Available online at: http://www.ijmtst.com/vol4issue8.html

International Journal for Modern Trends in Science and Technology

ISSN: 2455-3778 :: Volume: 04, Issue No: 08, August 2018

Germination Behavior and Nutritive Value of *Salvadora persica* Linn. (Khara Jhal) and *Balanites aegyptiaca* (Linn.) Delile (Hingoto)

Dr. Prashant Kumar Sharma

Associate Professor of Botany, Govt. Lohia College, Churu (Rajasthan)

To Cite this Article

Dr. Prashant Kumar Sharma, "Germination Behavior and Nutritive Value of *Salvadora persica* Linn. (Khara Jhal) and *Balanites aegyptiaca* (Linn.) Delile (Hingoto)", *International Journal for Modern Trends in Science and Technology*, Vol. 04, Issue 08, August 2018, pp.-89-94.

ABSTRACT

Salvadora persica (L), popularly known as miswak, toothbrush tree or khara jal, is facultative halophyte tree species growing on arid salt affected lands in Rajasthan, Gujarat, Punjab, Haryana and western Uttar Pradesh. Despite its multifold uses it is not very popular in afforestation program. Its slow growing nature may be the reason. Field trials were laid in arid sandy salt affected soils in Kaparda and Gangani in Jodhpur, Rajasthan, and highly saline black silty clay soils in little Rann of Kachchh, Patan Gujarat. It had very high survival rate at all the sites with appreciable biomass production. The survival was above 90% at Kaparda with slow growth, 85.2 to 66.7% survival and 7 to 12 kg plant-1 biomass yield with the use of FYM, gypsum and nitrogen on sandy soil, Gangani, Jodhpur at 72 months and 97.5 to 97.9% survival and 2.6 to 7.17 kg plant-1 biomass yield with FYM, wheat husk and nitrogen on silty black salty soil, Kordha Patan at 50 months. Thus, it can be concluded that with slight management S. persica is the best plant for various types of salt affected soils. Plantation of this important tree species will not only rehabilitate these wastelands, but also provide valuable products for livelihood support.

Balanites aegyptiaca Del. (Zygophyllaceae), known as 'desert date,' is spiny shrub or tree up to l0 m tall, widely distributed in dry land areas of Africa and South Asia. It is traditionally used in treatment of various ailments i.e. jaundice, intestinal worm infection, wounds, malaria, syphilis, epilepsy, dysentery, constipation, diarrhea, hemorrhoid, stomach aches, asthma, and fever. It contains protein, lipid, carbohydrate, alkaloid, saponin, flavonoid, and organic acid.

The present investigation explains germination behavior and nutritive value of Salvadora persica Linn. (Khara Jhal) and Balanites aegyptiaca (Linn.) Delile (Hingoto)

Keywords : *germination, nutritive, Salvadora persica , Balanites aegyptiaca , plantation, tree, shrub*

I. INTRODUCTION

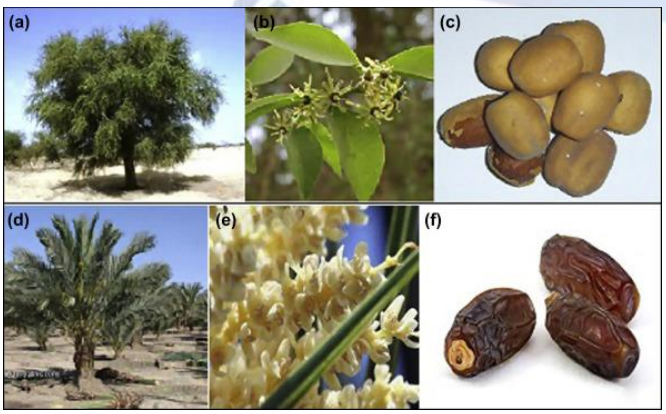
Toothbrush tree or miswak (*Salvadora persica* Linn.) is an important medicinal species found abundantly on dry saline lands of the warm subtropical region. Seed germination responses of this plant are not fully known. We therefore studied the effects of salinity (0–500 mM NaCl), temperature (10/20, 15/25, 20/30 and 25/35 °C) and photoperiods (12 h photoperiod and 24 h dark) on seed germination and seedling growth. Seeds were scarified before germination to address physical dormancy. Seeds germinated better at low (10/20, 15/25 °C) to moderate (20/30 °C) in comparison to high (25/35 °C) temperature regimes. Seeds in 12 h photoperiod had higher

germination percentages than those germinated in complete dark. [1]

