Germination Enhancing Treatments for Conserved Seeds of *Corchorus olitorius* L.

Nwosu, J.D.[1]* and Olosunde A.A.[1]

[1]National Centre for genetic Resources and Biotechnology, P.M.B 5382, Moor Plantation, Ibadan Nigeria.
olaraich75@yahoo.com.

Abstract: The effects of different seed treatment methods and durations of exposure on germination of conserved seeds of *Corchorus olitorius*, a traditional leafy vegetable consumed in many parts of Africa, were investigated. Seeds were exposed to eight treatments (water at room temperature, water for 17 hours, and four days, water exposed to sunlight for 4hours, water at 100°c for 5 minutes, water at 100°c for 10 minutes, concentrated Hydrochloric acid for 15 minutes and pre-chilling for 16 hours). Exposure for seed soaked in water for 17 hours was the most effective treatment for enhancing germination (93.3%), followed by Hydrochloric acid for 15 minutes (85.0%) and water for four days (73.3%). Other treatments were less effective. Therefore, soaking seeds in water at room temperature for about 17 hours may be recommended to farmers and research scientists as a simple, cheap and very effective way of germinating conserved seeds of *Corchorus olitorius*.
[Nwosu, J.D. and Olosunde A.A. **Germination Enhancing Treatments for Conserved Seeds of *Corchorus olitorius* L.** *Academ Arena* 2012;4(7):45-49] (ISSN 1553-992X). http://www.sciencepub.net/academia. 10
Key words: Seed, Conserved, Dormancy, Treatment, Exposure, Germination.

1. Introduction

Corchorus olitorius, a wild leafy vegetable with potential for development as a crop is an annual dicotyledonous herb that has been cultivated in India since ancient times (Fox and Norwood 1982; Voster *et al*., 2002). It is one of the leafy vegetables with much use in Nigeria especially in the Western Nigerian axis where it is used mostly in soup delicacies and as a weaning soup for children. The leaves of *Corchorus* are cooked as pot herbs, used in soups and added to salad. Dry leaves are used as a thickener in soups. Previous reports by Ndlovu and Afolayan (2008) indicated that *C. olitorius* is of more nutritional quality in terms of crude protein, iron, calcium and magnesium than cabbage and spinach. The leaves are demulcent, diuretic and tonic which are used in treatment of chronic cystitis, dysuria and gonorrhoea. A cold infusion is said to restore appetite and strength. A fibre (jute) obtained from it have various uses in fibre and paper industries.

Studies have shown that *Corchorus olitorius* among many indigenous vegetable species have sub-optimal germination capabilities that hinder cultivation efforts (Emenger, *et al*., 2004; Modi, 2007). Its seeds tend to show poor germination as a result of mechanical dormancy imposed by impermeable seed coat (Emengor *et al*., Velempini *et al*., 2003). In Botswana for instance, attempts to encourage farmers to cultivate this plant have been fruitless due to poor germination (Velempini *et al*., 2003). Hardseededness is likely to be the most prevalent problem in germination tests for stored seeds, but can be avoided by suitable treatments to the seed covering (Fox and Norwood, 1982). Several studies have been carried out on pre-germination treatments of seeds (Thakur and Sharma, 2005; Farooq *el al*., 2005; Basra *et al*., 2007). These include hot water, mechanical scarification and acid treatment (Hatmann *et al*., 2002; Velempini *et al*., 2003). Previous studies have shown that chemical seed treatment improved germination and growth under various conditions (Kozlowski, 1972; Anonymous, 2007; Ehiagbanare and onyibe, 2007; David and Midcap, 2007; Kak *et al*., 2009). Nkomo and Kambizi (2009) reported that pre-chilling followed by exposure to temperature higher than 30°C encourages germination of *C. olitorius* seeds. Some of the methods may be unfeasible for small scale farmers as well as some laboratories due to the danger of using acids as well as unavailability of controllable temperature baths.

Maintaining good germination percentage and vigour is the most important function of seed storage. Therefore, the objective of this study is to find simple and effective seed treatment methods for breaking of dormancy in conserved seeds of *C olitorius*.

