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Genetic Variability for Physical Parameters among Identified Distinct Genotypes of Tamarind

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A B S T R A C T

An investigation entitled "Genetic variability for physical parameters among identified distinct genotypes of tamarind" was conducted at the Department of Fruit Science, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola during the years 2023-2024 with objectives to evaluate the different tamarind genotypes based on physical parameters. Fourteen genotypes were used in the study. Ripe fruits were harvested from specific tamarind trees, and among studied genotypes AKCHT-11 was found to be the superior genotype in pod length (cm), width (cm), and thickness (cm), as well as the highest pod weight (g), pulp weight (g), shell weight (g), rag weight (g), seed weight (g) and pulp recovery (%). The maximum number of pods/ kg and highest pulp to seed ratio are observed in the genotype AKCHT-6. The highest pulp to shell ratio is observed in the variety Pratishthan. The higher number of seeds per pod and yield per plant (kg) recorded in AKCHT-12 genotype.

Introduction

Tamarindus indica L. is a semi- evergreen, multipurpose tropical fruit tree which is used primarily for its fruits/pods and used for incorporation in processing of different value-added products (Gitanjali *et al.,* 2020 and Jaspher *et al.,* 2017). Tamarind belongs to dicotyledonous family Fabaceae of subfamily Caesalpinieae, it is a diploid species with chromosome number of X= 12 and 2x = 24 (Purseglove, 1987). The Arabic language brought Tamarind into existence, creating a blend of Tamar, which means 'date', and in Hindi, which means 'of India'. The tamarind pulp's brown appearance led to the inclusion of the word date as Tamar-u'l-Hind in Arabic (El-Siddig *et al.,* 2006). Tamarind is widely grown in Tamil Nadu, Karnataka, Madhya Pradesh, Bihar, Chhattisgarh, and Andhra Pradesh in India (Anon, 1993). It is a sturdy and drought-tolerant tree that thrives in warm tropical and subtropical climates. It is commonly found growing in wastelands. Because of its high demand, this fruit crop is increasingly popular among farmers and processing firms. In an age of climate change, the performance of this fruit crop is encouraging.

Maharashtra has several regional varieties as well as enhanced variants that are cultivated commercially in various regions. Popularly produced improved varieties are Pratisthan, Akola Smruti, PKM-1, DTH and Ajintha. Local varieties have been grown for a long time by the

cultivators and have been incorporated into certain areas within the area. This implies that there is a lot of scope for development with this crop by applying genetic and plant breeding knowledge.

Materials and Methods

The experiment entitled "Genetic variability for physical and biochemical parameters among identified distinct genotypes of tamarind" was conducted at 'College of Horticulture, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola' and analytical work was conducted at Analytical laboratory, Department of Fruit Science, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola on tamarind trees during the year 2023-2024. The genotypes were coded as AKCHT- 1, AKCHT- 2, AKCHT-3, AKCHT-4, AKCHT-5, AKCHT-6, AKCHT-7, AKCHT-8, AKCHT-9, AKCHT-10, AKCHT-12, Pratishthan and Akola Smruti. One plant of each treatment selected, marked, and kept under observations for recording various observations. Since the study is based on single plant observation, the samples for observations were collected from each direction i.e. East, West, South and North and each of these directions were considered as one replication. Further, the observed characteristics were subjected to RBD analysis and statistical analysis was as per the procedure suggested by Panse and Sukhatme (1978). Observation were recorded on various physical parameters viz., Length of Pod (cm), Pod width (cm) and Thickness of pod (cm) was measured with the help of vernier calliper, Pod weight (g), Shell weight pod^{-1} (g), Rag weight pod^{-1} (g), Pulp weight pod^{-1} (g), Pulp recovery (%) by dividing pulp weight with respective pod weight and expressed as percentage, Number of seeds pod^{-1}, Seed weight pod^{-1} (g), Pulp: Shell ratio by dividing pulp weight by shell weight, Pulp: seed ratio by dividing pulp weight by seed weight, Number of pods per kg and Yield per plant (kg).

