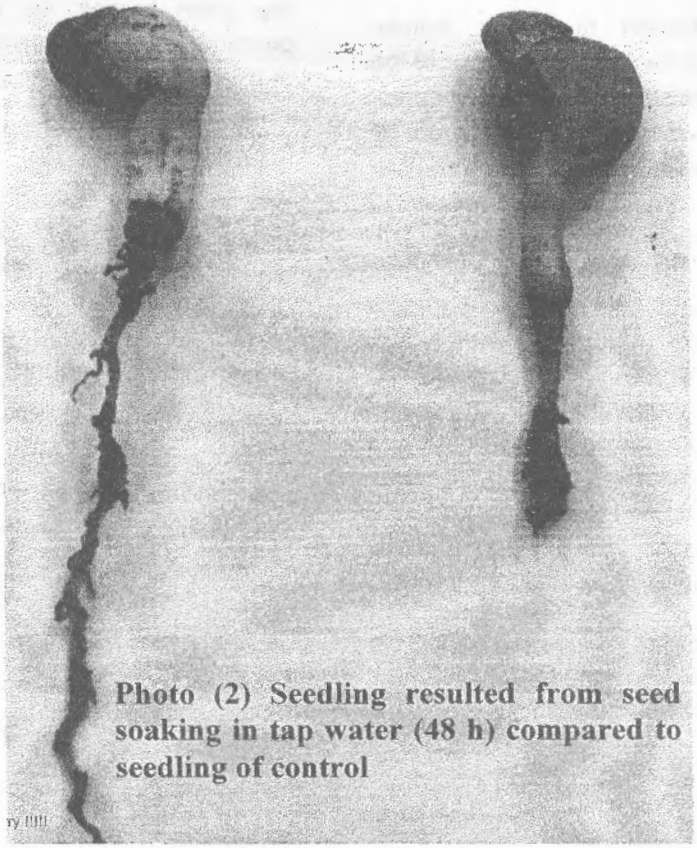

Photo (2) Seedling resulted from seed soaking in tap water (48 h) compared to seedling of control

Improving growth of the seedlings generated from seeds soaked in tap water may be attributed to that this treatment accelerated germination rate by about 13 days before control treatment and about 16-18 days before diluted H_2SO_4 treatments. So, the seedlings took a chance to grow well, while seeds under other treatments are still dormant. In general, the previous gains are in a good accordance with those revealed by Scalon *et al.*, (2008) on *Pyrostegia venusta*, Merou *et al.*, (2011) on *Albizia julibrissin* and Shahin *et al.*, (2015) on *Calliandra haematocephala*.

3- Leaf chemical composition:

Data illustrated in Table (5) exhibited that pigments content (mg/g f.w.) was progressively increased in the leaves of the seedlings with increasing soaking period in tap water, but descendingly decreased with prolonging soaking period in diluted sulphuric acid relative to control content in most cases of both seasons. Thus, the highest content in the two seasons was registered by treatment of soaking in tap water for 48 h. Hot water treatment, on the other hand, slightly reduced chlorophyll a and b content, but slightly improved carotenoids content in the 1st and 2nd seasons. A similar trend was also obtained regarding the percentage of total soluble sugars that reached to the maximal values in the two seasons by soaking the seeds in tap water for 48 h. This may indicate the role of elongating soaking period in increasing seeds imbibition of water to amount sufficient to hydrolyzing the food reserves to simple sugars necessary for formation of stroma lamella and grana, as well as

chlorophyll appearance during normal leaf growth (Agba *et al.*, 2005).

Data also showed that total indoles content (mg/100 g f.w.) was fluctuated in the two seasons, whereas total phenols content (mg/100 g.f.w.) was greatly decreased by soaking in tap water, especially for 48 h period which decreased such constituent to the minimum values in both seasons. The opposite was the right concerning the effect of hot water and diluted H_2SO_4 treatments which raised total phenols content over control to more than 5- to 6- fold in the first season and to more than 3-fold in the second one. In general, the best equilibrium between total indoles and total phenols was achieved in the two seasons by soaking the seeds in tap water for 48 h treatment as this treatment elevated content of total indoles to the highest values, but decreased total phenols to the minimal ones and this may be the main reason for obtaining the best germination characteristics and high quality of the produced seedlings.

On the same line, were those results explored by Azad *et* al., (2013) on *Tamarindus indica* and Shahin *et al.*, (2015) whom detected that immersing seeds of *Dillenia indica* in tap water for 72 h caused a marked increment in contents of pigments, total soluble sugars and indoles in the leaves of new generated seedlings.

Hence, it is recommended to soak the Sausage tree seeds in tap water for 48 hours under ambient conditions for favouring germination and improving the seedling quality.

Table (5): Effect of pregermination treatments on chemical composition of *Kigelia pinnata* (Jacq.) D.C. seedlings leaves during 2014 and 2015 seasons.