Seeds of *Salvadora persica*

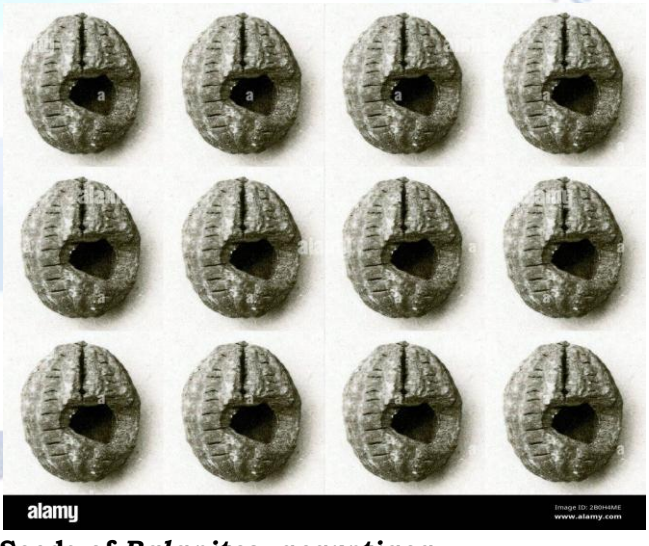
Germination decreased with increases in salinity and seeds failed to germinate at 400 mM NaCl or higher salinity. [20] However, un-germinated seeds when transferred to distilled water from high (400 mM NaCl) salinity germinated readily. Recovery percentage decreased with increasing temperature and there was no recovery under the highest temperature regime. Seedling growth was optimal at 15/25 °C and decreased with increases in salinity. Dry storage of seeds for 12 months resulted in substantial reductions in both germination and salinity tolerance. The seeds of *S. persica* are sensitive to variations in different abiotic factors, which seem to act as a possible cue for germination and subsequent seedling growth.[2]

Salvadora persica



Balanites aegyptiaca

In case of *Balanites aegyptiaca* , the outer fruit pulp must be removed as soon as possible to avoid fermentation. If extraction is not possible in the field, the fruits should be kept dry and spread in a thin layer during temporary field storage. The fruit pulp can be removed after soaking the fruits in water. [18] Alternatively the fruits may be fed to livestock (cattle) and the stones picked from the droppings. The latter method will kill possible insects in the seeds. After extraction the stones are dried in the sun before storage. Seed storage behaviour is orthodox and moisture content for storage should be 6-10%. Cleaned, dried and free of insects, the seeds will remain viable for about 1 year at ambient temperature, 2 years at cool temperatures and several years in hermetic storage at 3°C. Seeds that have passed the digestive tract of ruminants are said to germinate well without pretreatment. Fresh seeds need no pretreatment but seeds that have been stored will normally need manual scarification. Soaking in hot water for 12-18 hours, soaking in water for 24 hours at room temperature or boiling for 7-10 minutes and left to cool in the water are methods that have been reported to improve germination. The seed should be sown vertically with the stalk end down. Germination occurs in 1-4 weeks and the seedlings are kept in the nursery for about 12 weeks. [19] A major problem during storage is susceptibility to insect attack (seed borers). Short boiling (which may also serve as a pre-treatment before storage), insecticides or storage in CO2 may kill present insects and further attack is prevented by storage in air-tight containers.[21]

