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Collection and Conservation of Some Gourd Landraces of Tribal Areas of Rajasthan

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The farmers in the northwestern parts of India, particularly in the arid region of western Rajasthan, grow some semi-domesticated forms belonging to *Citrullus* and *Cucumis* groups. The *Arawalli* hill ranges separate this region from the eastern semi arid and sub-humid areas of Rajasthan, Gujarat and Central India, where *Cucumis*, *Luffa*, *Lagenaria*, *Momordica* and *Coccinia* are widely adapted and enormous diversity is available (Umesh Chandra, 1995; Pareek *et al.*, 1999). The native genetic resources of these species which possesses genes for adaptation, quality, yield, abiotic and biotic stresses, is under severe threat of erosion due to manifold reasons of socio-economic nature. Realizing this, an exploration was undertaken for survey, collection and conservation of genetic diversity of some important gourds.

This mission-oriented work was conducted during 2002 to 2004 under National Agricultural Technology Project on Sustainable Management of Plant Biodiversity. For the survey and collection of gourd germplasm from tribal areas, an intensive exploration was made in November 2002. A total of 55 accessions in the form of landraces and local cultivars comprising of bottlegourd (18), ridged gourd (19), sponge gourd (15) and bitter gourd (3) were collected. The collections were made from 85 diverse sites in Rajasthan and Gujarat, lying between 22° and 29° N latitude and 72° and 76° E longitude. Biased, random and bulk sampling procedures were followed for collecting fruits of gourds (2 to 15) for formulation of accessions in the targeted crops.

During the exploration, in depth discussions were held with the growers and tribal people to collect passport information on the germplasm sites, methods of crop production, plant growth and fruit yielding characters, uses and seed conservation, etc. and the data were recorded. The collected accessions were evaluated crop wise under RBD with three replications during kharif season of 2003-04 at CIAH, Bikaner. Seed enhancement

of all the accessions was done and deposited for the long-term conservation in National Gene Bank at NBPGR, New Delhi.

As the Indian subcontinent is primary and secondary centre of regional diversity for large number of cucurbitaceous crops, the arid and semi arid regions of Rajasthan and areas of adjoining states also possess rich genetic diversity in melons, gourds and cucumber. Gourds include *Benincasa hispida* (Thunb) Cogn., ashgourd; *Lagenaria siceraria* (Molina) Standl, calabash or bottle gourd; *Coccinia grandis* (L.) Voigt, Ivy or scarlet gourd; *Momordica charantia* (L.), bittergourd; *Momordica dioica*, spine gourd; *Luffa acutangula*, ridge gourd and *Luffa cylindrica*, sponge gourd. Among these, bottle gourd, ridge gourd, sponge gourd, bitter gourd, spine gourd and ivy gourd are adapted and grow well in the arid and semi-arid areas, areas near to the foothills of *Arawalli* and in tribal dominated parts of Rajasthan, and also in the adjoining areas of northern Gujarat and western Madhya Pradesh.

Farmer's fields and homestead gardens (*Bari*) were surveyed in the majority of growing areas and hot spots of variability pockets where cucurbitaceous vegetables particularly gourds have been grown over the period. In non-traditional areas, these crops are grown for domestic purposes. Therefore, farmer's fields where assured irrigation facilities for commercial vegetable crops were surveyed. Samples were collected directly from the available gourd plants or seeds as stored to raise future crops. During the surveys it was observed that the rate of adoption of high yielding varieties was high particularly in bottle gourd and bitter gourd, under remunerative vegetable farming systems. However, some traditional vegetable growers were maintaining the local cultivars as an open pollinated mixed seeds of desired population. In tribal dominating areas, gourds were in cultivation as a need based crops. Here enormous

variability existed owing to preservation of landraces or primitive selections for own requirements and also socio-economic needs and farming systems. Both biased and random population sampling strategies was followed to collect the maximum genetic variability from the tribal houses and villages.

In general, the rainy season gourd crops were ready to harvest as tender fruits in September whereas the mature fruits were available from October–December. In Rajasthan, the northwestern arid areas of Bikaner, Pali and Nagour, central semi-arid areas of Ajmer and Bhilwara and sub-humid to humid areas of Chittorgarh, Udaipur, Rajsamand, Banswara, Dungarpur and Sirohi and Dahod and Panchmahal areas of northeastern Gujarat were surveyed. In these areas, agro-climatic conditions, rainfall, farming systems and socio-economic needs predominantly supports the types of crop cultivation. Gourd cultivation was more concentrated in semi-arid to humid parts of central and south-east-western Rajasthan and northern Gujarat. The tribal dominating areas of Ajmer, Bhilwara, Chittorgarh, Nimbherha, Pratapgarh, Ghatol, Banswara, Kushalgarh, Sagwara, Dungarpur, Salumber, Jaisamand, Udaipur, Rajsamand, Pindwara and Sirohi in Rajasthan and Jalod, Piplod, Dahod, Baria, Godhara Lunawara and Modasa in Gujarat have rich genetic diversity. In this area, the average rainfall is from 500-750 mm but the distribution is variable and uncertain. The crop productivity is low. Most of the fields were with undulating topography and hilly, or few plain. In tribal villages, peasant farmers used to grow number of vegetable crops for their domestic consumption and also to fulfill some family income by selling them in to local markets (weekly *hatt*). Among cucurbits, bottle gourd, sponge gourd, ridged gourd, bitter gourd, cucumber, snapmelon and pumpkin were major and ivygourd, spinegourd and *kachri* were minor rainy season crops either in fields as mixed crops or in vegetable *bari* or trailed on trees, shrubs, live hedges, fenced material or on the roof of hut.

