Short Communication
Range Mgmt. & Agroforestry 39 (1) : 126-129, 2018
ISSN 0971-2070

Effect of seed morphometric variability on germination and seedling characteristics of *Prosopis cineraria* (l.) Druce under arid condition of Rajasthan

M.B. Noor mohamed*, Keerthika, A, D.K. Gupta, A.K. Shukla and B. L. Jangid
Regional Research Station, ICAR-CAZRI, Pali-Marwar-306 401, India
*Corresponding author e-mail: mohamedforester@gmail.com
Received: 21st March, 2017 Accepted: 14th April, 2018

Abstract
The present investigation was conducted to study the influence of various seed morphometric traits *viz*., size, shape, weight, thickness and its orientation of *Prosopis cineraria* population collected from arid zone of Rajasthan. A wide range of variability was observed among the individuals within population for various seed characters. The seeds were randomly selected and grouped into eight classes (S1 to S8) based on size, shape and thickness. The seed length varied from 7.9 mm (S1) to 4.26 mm (S4). Maximum seed breadth recorded as 4.9 mm (S1) whereas, minimum was 3.33 mm (S7). Thickness of seeds ranged between 1.53 to 1.1 mm, while hundred seed weight varied between 0.64 (S1) to 0.40 g (S7). Eight classes of *Prosopis cineraria* seeds were sown in the pots, among the seed classes, S1 class of seeds exhibited maximum germination (70%) followed by S2 and S3 where as S8 class seeds exhibited minimum and poor germination percentage (10%) followed by S7 and S4. Maximum shoot length, root length and collar diameter were also recorded in S1 class seeds. Therefore, seed size can be used as a parameter for predicting germination and seedling growth rate both in nursery and field conditions.

Keywords: Germination, Morphological variability, *Prosopis cineraria*, Seed size, Seedling characters

Khejri [*Prosopis cineraria* (L.) Druce], the 'Queen of the Desert', belongs to the subfamily Mimosoidae of Leguminosae family, and has an important place in the economy of the Indian desert. Khejri is a small to medium size tree, found mainly in the Thar Desert and other parts of Rajasthan in India. It grows in dry and arid regions of Arabia and in regions of India mainly Rajasthan, Haryana, Punjab, Gujarat, Western Uttar Pradesh and drier parts of Deccan. Khejri is a evergreen thorny tree with slender branches armed with conical thorns and light bluish-green foliage. The trees not only boost the growth and productivity of companion plants, but also provide fuel, fodder, food, small timber, medicines, gum and tannin. Its foliage is a nutritive fodder for animals and the wood is of good quality for domestic fuel purposes. Unlopped trees produce green, immature pods (sangri) used as a vegetable (fresh and also dried), and ripe pods (khokha) are used for fresh consumption and for the preparation of flour. Khejri trees occupy a special place in the life of desert dwellers, especially those of rural communities. Prosopis species are economically and ecologically important tree species in arid and semi-arid zones of the world (Vilela and Ravetta, 2001) and extensively deployed for rehabilitation of various kind of wastelands (Ramesha *et al*., 2016).

In spite of wide spread of indigenous tree species distribution in arid region, *Prosopis cineraria* ranks first by virtue of its high adoptability for multipurpose uses, there by serving as a lifeline tree for local people. Owing to the lack of any other effective mode of regeneration in *Prosopis cineraria* except through seed, it is essential that seeds used in nursery raising or afforestation possess high germinability. Seed is such a key element in plant production that it exercises a profound influence on the success or failure of both artificial and natural regeneration. Seed size is a parameter for predicting germination and seedlings growth rate both in the nursery and field condition (Oni and Bada, 1992). Seed size is an important attribute of plant fitness as increasing seed size within species was correlated with an increase in seed germination per cent. The most commonly cited advantages of large seed size through greater food reserves are drought resistance, early shade tolerance and other direct effects of larger initial seedling size (Westoby *et al*., 1992). Seed size affects dispersal distance (Stevenson, 2000), dormancy, or timing of germination (Simons and Johnston, 2000). Quantification of variations in seed size (seed length, width, and seed weight) and germination traits was documented in many tree species and these traits are widely used in studies of genetic variation and are

believed to be under strong genetic control (Hodge and Dvorak, 2004; Mamo *et al*., 2006). Therefore, the effect of seed sizes in morphological characteristics of *Prosopis cineraria* was necessitated to be considered and determined. With this background the present investigation was conducted to study the morphological variability of seed and seedling characters of *Prosopis cineraria* from arid region of Rajasthan.