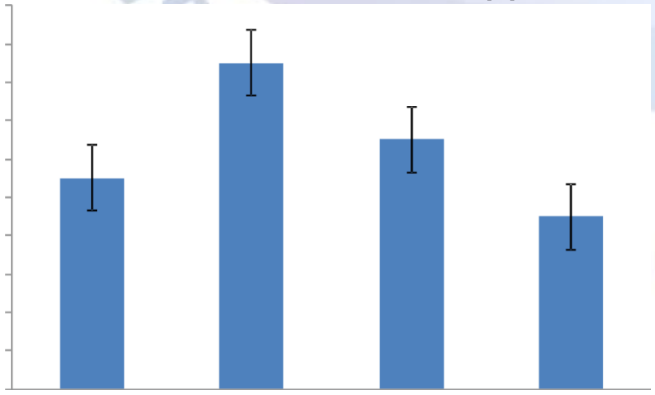


Seeds of *Balanites aegyptiaca*

OBSERVATIONS

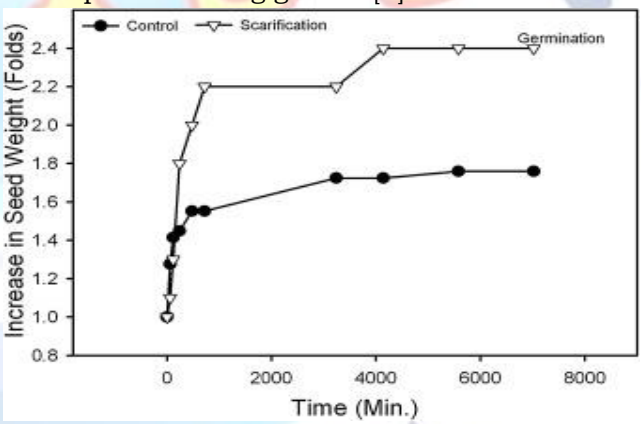
Balanites aegyptiaca falls in the category of endangered plants species which has necessitated conservation of this wild growing tree and hence action plan for its maintenance and sustainable

development has become indispensable. Therefore, effect of pre-sowing techniques and fertilizer application are inevitable for proper propagation and conservation. The effect of seed pre-treatments and potting mixtures on early growth performance can be investigated in case of *Balanites aegyptiaca.* Seeds were subjected to four (4) main pre-sowing seed treatment methods: control in which seeds were sown without pre-treatment (T 1), soak in cold water for 48 hours (T 2), soaked in hot water for 10 minutes (T 3) and soaked in 100 % concentrated Tetraoxosulphate (VI) acid (H 2 SO 4) for 10 minutes (T 4). The seedlings were subjected to two different inorganic fertilizers at different levels: Urea (10g), Urea (5g), NPK (10g) and NPK (5g) and the control seedlings planted with soil alone.[17] Growth parameters considered for assessment were shoot height, leaf area, stem diameter and leaf count. Completely Randomized Design was used for experiment.[22] The results of pre-sowing treatments showed that there is significant different (P=0.05) across the four treatments applied on seeds at one month of sowing. However, at the end of 4 week, T 2 maintained the highest germination percentage 85.50% followed by T 3 , T 1 and T 4 respectively 81.10%, 78.43% and 77.23%. The results of growth performance showed that there was significant difference (P=0.05) across all fertilizers applied. The shoot height showed that the seedlings performed better in NPK (10g) followed by NPK (5g), control (soil application), Urea (5g) and Urea (10g). Leaf area also showed that there was significant difference (P=0.05) across all fertilizers applied. Both single application of Urea and combined application of NPK caused enhanced performance on the growth parameters measured.[3]



Mean germination percentage of *Balanities aegyptiaca* based on seed treatment

Toothbrush tree or miswak (*Salvadora persica* Linn.) is an important medicinal species found abundantly on dry saline lands of the warm subtropical region. Seed germination responses of this plant are not fully known. We therefore studied the effects of salinity (0–500 mM NaCl), temperature (10/20, 15/25, 20/30 and 25/35 °C) and photoperiods (12 h photoperiod and 24 h dark) on seed germination and seedling growth. Seeds were scarified before germination to address physical dormancy. Seeds germinated better at low (10/20, 15/25 °C) to moderate (20/30 °C) in comparison to high (25/35 °C) temperature regimes.[4] Seeds in 12 h photoperiod had higher germination percentages than those germinated in complete dark. Germination decreased with increases in salinity and seeds failed to germinate at 400 mM NaCl or higher salinity.[23] However, un-germinated seeds when transferred to distilled water from high (400 mM NaCl) salinity germinated readily. Recovery percentage decreased with increasing temperature and there was no recovery under the highest temperature regime. Seedling growth was optimal at 15/25 °C and decreased with increases in salinity. Dry storage of seeds for 12 months resulted in substantial reductions in both germination and salinity tolerance. Our data indicates that the seeds of *S. persica* are sensitive to variations in different abiotic factors, which seems to act as a possible cue for germination and subsequent seedling growth.[5]