Results and Discussion

The mean of all the physical parameters is shown in table 1, table 2 and figure 1 and 2. The genotypes AKCHT-11 was found to have the longest pods (15.0 cm), followed by the genotype AKCHT-10 (13.6 cm). With an overall mean of 11.0 cm, the genotype AKCHT-6 had the shortest pod length (8.2 cm), which was much less than the pod lengths of all other genotypes. The differences in the pod length may be attributed to the genetic makeup of each genotype. These results coincide with those of Kotecha and Kadam (2002); Patil (2004); Ganacharya (2005); Sharma *et al.,* (2015) and Tania *et al.,* (2018) in tamarind. The genotype AKCHT-11 showed the highest pod width (2.40 cm), which was at par to the genotypes Pratishthan, Akola Smruti, AKCHT-1, AKCHT-2, AKCHT-4, and AKCHT-10. AKCHT-5 reported the smallest pod width (1.2 cm), and the average pod width was 1.9 cm. The variation in width of fruit might be due to genetic differences among selected genotypes. These findings agree with the findings of Kotecha and Kadam (2002); Sharma *et al.,* (2015); Tania *et al., (*2018) and Rajamanickam (2019) in tamarind. The results presented in Table 1 clearly show that there was a significant difference in the thickness of the pods. It was noted that AKCHT-11 had the thickest pods, measuring 1.7 cm, which was at par to genotype AKCHT-10 (1.65 cm). AKCHT-6 has the thinnest pods, measuring 1.1 cm. Pod thickness was 1.37 cm on average. Similar results were obtained in tamarind by Fandohan *et al.,* (2011); Sinha (2015); Shukla and Singh (2019) and Bhavani *et al.,* (2021). The genotype AKCHT-11 has the largest pod weight (31.45 g), followed by the genotype AKCHT-10, which weighs 28.31 g. The genotype AKCHT-6 has the lowest weight (9.02 g), while the mean pod weight is 17.89 g (Table 1). The pod weight and the pod yield per tree are related factors. The higher pod weight resulted in higher pulp, seed, shell and rag weight per pod. Kotecha and Kadam (2002); Hanamashetti *et al.,* (2003); Patil (2004) and Divakara (2008) all reported similar outcomes while studying tamarind.

The genotype AKCHT-11 had the largest shell weight pod^{-1} (6.95 g), while the genotype AKCHT-10 (6.55 g) had shell weight that was at par. The mean shell weight pod^{-1} for all 14 genotypes is 3.89 g, with the genotype AKCHT-5 having the lowest shell weight pod^{-1} at 2.4 g. The variance in fruit size might be the cause of the variation in shell weight per pod of all the tamarind genotypes under study. Comparable variations were noted by Hanamashetti *et al.,* (2003); Ganacharya (2005); Tadas *et al.,* (2015); Shukla and Singh (2019) and Rajamanickam (2019) about shell weight pod^{-1} of several tamarind genotypes. The genotype AKCHT-11 had the highest recorded rag weight per pod (0.58 g), whereas the genotype AKCHT-10 (0.53 g) was at par. The genotype AKCHT-5 recorded the lowest weight (0.15 g). The mean rag weight was 0.39 g. The variation in the rate at which vascular tissue develops in fruit might be the cause of the variations in rag weight among the genotypes (Hanamashetti, 1997). Similar findings in tamarind have also been shown by Prabhushankar *et al.,* (2004) and Divakara *et al.,* (2012).

Table.1 Mean performance of different physical parameters of 14 tamarind genotypes

Genotype	Length of pod(cm)	Pod width (cm)	Thickness of pod(cm)	Pod weight (g)	Shell weight pod^{-1} (g)	Rag weight pod^{-1} (g)	Pulp weight pod^{-1} (g)
AKCHT-1	10.5	2.10	1.30	14.11	3.65	0.35	5.81
AKCHT-2	12.2	2.15	1.32	14.65	3.45	0.31	6.41
AKCHT-3	9.6	2.00	1.25	18.04	4.60	0.29	7.75
AKCHT-4	11.6	2.20	1.28	18.95	3.25	0.42	8.93
AKCHT-5	8.6	1.20	1.15	9.19	2.40	0.15	4.24
AKCHT-6	8.2	1.25	1.10	9.02	2.50	0.17	4.2
AKCHT-7	12.5	1.45	1.45	16.47	3.78	0.43	6.71
AKCHT-8	8.3	1.60	1.35	18.27	3.58	0.39	6.95
AKCHT-9	9.2	1.85	1.50	18.98	3.43	0.41	8.79
AKCHT-10	13.6	2.30	1.65	28.31	6.55	0.53	12.7
AKCHT-11	15.0	2.40	1.70	31.45	6.95	0.58	15.32
AKCHT-12	11.2	1.75	1.40	19.64	3.38	0.45	7.46
Pratishthan	10.6	2.28	1.35	16.83	2.65	0.46	7.62
Akola Smruti	13.7	2.35	1.38	16.65	4.25	0.52	7.5
Mean	11.0	1.9	1.37	17.89	3.89	0.39	7.88
SE (m) ±	0.17	0.119	0.066	0.125	0.143	0.020	0.046
C.D 5%	0.486	0.339	0.190	0.358	0.410	0.058	0.131

