Content list available at http://epubs.icar.org.in, www.kiran.nic.in; ISSN: 0970-6429

Indian Journal of Hill Farming

Special Issue 2022,Volume 35, Page 38-43

Studies on morphological characteristics of ber (*Ziziphus mauritiana* L.) genotypes

Utpal Das[1,2*] • Ashok Hugar[1] • A. R. Kurubar[1] • M. G. Patil[1]

[1]Department of Horticulture, University of Agricultural Sciences, Raichur, Karnataka
[2]Vellore Institute of Technology, VAIAL, Vellore, Tamil Nadu

ARTICLE INFO

Article history:
Received:30 April, 2022
Revision:22 August, 2022
Accepted:13 September, 2022

Key words: Ziziphus mauritiana L., variability, thorn, leaf, fruit and stone characters.

DOI: 10.56678/iahf-spl2022.6

ABSTRACT

The study was carried out to characterize morphological parameter of twelve *Z. mauritiana* genotypes using randomized block design with three replications during the year 2017-18 and 2018-19 at Department of Horticulture, University of Agricultural Science, Raichur 584104, Karnataka. The results revealed a significant variability across the *Z. mauritiana* genotypes for all the characters under study exception of thorn base width. Low to comparatively moderate environmental variations for the characters were observed from 1.98% to 16.85%. Among the genotypes, Chhuhara and Mehrun showed excellent thorn characteristics and produced chocolate brown colour fruit, round fruit base, less numbers of fruit drop and highest number of fruits per kg. Thus, these recognized genotypes might be considered as prominent for growing or further utilization as a source of desirable gene in future for *Z. mauritiana* improvement.

1. Introduction

The Ber (*Ziziphus mauritiana* L.) also called as Indian Jujube, Chinese date, Indian cherry and Indian date, a fruit crop from the family Rhamnaceae which consists of approximately 45 genera and 550 species (Ezz *et al.* 2011). It can withstand under alkaline soil condition and moderate water-logged condition. *Ziziphus* species are highly potentially to check soil erosion and desertification and has therefore, been planted in India and many more countries. However, indiscriminate felling of *Z. mauritiana* trees in the last 50 years has caused serious state of deterioration in their genetic resources (Morton, 1987).

Z. mauritiana L. is often spiny, evergreen tree and grows to a height of 15 m having a trunk diameter of greater than or equal to 40 cm; spreading crown; stipular spines and many droopy branches. It grows vigorously and starts bearing within three years (Mukhtar *et al.* 2004). The leaves are variable, alternate in two rows and oblong to elliptic. The fruits of *Z. mauritiana* are rich source of vitamin (*viz.*, C, A and B complex) and mineral (*viz.*, calcium and potassium) (Tiwari and Banafar, 1995). The fruit contain 81-83 % moisture, 17.0 % carbohydrates, 0.8 % protein, 65-76 mg ascorbic acid, 22g sugar, 1.3g fiber, 0.2g fat per 100g of fruit (Morton, 1987). The various parts of the plant have numerous practical utility. The leaves and twigs are rich in protein content and can be used as nutritious fodder for livestock (Ngwa and Mafeni, 2000). The plant also has several medicinal uses like fruits are utilized on cuts of ulcers, are implemented in pulmonary ailments and fevers indigestion and biliousness. The leaves are beneficial for the liver troubles, asthma and fever. Juice of the root bark is used to alleviate gout and rheumatism.

The wide geographical and climatic distribution is an indicative of a tremendous variation in *Z. mauritiana*, which needs to be identified and catalogued. The commercial genotypes of *Z. mauritiana* have been evolved through selection of promising types from this wide spread natural variability followed by budding on suitable rootstocks. The plant morphological characters have been identified as invariably undisputed descriptors for DUS testing and varietal characterization of crop genotypes (Joshi *et al.*, 2011). To distinguish distinctive genotypes, morphological descriptions and physiological characteristics in successive approaches is more adventitious. Exhibiting self incompatibility in *Z. mauritiana* leads to wide range of variation for several qualitative and quantitative characters. Therefore, this investigation was performed to characterize the selected *Z. mauritiana* genotypes for identification of superior genotypes for future crop improvement programme.