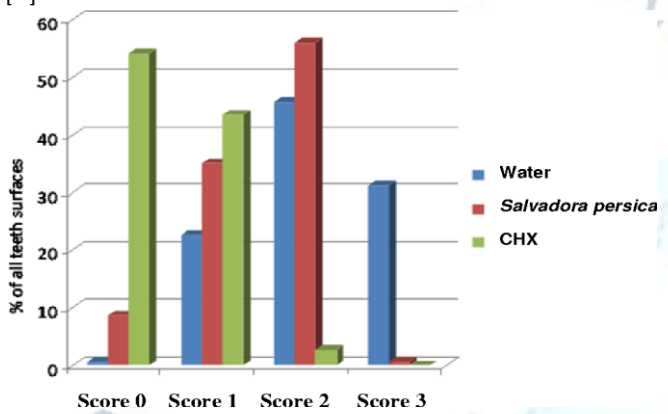


Seed germination responses of *Salvadora persica*

DISCUSSION

Salvadora persica fruits are sweet and edible. The fruits of *Salvadora* are eaten locally and the pulp contains glucose, fructose, sucrose and is a good source of calcium . Fruits are fed to cattle to increase the milk yield. Fruits are also used in the treatment of enlarged spleen, rheumatism and low fever. Seeds are rich in non edible oil as characterized by high amount of myristic acid. Seed fat is used in the treatment of rheumatic pains .[6] Purified oil is used in soap and candle making as well as in detergent industries as a

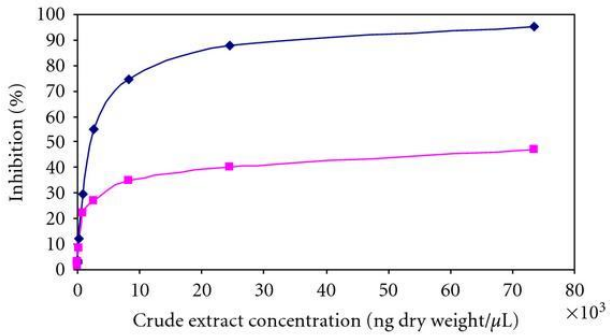
substitute for coconut oil. Root bark contains resin , colouring matter and traces of an alkaloid called "Salvadorine", trimethylamine and ash containing a large amount of sugar, fat, coloring matter. Pieces of the roots are used as tooth brushes known as Meswak . Bark is also used as a tooth brush to strengthen the gums. It suppresses bacterial growth and the formation of plaque. The tooth stick is also said to relieve toothache and gum disease. [7]



Effect of mouthwash extracted from *Salvadora persica*

Root bark is used to treat gonorrhoea, general body pain, back pain, spleen trouble, headaches and stomach-aches . Shoots and leaves are antidotes to poison of all sorts. Leaves are fleshy and make good fodder and increase lactation in cows. Leaves are also used for treating cough and asthma, in painful piles, tumors and in scurvy. Flowers yield oil, which is stimulant and laxative and beneficial in wind, phlegm, worm, leprosy, gonorrhoea and headaches. It is applied to painful rheumatic, affections. The fruits are sweet and peppery in taste with pungent smell and eaten when ripe for medicinal purposes. Seed oil is used in rheumatic pain, diabetes, spleen and stomach disorders.[24] Ash of the plant is used as a source of vegetables salt known as 'Kegr'. The fruits are used to increase urine flow and claimed to dissolve urinary stones. Nutritive contents are the basic building blocks in the synthesis of other complex substances in the cell, so that the plant as a whole or part may be efficiently utilized by livestock population.[25] The chemical analysis of the *Salvadora* species indicates that these are rich in nutrients and can be considered as a concentration ration of the livestock. These trees are evergreen and provide fodder for livestock even in the lean periods. These plants do not show much variation in their chemical composition in the different months of a year.[8,9]

