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SHORT COMMUNICATION

# Variability in Fruit and Seed Parameters of *Manilkara hexandra* (Roxb.) Dubard in Rajasthan

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Exploration trips were conducted in different villages of Pali district in Rajasthan for germplasm collection of *Manilkara hexandra* (Roxb.) Dubard. All the parameters i.e., fruit length, fruit width, fruit weight, pulp weight, seed length and seed width varied significantly ($p<0.001$) except for seed weight ($p=0.087$). Highest coefficient of variation (CV) was recorded for pulp weight (43.54%), followed by fruit weight (33.49%) and seed length (19.48%). Among the germplasm collected, the one from U1 (Utharan) area was found to be good in terms of all fruit parameters.

**Key Words: Co-efficient of variation, Correlation, Germplasm collection, Khirni, Pali district**

*Manilkara hexandra* (Roxb.) Dubard is an indigenous underutilized fruit tree belonging to the family Sapotaecae. It is locally known as 'khirni' or 'rayan' and is generally distributed in states such as Rajasthan, Gujarat, Madhya Pradesh and Maharashtra (Malik *et al*., 2010). In wild condition, it is found in dry deciduous forests of western and central India. The tree is adapted to semi-arid regions and drought conditions and also thrives well on rocky, saline and sodic soils. It is widely used as rootstock for grafting of sapota plants. Seed is also good source of edible oil which contains about 24.6% oil. The tree bears attractive golden yellow fruit with pulp which is soft and sweet in taste which possesses high nutritive value. Fruit is milky, sweet, sour, cooling, aphrodisiac, appetizer, emollient and used as tonic and a good source of minerals, sugars, protein, carbohydrates, vitamin-A and C (Pareek *et al*., 1998). Fresh or dried fruits are sweet; consumed raw as well as after drying by local inhabitants/tribal people (Malik *et al.,* 2010, 2012). Fruit serves as 'Vitamin A capsule' especially for nutritionally deficient tribal women and children. Mashed fruits are taken to cure diseases like arthritis, jaundice, and also for heat burning, deworming, for blood purification.

Germplasm collection is an indispensable component for tree improvement programme ensuring quick genetic gain of superior genotypes. The tree exhibits a wide range of variation due to heterozygous and cross-pollinated nature, which aids in selection of superior genotypes. It is essential to determine extent, cause and nature of variation present in the species which is also the first step towards improvement work. Owing to its economic importance as fruit, documentation of genetic variation of this species is needed for selection and improvement programme. Despite its ability to withstand adverse climatic conditions, there are no varieties or cultivars available for Rajasthan conditions. Locally grown trees in farmer's field show variation from tree to tree for fruit size, shape and pulp content. Therefore, an attempt has been made to document variability existing in khirni germplasm collection for fruit and seed characteristics.

With this background, a survey for khirni population was made during the fruit ripening stage in the month of May 2017 in the Pali and Sumerpur blocks of Pali district, Rajasthan. The average annual rainfall of the study area ranged from about 420mm in Pali to 550 mm in Sumerpur. The collections were made on random sampling method and the latitude, longitude and elevations details were recorded with GPS during collection (Table 1). A total of ten-germplasm collections were made (one from Pali and remaining nine from Sumerpur). Large populations were found in Santarao areas of Sumerpur. The defect-, insect and disease-free trees were selected falling in the age group of 25-80 years. The tree starts bearing fruit from 10$^{th}$ year onwards. Discussions were made with farmers and local people, and information on harvesting and mode of marketing were also gathered.

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**Table 1. Details of collection localities of *Manilkara hexandra***

| Location | Latitude (N°) | Longitude (E°) | Elevation (m) |
|---|---|---|---|
| Pali - P | 25.46407 | 73.20199 | 217 |
| Sumerpur – S1 | 25.06332 | 72.98021 | 281 |
| Sumerpur – S2 | 25.06332 | 72.98021 | 281 |
| Sumerpur – S3 | 25.06332 | 72.98021 | 281 |
| Santaro – SA1 | 25.04265 | 72.98234 | 289 |
| Santaro – SA2 | 25.04212 | 72.98212 | 277 |
| Utharan – U1 | 25.15063 | 73.05064 | 285 |
| Utharan – U2 | 25.03053 | 72.96573 | 285 |
| Korta - K | 25.1764 | 72.97547 | 245 |
| Chandana - C | 25.15044 | 73.05029 | 277 |

Matured fruits were collected from different parts of the crown as they may differ genetically, as khirni is insect-pollinated. In some of the collections, fruits fallen on the ground were also collected. Nearly 300 fruits were augmented for each germplasm collection, 25 fruits were randomly chosen from the lot and data were recorded for fruit and seed parameters. Analysis was made using SPSS (17) software for mean, standard error, coefficient of variation and analysis of variance at 95% level (ANOVA). Variations in fruit size were also noticed at the time of collection. Pearson method of correlation was used to find the correlation among the fruit and seed traits. The locations were named as P for Pali, S1, S2, and S3 for Sumerpur, SA 1 and SA 2 for Santarao, U1and U2 for Utharan, K for Korta and C for Chandana. (Table 1).