*Corresponding author: utpaldashorts14@gmail.com

2. Materials and methods

This investigation was carried out with twelve cultivars of *Z. Mauritiana* L. (Umran, Kadaka, Chhuhara, Dandan, Sanaur-2, Illaichi, Seb, Jogia, Mehrun, Manuki, Gola and Sanaur-6) considering randomized block design (RBD) with three replications during the year 2017-18 and 2018-19 at Department of Horticulture, University of Agricultural Sciences, Raichur 584104, Karnataka. The plant to plant and row to row spacing was 7×7 m^2 and pruning was carried out for evenly removal of 1st order shoots to encourage new reproductive shoots. To maintain a uniform growth and development of the trees a recommended package of practices was followed (Meghwal *et al.* 2007). The observations were noted down on sum of nineteen qualitative and quantitative characters. The data collected from each plant selected randomly from various parts of plants at the maturity stage. The qualitative characters like thorn base, leaf shape, leaf apex, fruit apex, fruit base and pulp texture at maturity were recorded visually according to the nature of morphology. The genotypes were grouped in different maturity period *viz.*, very early (100 to 120 days), early (120 to 140 days), mid (140 to 150 days), late (150 to 170 days) and very late (>170 days) from the day of 50 percent flowering (Saran, 2005). The fruit colour was described on the basis of Royal Horticultural Society (RHS media, 2015) colour chart for observation. The quantitative parameters like thorn base width, thorn length, stone length and stone width was measured using a verniercaliper with an accuracy of 0.10 mm. The fruit set and fruit drop percentages were determined according to the following equation given by (Ezz *et al.*, 2011).

$$\text{Fruit set \%} = \frac{\text{Number of developing fruitlets}}{\text{Number of flowers at full bloom}} \times 100$$

$$\text{Fruit drop \%} = \frac{\text{No. of developing fruitlets-No. of remained fruits}}{\text{No. of developed fruitlets}} \times 100$$

The two years' data obtained from the experimentation were based on the pooled analysis of variance utilizing SPSS software and results were evaluated at 5% level of significance.

3. Results and discussion

Qualitative character:

The variations in 12 jujube genotypes for eight qualitative characters are shown in fig.1 and fig. 2. Thorns base varied from narrow to broad among the genotypes. Thorns are one of the morphological adaptation traits of plants to overcome abiotic stresses such as heat and drought, eventually to reduce the water loss (Khakdaman *et al.* 2007). Therefore, thorns are evolved in *Z. mauritiana* as they are tropical tree and well adopted in dry situations. Most of the genotypes except Jogia and Mehrun had medium pulp texture which is suitable for long storage and transport without much deterioration (Krishna *et al.* 2014). The wide range of variation was recorded with respect to leaf shape and leaf apex. The genotype Kadaka had broadly pointed fruit apex and rest of the genotypes had round to beaked fruit apex. The genotypes Illaichi and Seb had broad fruit base whereas, Mehrun, Manuki and Chhuhara expressed round fruit base (Fig. 2). The genotype Umran and Jogia expressed greenish with pink tinge fruit colour at maturity which is distinct from all other genotypes. The genotypes Chhuhara, Illaichi, Mehrun and Sanaur-6 had chocolate brown colour of fruit which is desired by consumer and increase market value (Fig. 2). Chocolate brown colour of fruit could be considered as desirable for processing and value addition. The genotypes Chhuhara, Mehrun, Kadaka and Dandan shows very early to early maturity. Considering all the qualitative characters, Chhuhara and Mehrun are found to be prominent and distinct with respect to fruit colour, fruit base and maturity.

Quantitative character:

Pooled analysis of variance showed significant genotype x year interaction in leaf length to width, fruit set percentage, fruit drop percentage, fruits retention per cluster and the ratio of fruit length to width revealed year to year environmental fluctuation which affects the phenotypic performance of the genotypes (Table 1). The environmental coefficient of variation (ECV) ranged from 1.98% to 16.85% indicating low to comparatively moderate environmental variations for the characters.

