

Variability for Seed Size, Oil Content, Seed Germination and Juvenile Traits in Germplasm Collections of *Salvadora oleoides* Decne from Arid Parts of Gujarat

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Abstract: *Salvadora oleoides* Decne, a multipurpose tree, locally known as 'mitha jal', is found growing in dry and desert areas of Uttar Pradesh, Rajasthan, Haryana, Punjab, Gujarat and Madhya Pradesh. Its seeds are rich in non-edible oil. Fruits are eaten by local people, leaves are relished by animals; stem and branches are used for fuel. Arid parts of Gujarat and parts of Rajasthan adjoining Gujarat were explored in May 2003 for germplasm collection of *S. oleoides*. Twenty-four accessions were collected from different sites and seed material deposited with National Bureau of Plant Genetic Resources, New Delhi. The seed oil content varied from 41.0% in Acc. No. SKJ 217 to 55.4% in Acc. No. SKJ 212 with a mean of 47.5%. Seeds of eight collections, out of 24, had more than 50% oil content. Seed germination was 87.1%. Three-month-old seedlings evaluated in nursery showed significant variation for plant height, nodes per plant, number of leaves per plant, leaf length and width. 100-seed weight and seed oil content were the only traits, which did not show any significant association with the seedling characters. Plant height had positive and significant association with number of nodes, number of leaves, leaf length and leaf width. Acc. No. SKJ 217 had best shape of tree, was free from witches broom, showed profuse and synchronous fruiting *in situ*, and had large, light red colored fruits with sweet taste and small seeds.

Key words: Variability, germplasm, *Salvadora oleoides*

Salvadora oleoides Decne, a much branched evergreen tree, is widely distributed in parts of India, Sri Lanka, Pakistan, Egypt, Ethiopia, Senegal and Middle East countries near sea shore, along with rivers in wadis and saline patches in dry regions. In India its fruit is known as 'pillu' and tree as 'mitha jal' and is found growing in dry and desert areas of Uttar Pradesh, Rajasthan, Haryana, Punjab, Gujarat and Madhya Pradesh (Gupta and Saxena, 1968). It is found in annual rainfall zone of 180-1000 mm and is most drought hardy during planting and as mature tree (Hocking, 1993). *Salvadora* spp. are highly

salt tolerant at germination, early and late stages of growth (Makwana *et al.*, 1988).

The seeds yield non-edible oil that is used in soap making, ethnic medicine by local and tribal (Sikawar, 1994) and by pharmaceuticals (Hamid *et al.*, 1996). The fat can substitute coconut oil and finds use in various industries. It is also reported to have 100% toxicity to *Anopheles stephensi* at the 0.01% dose rate (Tare and Sharma, 1991). The oil cake contains 19% protein and is used as cattle feed (Srivastava, 1984). Leaves, rich in calcium (Thukral *et al.*, 1984) are relished by cattle, stem is used for fuel and timber, fresh and dry

fruits are relished by local inhabitants, roots act as good soil binder and protects the soil from erosion. Rao and Tarafdar (1998) identified it as Ca loving plant and recommended for revegetation of gypsum mine spoil.

The tree is slow growing with very low reproductive capacity and is susceptible to witches broom, where inflorescence turns into vegetative part. This multipurpose tree needs improvement for more foliage, more large fruits, seeds with more oil content and resistance to witches broom. For any improvement program knowledge of variation existing in natural populations for various traits is required. With this objective an exploratory survey was undertaken to collect the germplasm and to assess the variability for economic traits.

Materials and Methods

In May 2003, an exploratory survey of arid areas of Gujarat and parts of Rajasthan adjacent to Gujarat was undertaken to collect germplasm of trees with more foliage, good fruiting, and free from witches broom. In case of most of the accessions about 500 fruits were collected using random and selective sampling from individual trees. When fruits from individual trees were not available in sufficient quantity, then these were collected from 2-3 trees and bulked. Due to short shelf life fruits were depulped on the same day. The seeds were dried to record 100-seed weight, and oil content was estimated using cold percolation technique (Kartha and Sethi, 1957).

Twenty seeds of each accession of *S. oleoides* were sown in polybags containing mixture of sand, clay, and FYM (2:1:1) in the third week of May and Seed

germination was counted daily. After 3 months of sowing data on ten seedlings of each accession were recorded for seedling height, nodes per plant, leaves per plant, leaf length and leaf width. Simple correlation coefficients were worked out for all possible combinations of nine characters using standard statistical procedures.