2. Materials and Methods

The experiment was conducted in the Seed Testing Laboratory of National Centre for Genetic Resources and Biotechnology (NACGRAB), Moor Plantation Ibadan, Nigeria. Seeds of three accessions (NHGB/09/141, NHGB/09/142 and NHGB/09/143) of *Corchorus olitorius* conserved for 2 years were collected from the short term Gene bank (20°C, 40% RH) of NACGRAB. The seeds were kept in ambient temperature for 24 hours to acclimatize. 120 seeds were placed in a 200ml beaker and 50ml of concentrated Hydrochloric acid poured unto the seeds. After 15 minutes, the acid was drained off and the seeds were rinsed thoroughly and severally with tap water. Other *C. olitorius* seeds were subjected to the following treatments: Seeds pre-chilled (-20°C) for 16

hours; soaked in water for 17 hours, soaked in water for four days, soaked in water and exposed to sunlight (by placing by the window edge) for 5 hours, soaked in water at 100°C for 5 minutes, water at 100°C for 10 minutes, Hydrochloric acid for 15 minutes and seeds rinsed in water as control. Pre-germination treatments were synchronized in such a way that the seeds were sown at the same time.

After the pre-germination treatments, seeds were sown in closed plastic rubber containers lined with two layers of tissue paper. 40 seeds were used for each treatment and laid out in a randomized complete block design of three replicate. Only the treatment involving exposure to sunlight was restricted in this design. The number of germinated seeds was recorded after 7 days. Data was subjected to Analysis of Variance and significance difference among the means separated for Tukey's Standardized Range (HSD) at $P \leq 0.05$. Percentages were also calculated for viability.

3. Results

Analysis of variance shows a very highly significant ($P<0.001$) difference among the eight treatment means with Treatment 1 having the highest germination across the three genotypes (Table 2). However this was not significantly different from Treatments 2 and 3. The worst germination percentage was recorded for Treatment 8. There was however no significant difference for germination among the three accessions Table 1 and 2.

Again, highly significant ($p<0.001$) interaction was visible among the eight treatments and three accessions (Figure 1). Soaking in water at room temperature for 17 hours and 4 days as well as acid scarification with HCl were very promising over the other treatments (Table 2). Hot water treatment produced a marginal germination result (Table 2).

Table 1. Analysis of variance for germination rates in three accessions of *Corchorus olitorius* subjected to eight treatments

Source	Sum of squares	df	Mean squares	F	Sig.
Treatment	6711.111	7	958.730	33.544	.000
Accession	140.394	2	70.197	2.456	.097
Treatment*Accession	1917.390	14	136.956	4.792	.000
Error	1343.333	47	28.582		
Total	41947.000	70			

Table 2. Accession and treatment interaction for seeds of *Corchorus olitorius*.

Treatments	Germinations			
	NHGB/09/141	NHGB/09/142	NHGB/09/143	Means for treatments
Water 17 for hours	34	40.00	37.33	37.11[a]
Concentrated HCl for 15 min.	24	36.67	32.00	30.89[a]
Water for 4 days	30	32.00	26.00	29.33[a]
Water in sunlight for 8 hours	34	26.00	16.00	25.33[ab]
Pre-chilled for 17hrs	20	16.67	14.67	17.11[c]
Water 100°C for 5 min.	04	12.00	26.00	14.00[c]
Control	06	10.67	10.00	8.89[cd]
Water 100°C for 10 min.	02	6.00	12.00	6.67[d]
Means for accessions	19.25	22.50	21.75	