Pre-germination treatments	Pigments content (mg/g. f.w.)						Total soluble sugars (%)		Total indoles (mg/100 g. f.w.)		Total phenols (mg/100 g. f.w.)	
	Chlorophyll (a)		Chlorophyll (b)		Carotenoids							
	2014	2015	2014	2015	2014	2015	2014	2015	2014	2015	2014	2015
Control	1.372	1.48	0.363	0.389	0.197	0.206	3.085	3.138	1.014	1.311	2.045	2.19
Soaking in tap water (24 h.)	1.524	1.646	0.365	0.396	0.256	0.247	3.170	3.332	1.428	1.261	0.789	0.912
Soaking in tap water (48 h.)	1.945	2.101	0.631	0.604	0.387	0.371	3.469	3.599	1.936	1.503	0.313	0.343
Soaking in hot water (24 h)	1.359	1.471	0.343	0.371	0.199	0.215	2.925	3.160	1.063	1.368	11.694	7.867
Soaking in diluted H_2SO_4 (1 h.) + soaking in tap water (12 h.)	1.217	1.318	0.327	0.357	0.185	0.201	2.900	3.102	1.085	1.210	11.865	7.834
Soaking in diluted H_2SO_4 (2 h.) + soaking in tap water (12 h.)	1.269	1.301	0.321	0.396	0.167	0.183	2.737	2.809	1.323	1.096	13.153	7.168

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دراسات على إنبات بذور المشطورة (شجرة السجق أو أم النجف)

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الملخص العربى

أجريت هذه الدراسة تحت الشمس الساطعة بمشتل حديقة الأورمان النباتية، معهد بحوث البساتين، الجيزة، مصر خلال موسمي ٢٠١٤، ٢٠١٥ للتعرف على استجابة بذور شجرة السجق الصلبة (***Kigelia pinnata*** (Jacq) D.C.) لبعض معاملات ما قبل الإنبات والتى اشتملت على: بذور غير معاملة (مقارنة)، النقع في ماء الصنبور لمدة ٢٤ أو ٤٨ ساعة على درجة حرارة الغرفة، النقع فى ماء ساخن (٦٠-٧٠ °م) لمدة ٢٤ ساعة وكذلك النقع في حمض كبريتيك مخفف (٥٠ %) لمدة ساعة، أو ساعتين ثم فى ماء الصنبور لمدة ١٢ ساعة على درجة حرارة الغرفة فى تجربة تامة العشوائية، بها ثلاث مكررات وبكل مكررة عشرة بذور.

أوضحت نتائج هذه الدراسة أن أعلى نسبة مئوية للإنبات فى الموسمين حققتها معاملة النقع فى ماء الصنبور لمدة ٤٨ ساعة وتلتها أيضاً معاملة النقع فى ماء الصنبور ولكن لمدة ٢٤ ساعة فقط، لكن أدنى نسبة مئوية للإنبات فى كلا الموسمين أحرزتها معاملتى النقع فى الماء الساخن (لمدة ٢٤ ساعة) أو فى حمض الكبريتيك المخفف (لمدة ساعة أو ساعتين). أيضاً، أسرعت معاملة النقع فى ماء الصنبور لمدة ٤٨ ساعة من معدل وسرعة الإنبات بدرجة أكبر من المقارنة، بينما أحدثت معاملات النقع فى الماء الساخن أو حمض الكبريتيك المخفف تأخراً معنوياً فى هاتين الصفتين. ولقد حسنت معظم المعاملات المستخدمة بهذه الدراسة من متوسط دليل معدل الإنبات (GRI) بدرجة طفيفة وبدون وجود أية فروق معنوية فيما بينها، بينما تحسنت معنوياً متوسطات دليل قوة الإنبات (VI)، حيوية البذور (S.V.)، طول السويقة الجنينية السفلى للبذور المنبتة، طول الشتلة، طول الجذر، عدد الأوراق/شتلة، الوزن الطازج والجاف للأوراق والجذور وكذلك محتوى الأوراق من كلوروفيللي أ، ب، الكاروتينويدات والسكريات الكلية الذائبة فقط بمعاملة النقع فى ماء الصنبور (٤٨ ساعة) والتى سجلت أعلى المتوسطات مقارنة بالكنترول فى معظم الحالات بكلا الموسمين. أما محتوى الأوراق من الأندولات الكلية فقد كان متقلباً في الموسمين، بينما إنخفض وبشكل واضح محتوى الفينولات الكلية فقط فى أوراق الشتلات الناتجة من البذور التى نقعت فى ماء الصنبور، وبصفة خاصة لمدة ٤٨ ساعة، حيث أعطت هذه المعاملة بشكل عام أفضل توازن بين محتوى الأندولات الكلية والفينولات الكلية فى كلا موسمي الدراسة.

وعليه، يمكن النصح بنقع بذور شجرة السجق (المشطورة) قبل الزراعة فى ماء الصنبور لمدة ٤٨ ساعة على درجة حرارة الغرفة للحصول على أفضل صفات للإنبات وأعلى جودة للشتلات الناتجة.

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