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The Effect of Pre-Sowing Treatments on Seed Germination of *Erythrina humeana* Spreng

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***Keywords**: coral tree, Germination Percentage, Pre-sowing treatments.*

ABSTRACT

This study was carried out to investigate the effect of pre-sowing treatments on seed germination of Erythrina humeana Spreng. The Cold water-treated seeds were soaked in distilled water for 24 hours, hot water-treated seeds were soaked in boiled water (away from heat source) for 24 hours, seeds were immersed in 98% sulphuric acid for 5 minutes (SA 98%-5M), and sulphuric acid 98% treatment seeds were immersed for 15 minutes (SA 98%-15M). Erythrina humeana Spreng grown in the campus of Omar Al-Mukhtar university Albyda, Libya. The following germination parameters were determined: Germination Percentage (GP), Mean Germination Time (MGT), Germination Index (GI), and root length. One-way analysis of variance (ANOVA) was conducted to confirm the variability and validity of the data. The result showed the highest germination was recorded when seeds were treated with hot water and SA 98%-15M. MGT showed no statistical differences observed among the pre-sowing treatments. However, the cold water and SA 98%-5M treatments significantly decreased the GI in Erythrina humeana Spreng. Result found that root length of the seedlings developed under treatments was highest (1.765 cm) in hot water treatment followed by SA 98%-15M treatment (1.35 cm). In the conclusion of the study it was indicated that the hot water and SA 98%-15M treatments break dormancy and promote germination of Erythrina humeana Spreng. The present study will be useful to screen other pre-sowing treatments such as immersing seeds of Erythrina humeana Spreng in absolute sulphuric acid for 20 , 25 ,30 and 60 minutes. Further work is required to develop the pre-sowing treatments to ensure high germination ratio in the field.

تأثير معالجات ما قبل البذر على إنبات بذور *Erythrina humeana* spreng

موسى مسعود   محمد عبد العزيز عمر

أجريت هذه الدراسة للتحقيق في تأثير عدد من معاملات ما قبل البذر (نقع البذور في الماء البارد لمدة 24 ساعة، نقع البذور في ماء ساخن (بعيد عن مصدر الحرارة) لمدة 24 ساعة، وغمر البذور في حمض الكبريتيك 98% لمدة 5 دقائق، وغمر البذور في حمض الكبريتيك 98% لمدة 15 دقيقة) علي إنبات بذور *Erythrina humeana* Spreng التي تنمو في حرم جامعة عمر المختار في مدينة البيضاء- ليبيا. تم تحديد معايير الإنبات التالية: نسبة الإنبات (GP)، متوسط وقت الإنبات (MGT)، مؤشر الإنبات (GI)، وطول الجذير. أجري تحليل التباين (ANOVA) في اتجاه واحد لتأكيد التباين وصلاحية البيانات. واضحت النتائج ان اعلي نسبة للإنبات سجلت في البذور المعاملة بالماء الساخن وحمض الكبريتيك 98% لمدة 15 دقيقة. متوسط وقت الإنبات لم يظهر أي اختلاف احصائي بين المعاملات. معاملة النقع في الماء البارد وحمض الكبريتيك لمدة 5 دقائق خفضت مؤشر الإنبات بشكل كبير في *Erythrina humeana* Spreng. لقد

أوجدت النتائج أن أطول جذر(1.765 سم) للشتلات النامية تحت المعاملات كان في البذور المعاملة بالماء الساخن متبوعا بمعاملة حمض الكبريتيك 98% لمدة 15 دقيقة (1.35 سم). كما أشارت نتائج هذه الدراسة إلي أن المعاملة بالماء الساخن وحمض الكبريتيك 98% لمدة 15 دقيقة كسرت السكون وعززت إنبات بذور *Erythrina humeana* Spreng. ستكون هذه الدراسة مفيدة لتسليط الضوء علي مجموعة اخري من معاملات ما قبل الإنبات مثل غمر البذور في حمض كبريتيك المطلق لمدة 20، 25، 30، 60 دقيقة. في المستقبل مطلوب مزيد من العمل لتطوير معاملات ما قبل الإنبات لضمان نسبة إنبات عالية في هذا المجال.