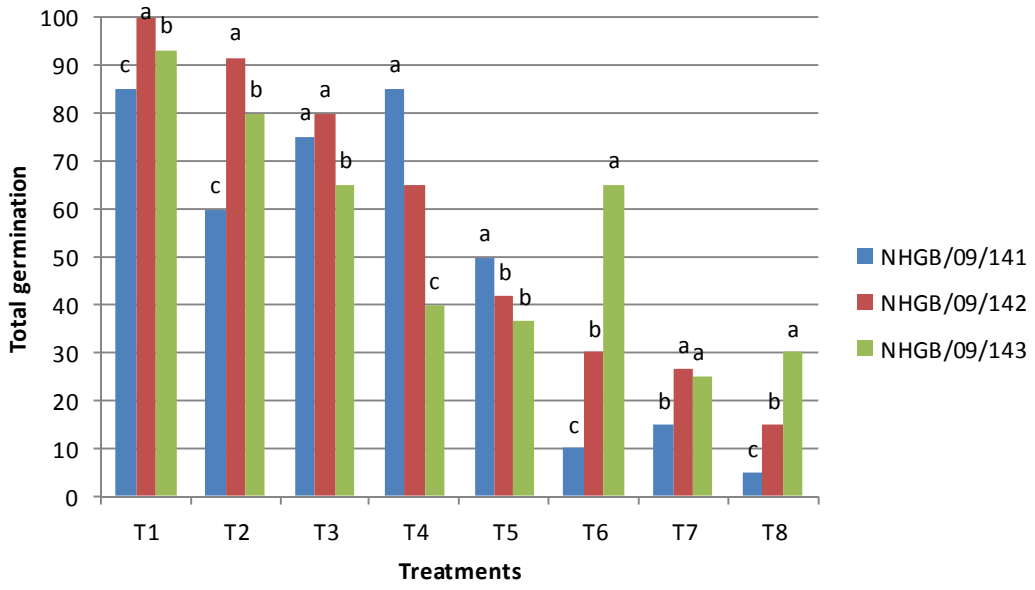

Figure 1. Interaction effects among eight different treatments and genotypes on germination percentages of *Corchorus olitorius* seeds. T1-seeds soaked in water for 17hours, T2- seeds soaked in concentrated HCl for 15mins, T3 – seeds soaked in water for 4 days, T4 – seeds soaked in water and placed in sunlight for 4 hours, T5 – seeds pre-chilled for 17hours, T6 – seeds soaked in 100^{o}c water for 5mins, T7 – control, T8 – seeds100^{o}c water for 10mins. Bars with different letters within the same cluster (T1 – T8) are significantly different at 5% level of significance Tukey's standardized range (HSD).

4. Discussion

This study shows that soaking seeds of *C. olitorius* in water for periods of 17hours and 4 days significantly increased the germination percentage. Most authors reviewed reported hot water treatment. However it has been shown that ordinary water treatment for a longer time may produce a better result. Chemical scarification of *Corchorus* seeds using hydrochloric acid significantly increased germination percentage. Previous studies have shown that chemical seed treatment improved germination and growth under various conditions (Kozlowski, 1972; Anonymous, 2007; Ehiagbanare and Onyibe, 2007; David and Midcap, 2007). Basra *et al*., (2007) reported that seed priming allows for some of the metabolic processes necessary for germination to occur without actual germination of seed. Several authors (Hatmann *et al*., 2002; Velempini *et al*., 2003; Emongor, *et al*., 2004; Mavenghama and Lewu, 2012 have reported the acid scarification of *corchorus olitorius* seeds using Sulphuric acid , but literature on the use of Hydrochloric acid is rare or even non-existent till now. Partly successful dormancy breaking treatment of exposing plants to 25°C in light, 8h/d has been reported by Singh, *et al.,* (1972). Pre-chilling for 17 hours significantly increased germination over the control but was not better than other treatments. Contrary to the study that *Corchorus* seeds show a high degree of dormancy which can be broken by means of hot water treatment (Schippers *et al*., 2002), in this experiment seeds subjected to pre-chilling conditions showed germination significantly better than those exposed to hot water treatment (100^{o}c for 5min). Pre-chilling has also been reported to cause lethal effects on viable seeds (Ren and Tao, 2004) while other studies have implicated it in dormancy breaking of viable seeds and enhanced germination of many species (Baskin *et al*., 2001). This result agrees with the report of Nkomo and Lmbizi (2009).

Hot water treatment did not fare very well as reported by many authors ((Hatmann *et al*., 2002; Velempini *et al*., 2003). The poor result in hot water treatment may be due to the seed size. Mavengahama and Lewu (2012) suggested that heat treatment killed small seeded genotypes. The germination in the untreated seeds of *Corchorus olitorius* was generally low. This low viability shown by the untreated accessions agrees with the report of Rao *et at*., (2006) that unlike cultivated species, seeds of wild species are generally dormant. However, this also suggests that some *C. olitorius* seeds were able on their own to

overcome the dormancy and may elucidate their continuance in the wild

5. Conclusion

Seeds of Corchorus olitorius like other wild vegetable exhibit dormancy imposed by hard seededness. Results obtained from this experiment indicate that the pregermination treatment of corchorus seeds by soaking in water for 17 hours, 4 days and acid scarification for 15 minutes enhanced germination of the seeds. Hence, it is recommended that farmers as well as research scientists keen on Corchorus cultivation soak their seeds in readily available water for 17 hours before planting.

Acknowledgement

The authors sincerely appreciate the technical staff in Seed Testing Unit of National Centre for Genetic Resources and Biotechnology Ibadan for their support.

