

Original Research Article

<https://doi.org/10.20546/ijcmas.2020.905.141>

Estimation of Intra-Cultivar Diversity in Dashehari Mango (*Mangifera indica* L.) through Stone and Kernel Parameters

Sachin Kishor*, Deepa H. Dwivedi, Munni Gond and Sutanu Maji

Department of Horticulture, School of Agricultural Sciences and Technology,
Babasaheb Bhimrao Ambedkar University, Lucknow- 226025, U.P., India

*Corresponding author

ABSTRACT

Keywords

Dashehari, genetic, genotype, phenotype, stomata, variability

Article Info

Accepted:
10 April 2020
Available Online:
10 May 2020

Dashehari is an important export variety of mango (*Mangifera indica* L.) for its attractive appearance, excellent taste and pleasing flavour which is cultivated on a commercial level and propagated through vegetative means to ensure multiplication of true to type plants. Despite this, intra-varietal variability is reported in certain varieties although limited. In the present study, 45 Dashehari trees, 25-30 years in age from 15 different orchards in 2 blocks viz. Malihabad and Mall from Agri-Export Zone for mango of Uttar Pradesh, India were selected for study. The significant intra-varietal variability in stone weigh was observed to range from (24.17 to 33.50g), pulp:stone ratio (4.36 to 8.04), stone length (8.99 to 11.75cm), stone width (2.72 to 4.14cm) and stone thickness (1.44 to 1.93cm), kernel length (3.65 to 6.65cm), kernel width (1.46 to 4.13cm) and kernel thickness (1.04 to 2.07cm). The intra-cultivar diversity was observed in terms of PCV (Phenotypic coefficient of variation), GCV (Genotypic coefficient of variation), heritability (h^2), genetic advance (GA) and genetic advance as percent of mean (GAM%) for stone and kernel parameters. Kernel width showed highest PCV (22.15%) and GCV (19.65%). The highest heritability (85.50%) and genetic advance (2.80%) was observed from kernel length. However, maximum GAM% (75.35%) was observed for kernel thickness which indicated predominance of additive gene action for these parameters and these parameters may be considered for intra-cultivar diversity analysis of Dashehari mango for further crop improvement through selection.

Introduction

Mango (*Mangifera indica* L.) is one of the choicest and admired fruit crops of the tropical and subtropical areas of the world. Its significance can easily be recognized by the fact that it is known as 'King of Fruits'. Utilization of germplasm with distinctive characteristics in breeding programmes desires precise information to develop new

cultivars (Vasugi *et al.*, 2012). India is the centre of origin for cultivated mango and is distributed in tropical and subtropical regions. Mango has been cultivated in India for more than 4000 species having chromosome number $2n=40$ (Mukherjee, 1950). It is a highly cross-pollinated and heterozygous plant whose performance varies with the climate which resulted in a high level of genetic diversity.

Characterization and assessment of diversity is essential to utilize these unique cultivars in crop improvement programmes and also for better conservation of genetic resources that especially benefits a plant breeder in choosing proper parental materials. Dashehari is an important export variety of mango (*Mangifera indica*L.) for its attractive appearance, excellent taste and pleasing flavour.

The inter-specific diversity in mango is due to allopolyploidy, out breeding and phenotypic differences arising from varied agro climatic conditions in different mango growing regions (Ravishankar *et al.*, 2000). Intra-cultivar diversity in mango has also been reported based on morphological traits and genetic markers (De Souza and Lima, 2004; Rocha *et al.*, 2012).

Until recently, morphology has been the base for characterization of intra-cultivar diversity in mango where significant variation among the trees of a variety was ascribed to bud mutations (Pandey, 1998). Commercially grown mango cultivars have been identified on the basis of vegetative and reproductive parameters such as leaf size, leaf shape, shoot length, panicle length, fruit size, fruit shape, peel colour, stone size and stone weight.

Since mango is an allogamous species, high genetic diversity exists within populations. The present studies were conducted to establish intra-cultivar diversity on the basis of stone and kernel parameters in Dashehari morphotypes in Agri-Export Zone for mango in Uttar Pradesh, India.

Materials and Methods

The present study assessed Intra-cultivar diversity in 45 Dashehari morphotypes through stone and kernel parameters. Three plants each, 25-30 years old from 15 different orchards were selected for study from Agri-

Export Zone for mango in Uttar Pradesh, India. Observations were recorded for stone and kernel parameters *viz.* stone weight (g) was measured on a digital weighing balance.

Stone length (cm), stone width (cm), stone thickness (cm), kernel length (cm), kernel width (cm) kernel thickness (cm) were measured with digital vernier calliper (Mitutoyo, Japan). Pulp:peel ratio and pulp:stone ratio was calculated from the values recorded (Ranganna, 1986).