INTRODUCTION

The name *Erythrina* is derived from the Greek erythros, meaning red, and refers to the bright red flowers. *Erythrina* spp, a member of the Fabaceae (formerly Leguminosae, bean family) encompasses about 200 species (Zhang *et al*., 2016). The name coral tree which is habitually utilized for these plants refers to the ruddy seeds and the brilliant ruddy blooms produced. (Pillay, *et al*., 2001). *Erythrina humeana* Spreng is native to the subtropical and tropical regions of southern east Africa, growing in sub-arid climates. *Erythrina humeana* Spreng could be a deciduous shrub or sometimes a little tree (Mackinder, 1993), regularly multi-stemmed, have little thistles and produces red blossoms on dark bloom stalks that reach out over the foliage. The blossoms are produced on verdant plants but the long, generally free inflorescences are tall over the level of the leaves, which are feebly to unequivocally 3-lobed. Fruit is a Pod and is up to 16cm long (Hennessy, 1991). It is mightily choked between the seeds. In spite of the fact that the pods are dehiscent, the oval, the to some degree smoothed orange-red seeds may stay on the pods until after the new blossoms have showed up. All *Erythrina* species have more noteworthy or lesser amounts of toxic alkaloids, these can be found in all parts of the plant but are ordinarily most concentrated within the seeds. Concentrations different from species to species, in some it is significantly less that the plant is safely used as a food. In many, the alkaloids are utilized for their medicinal effects (*Hennessy*, 1991). The burnt bark of *Erythrina humeana* Spreng is powdered and applied to the umbilical cord of newly born babies for fast healing of the umbilical cord (Dlisani & Bhat**,** 1998**)**. The roots have been used for sprains, tuberculosis and bronchitis (Van Rensburg, 1982). The bark and leaves extracts of have been reported to have an antibacterial activity (Pillay *et al*., 2001). Seeds give the foremost common implies of plant propagation, conservation of hereditary inconstancy, transportation and propagation in angiospermic plants. (Vazquez & Rojas, 1996). Propagation through seeds is rated to be one of the foremost strong, capable and universally applied methods (Hartmann & Kester, 1990). In numerous cases, viable seeds don't grow beneath favorable natural conditions; this event is named seed dormancy. (Taiz & Zeieger, 2002). A few inside components cause dormancy which incorporate seed coat, embryo or inhibitors which impact the seed germination rate (Agrawal & Dadlani, 1995). Therefore, many techniques such as stratification, heating, soaking water or chemical treatment such as hydrogen peroxide, citric acid, and gibberellines (Herranz *et al*., 1999; Narbona *et al*., 2003) are well known to make possible results for breaking dormancy in many species. (Bonner *et al*., 1994). The strategy of overcoming dormancy in hot water submersion were greatly utilized in legume species and considered invaluable and of low cost (Kimura & Islam, 2012; Narbona *et al*., 2003; Masoud & Omar, 2018).
The knowledge of new, more efficient, more economical and practical methods for overcoming seed dormancy in *Erythrina humeana* Spreng can lead to obtaining large amount of germinated seeds to rapid establishment of this species in the field and for the production of seedlings. Therefore, the aim of this study was to evaluate the effects of hot water, cold water and sulphuric acid treatments on the seed germination of *Erythrina humeana* Spreng.

MATERIALS AND METHODS

Seeds collection

The seeds (*Erythrina humeana* Spreng) for the experiment were collected from their localities on the campus of Omar Al-Mukhtar university - Al Bayda,- Libya (604 m above sea level a latitude 32°45`184 N, and a longitude of 21°42`374 `E) (Figure 1). The seeds were later air dried and stored at room temperature before experimentation.

Test for viability

After seed collection, the seed viability was checked by dipping seeds in a flask containing tap water. Seeds having embryo settled down and embryoless seeds floated in the water. Settled down seeds were considered as viable seeds and selected for the study.

Figure (1) The *Erythrina humeana* Spreng tree on the campus of Omar Mukhtar University.

Germination experiment

Cold water-treated seeds were soaked in distilled water for 24 hours at room temperature. Hot water-treated seeds were soaked in boiled water (away from heat source) for 24 hours. Seeds were immersed in 98% sulphuric acid for 5 minutes (SA 98%-5M). Sulphuric acid 98% treatment seeds were immersed for 15 minutes (SA 98%-15M), then seeds were thoroughly washed and rinsed in tap water and distilled water, respectively, to remove all the acid, after which they were germinated in petri dishes. The seeds were placed in 90mm diameter petri dishes with ample amounts of water with four replications (20 seeds per replication). They were checked every day for two weeks for radical protrusion. The following germination parameters were determined Germination Percentage (GP), Germination Index (GI), Mean Germination Time (MGT), and root length which was given according to Hossain (2005).

Germination percentage (GP) calculated as follows:

$$GP = \frac{Total\ seed\ germinated}{Total\ numberof\ seed} \times 100$$

Mean germination time (MGT) using the equation

$$MGT = \frac{\Sigma ni * di}{N} \times 100$$

Where ni = Number of germinated seeds at di days.
di = Incubation period in days at ni
N = Total number of seeds germinated in the treatment.