Correspondence to:
Nwosu, D.J.
National Centre for Genetic Resources and Biotechnology,
P.M.B. 5382, Moor plantation,
Ibadan, Nigeria.
Cell phone: +2347069739901
E-mail: olaraich75@yahoo.com

References

1. Vorster HJ. Jansen Van Rensburg, WS, Van Ziji JJB, Van Den Heever E. Germplasm management of African leafy vegetables for the nutritional and food security needs of vulnerable groups in South Africa. Progress Report ARC-VOPI, 2002; Pretoria South Africa, p.130.
2. Ndlovu J, Afolayan AJ. Nutritional analysis of the South African wild vegetable *Corchorus olitorius* L. *Asian J. Plant. Sci*. 2008; **7**(7): 615-618
3. Fox FW, Norwood Young ME. Food from the Veld; Edible Wild Plants of Southern African. Delta Books, 1982; Johannesburg, South Africa. P.399.
4. Emongor VE, Mathowa T, Kabelo S. The effect of hot water, sulphuric acid, Gibberellic acid and Ethephon on germination of Corchorus (Corchorus tridens) seed. Journal of Agronomy 2004;**3**(3): 196-200.
5. Modi A. Growth temperature and plant age influence on nutritional quality of *Amaranthus* leaves and seed germination capacity. Water S.A. www.wrc.org.za. 2007;**33**(3): 368-375.
6. Velempin P., Riddoch, I Batisani N, Seed treatment for enhancing germination of wild okra (*Corchorus olitorius*) *Exp. Agric*. 2003**39**:441-447.
7. Thakur, M. and A.D. Sharma. Salt stress and phytohormone (ABA)- induced changes in germination, sugars and enzymes of carbohydrate metabolism in *Sorhum bicolour* (L.) Moench seeds. *J. Agric. Soc. Sci*., 2005;**1**: 89–93
8. Farooq, M., Basra, SMA. Hafeez, K. Asad, S.A and Ahmad, N. Use of commercial feritilzers as osmotica for rice primimng. *J. Agric. Soc. Sci*., 2005;**1**:172–175.
9. Basra, SMA, Farooq M, Rahman H, and Saleem BA. Improving the germination and early seedling growth in melon (*Cucumis melo* L.) by pre-sowing salicylicate treatments. *Int. J. Agric. Biol,*. 2007;**10**:238–240.
10. Hartmann HT, Kester DL, Davies, FT. and Geneve, RL. *Plant Propagation: Principles and Practices*. Pearson Education limited, 2002; New Jersey.
11. Kozlowski, TT. *Seed Biology*. Academic Press, 1972, New York, USA.
12. Anonymous, *The Role of Sucrose Transporter in Germination*. http://www.jxb.oxfordjornals.org/cgi/content/abstract, 2007.
13. Ehiagbanare, JE, Onyibe HI. *Effect of Pre-sowing Treatments on Seed Germination and Seedling Growth of Tetracarpidium conophorun Mull*, 2007.
14. David, F.H. and Midcap, JT. *Seed Propagation of Woody Ornamentals*. 2007
15. Kak, A., Pandey, C., Gupta, V., Bhardwej, M., and Dashora, K. Effect of sulphuric acid pretreatment on breaking hard seed dormancy in diverse accessions of four wild *Corchorus* species. Seed Science and Technology 2009;**37**(3): 568-572.
16. Nkomo M., and Kambizi, L. Effects of pre-chilling and temperature on seed gewrmination of *Corchorus olitotius* L. (Tiliaceae) Jew's Mallow), a wild leafy vegetable. A*frican Journal of Biotechnology* 2009;**8**(6): 1078-1081.
17. Mavengahama, S. and Lewu, FB. Comparative evaluation of germination capability of three morphologically different wild genotypes of *Corchorus olitorius* L. from northern KwaZulu-Natal, South Africa. African Journal of Biotechnology 2012;**11**(22): 6050-6054.

18. Singh, A., Karna, I. and Verma, K. Germination methods for jute seed. **Proceedings of the International Seed Testing Association** 2012;37:793-796.
19. Schippers R, Maundu P, Imbuni M, Obiero H. How to grow and use Jew's Mallow. Horticultural Development Services, Baarn, 2002; The Netherlands. p. 10.
20. Singh, A., Karna, I. and Verma, K. Germination methods for jute seed. **Proceedings of the International Seed Testing Association**, 1972;**37**: 793-796.
21. Baskin CC, Milberg P, Andersson L, Baskin JM. Seed dormancy breaking and germination requirements of *Drosera anglica*, an insectivorous species of the Northern Hemisphere. *Acta Oecol* 2001;12: 1-8.
22. Rao NK., Hanson J., Dulloo ME., Ghosh K., Nowel D. & Larinde M. Manuel de manipulation des semences dans les banques de gènes. Manuel pour les banques de gènes n° 8. Bioversity International, 2006; Rome, Italie, 165 p.

6/6/2012