The frequency distribution illustrate on the histogram for different characters, it was evident that not any of those followed the accurate normal distribution pattern (Fig. 3). All of the *Z. mauritiana* genotypes are at par performing among themselves for thorn base width (supplementary table 1). The genotype Seb had highest thorn length and at par with Kadaka, Dandan, Sanaur-2, Jogia and Gola. Highest leaf length to width ratio was recorded in Kadaka. Highest fruit set were observed in Umran which was at par with Kadaka, Jogia and Gola. A few ecotypes in comparable climates exhibited differences reproductive behaviors which can be associated to the variation in pollination system (high rate of cross compatible) of *Ziziphus spp.* (Khakdaman *et al.*, 2007). Fruit set also depends on physiological and environmental conditions (Corelli-Grappadelli and Lakso, 2002). The genotype Kadaka showed lowest fruit drop per cent followed by Illaichi, Umran, Chhuhara, Sanaur-2, Dandan and Mehrun. Illaichi retained highest fruits per cluster. Heavy fruit drop in Sanaur-6 and Gola during early stages of fruit development

may be attributed to unsuccessful fertilization or ovule degeneration (Tarai and Ghosh, 2010). Fruit length to width ratio was highest in Kadaka which is at par with Gola and Sanaur-2.

The genotype Mehrun produced the highest number of fruits per kg. The increase in the number of fruits per kg might be due to less fresh weight of fruit (Kumar and Bhusan, 2001). The highest pulp to stone ratio was recorded in Gola. Similarly, Illaichi produced the shortest stone whereas the narrowest stone was recorded in Gola (Fig. 4). The genotypes with superior performance for these characters can be used as a basis of selection or as a source of desirable gene for genetic improvement of *Z. mauritiana*.

4. Conclusion

The *Z. mauritiana* genotypes under study showed ample variation in the qualitative and quantitative characters. Very early maturing genotypes Chhuhara and Mehrun are found to be prominent as they have wide adaptation, preferable fruit colour, lower fruit drop and medium to higher fruits per kg. Identified genotypes can be further employed for gene pool conservation or varietal improvement programme.

5. References

Corelli-Grappadelli, L. and Lakso, A.N. (2002). Fruit development in deciduous tree crops as affected by physiological factors and environmental conditions. In *XXVI International Horticultural Congress: Key Processes in the Growth and Cropping of Deciduous Fruit and Nut Trees 636* (pp. 425-441). Toronto, Canada.

Ezz.,Thanna, M., Yousif, A.F. and Farag, M.E. (2011). Morphological, physiological and biochemical genetic studies on some Indian jujube (*Ziziphusmauritiana*lamk.) varieties grown at el nubaria. *Egyptian Journal of Agricultural Research*89: 1499-1524.

Joshi, A., Agrawal, R.C. and Chawla, H.S. (2011). Assessment of distinctiveness, uniformity and stability of indigenous aromatic Rice (*Oryzasativa*) varieties based on morphological descriptors. *Indian Journal of Agricultural* Sciences81: 595-601.

Khakdaman, H., Pourmeidani, A. and Adnani, S.M. (2007). Study of genetic variation in Iranian jujube (*Zyziphus jujube* Mill.) ecotypes. *Iranian Journal of Rangelands* and *Forests Plant Breeding* and *Genetic Research* 14: 202-214.

Krishna, H. Parashar, A. Awasthi, O.P. and Singh, K. (2014). *Ber. (in) Tropical And Sub Tropical Fruit Crops: Crop Improvement and Varietal Wealth*, Part-I, 137–55. Ghosh S N (Ed). Jaya Publishing House, Delhi.

Kumar, D. and Bhusan, J.S. (2001). A note on performance of ber cultivars in reclaimed ravines. *Orissa Journal of Horticulture* 29:104-05.

Meghwal, P.R., Khan, M.A. Tewari, J.C. (2007). Growing Ber (*ZiziphusMauritiana* Lam.) for sustainable income and employment in arid and semiarid region, Central Arid Zone Research Institute, ICAR, Jodhpur.

Morton, J. (1987). Indian jujube (*Ziziphusmauritiana*Lam.) in Fruits of Warm Climates, Morton, *J. F. Mi-Ami*, Florida, 272–275.