Individuals within populations were surveyed in the arid region of Pinjarapole, Pali, Rajasthan to study the morphological variability of seeds of *Prosopis cineraria.* Trees growing at one location were considered to be one population. There variability were existed within population and twelve trees were selected randomly. In fact, trees were randomly chosen following a minimum distance of 500 m between each tree. Based on morphological characters such as tree height, diameter at breast height (DBH), number of branches and its pattern, straight trunk and free from pest and disease attack etc, superior *Prosopis cineraria* individuals were selected. From the selected individual's seeds were collected to study the morphological variability of seeds and its germination potential. Mature pods of such selected trees were collected and pooled it for analysis of the seed attributes/characters. Seed characters *viz*., length (mm), breadth (mm), thickness (mm), shape and weight (gm) were recorded for all the individuals. Since the seeds fallen under different size and shape, they were classified and named as S1, S2, S3, S4, S5, S6, S7 and S8. In order to soften the hard seed coat, seeds were treated with concentrated HCL for ten minutes before sowing. Seeds were sown in pot with sand, soil and FYM mixture in the ratio of 1:2:1. Pots were kept in shade throughout the experiment and watering was done manually once in a day. After 21 days of germination, plant height (cm), collar diameter (mm), root length (cm) and germination percentage were recorded.

Seedling growth in nursery and plantations greatly depends on seed characteristics as well as genetic constitution of trees and exhibited variability in germination and growth characteristics at nursery stage (Radwanski and Wickens, 1981). The experimental study indicated that there was considerable variation within the populations for all seed morphological characters. Regarding the qualitative characters, seeds exhibited typically unique pattern for its shape, size, orientation, boldness and structure traits (Fig 1). The seeds were randomly selected and grouped into eight classes based on size, shape and its orientation (Table 1). The recorded seed length varied from 7.9 mm (S1) to 4.26 mm (S4). Maximum seed breadth recorded as 4.9 mm (S1) whereas, minimum was 3.33 mm (S7). Thickness of seeds ranged between 1.53 to 1.1 mm, while hundred seed weight varied between 0.64 (S1) to 0.40 g (S7).

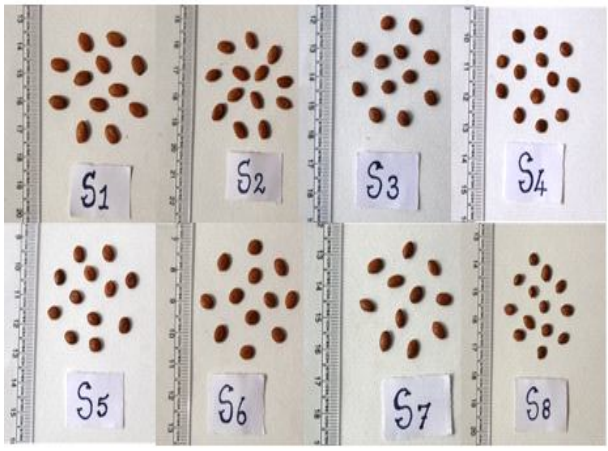

Fig 1. Variation in seed morphometric traits of *Prosopis cineraria*

Eight classes of *Prosopis cineraria* seeds were also sown in the pots to record their growth and germination potentials. Among the seed types, S1 type of seeds exhibited maximum germination (70%) followed by S2

Table 1. Seed variability in morphometric traits of *Prosopis cineraria*

Class	Size	Shape	Length (mm)	Breadth (mm)	Thickness (mm)	100 seed weight (g)
S1	Large	Oblong, flat	7.9	4.9	1.23	0.64
S2	Small	Oblong, flat	6.9	3.76	1.1	0.48
S3	Large	Round, flat	5.03	4.1	1.1	0.52
S4	Small	Round, flat	4.26	4.06	1.53	0.41
S5	Small	Oval, flat	5.1	3.9	1.53	0.43
S6	Large	Oval, flat	6.0	3.93	1.6	0.50
S7	Medium	Slender, buldged	7.0	3.33	1.9	0.40
S8	Small/Large	Irregular	5.6	3.9	1.13	0.42