The trees surveyed were in the height range between 8 and 12 m and diameter at breast height (DBH) of 85 cm to 210 cm approximately. All the collections were characterized for fruit and seed characters. The fruit length varied from 1.45 to 2.24 cm (SA 1) with average of 1.80 cm. All the parameters i.e., fruit length, fruit width, fruit weight, pulp weight, seed length and seed width varied significantly (ANOVA p value <0.001) except for seed weight (p=0.087). Fruit width ranged from 0.79 (S2) to 1.33 cm (U1) with average of 1.06 cm. U1 collection recorded the highest fruit weight (2.39g), while the over all mean was 1.38 g. Lowest fruit weight was recorded for S2 (Table 2). The pulp weight ranged from 0.49 to 2.19g. Similar findings were reported by Malik *et al.* (2012) for *Manilkara hexandra* which were collected from Madhya Pradesh, Gujarat and parts of Rajasthan. The pulp weight from Sirohi (IC no. 546121 and 546123) germplasm collection recorded the lowest pulp weight (0.83g and 0.81g) (Malik *et al.,* 2012), whereas in the present study the highest pulp weight (g) is from U1 collection i.e., 2.19. The result indicates that, there exist chances for better germplasm in Rajasthan. The fruit also showed variation in size and shape in all the germplasm collections.

During the survey and exploration, it was also noticed that, some of the fruit contains two seeds per fruit. The seed length ranged from 0.80 (S-2) to 1.50 cm (SA-2) with average of 1.20 cm respectively. The seed width does not record much difference among the collections. The highest seed width was recorded from K collection i.e., 0.66 cm and the lowest from P collection 0.55cm with average of 0.62cm. Non-significant differences were observed for seed weight (p< 0.087) (Table 2). Seed colour also varied from light brown to dark brown in different germplasm. Almost, similar germplasm collection study revealed seed weight with average of 0.18g (Malik *et al.*, 2012). In the present study, the

**Table 2. Variation in fruit and seed parameters of *Manilkara hexandra* in Pali district of Rajasthan**

| Location | Fruit | | | Pulp weight (g) | Seed | | |
|---|---|---|---|---|---|---|---|
| | Length (cm) | Width (cm) | Weight (g) | | Length (cm) | Width (cm) | Weight (g) |
| P | 1.45±0.02 | 1.07±0.01 | 1.22±0.02 | 1.01±0.03 | 1.13±0.01 | 0.55±0.005 | 0.20±0.05 |
| S 1 | 1.69±0.02 | 1.03±0.01 | 1.25±0.03 | 1.00±0.02 | 0.95±0.01 | 0.63±0.006 | 0.17±0.01 |
| S 2 | 1.53±0.01 | 0.79±0.008 | 0.64±0.01 | 0.49±0.01 | 0.80±0.01 | 0.58±0.003 | 0.17±0.04 |
| S 3 | 1.76±0.02 | 1.04±0.01 | 1.33±0.03 | 1.13±0.02 | 1.00±0.02 | 0.65±0.006 | 0.16±0.002 |
| SA 1 | 2.24±0.04 | 1.06±0.02 | 1.58±0.08 | 1.26±0.06 | 1.47±0.01 | 0.63±0.008 | 0.18±0.004 |
| SA 2 | 2.11±0.03 | 1.10±0.02 | 1.61±0.08 | 1.30±0.06 | 1.50±0.01 | 0.61±0.008 | 0.18±0.003 |
| U 1 | 2.02±0.04 | 1.33±0.02 | 2.39±0.08 | 2.19±0.07 | 1.33±0.01 | 0.64±0.006 | 0.17±0.003 |
| U 2 | 1.90±0.025 | 1.07±0.01 | 1.44±0.06 | 1.06±0.03 | 1.42±0.01 | 0.64±0.005 | 0.18±0.003 |
| K | 1.73±0.02 | 1.14±0.01 | 1.43±0.04 | 1.15±0.03 | 1.18±0.02 | 0.66±0.005 | 0.15±0.003 |
| C | 1.53±0.02 | 0.98±0.02 | 0.92±0.04 | 0.75±0.01 | 1.20±0.01 | 0.63±0.006 | 0.15 |
| AVG | 1.80±0.01 | 1.06±0.01 | 1.38±0.03 | 1.16±0.03 | 1.20±0.01 | 0.62±0.002 | 0.17±0.007 |
| SD | 0.27 | 0.13 | 0.46 | 0.50 | 0.23 | 0.04 | 0.02 |
| CV (%) | 14.79 | 12.60 | 33.49 | 43.54 | 19.48 | 5.73 | 9.30 |
| p value of ANOVA | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.087 |