Mukhtar, H.M., Ansari, S.H., Ali, M. and Naved, T. (2004). New compounds from *Zizyphus vulgaris*. *Pharmaceutical Biology*42: 508-511.

Ngwa, A.T. and Mafeni, J.M. (2000). Feed selection and dietary preferences of forage by small ruminants grazing natural pastures in the sahelian zone of Cameroon. *Animal Feed Science Technology* 88: 253- 266.

RHS Media (2015). Royal Horticultural Society (RHS) Colour Chart, 6th ed.; Royal Horticultural Society: London, UK.

Saran, P.L. (2005). *Studies on genetic divergence in ber (ZiziphusmauritianaLamk.) germplasam*, Ph.D Thesis, HAU, Hisar.

Tarai, R.K. and Ghosh, S.N. (2010). Varietal evaluation for yield and yield parameters of ber under semi-arid region of West Bengal, *Journal of Horticultural Sciences* 5: 17-20.

Tiwari, R.J. and Banafar, R.N.S. (1995). Studies on the nutritive constituents, yield and yield attributing characters in some ber (*Zizyphusjujuba*) genotypes. *Indian Journal* of *Plant Physiology*38: 88-89.

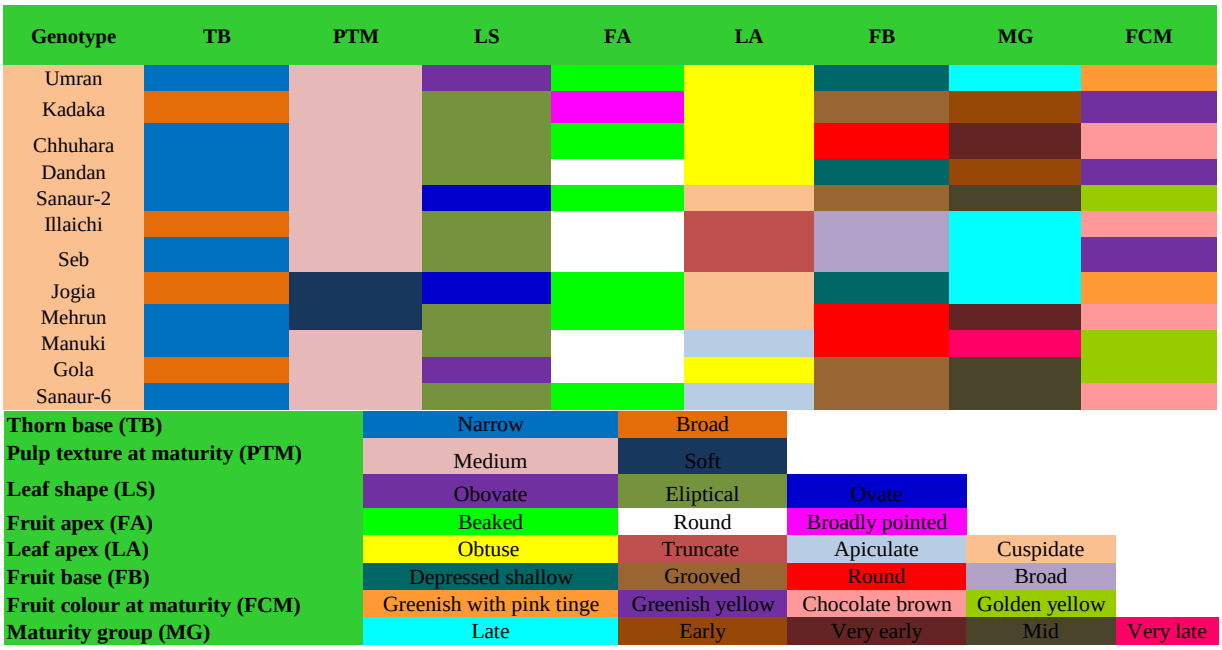
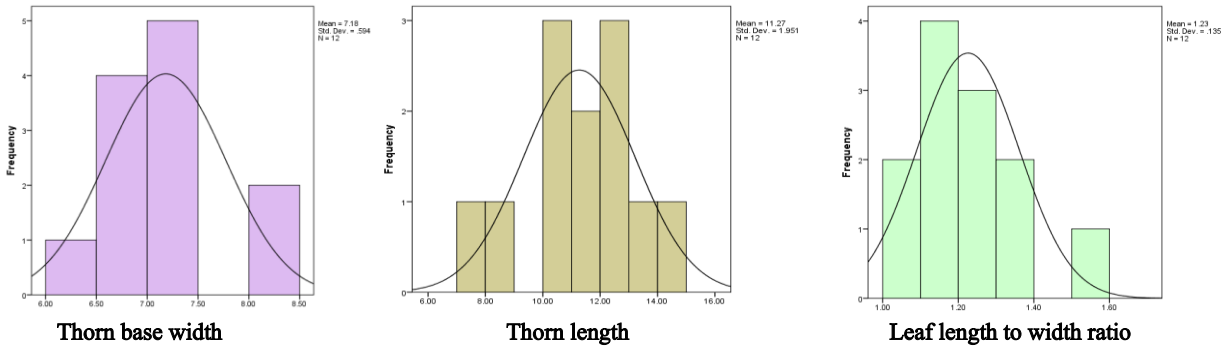