Germination index (GI) calculated as follows:

GI=(14×n1) + (13×n2) + · · · + (1×n10)

n1, n2 . . . n10 = Number of germinated seeds on the first, second and subsequent days until the 14th day; 14, 13 . . . and 1 are weights given to the number of germinated seeds on the first, second and subsequent days, respectively.

Statistical analysis

Germination data were transformed arcsine before a statistical analysis. One-way analysis of variance (ANOVA) was conducted to confirm the variability and validity of the data. Differences between the treatment means were compared using LSD test at 0.05% probability level. All statistical analyses were done by SPSS.

RESULTS AND DISCUSSION

Germination percentage (GP)

The different pre-sowing treatments differently affected the germination of *Erythrina humeana* Spreng seeds. The highest germination was recorded when seeds were treated with hot water and SA 98%-15M (70 and 50%, respectively). The lowest germination (25%) was found in untreated seeds (control) (Figure 2). This confirms the presence of a strong hard seed coat physical dormancy in the studied species. According to Rolston (1978) and Carvalho & Nakagawa (2000), the seed dormancy of leguminous plants is related to impermeability of seed coat to water due to the solid seed, and coat structure which limit the entry of clamminess into the seeds. Contrariwise, soaking in cold water, and SA 98%-5M (35%) were not significantly different from control seeds compared to untreated seeds (25%) (Table 1).

Table 1: Effects of pre-sowing treatments on germination percentage, mean germination time, root length , and germination index of Ceratonia siliqua L. seeds.

Treatment	GP (%)	MGT (day)	GI	Root length (cm)
Control	25 ^{a}	7.375	0.181^{a}	0.45 ^{a}
Cold water	35^{ab}	8	0.319 ^{a}	0.86 ^{ac}
Hot water	70^{c}	7.412	0.715 ^{b}	1.765 ^{bc}
SA 98%-5M	35^{ab}	6.625	0.303 ^{a}	0.715 ^{ac}
SA 98%-5M	50^{bc}	7.667	0.456 ^{ab}	1.35 ^{bc}

Different letters in the table of the values in column indicate that the values are significantly different ($p<0.05$).Hot water treatments showed better performance than other treatment and differed significantly for all treatment except with SA 98%-15M. Our results consistent the findings Masoud & Omer (2018) who stated that hot water and absolute sulphuric acid treatments were the most effective method in increasing the germination percentage of *Ceratonia siliqua* L. seeds by compared to untreated seeds. Duguma *et al*. (1988) reported high percentage germination in seeds of *Leucaenia leucocephala* Lam and *Acacia nilotica* Lam with increasing ratio of seed weight to hot water volume. Hot water soaking have higher rate germination than tap water (Muhammad & Amusa, 2003). Hot water is utilized and has demonstrated viable in overcoming dormancy of *Leucaena leucocephala* (Lam.) , *Acacia farnesiana* (L.) (Tadros *et al*. 2011) and *Ceratonia silique* L (Masoud & Omar, 2018).
Furthermore, it was observed that seed germination increased with increasing acid concentration and treatment time (Table 1). Similar results were reported by Awodola (1994) and Masoud & Omar (2018) that the treatment time exerted a considerable impact on seed germination.

Mean germination time (MGT)

MGT that is time over which germination took place varied with treatments. SA 98%-5M had the least MGT value of 14 days (Figure 3). No statistical differences (p>0.05) were observed among the both sulfuric acid and soaked water treatments. Masoud & Omar (2018) found that sulphuric acid 50% had the least MGT value of 14 days , while the hot water had the highest MGT value, but Al-Ansari & Ksiksi (2016) found MGT was lowest under distilled water for *Crotalaria. persica* and *Tephrosia.apollinea*. The reduction of MGT in acid treated seeds implies that the dormancy period in these seeds has been reduced due to pretreatment.(Peter-Onoh *et al*. 2017; Kheloufi *et al*. 2019; Masoud & Omar, 2018).

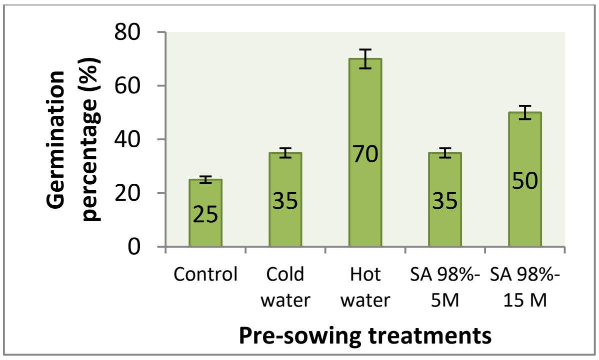

Figure 2. Germination percentages of Erythrina humeana Spreng seeds in four pre-sowing treatments.