Balanites aegyptiaca, a forest species of socio-economic interest for rural people, was chosen to be planted in the frame-work of the Great Green Wall project in Senegal. Although in vastly demand during food scarcity period before crops harvest, the species' fruit is poorly valued despite its important production. In this study, the fruit pulps were harvested at maturity and the biochemical characteristics were accessed in order to better understand the fruit's nutritional value. The moisture, sugars, proteins, amino acids, ash, fat, minerals and some vitamins were determined by standard methods of analysis. The results indicated that the fruits are a good alimentary source of sugar, minerals (mainly potassium) and ascorbic acid. The pulp proteins were qualitatively balanced, but were present only in weak quantities. Its caloric value is high due to the high concentration of sugars. Low humidity should allow a fairly good postharvest fruit conservation. [16]



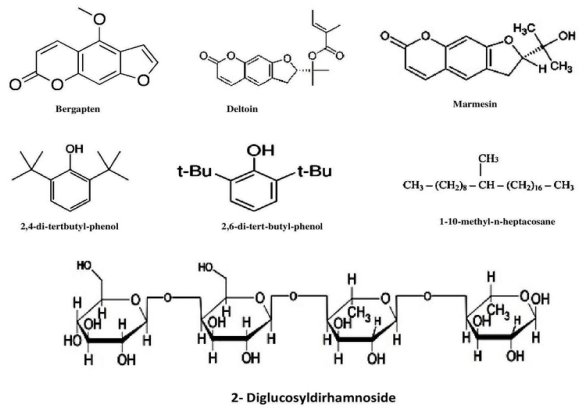
Antimalarial activity of seeds of *Balanites aegyptiaca*

The dietary intake of this fruit for local people is very valuable especially in terms of nutrition. Proximate, mineral, amino acid, antinutrient and sugar compositions were determined using standard analytical techniques. The calculated parameters were metabolized energy, mineral safety index (MSI), mineral ratios of some minerals, isoelectric point (pI), predicted protein efficiency ratio (P–PER) and leucine to isoleucine ratio. The results showed that seed was very rich in crude protein and crude fat with values of 30.80 and 45.53 g/100 g dry weight basis, respectively whereas, the pulp had values of 8.36 and 5.10 g/100 g dw for the same parameters. The following were observed as the most concentrated minerals: P (312.72 and 138.62 mg/100 g dw), Na (58.49 and 47.65 mg/100 g dw) and Ca (48.57 and 40.26 mg/100 g dw) for seed and pulp, respectively. Other minerals analyzed in the samples had values less than 15.0 mg/100 g. No mineral had deleterious value in the MSI. Amino acid analysis of seed and pulp showed concentrations of TAA

(63.21 and 42.62 g/100 g cude protein), TEAA (26.19 and 21.88 g/100 g cp) and TNEAA ((26.19 and 21.88 g/100 g cp). Leucine (7.30 g/100 g cp) and Arg (3.69 g/100 g cp) were the most concentrated essential amino acids in seed and pulp. The phytate, tannin and oxalate concentrations were higher in seed compared with that of the pulp. All the sugars were of low levels. Generally, *Balanites aegyptiaca* seed and pulp contained nutritive minerals and sufficient proportions of EAAs however, dietary formula based on samples of the seed and pulp will require EAAs supplementation except in Leu, TSAA and Phe + Tyr of the seed. Likewise, the high contents of some of the antinutrients may pose a nutritional problem in their consumption.[15]

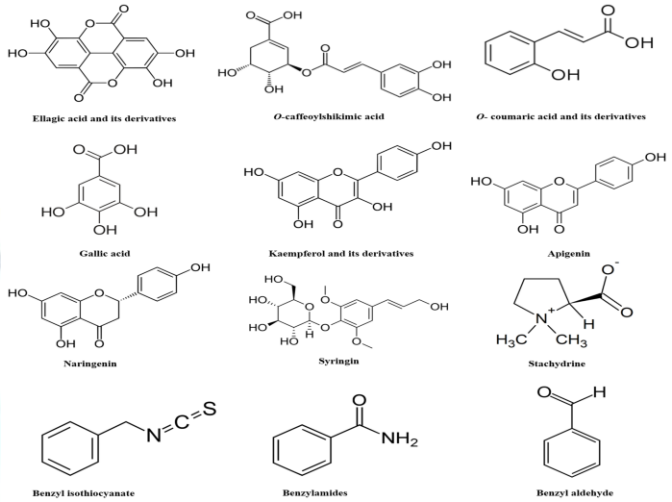
RESULTS

Balanites aegyptiaca tree is managed through agroforestry. It is planted along irrigation canals and is used to attract insects for trapping. The pale to brownish yellow wood is used to make furniture and durable items such as tools, and is a low-smoke firewood that makes good charcoal. The smaller trees and branches are used as living or cut fences because they are resilient and thorny. The tree fixes nitrogen. It is grown for its fruit in plantations in several areas. The bark yields fibers, the natural gums from the branches are used as glue, and the seeds have been used to make jewelry and beads.[14]