(55%) and S3 (35) where as S8 type seeds exhibited minimum and poor germination percentage (10%) followed by S7 (20%) and S4 (20%) (Table 2). Superior germination exhibited by large seed size could be attributed to availability of more food reserves in large seeds (Fig 2). On the other hand, the lower germination obtained from small seeds was attributed to relatively lower food reserve in the small sized seeds, the stage of maturity, size of cotyledons and genetic factors. Oni and Bada (1992) also reported that large seeds showed better germination and growth than small seeds. Similarly, Simmone *et al*. (2000) reported that seed size had a strong influence on germination as well as growth and biomass increment of a plant. The highest plant height recorded was 22 cm in S1 seeds followed by S2 and S5. Collar diameter of seedlings ranged between 1.3 mm (S1) to 0.4 mm (S8). Maximum root length was observed in S1 and S2 (13 cm) followed by S5 (6.5 cm) whereas, minimum root length was in S8 (3.4 cm) followed by S6 (4 cm). Owoh *et al.* (2011) reported that seed sizes affect plant vigour as seeds with greater mass-produced vigorous plants. Seeds in the large seed size had the highest values of seedling height, collar diameter, number of leaves and root length, since physical characters of seed are strongly related to the physiological potential of the seed (Gurunathan and Srimathi, 2012). Increase in germination percentage with increase in seed weight and seed size was reported earlier in other tree species like *Hardwickia binnata* (Ponnamal *et al*., 1993), *Leuceana leucocephala* (Gupta *et al*., 1983), *Acacia mellifera* (Srimathi *et al.,* 1991) and *Abies pindrow* (Singh and Sah, 1992). Similar findings for seed characters among different seed sources and populations were reported in *Tamarindus indica* (Azad *et al*., 2014), *Prosopis juliflora* (Sharma *et al*., 1994), *Terminalia chebula* (Thakur *et al.,* 2008), *Acacia nilotica* (Chillar *et al.,* 2002), *Dalbergia sisoo* (Dhillon *et al.,* 1995) and *Pongamia pinnata* (Divakara *et al*., 2010; Raut *et al.,* 2011).

Fig 2. Seedling performance based on seed morphometric traits in *Prosopis cineraria*

Table 2. Growth parameters of seedlings of *Prosopis cineraria*

Class	Plant height (cm)	Collar diameter (mm)	Root length (cm)	Germina -tion (%)
S1	22	1.3	13	70
S2	20	1.2	13	55
S3	14	0.8	7	35
S4	9	0.8	4.5	20
S5	17	1.0	16.5	30
S6	11	0.5	4	30
S7	14.5	1.0	5.5	20
S8	7.5	0.4	3.5	10

Thus, study indicated that variability exists in seed morphological and seedling characters of *Prosopis cineraria,* collected from arid zone of Rajasthan and the seed size can be exploited as a parameter for predicting germination and seedling growth rate both in nursery and field conditions.

References

Azad, Md. Salim, Nurun Nahar, Abdus Subhan Mollick and Md. Abdul Matin. 2014. Variation in seedling growth of *Tamarindus indica* (L.): A threatening medicinal fruit tree species in Bangladesh. *Journal of Ecosystems*. pp 9. (http://dx.doi.org/10.1155/2014/270956)

Chillar, S, M. S. Hooda and D. Chopra. 2002. Seed source variation in *Acacia nilotica* (L.) wild. *Indian Journal of Forestry* 25: 150-153.

Dhillon, R. S., S. S. Bisla and R. P. S. Tomer. 1995. Variability studies of seed characters in Shisham (*Dalbergia sissoo* Roxb.). *Indian Journal of Forestry* 18: 53-55.

Divakara, B. N., A. S. Alur and S. Tripati. 2010. Genetic variability and relationship of pod and seed traits in *Pongamia pinnata* (L.) Pierre., a potential agroforestry tree. *International Journal of Plant Production* 4: 129.