A rich genetic diversity of bottlegourd was observed in tribal dominating parts of Rajasthan and Gujarat. The maximum variability exhibiting areas were in the districts of Chittorgarh, Banswara, Dungarpur, Udaipur, Dahod and Panchmahal. A total of 18 population samples were made which includes landraces, primitive selections and local cultivars. A wide range of variation was recorded for plant growth and fruit shape, size, colour

and tenderness. Variation in mature fruit and seed characters was also recorded (Table 1). Farmers of tribal and *mali* community were very conscious for the preservation of desirable types of landraces by timely seed storage, regeneration and continuity in production. The accession DKS/AHLS 23 which produced only bitter fruits, was being maintained by a tribal family for over more than 70 years (to measure and serve the *Tadi* liquor). On evaluation, AHLS 23, AHLS 24, AHLS 27 and AHLS 28 were found to be potential germplasm material for multiple characters.

During the surveys, it was noticed that the tribal dominating adjoining areas of south Rajasthan, north Gujarat and western Madhya Pradesh are important regions for *Luffa* gourds where wide range of variability existing in the form of wild species, primitive landraces and domesticated local cultivars. In these areas, several

Table 1. Characters observed in the landraces of gourds from tribal areas

| CROP/CHARACTERS | Range value |
|---|--|
| Bottlegourd [<i>Lagenaria siceraria</i> (Molina) Standely] | |
| Fruit shape | Long, round, oblong, pyriform, club shaped |
| Fruit colour | Light green, green, dark green, mottled green |
| Seed colour | White brown, brown, dark brown |
| Mature fruit length | 16 – 85 cm |
| Seed length | 1.15 – 1.92 cm |
| Seed width | 0.445 – 0.815 cm |
| Test weight (100 seeds) | 11.54 – 22.85 g |
| Number of seeds per fruit | 165 – 683 |
| Spongegourd [<i>Luffa cylindrica</i> Roem] | |
| Fruit shape | Straight long, necked long, elliptical, oblong |
| Fruit colour | Dark green, light green, whitish green |
| Seed colour | Black, white/dull or glossy |
| Mature fruit length | 10.5 – 39.8 cm |
| Seed length | 0.85 – 1.25 cm |
| Seed width | 0.551 – 0.732 cm |
| Test weight (100 seeds) | 7.754 – 12.124 g |
| Number of seeds per fruit | 65 – 523 |
| Ridged gourd [<i>Luffa acutangula</i> and <i>L. hermaphrodita</i>] | |
| Fruit shape | Long cylindrical, spindle, elliptical, club |
| Fruit colour | Light green, green, dark green |
| Seed colour | Black, brown black, dark black/glossy or dull |
| Mature fruit length | 6.0 – 95 cm |
| Seed length | 0.75 – 1.25 cm |
| Seed width | 0.41 – 0.85 cm |
| Test weight (100 seeds) | 7.412 – 16.624 g |
| Number of seeds per fruit | 29 – 299 |
| Bitter gourd [<i>Momordica charantia</i> L.] | |
| Fruit shape | Spindle, elliptical, long |
| Fruit colour | Dark green, green, whitish green, |
| Mature fruit length | 11.45 – 28.54 cm |
| Seed length | 1.02 – 1.35 cm |
| Seed width | 0.51 – 0.92 cm |
| Test weight (100 seeds) | 8.542 – 20.812 g |
| Number of seeds per fruit | 8 – 42 |

landraces and natural selections were in cultivation and preserved by the tribal families. The maximum variability exhibiting areas were in the districts of Ajmer, Bhilwara, Chittorgarh, Banswara, Dungarpur, Udaipur, Dahod and Panchmahal. In ridge gourd (*kali tori*, *aara tori*) the tender fruits were of 9 to 90 cm in length. The wild forms were extremely bitter but the domesticated types were less or rarely bitter. The hermaphrodite type "Satputia" bears perfect flowers in clusters. The fruits were small in size (5-7 cm) and in clusters (4-7). Tender fruits of spongegourd (smooth gourd, *chikni tori*, *ghiya tori*, *gulki*) were much variable in sizes. In *Luffa* gourds, maximum variability was recorded for fruit characters in respect of size, shape, and tenderness and seed characters (Table 1). Nineteen population samples of ridged gourd and 15 of sponge gourd were collected. On evaluation, a wide spectrum of variation were observed and recorded for plant phenological characters, flowering and fruiting behaviour, fruit characters and biotic and abiotic stresses. The genotypes AHRG 1, AHRG 4, AHRG 8 and AHRG 15 in ridgegourd and

AHSG 4, AHSG 5 and AHSG 13 of sponge gourd were found to be particularly under arid conditions.

In tribal dominated areas of South Rajasthan and north Gujarat, *M. dioica* (spine gourd, *kakoda*) occurs in semi wild form. It is perennial and dioecious. *M. charantia* (bittergourd, *karela*) is annual and monoecious. Tender fruits of both the species have been used as curries and pickled. In bittergourd, the availability of local cultivars and landraces was very low where as a high range in adoption of cultivars was observed. Four bittergourd land races were evaluated for growth, flowering, fruiting, maturity, fruit yield and quality and seed and reaction to biotic and abiotic stresses under hot arid environment.]

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