

Assessment of *in-situ* Variability in Kair (*Capparis decidua*) Germplasm for Utilization in Genetic Improvement through *ex-situ* Conservation

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Abstract: Kair (*Capparis decidua*) is one of the multipurpose shrubs of hot arid ecosystem and found in diverse habitats unattended and unprotected. In recent past, due to changes in land use pattern, mechanization, expansion of irrigation facilities, urbanization etc. natural habitats of kair are under serious threat. For achieving sustainable development, based on use of available genetic wealth, promotion and conservation of adapted arid species like kair is of immense importance. Extensive survey of western Rajasthan was carried out to collect germplasm from different habitats during April-May 2011 and 45 accessions were collected from different sites. Marked diversity with respect to plant types, canopy, flowering and fruiting were observed in natural population. The seeds of collected germplasms were further sown in nursery for seedling study and field planting for *ex-situ* conservation. Among the accessions, germination ranged from 41.6-93.4% and survival ranged from 44.2 to 76.8% in nursery. After one year of field planting accessions, CZJK-8 followed by CZJK-9, CZJK-4, CZJK-15 and CZJK-21 showed better survival (>80%), however, accessions CZJK-14, CZJK-33, CZJK-34 and CZJK-35 showed poor survival (<25%). The available germplasm is being further evaluated for characterization and utilization in breeding programme for selection of elite plant types.

Key words: *Capparis decidua*, *ex-situ* conservation, diversity, germplasm, survival.

Kair [*Capparis decidua* (Forsk.) Edgew.] is one of the important indigenous multipurpose shrubs of hot arid ecosystem with the ability to survive in various unattended and unprotected habitats (Singh *et al.*, 2005). It grows abundantly in dry, arid and exposed habitats like wastelands, ditches, drying ponds, cultivated lands, road sides and surrounding plains of hills as it is tolerant to prolonged drought due to its excellent adaptation to arid conditions (Pandey and Rokad, 1992). It provides food (pickle and vegetable), fodder, fuel wood and timber, thus plays an important role in the rural economy of arid regions (Kumar *et al.*, 2005). The flower buds and immature green fruits of kair are pickled, cooked and consumed as vegetables (Harsh and Tewari, 1998). Young branches are relished by camel and goats particularly during post winter season, when little else is available for browsing (Khan, 2005). The species has important ecological roles i.e.; provides vegetation cover, improves soil, prevents soil erosion and promotes biodiversity in arid regions (Shankarnaryan *et al.*, 1987).

Besides socio-economic and ecological benefits, it has a number of medicinal properties

as the plant has significant pharmacological activities like hypercholesterolemic, anti-inflammatory and analgesic, antidiabetic, antimicrobial, antiplaque, antihypertensive, antihelmintic and purgative activities (Satyanarayana *et al.*, 2008). In spite of multifarious uses and highly adapted to desertic conditions of arid western Rajasthan, there have been few attempts to domesticate or study kair, particularly its genetic potential and scope for orchard plantation in arid zone. Looking to the diversified uses and ecological adaptation to harsh climatic conditions in Thar Desert an attempt was made to collect kair germplasm from different habitats of arid zone to create live repository for *ex-situ* conservation and its further utilization in genetic improvement for higher fruit yield.

Materials and Methods

An extensive survey of Western Rajasthan (Bikaner, Nagaur, Jodhpur, Barmer and Jaisalmer districts) was carried out to congregate information on *in-situ* variability and to collect diverse germplasm from different habitats *viz.* rocky, gravely, sand dunes, natural rangelands and cultivated fields during April-May 2011. Forty five accessions of *C. decidua*

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Fig. 1. Plant type variation in kair population (Compact shrub-left and tree form-right).

were collected from different sites. Passport and morpho-metric information were also collected during the germplasm collection. It was found associated mainly with *Ziziphus nummularia* (bordi), *Prosopis cineraria* (khejri), *Salvadora oleoides* (jal) and *Calotropis procera* (aak). Mature fruits were collected from individual plants and depulped in warm water for seed extraction. Fruit and seed characters were recorded on randomly selected 20 fruits from each plant. The collected seeds of kair were sown in poly bags filled with soil-FYM mixture (3:1) in nursery during last week of August, 2011. The germination percentage was recorded on the basis of total sown seeds and germinated seeds up to one month period, while survival was recorded on the basis of germinated seeds surviving in nursery up to six months. Seedling characters were recorded after six months of sowing on 10 randomly selected seedlings per accession. Nursery raised seedlings of all the collected 45 accessions were transplanted in field during August 2012

for primary evaluation and to create a live repository of diverse germplasm.