Results and Discussion

Significant intra-cultivar diversity with wide range was observed for stone and kernel parameters (Table 1). The stone weight was observed to range from 24.17 to 33.50g these findings consonance with Bora *et al.*, (2017) who observed significant variation among the different cultivars of mango under study.

The higher stone weight was recorded in cv. Langra (35.06 g) while lower weight of stone was observed in Dashehari Clone (12.49 g) was also reported by Kundu and Ghosh (1992) and Abirami *et al.*, (2004). The present findings related to stone weight are also in accordance with the results of Jilani *et al.*, (2010) and Anila and Radha (2005), who observed that stone weight ranged from 22.99 g to 47.07 g in four varieties and two hybrids *viz.*, Alphonso and Ratna.

The pulp:stone ratio was observed to range from (4.36 to 8.04) the results of the present study are in partial agreement with the research findings of Bora *et al.*, (2017) who observed significant variation in ratio of pulp and stone clearly revealed that the variety Mallika had higher pulp and stone ratio and the lower values was obtained for Amrapali. Stone size is an important character of mango as it determines the edible portion in the fruit.

The lower stone length was noted in cv. Arunika (5.74 cm) which was statistically at par with Dashehari Clone (5.91cm), Sabri (6.17 cm), Swarna Jahangir (6.28 cm) and Langra (6.58 cm). The stone length was observed to range from (8.99 to 11.75cm), stone width (2.72 to 4.14cm) and stone thickness (1.44 to 1.93cm), kernel length (3.65 to 6.65cm), kernel width (1.46 to 4.13cm) and kernel thickness (1.04 to 2.07cm).

Bora *et al.*, (2017) observed significant variation in stone and kernel size and he observed the mean value for the stone width showed a range of 2.33 to 4.11 cm and similar significant variation in stone length and width in different mango varieties was also recorded by Abirami *et al.*, (2004) in (Bappakal, Chandrakaran, EC-95862, Kensington, Kitchner, Kurukkan, Muvandan, Mylepelian, Nekkare, Olour, Peach, Prior and Starch.

This variation in stone characteristics might be due to different in environmental interaction and genetic composition. Kundu and Ghosh (1992) and Abirami *et al.*, (2004) also observed significant variation in stone length and width of different mango cultivars.

In the present investigation, phenotypic coefficient of variation (PCV) was greater than the corresponding genotypic coefficient of variation (GCV) for all the characters indicating the importance of environment in expression of characters. However, the differences between the GCV and PCV for all the characters were narrow suggesting that the characters were less affected by environment.

The differences between values of PCV and GCV were less for kernel length, kernel width and kernel thickness indicating that these characters were largely under genetic control and environment had least influence on the

expression of these traits. The results of the present study are in partial agreement with the research findings of Patel *et al.*, (2016), Himabindu *et al.*, (2016) and Galal *et al.*, (2017) findings in mango.

The broad sense heritability is the relative magnitude of genotypic and phenotypic variances for the traits and it is used as a predictive role in selection procedures. High heritability was recorded for majority of the characters *viz.* kernel length (85.50%), kernel width (78.20%) and kernel thickness (81.50%).

High heritability generally indicates that the environment effect was very low and enables the breeder to select plants on the basis of the phenotypic expression. Therefore, selection of these characters would be feasible for mango improvement. Similar results were observed by Majumder *et al.*, (2012) and Galal *et al.*, (2017).

Genetic advance as per cent of mean was recorded highest for kernel length (51.37%), kernel width (73.44%) and kernel thickness (75.35%). It also revealed high degree of variation among the cultivars.

High heritability do not always indicate high genetic gain, heritability with genetic advance considered together should be used in predicting the ultimate effect for selecting superior genotypes.

High estimates of heritability estimates coupled with high genetic advance were obtained for all traits and it indicated the presence of additive gene action in the inheritance of these traits and simple selection would be highly rewarding for improving these characters. Rajan *et al.*, (2009), Patel *et al.*, (2016), Himabindu *et al.*, (2016) and Galal *et al.*, (2017) reported similar experimental findings in mango.