Chemical composition of *Balanites aegyptiaca*

Salvadora persica stick, known as miswak, is popular for teeth cleaning throughout the Arabian Peninsula, Iranian Plateau, as well as the wider Muslim world.The fresh leaves can be eaten as part of a salad and are used in traditional medicine.The flowers are small and fragrant and are used as a stimulant and are mildly purgative. The berries are small and barely noticeable; they are eaten both fresh and dried. The wood of the *Salvadora persica* can be used for charcoal and firewood. In Namibia, the mustard bush is used as drought-resistant fodder for cattle. The seeds can be used to extract a detergent oil.[10,11]



Chemical composition of *Salvadora persica*

CONCLUSION

The knowledge of various medicinal plants being used is confined to mostly local healers, it is of utmost importance to record this knowledge for future generations, otherwise it will be lost forever with the death of local healers/ persons with knowledge about indigenous health care systems. The traditional values, faith, and indigenous knowledge related to indigenous health care systems of the present society are facing serious challenges due to migration of youths to cities and these urban migrants tend to determine their own cultural beliefs and practices. Thus, the recording of indigenous health care system becomes increasingly important for society. On the basis of a literature survey, it has been found that there are various traditional uses of these plants, which has to be scientifically proved. [13]

REFERENCES

[1] Orwa C., Mutua A., Kindt R., Simons A., Jamnadass R.H. Agroforestree Database: A Tree Reference and Selection Guide Version 4.0. World Agroforestry Centre, Kenya. [(accessed on 10 November 2020)];2009 Available online: http://apps.worldagroforestry.org/treedb2/specieprofile.php?Spid=279.

[2] Sarker S.D., Barholomew B., Nash R.J. Alkaloids from *Balanites aegyptiaca*. *Fitoterapia.* 2000;71:328–330. doi: 10.1016/S0367-326X(99)00149-5. [PubMed] [CrossRef] [Google Scholar]

[3] Ojo O.O., Nadro M.S., Tell I.O. Protection of rats by extracts of some common Nigerian trees against acetaminophen-induced hepatotoxicity. *Afr. J. Biotechnol.* 2006;5:755–760. [Google Scholar]

[4] IwuMaurice M. *Handbook of African Medicinal Plants.* CRC Press; Boca Raton, FL, USA: 1993. p. 129. [Google Scholar]

[5] Achaglinkame M.A., Aderibigbe R.O., Hensel O., Sturm B., Korese K. Nutritional characteristics of four underutilized wild fruits of dietary interest in Ghana. *Foods.* 2019;8:104. doi: 10.3390/foods8030104. [PMC free article] [PubMed] [CrossRef] [Google Scholar]

[6] Sagna M.B., Diallo A., Sarr P.S., Ndiaye O., Goffner D., Guisse A. Biochemical composition and nutritional value of *Balanites aegyptiaca*(L.) Del fruit pulp from Northern Ferlo in Senegal. *Afr. J. Biotechnol.* 2014;13:336–342. [Google Scholar]

[7] Amadou I. Date fruits: Nutritional composition of dates (*Balanites aegyptiaca* Delile and *Phoenix dactylifera* L.) In: Simmonds M.S.J., Preedy V.R., editors. *Nutritional Composition of Fruit Cultivars.* Elsevier Inc.; Amsterdam, The Netherlands: 2016. pp. 215–233. [Google Scholar]

[8] Cook J.A., VanderJagt D.J., Pastuszyn A., Mounkaila G., Glew R.S., Glew R.H. Nutrient content of two indigenous plant foods of western Sahel: *Balanites aegyptiaca* and *Maerua crassifolia. J. Food Comp. Anal.* 1998;11:221–230. doi: 10.1006/jfca.1998.0582. [CrossRef] [Google Scholar]