Results and Discussion

Natural population exhibited marked diversity with respect to plant types, canopy (spread and compactness), flowering (time of flowering, color of flower), and fruiting (size and color of fruits) characters. Two distinct plant types were observed, shrub with large canopy spread and small tree form having more than 5 m height (Fig. 1). Flowers were light red to scarlet red. Occasionally few plants had yellow flowers (Fig. 2). Mertia (2001) also reported yellow flowered kair plant in Jaisalmer district. Genetic diversity of a population forms the basis of the plant adaptability to climatic changes. As genetic diversity within a particular population increases, the population is likely to tolerate adverse biotic and abiotic factors. Ample variability was recorded for fruit diameter (11.42-22.63 mm), fruit weight (1.18-7.23 g) and number of seeds per fruit

Table 1. Ancillary observations on fruit and seedlings characteristics of kair

Character (s)	Mean	Range	Standard deviation	Coefficient of variation
Fruit diameter (mm)	15.94	11.42-22.63	2.61	16.37
Fruit weight (g)	3.19	1.18-07.23	1.44	45.22
Number of seeds per fruit	12.75	5.20-27.80	5.38	42.17
Test weight (g)	21.29	14.59-26.92	2.34	11.01
Germination (%)	72.40	41.60-93.40	15.87	21.92
Survival (%)	60.20	44.20-76.80	11.74	19.50
Root length (cm)	13.69	8.13-17.52	2.64	19.30
Shoot length (cm)	19.88	12.33-28.25	3.42	17.22
R:S ratio	0.70	0.40-00.98	0.14	19.49



Fig. 2. Flower color variation observed in kair under natural conditions.

(5.2-27.8). The range for the test weight was 14.6-26.9 g (Table 1). Higher coefficient of variation for fruit weight and number of seeds per fruit is clearly indicative of resilience of species to climatic factors for survival under harsh climatic conditions. Singh *et al.* (2007) suggested that variability in natural population for different traits may be due to genotypic differences or environmental factors and this variation provides buffering potential as well as phenotypic stability to the individual against unpredictable environment.

The germination started on 10th day of sowing and continued up to 27th day, however 50% germination was recorded after 19th day of seeding. Considerable variation was observed among the 45 accessions during seedling stage. Among the accessions germination ranged from 41.6-93.4%. The mean germination was 72.4%, but two collections (CZJK-3 and CZJK-5) did not germinate. Six-months-old seedlings showed varying magnitude of survival ranging

from 44.2 to 76.8% (Table 1). After one year of field planting, more than 65% survival was recorded among the accessions. Accessions, CZJK-8 followed by CZJK-9, CZJK-4, CZJK-15 and CZJK-21 showed better survival (>80%), while accessions CZJK-14, CZJK-33, CZJK-34 and CZJK-35 showed poor survival (<25%). If proper selection is made from available variability, kair could be an excellent crop for extreme arid zone of India, where a few species can survive and can be domesticated (Chundawat, 1990).

Since, the natural habitats of kair are under serious threat due to various developmental activities for creating infrastructure as well as mechanization of agriculture for increasing productivity to feed the large population. To safeguard the existing diversity and to achieve sustainable development based on use of available genetic wealth, promotion and conservation of kair is of immense importance. This species has not been given

desired attention due to comparatively less commercial importance and limited research on its genetic improvement. Kair is well adapted to the stressed, arid and semi-arid ecosystems having high potential for mitigating inevitable climate change and hence need immediate attention. Therefore, *ex-situ* conservation of precious germplasm may be given high priority for further utilization in selection of superior plant types for higher fruit yield.

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