Figure 1. Assessment of physio-qualitative characters among ber genotypes
[Note: Thorn base (TB), Pulp texture at maturity (PTM), Leaf shape (LS), Fruit apex (FA), Leaf apex (LA), Fruit base (FB), Fruit colour at maturity (FCM) and Maturity group (MG)]

Figure 2. Variations in shape and colour of fresh fruits of selected ber genotypes



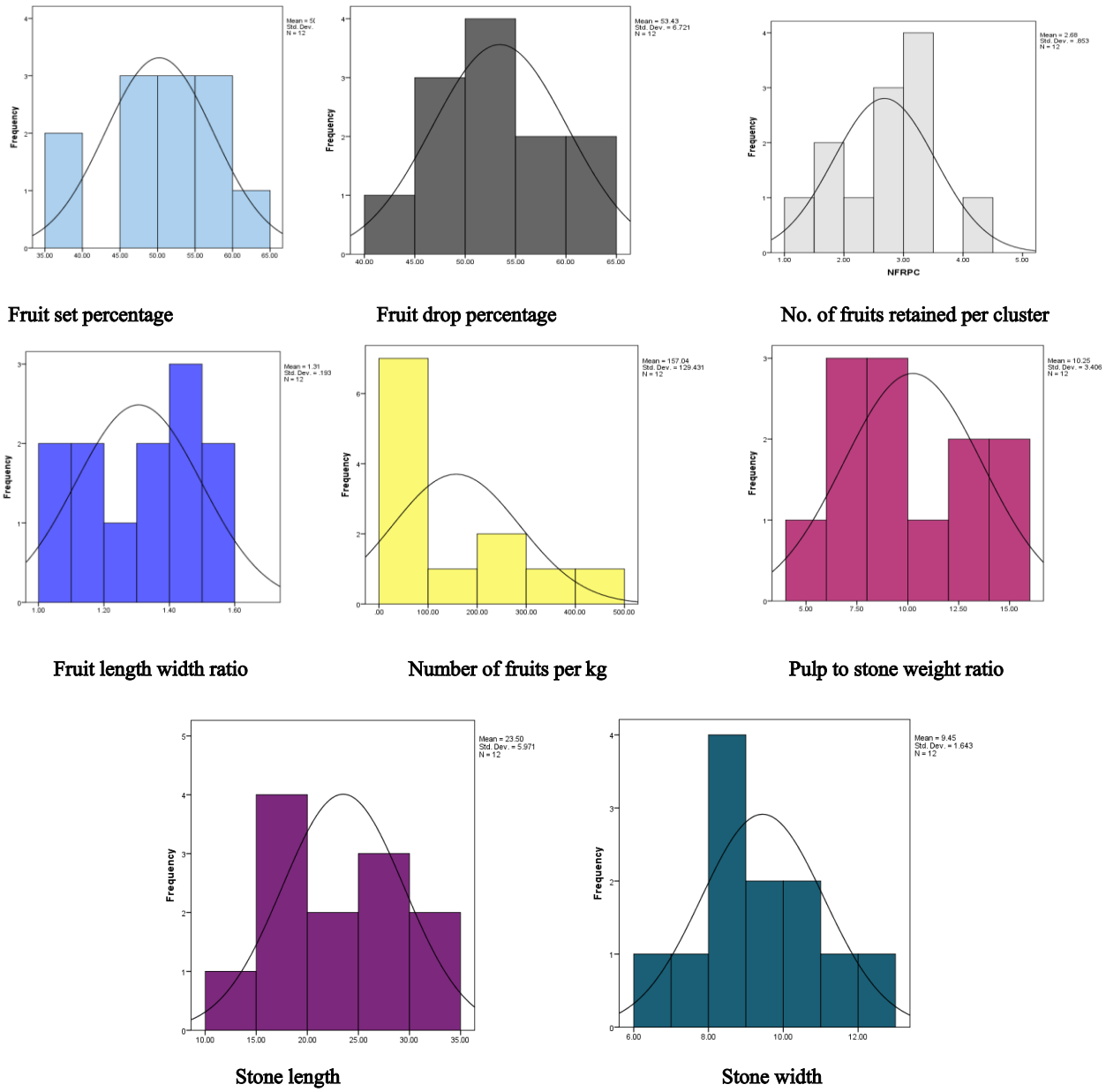


Figure 3. Assessment of physio-quantitative characters among ber genotypes

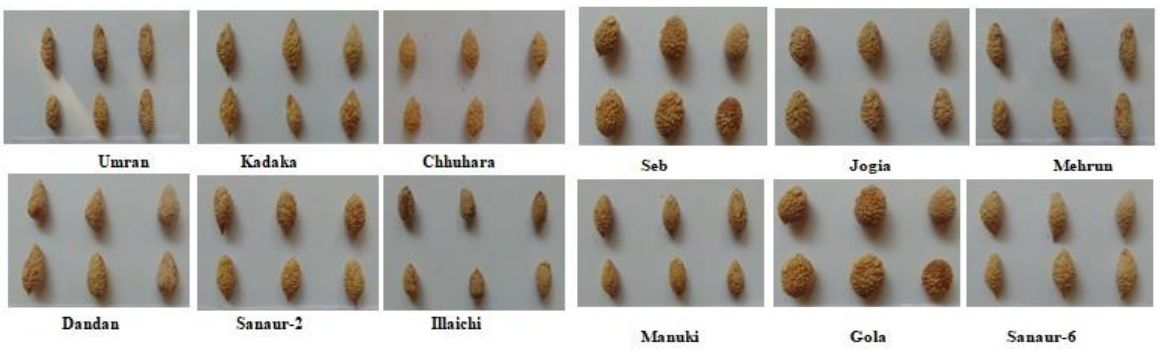


Figure 4. Variation in stone length and width of ber genotypes

Table 1. Pooled analysis of variance for different morphological characters of ber genotypes

Source	*df*	TBW	TL	LLWR	FSP	FDP	NRFC	FLWR	NFPK	PSWR	SL	SW
Year	1	0.038	9.798	0.631**	0.472	800.133**	47.126**	0.007	6.272	2.22	5.184**	0.454**
Replication × Year	4	8.443**	24.456**	0.006	97.313	148.211	0.631	0.006	28.121	0.000**	0.981**	0.224
Genotype	11	2.113	22.822**	0.110**	313.132**	271.186**	16.721**	0.220**	100513.78**	0.011**	213.913**	16.212**
Genotype × Year	11	0.435	0.705	0.064**	166.374**	216.463**	7.230**	0.018**	21.027	6.16	0.225	0.147
Error	44	1.464	3.376	0.013	38.32	78.878	0.246	0.005	16.534	7.18	0.216	0.096
CV (%)		16.85	16.30	9.17	12.32	16.62	11.06	5.63	2.59	7.63	1.98	3.27

**** Significant at 5% level: TBW**: torn base width, **TL**: thorn length, **LLWR**- leaf length to width ratio, **FSP**: fruit set percentage, **FDP:** fruit drop percentage, **NRFC:** number of retained fruits per cluster, **FLWR:** fruit length to width ratio, **NFPK:** number of fruits per Kg, **PSWR:** pulp to stone weight ratio, **SL:** stone length **SW:** stone width.