[9] Samuel A.L., Temple V.J., Ladeji O. Chemical and nutrition evaluation of the seed kernel of *Balanites aegyptiaca. Niger. J. Biotechnol.* 1997;8:57–63. [Google Scholar]

[10] Mohamed A.M., Wolf W., Spieb W.E.L. Physical, morphological and chemical characteristics, oil recovery and fatty acid composition of *Balanites aegyptiaca* Del. kernels. *Plant. Foods Hum. Nutr.* 2002;57:179–189. doi: 10.1023/A:1015237612018. [PubMed] [CrossRef] [Google Scholar]

[11] Chapagain B.P., Yehosha Y., Wiesman Z. Desert date (*Balanites aegyptiaca*) as an arid lands sustainable bioresource for biodiesel. *Bioresour. Technol.* 2009;100:1221–1226. doi: 10.1016/j.biortech.2008.09.005. [PubMed] [CrossRef] [Google Scholar]

[12] Kubmarawa D., Andenyang I.F.H., Magomya A.M. Amino acid profile of two non-conventional leafy vegetables, *Sesamum indicum* and *Balanites aegyptiaca. Afr. J. Biotechnol.* 2008;7:3502–3504. [Google Scholar]

[13] Almas K. The antimicrobial effects of extracts of *Azadirachta indica* (Neem) and *Salvadora persica* (Arak) chewing sticks. *Indian J Dent Res.* 1999;10:23–6. [PubMed] [Google Scholar]

[14] Al-Otaibi M. The miswak (chewing stick) and oral health. Studies on oral hygiene practices of urban Saudi Arabians. *Swed Dent J Suppl.* 2004;167:2–75. [PubMed] [Google Scholar]

[15] Hyson JM. History of the toothbrush. *J Hist Dent.* 2003;51:73–80. [PubMed] [Google Scholar]

[16] Khalil AT. Benzylamides from *Salvadora persica. Arch Pharm Res.* 2006;29:952–6. [PubMed] [Google Scholar]

[17] Raj KP, Agarwal YK. Heavy metal contents of the leaf-gall. *Sci Cult.* 1979;45:35. [Google Scholar]

[18] Almas K. The antimicrobial effects of seven different types of Asian chewing sticks. *Odontostomatol Trop.* 2001;24:17–20. [PubMed] [Google Scholar]

[19] Maggio A, Reddy MP, Joly RJ. Leaf gas exchange and solute accumulation in the halophyte *Salvadora persica* grown at moderate salinity. *Environ Exp Bot.* 2000;44:31–8. [PubMed] [Google Scholar]

[20] Quinlan R, Robson G, Pack AR. A study comparing the efficacy of a toothpaste containing extract of *Salvadora persica* with a standard fluoride toothpaste. *J N Z Soc Periodontol.* 1994;77:7–14. [PubMed] [Google Scholar

[21] Joshi AJ, Krishan MK, Mali BS. Seasonal changes in proteins, amino acids and minerals in *Salvadora persica* with reference to saline habitats. *Indian J. Plant Physiol.* 1993;17:202–4. [Google Scholar]

[22] Galati EM, Monforte MT, Forestieri AM, Miceli N, Bader A, Trovato A. Salvadora persica hypolipidemic activity on experimental hypercholesterolemia in rat. *Phytomedicine.* 1999;6:181–5. [PubMed] [Google Scholar]

[23] Sanogo R, Monforte MT, Daquino A, Rossitto A, Maur DD, Galati EM. Antiulcer activity of *Salvadora persica* structural modifications. *Phytomedicine.* 1999;6:363–6. [PubMed] [Google Scholar]

[24] Monforte MT, Trovato A, Rossitto A, Forestieri AM, Daquino A, Miceli N, et al. anticonvulsant and sedative effects of *Salvadora persica* stem extracts. *Phytother Res.* 2002;16:395–7. [PubMed] [Google Scholar]

[25] Darmani H, Al-Hiyasat AS, E1betieha AM, Alkofahi A. The effect of an extract of *Salvadora persica* (Meswak chewing stick) on fertility of male and female mice. *PhytoMedicine.* 2003;10:63–5. [PubMed] [Google Scholar]