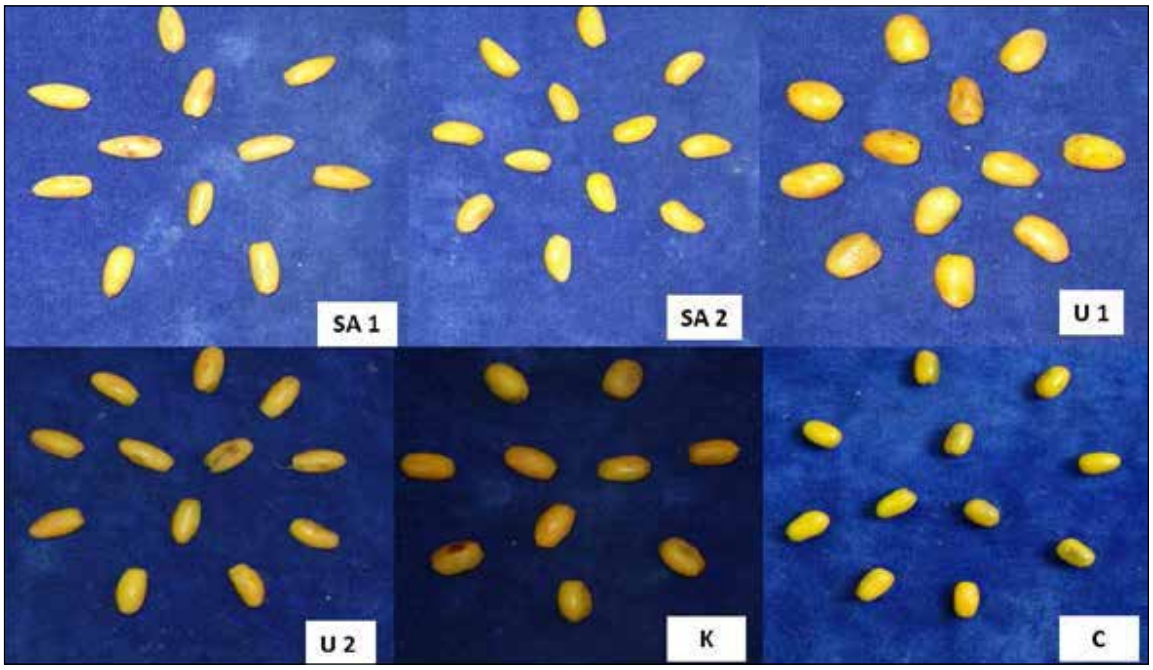


**Fig. 1. Variation in fruit of *Manilkara hexandra* germplasm**

average seed weight recorded was also 0.17g. Singh *et al*. (2006) also recorded variation in fruit and seed parameters in germplasm collection from candidate plus trees collected from Gujarat.

Among the morphological characters studied, the highest CV were recorded for pulp weight (43.54%), fruit weight (33.49%) followed by seed length (19.48%) (Table 2). The variability present in phenotypic characters may be due to heterozygous and cross pollinated nature of the tree. Thus, the variability existing in germplasm collection may guide in selection of superior performing genotypes having desirable traits. Gill and Navprem (2015) also observed highest co-efficient of variation in mango for fruit yield (19.63%) followed by fruit weight (17.28%). Besides this, variation in fruit and seed parameters has also been reported by Keerthika *et al.* (2017) in *Balanites roxburghii* and Meena *et al*. (2015) in *Tecomella undulata.*

Correlation is an important tool which measures degree and magnitude of association between various traits. In this study, pulp weight was significantly correlated with weight, length and width of fruit and length and width of seed. However, seed weight was not significantly correlated. Correlation coefficient of pulp weight was the highest with fruit weight (r = 0.916) and width (r =0.839). It indicated that higher the weight and width of fruit, higher the pulp content while seed weight have negligible effect on pulp content. Similar correlation study among fruit and seed parameters has been reported by many workers (Mkwezalamba *et al.,* 2015 and Dev *et al*., 2017). Mkwezalamba *et al.* (2015) reported strong relationship (r= 0.987) between fruit weight and pulp weight among provenances of *Sclerocarya birrea*. Variation in reproductive traits and economic traits among genotypes is useful for further selection and development of species for better utilization. This study indicated that selecting trees with higher fruit weight is a reliable indicator for pulp weight. This approach may have advantage of selecting improved germplasm.

It was also noticed that there were no new plantation and only sparse regeneration observed in this tree. It might be due to non-orthodox behaviour of seed and poor germination (Malik *et al.* 2012). Despite its demand as minor fruit tree species, a very few efforts have been taken for selection of suitable germplasm and popularization of this tree in the region. Almost all the trees in the surveyed region were found to be old, so it is need of the hour to give emphasis on establishing new plantations for conservation and utilization.

In this study, *Manilkara hexandra* germplasm showed significant variation in all the quantitative traits of fruits and seeds. Among ten collections, the U1 collection showed better for fruit width, fruit weight and pulp weight. Significant correlation was observed

in fruit and pulp weight, therefore, fruit weight may be a reliable indicator of pulp weight. Thus, these traits may be given importance in selection, improvement and breeding programme. Moreover, the genetic variability of this fruit species is under threat due to the large-scale urbanization, developmental activities and need for agriculture land. Hence, it is pertinent to collect, characterize and document the germplasm for future conservation and utilization programme.

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