Germination index (GI)

Highest GI occurred following hot water treatments compared with the cold water and SA 98%-5M. The cold water and SA 98%-5M treatments significantly decreased the GI in *Erythrina humeana* Spreng (Figure 4).

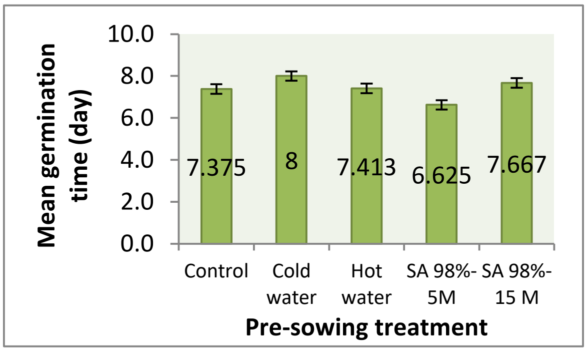

Figure 3. Mean germination time of Erythrina humeana Spreng seeds in four pre-sowing treatments.

Similar results were reported by Masoud & Omar (2018) that GI among sulphuric acid 98% and hot water treatments showed better performance than other treatment. GI was affected statistically only among pre-sowing treatment and no significant differences between both cultivated and wild genotypes of *Ceratonia siliqua* L.(Gunes *et al*. 2019). The lowest GI was in the control for seeds of *Ceratonia siliqua* L., *Crotalaria Persica* and *Tephrosia Apollinea*, while the highest in the mechanical scarification treatment. (Al-Ansari & Ksiksi, 2016; Masoud & Omar, 2018).

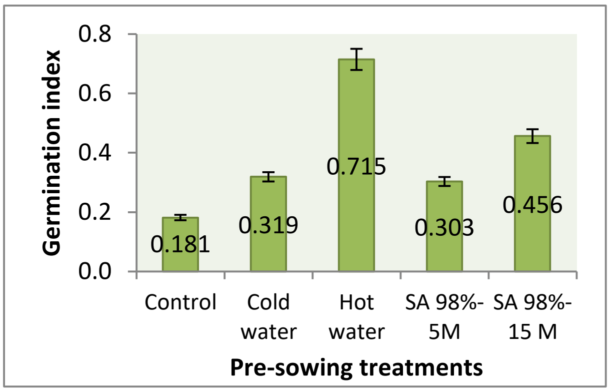

Figure 4. Germination index of Erythrina humeana Spreng seeds in four pre-sowing treatments.

Root length

Root length of the seedlings developed under treatments was highest (1.765 cm) in hot water treatment followed by SA 98%-15M treatment (1.35 cm) which was significantly higher than that of control (Table 1). No statistical differences (p>0.05) were observed among the SA 98%-5M, cold water and control treatments (Figure 5). Hossain *et al*. (2005) also found that pre-sowing treatments have significant impact on initial seedling growth and shoot length (Olatunji *et al*., 2012). The behavior of different pre-sowing treatment was highly significant in root length, where the root length significantly affected by the hot water and sulfuric acid treatment (Masoud & Omar, 2018).

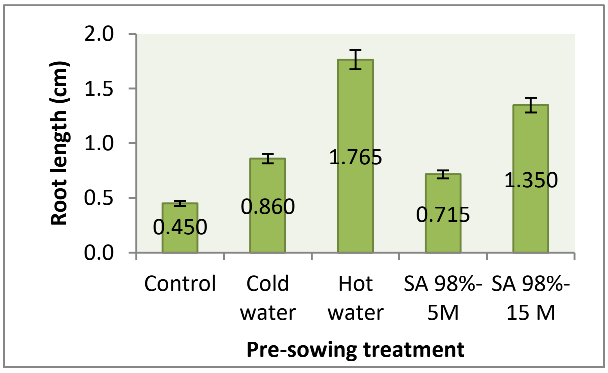

Figure 5. Root length of Erythrina humeana Spreng seeds in four pre-sowing treatments.

CONCLUSION

The present study reveals that *Erythrina humeana* Spreng exhibit physical or exogenous dormancy and is entirely imposed by the hardness of the seed coat. The integument is able to withstand unfavorable conditions such as heat, and mechanical damage prevailing in the natural habitat. In addition, the hot water and SA 98%-15M treatments break dormancy and promote germination of *Erythrina humeana* Spreng. The present study will be useful to screen other pre-sowing treatments such as immersing seeds of *Erythrina humeana* Spreng in absolute sulfuric acid 20, 25 ,30 and 60 minutes. Hence, further work is required to develop the pre-sowing treatments to ensure high germination ratio in the field.

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