Table.2 Mean performance of different physical parameters of 14 tamarind genotypes

Genotype	Seed weight pod^{-1} (g)	No. of seeds pod^{-1}	Pulp Recovery (%)	Pulp: Shell Ratio	Pulp:SeedRatio	Number of pods / kg	Yield per plant (kg)
AKCHT-1	4.3	6.40	41.18	1.59	1.35	98.9	98.4
AKCHT-2	4.48	5.30	43.75	1.87	1.44	88.5	93.9
AKCHT-3	5.4	7.30	42.96	1.69	1.44	79.0	90.4
AKCHT-4	6.35	5.55	47.12	2.81	1.41	55.5	75.6
AKCHT-5	2.4	4.30	46.14	1.77	1.79	114.3	70.5
AKCHT-6	2.15	4.25	46.56	1.69	1.97	117.3	72.5
AKCHT-7	5.55	6.35	40.74	1.78	1.21	104.6	88.4
AKCHT-8	7.35	6.25	38.04	1.95	0.95	73.6	101.5
AKCHT-9	6.35	6.95	46.31	2.57	1.39	90.3	99.8
AKCHT-10	8.53	8.80	44.86	1.94	1.49	50.1	104.5
AKCHT-11	8.6	8.50	48.71	2.21	1.78	48.7	106.0
AKCHT-12	8.35	8.90	37.98	2.21	0.89	59.8	150.8
Pratishthan	6.1	7.75	45.28	2.89	1.25	60.7	144.5
Akola Smruti	4.38	7.60	45.05	1.77	1.72	62.5	149.0
Mean	5.73	6.73	43.06	2.1	1.43	78.8	103.3
SE (m) ±	0.129	0.222	0.434	0.096	0.051	1.445	1.285
C.D 5%	0.368	0.635	1.242	0.274	0.145	4.134	3.855