Table.1 Intra-cultivar diversity in stone and kernel morphology of mango (*Mangifera indica* L.) cv. Dashehari collected from 15 different orchards in Malihabad and Mal block of district Lucknow

Morphotypes	Stone weight (g)	Pulp:stone ratio	Stone length (cm)	Stone width (cm)	Stone thickness (cm)	Kernel length (cm)	Kernel width (cm)	Kernel thickness (cm)
DM ₁	29.50	5.43	10.20	3.04	1.56	5.48	2.46	1.04
DM ₂	29.50	4.70	10.12	3.45	1.63	5.32	1.79	1.40
DM ₃	30.33	5.47	10.57	3.04	1.56	5.28	2.30	2.05
DM ₄	29.33	5.38	10.55	3.35	1.61	5.95	3.04	1.69
DM ₅	30.50	4.92	10.14	3.02	1.54	5.45	3.29	1.17
DM ₆	32.33	5.32	8.99	3.70	1.55	6.10	2.44	1.33
DM ₇	27.50	4.86	9.34	4.14	1.93	5.04	2.07	1.17
DM ₈	30.00	6.33	10.50	3.20	1.75	4.90	2.29	1.18
DM ₉	30.17	5.07	11.69	3.19	1.44	4.93	1.68	1.21
DM ₁₀	30.67	4.80	10.57	3.30	1.66	5.57	4.13	1.40
DM ₁₁	30.50	5.87	11.27	3.69	1.79	5.05	1.64	1.37
DM ₁₂	31.67	8.04	11.75	3.25	1.68	6.30	3.35	1.09
DM ₁₃	29.33	5.03	11.00	3.42	1.85	4.57	1.87	1.51
DM ₁₄	29.17	5.86	9.52	3.85	1.72	6.32	1.46	1.66
DM ₁₅	32.17	4.76	9.80	3.32	1.53	6.12	2.50	1.27
DM ₁₆	30.67	4.79	9.84	3.43	1.63	6.28	2.47	1.33
DM ₁₇	29.67	4.78	9.87	3.58	1.59	5.79	2.20	1.53
DM ₁₈	29.67	4.65	9.65	3.87	1.52	4.42	2.49	1.36
DM ₁₉	31.67	4.70	9.77	3.72	1.64	5.63	1.75	1.27
DM ₂₀	30.50	5.42	10.73	3.30	1.70	4.57	2.50	2.06
DM ₂₁	29.67	4.88	9.09	3.02	1.73	5.64	2.32	1.44
DM ₂₂	30.17	5.33	10.12	3.37	1.52	5.35	2.49	1.57
DM ₂₃	31.17	4.93	9.05	3.12	1.60	6.49	2.24	1.17
DM ₂₄	31.00	4.62	9.64	3.18	1.70	5.67	1.79	1.54
DM ₂₅	30.17	4.71	9.37	3.37	1.74	5.39	2.14	2.07
DM ₂₆	30.83	5.46	10.24	3.37	1.70	4.70	2.34	2.01
DM ₂₇	31.17	4.58	9.87	3.40	1.64	3.65	2.42	2.04
DM ₂₈	29.00	4.36	9.35	3.57	1.63	4.52	2.33	1.13
DM ₂₉	29.00	4.70	9.47	3.10	1.87	4.50	1.92	1.10
DM ₃₀	30.83	5.64	10.15	3.29	1.66	5.19	2.52	1.13
DM ₃₁	24.17	5.29	9.62	3.42	1.67	6.64	2.60	1.52
DM ₃₂	28.00	4.74	9.29	3.30	1.74	5.24	2.72	1.34
DM ₃₃	30.50	4.72	9.72	2.72	1.69	4.22	2.14	1.18
DM ₃₄	25.67	5.31	9.00	3.24	1.76	5.12	2.27	1.24
DM ₃₅	29.50	5.24	9.99	3.45	1.62	4.85	2.52	1.14
DM ₃₆	26.67	5.70	10.37	3.19	1.68	5.48	2.27	1.40
DM ₃₇	32.67	5.24	10.42	3.55	1.63	6.48	2.52	1.56
DM ₃₈	33.50	5.71	9.80	3.25	1.78	6.39	3.00	1.66

DM₃₉	30.17	5.14	11.27	3.62	1.62	5.45	2.42	1.34
DM₄₀	30.67	5.24	9.68	3.32	1.77	6.50	2.48	1.37
DM₄₁	31.33	5.06	9.55	3.40	1.79	6.49	2.37	1.43
DM₄₂	31.83	5.05	9.37	3.10	1.91	6.62	3.20	1.47
DM₄₃	25.67	5.35	9.18	3.24	1.69	4.32	2.70	1.24
DM₄₄	28.50	4.95	10.50	3.83	1.73	6.64	2.70	1.44
DM₄₅	31.50	4.62	10.67	3.49	1.90	5.09	2.50	1.59
SE(m)±	1.30	0.37	0.44	0.21	0.13	0.17	0.14	0.07
CD (P=0.05)	2.58	0.73	0.87	0.41	0.25	0.33	0.27	0.13

Table.2 Estimates of genetic components for stone and kernel characters in mango cv. Dashehari collected from 15 different orchards in Malihabad and Mal block of district Lucknow