Gupta, S. K., P.S. Pathak and R. Deb Roy. 1983. Seedling growth of *Leucaena leucocephala*. II: Effect of seed size. *Indian Journal of Forestry* 5: 202-204.

Gurunathan, N. and P. Srimathi. 2012. Evaluation on seed and seedling quality characters of *Jatropha curcas. Range Management and Agroforestry* 33: 43-46.

Hodge, G.R. and W.S. Dvorak. 2004. The CAMCORE international provenance/progeny trials of *Gmelina arborea*: genetic parameters and potential gain. *New Forests* 28: 147-166.

Mamo, N., M. Mihtetu, M. Fekadu, M. Tigabu and D. Teketay. 2006. Variation in seed and germination characteristics among *Juniperus procera* populations in Ethiopia. *Forest Ecology and Management* 225: 320-327.

Oni, O. and S. O. Bada.1992. Effects of seed size on seedlings vigour in Idigbo (*Terminalia ivorensis.* A. Chev). *Journal of Tropical Forest Science* 4: 218.

Owoh, P.W., M. O. Offiong and S.I. Udofia and V. U. Ekanem. 2011. Effect of seed size on germination and early morphological and physiological characteristics of *Gmelina arborea,* Roxb. *African Research Review* 5: 422-433.

Ponnamal, N. R., M. C. Arjunan and K. A. Anthony. 1993. Seedling growth and biomass production of *Hardwickia binnata* Roxb. as affected by seed size. *Indian Forester* 119: 59-62.

Radwanski, S. A, and G. E. Wickens. 1981. Vegetative fallows and potential value of neem tree in the tropics. *Economic Botany* 35: 398-414.

Ramesha, M.N., S.L. Patil, P. Ratha Krishnan and B. N. Seshadri. 2016. Effect of pre-sowing treatments on *Prosopis pallida* seed germination attributes. *Range Management and Agroforestry* 37: 104-107.

Raut. S. S., S. S. Narkhede, A. D. Rane and R. P. Gunaga. 2011. Seed and fruit variability in *Pongamia Pinnata* (L.) Pierre from Konkan Region of Maharashtra. *Journal of Biodiversity* 2: 27-30.

Sharma, N. K., U. Burman, J. C. Tewari, M. D. Bhora and L. N. Harsh. 1994. Variability studies in pod and seed characteristics of *Prosopis juliflora* (SW.) DC. *Indian Journal of Forestry* 17: 161-165.

Simmone, R., H. Ter Steege and M. Werger. 2000. Survival and growth in gaps – A case study for tree seedlings of 8 species in the Guyanese tropical rainforest in seed seedlings and gap size matters. Troplenbos-Guyana programmes.

Simons, A.M. and M.O. Johnston. 2000. Variation in seed traits of *Lobelia inflate* (Companulaceae). Sources and fitness consequences. *American Journal of Botany* 87: 253-263.

Singh, V. and V. K. Sah. 1992. Effect of seed weight on germination and seedling growth in Silver Fir (*Abies pindrow* Spach). *Van Vigyan* 30: 104-106.

Srimathi, I., R. S. Vinaya Rai, and C. Sureram. 1991. Studies on the effect of seed colour and seed size on seed germination on *Acacia mellifera* (Vahl) Benth. *Indian Journal of Forestry* 14: 14.

Stevenson, P. R. 2000. Seed dispersal by woolly monkey (*Lagothrix longothricha*) at Tinigua Natural park, Colombia: dispersal, germination rates and dispersal quantity. *American Journal Primatol* 50: 275-289.

Thakur, S., K. Sharma and A. Gupta. 2008. Assessing natural variation in fruits and seeds of Harar (*Terminalia chebula* Retz). *Indian Journal of Agroforestry* 10: 66-70.

Vilela, A.E. and D.A. Ravetta. 2001. The effect of seed scarification and soil-media on germination, growth, storage, and survival of seedlings of five species of *Prosopis* L. (Mimosaceae). *Journal of Arid Environments* 48: 171–184.

Westoby, M, E. Jurado and M. Leishman. 1992. Comparative evolutionary ecology of seed size. *Trends in Ecology and Evolution* 7: 368–372.