Figure.1 Pod, seed, and pulp weight (g) of different tamarind genotypes

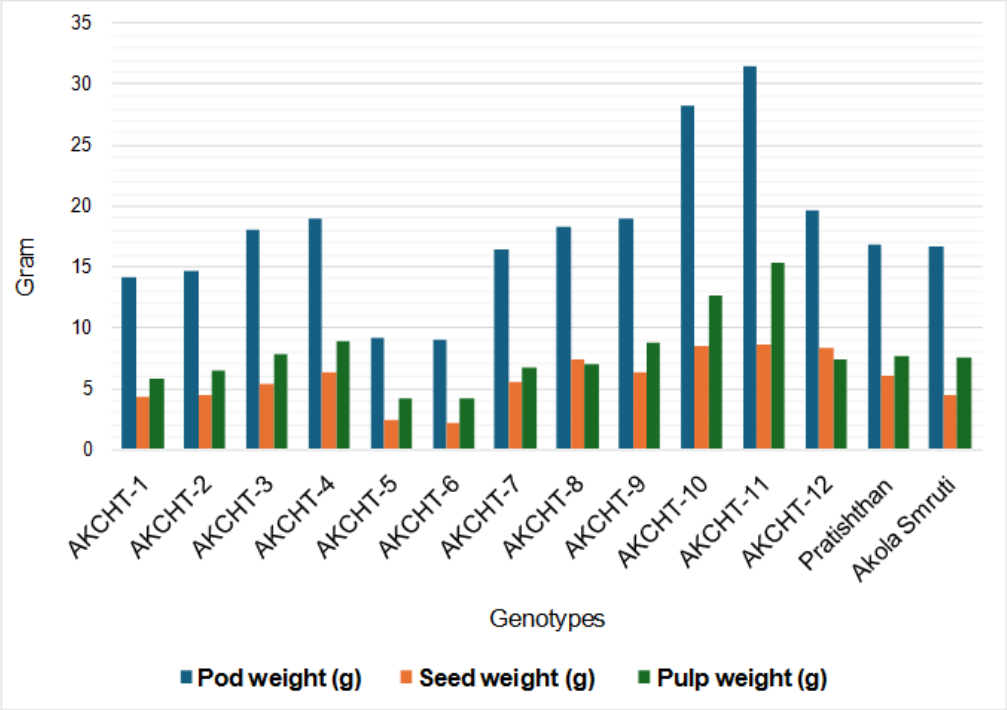
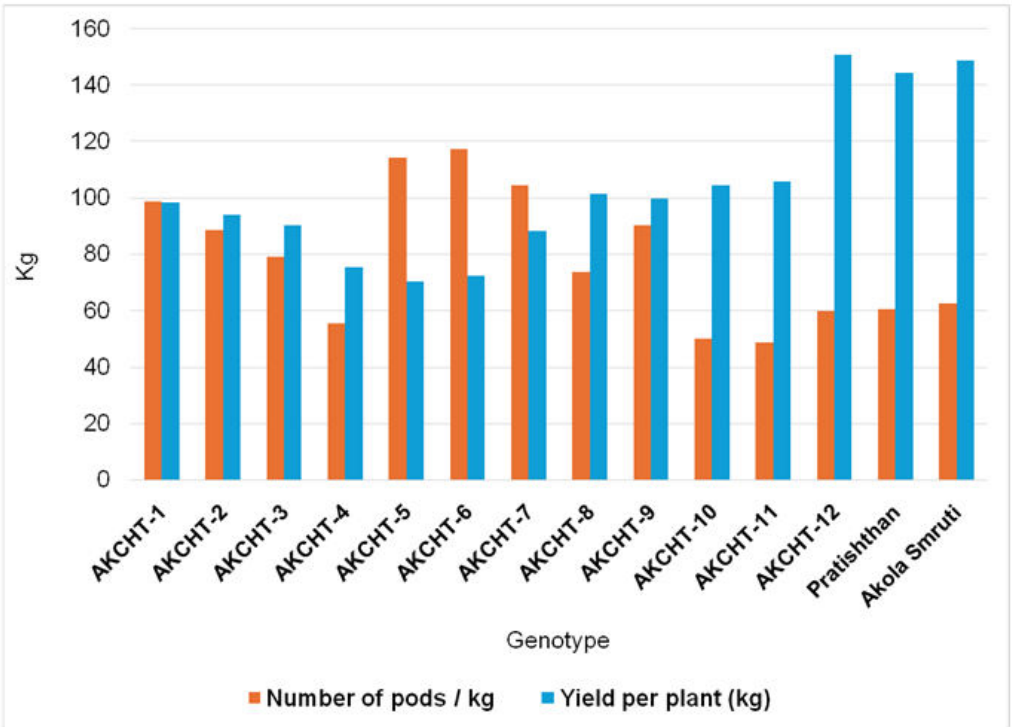


Figure.2 Number of pods per kg and Yield per plant (kg) of different tamarind genotypes



The results indicated that significant differences were observed in pulp weight during the seasons of study, it is shown in table1 and figure1. The data revealed that the maximum pulp weight was recorded in genotype AKCHT-11 (11.52 g) followed by genotype AKCHT-10 (12.70 g). However, it was minimum in genotype AKCHT- 6 (4.20 g). Mean pulp weight across 14 genotypes was 7.88 g. Fruit length, breadth and weight are measures of fruit size, the larger the fruit the more is the pulp weight (Karale *et al.,* 1999). Significant variation in pulp weight trait studied in the present investigation have also been reported in tamarind by Hanamashetti *et al.,* (2003); Patil (2004); Ganacharya (2005); Divakara (2008) and Raut *et al.,* (2022).