Characters	PCV%	GCV%	h²%	GA%	GAM%
Stone weight (g)	7.05	2.33	10.90	0.99	3.30
Pulp:stone ratio	12.47	0.61	0.20	0.00*	0.00*
Stone length (cm)	7.88	1.95	6.10	0.21	2.09
Stone width (cm)	11.16	0.94	0.70	0.03	0.89
Stone thickness (cm)	14.24	1.88	1.70	0.21	2.09
Kernel length (cm)	14.16	13.09	85.50	2.80	51.37
Kernel width (cm)	22.15	19.65	78.20	1.77	73.44
Kernel thickness (cm)	21.77	19.58	81.50	1.07	75.35

From the results presented in the afore said paragraphs it was evident that the characters namely, kernel length, kernel width and kernel thickness had recorded higher estimates for phenotypic coefficient of variation, genotypic coefficient of variation, genetic advance as per cent mean and heritability its indicated that the presence of additive gene action in the inheritance of this trait and simple selection would be highly rewarding for improving these characters.

References

Abirami, K., Nacheegowda, V. and Reddy Y. T. N. (2004). Physico- chemical attributes of certain polyembryonic varieties of mango. *South Indian Hort.*, 52(1/6): 291-296

Anila, R. and T. Radha. (2005). Physico-chemical analysis of mango varieties

under kerala conditions. *J. of Trop. Agri.*, 41: 20-22

Bora, L., Singh, A. K. and Singh, C. P. (2007). Characterization of mango (*Mangifera indica* L.) genotypes based on physio-chemical quality attributes. *Journal of Applied and Natural Science*, 9 (4): 2199 – 2204.

De Souza V A B and Lima PSC (2004). Genetic variability in mango genotypes detected by RAPD markers. *Acta Hort.*, 64: 303-310.

Galal, O. A, Galal, H. A. and Aboulila. A. A. (2017). Genetic variability and molecular characterization of some local and imported mango cultivars In Egypt. *Egypt Journal of Genetics and Cytology*, 46: 121-138.

Himabindu, A, Srihari, D, Rajasekhar, M, Sudhavani, V, Subbaramamma, P. and Krishna, U. K. (2016). Genetic

- variability and heritability studies of mango cultivars. *International Journal of Science and Nature*, 7(1): 168-172.
- Kundu, S. and Ghosh, S. N. (1992). Studies on physico chemical characteristics of mango cultivars grown in the laterite tract of West Bengal. *Haryana J. of Hort. Sci.*, 21: 129-34
- Majumder, D. A. N., Hassan, L., Rahim, M. A. and Kabir, M. A. (2012). Correlation and path coefficient analysis of mango (*Mangifera indica* L.). *Bangladesh Journal of Agricultural Research*, 37(3): 493-503.
- Mukherjee, S. K. 1950. *Mango: Its allopolyploid nature*. *Nature*, 166: 196-197.
- Pandey, S. N. (1998). Mango cultivars, in: *Mango Cultivation* edited by R.P. Srivastav, *International Book Distributing Company*, Lucknow, India, 39-99.
- Patel, M. C, Patel, D. A, Patel, K. V, Soni, N.V, Satodiya, B.N. and Jadav, R. G. (2016). Genetic variability and correlation studies for fruit yield and quality parameters in mango (*Mangifera indica* L.). *Green Farming*, 7(3): 706-709.
- Rajan, S, Yadava, L. P., Kumar, R. and Sexena, S. K. (2009). Genetic divergence in mango varieties and possible use in breeding. *Indian Journal of Horticulture*, 66: (1) 7-12.
- Rangna, S. (1986). *Handbook of analysis and quality control for fruit and vegetable products*. *Tata McGraw Hill Publication Company Limited*, New Delhi.
- Ravishankar, K. V., Lalitha, A., Dinesh, M. R. and Anand, L. (2000). Assessment of genetic relatedness among mango cultivars of India using RAPD markers. *Journal of Horticultural Science Biotechnology*, 15(2):198-201.
- Rocha, A., Salomao, L. C. C., Salomao, T. M. F., Cruz, C. D. and de Siqueira, D. L. (2012). Genetic diversity of 'Uba' mango tree using ISSR markers. *Mol. Biotechnol*, 50(2): 108-113.
- Vasugi, C, Dinesh, M. R., Sekhar, K, Shivashankara, K. S., Padmakar, B. and Ravishankar, K. V. 2012. Genetic diversity in unique indigenous mango accessions (Appemidi) of the Western Ghats for certain fruit characteristics. *Current Science*. 103(2): 199-207.

How to cite this article:

Sachin Kishor, Deepa H. Dwivedi, Munni Gond and Sutanu Maji. 2020. Estimation of Intra-Cultivar Diversity in Dashehari Mango (*Mangifera indica* L.) through Stone and Kernel Parameters. *Int.J.Curr.Microbiol.App.Sci*. 9(05): 1271-1276.
doi: <https://doi.org/10.20546/ijcmas.2020.905.141>