The saplings of these accessions were transplanted into field in third week of July 2003 and data of all surviving plants for height and mortality were recorded in first week of September 2003 and January 2004.

Results and Discussion

Bhuj, Palanpur, Rajkot, Mehsana, Surendranagar and Banaskantha districts of Gujarat, and Jalore and Sirohi districts of Rajasthan were explored. Twenty-four accessions of *Salvadora oleoides* were collected using random and selective sampling. Of the 24 accessions 23 were from Gujarat and one from Rajasthan. Seed material has been deposited with National Bureau of Plant Genetic Resources, New Delhi. In Jalore district, near Bhilwara, an irrigated area, *S. oleoides* was abundant and it was growing as farm fence. Sixteen collections of *S. oleoides* were collected from individual trees with selective sampling. About half of the collections were from Bhuj district. About 25 km away from Bhuj on north side of the town the species was abundant on roadside, at farmers' field as fencing, as shade tree (for buffaloes, cows, etc. and for villagers) and in graveyards. Some of the trees were bearing profuse fruiting and fruit color was pale yellow (as of fully matured grapes), red and dark maroon. Shrubs bearing red

Table 1. Mean, range and coefficient of variation for seed weight, oil content, germination and morphological traits (three-month-old seedlings) of *S. oleoides*

Seed characters	Mean	Minimum	Maximum	CV (%)
100-seed weight (g)	2.83	1.95	3.75	15.9
Seed oil content (%)	47.5	41.0	55.4	9.3
Germination (%)	87.1	70.0	100	11.5
GEI	9.23	3.83	16.3	34.8
Plant height (cm)	16.8	10.8	20.4	16.0
Nodes/plant	8.2	7.0	10.0	10.8
Leaves/seedling	21.0	14.0	26.0	17.9
Leaf length (cm)	5.56	3.98	6.77	13.6
Leaf width (cm)	1.19	0.82	1.51	16.9

fruits were more in number than yellow fruit-bearing trees. Variation in fruit size, color and resistance to witches broom was observed. About 50% of the plants were free from this disease.

The species was growing in association with *Prosopis juliflora*, *Azadirachta indica*, *Euphorbia* sp. and *P. cineraria*. The trees were also seen as roadside plantation of seven rows with spacing of 2m x 2m. Acc. No. SKJ 217 identified from Vithalgarh (Surendranagar) was excellent in terms of shape of tree (single stem, straight bole, large canopy), free from witches broom, about 150 years old, profuse and synchronous fruiting, large, light red fruits with sweet taste and small seeds.

Mean 100-seed weight was 2.83 g and it ranged between 1.95 g for SKJ 217 to 3.75 g for SKJ 197 (Gangotri, Banaskantha) and SKJ 218 (Lilki, Surendranagar). Mean seed oil content was 47.5% and it varied from 41.0% (SKJ 217) to 55.4% (SKJ 212). Seeds of eight accessions viz. SKJ 197, SKJ 203, SKJ 207, SKJ 210, SKJ 211, SKJ 212, SKJ 214 and SKJ 215 had more than 50% oil (Tables 1 and 2).

Oil seeds often lose viability, so seed was sown immediately after coming back from exploration. Seed germination up to 15 days after seed sowing was 87.1% and for four accessions it was 100 percent. GEI usually defined as the percentage, which has germinated upto the time when the number of seeds germinating per day has reached a peak, was 9.23 and ranged between 3.83 and 11.3. A little low germination (79.3%) with 18.2% seedling mortality has been reported by Jindal *et al.* (1999) when the seeds were sown in last week of September. There was no seedling mortality due to damping-off, may be due to more temperature and less humidity than in September-October.

Mean values of three-month-old seedlings in nursery were 16.8 cm for plant height, 8.2 for number of nodes per plant, 21.0 for number of leaves per plant, 5.56 cm for leaf length, 1.19 cm for leaf width. Maximum values were 20.4cm (SKJ 214) for plant height, 10.0 (SKJ 206) for number of nodes per plant, 26 (SKJ 195, SKJ 202, SKJ 209, SKJ 210, SKJ 215) for number of leaves per seedling, 6.77 cm (SKJ 216) for leaf length, and 1.51 cm (SKJ 213, SKJ 215) for leaf width.

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