The genotype AKCHT-11 exhibited significantly the highest pulp recovery per cent (48.71 %) which was followed with genotypes AKCHT-4 (47.12 %). However, the minimum pulp recovery per cent (37.98 %) was showed by genotype AKCHT-12 with mean of 43.06 per cent. Table 2 and figure 2 displays the data. Similar results were observed by Prabhushankar *et al., (*2004); Ganacharya (2005); Sharma *et al.,* (2015); Tadas *et al.,* (2015) and Raut *et al.,* (2022) in tamarind.

There was a significant difference among the genotypes in respect to the number of seeds per pod. The maximum number of seed per pod was recorded with the genotype AKCHT-12 which was 8.90 and the genotype AKCHT-10 with 8.8 seeds and AKCHT-11 (8.5) was found at par. However, the minimum number of seeds per pod was recorded in the genotype AKCHT-6 (4.25).

The seed number per fruit seemed to result from a tradeoff between fruit length and seed size. Fruits having greater or lower length may contain either a lower or higher number of seeds depending on seeds size (Fandohan *et al.,* 2011). The difference in seed number may be attributed to the difference in length of pod and ovule fertility (Shivanandam, 1980 and Hanamashetti, 1996). Similar conclusions were made by Hanamashetti *et al.,* (2003); Patil (2004); Ganacharya (2005); Abraham *et al.,* (2006) and Sharma *et al.,* (2015) in tamarind.

The maximum seed weight was noted in genotype AKCHT-11 (8.60 g) and at par by genotype AKCHT-10 (8.53 g) and AKCHT-12 (8.35 g). Whereas the minimum value (2.15 g) was recorded in genotype AKCHT-6 with a mean of 5.73 g. The difference in seed weight may be attributed to the difference in the number and size of seeds (Shivanandam, 1980; Hanamashetti, 1996). Similar results were observed by Hanamashetti *et al.,* (2003); Patil (2004); Prabhushankar *et al.,* (2004); Shukla and Singh (2019) and Raut *et al.,* (2022).

Maximum pulp: shell was noted in the variety Pratishthan (2.89) which was at par with the genotypes AKCHT-4 (2.81). Mean pulp: shell ratio was 2.1. Whereas the lowest value (1.59) was recorded in genotype AKCHT-1 (Table 2). Similar variation in pulp to seed ratio in tamarind genotypes were noticed by Raut *et al.,* (2022). Maximum pulp: seed ratio was noted in genotype AKCHT-6 (1.97) followed by genotypes AKCHT-5 (1.79). The lowest pulp: seed ratio was observed in genotype AKCHT-12 (0.89). Overall mean of pulp: seed ratio was 1.43. Similar variation in pulp to seed ratio in tamarind genotypes were noticed by Raut *et al.,* (2022).

The maximum number of pods kg^{-1} was observed in genotype AKCHT-6 (117.3) which was at par with genotypes AKCHT-5 (114.3) with a mean value of 78.8. The minimum number of pods kg-1 was recorded in genotype AKCHT-11 (46.7). The data is shown in table 2 and figure 2. Higher number of pods kg^{-1} indicated lower pod weight or small sized pods, whereas the lowest number of pods in a kilogram resulting in bigger sized pods and higher pod weight. Similar results were observed by Sivakumar (2000) and Raut *et al.,* (2022).

Maximum yield per plant (150.8 kg) was recorded in the genotype AKCHT-12, which was at par with Akola Smruti (149.0 kg). Whereas it was minimum (70.5 kg) in the genotype AKCHT-5 with overall mean of 103.3 kg (Table 2, Figure 2). The genetic composition of the plant is a major factor in its productivity. In addition to orchard care and maintenance, the age of the plant and the season are known to have a significant impact on production, which is recognized to be a polygenic trait. Similar studies in tamarind have been reported by Gunasena and Hughes (2000); Sharma *et al.,* (2015); Tania *et al.,* (2018) and Reddy *et al.,* (2024).

Author Contributions

Pranjali G. Laharia: Investigation, formal analysis, writing—original draft. Ujwal A. Raut: Validation, methodology, writing—reviewing. Hrishika Rajiv:—Formal analysis, writing—review and editing. Amruta G. Madane: Investigation, writing—reviewing.

Data Availability

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethical Approval Not applicable.

Consent to Participate Not applicable.

Consent to Publish Not applicable.

Conflict of Interest The authors declare no competing interests.

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