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Research Article

GENETIC VARIABILITY OF AVAILABLE KHIRNI (*Manilkara hexandra*) GERMPLASM

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Abstract: The study was carried out to find out the extent of variability among the khirni genotypes. All the characters varied significantly. The fruit ripening time varied from second week of March to fourth week of May. Number of fruits per fascicle ranged from 1.67 to 10.33.Fruit weight varied from 3.33g to 14.85g. Fruit length found in between 2.23cm (MGK31) to 3.25cm (MGK16). Fruit diameter varied from 0.86cm to 2.11 cm. Pulp: seed ratio fall in between 1.57cm to 10.64. Fruit yield per side of tree varied from 4.40kg to 10.90kg. TSS varied from 19.00 °Brix to 31°Brix. Vitamin C ranged from 15.20 mg/100g to 25.70 mg/100g and carotene content varied from 3.57 mg/100g to 6.47 mg/100g. Seed weight and germination percentage ranged 0.74g to 2.57g and 56% to 88.33% respectively. The Phenotypic coefficient of variation was higher than Genotypic of variation for all the characters studied indicates effect of environment in expression of characters. High heritability combined with high genetic advance was recorded for pulp: seed ratio, fruit weight, number of fruits per fascicle indicating these characters can be improved by selection.

Keywords: Genetic Variability, Khirni genotypes

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Introduction

Khirni (*Manilkara hexandra* Roxb.) Dubard syn. (*Mimusops hexandra* Roxb.) belongs to the family sapotaceae. It is believed to be originated in India [1]. It occurs naturally in forests and common lands particularly Central and Deccan peninsular India. The tree is evergreen, long lived, small to medium size, 10-12m in height with a spreading crown, straight growing and massive bole. . Flowering occurs in the month of October–November–December and fruit ripens during April–May [2]. Ripe fruits are eaten fresh or after dehydration, they are sweet but astringent. The seed contains 24.6% of edible oil. Bark and fruits are also used for several medicinal purposes like treatment of ulcers, dyspepsia, opacity of cornea, bronchitis, urethrorrhea, leprosy, *etc.* Besides different medicinal and social uses of Khirni, it is commercially used as rootstock for grafting of sapota plant. In terms of yield also trees grafted on Khirni gave 50 percent more than that on air layers and twice that on sapota seedling stock. Khirni is highly heterozygous, cross pollinated fruit crop. Due to predominant cross pollination and seed propagation wide variation exits among the genotypes with respect to fruit characters and seed characters *etc.* (Considerable variability was also reported by Patel *et al.* (2005) in jamun in Uttar Pradesh and Malik *et al.* (2012) in Khirni in central India) [3,4]. Present experiment was undertaken to find out the extent of variability in available germplasm of Khirni. So that this variation can be further utilized in crop improvement programmes.

Materials and methods

The present investigation was carried out on twenty seven years old khirni orchard during the year 2015-2016 at Main Garden Department of Horticulture, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola. In the present investigation 31 genotypes were selected, which have produced flowers during October-November 2015. 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. The observations were recorded on fruit and seed characters further, the observed characteristics were subjected to RBD analysis.

The genotypic (GCV) and phenotypic (PCV) coefficient of variation will be calculated by the formulae given by Burton (1952) [5]. Heritability percentage in broad sense is calculated by the formulae as suggested by Johnson *et al.* (1995) [6]. The seeds of individual genotype were collected and seeds were treated with 500ppm GA3 for 24 hr. Then the treated seeds were sown in polythene bags containing soil, sand and FYM in 1:1:1 ratio to record germination percentage and seedling vigour at 90, 120 and 150 days after sowing (DAS).

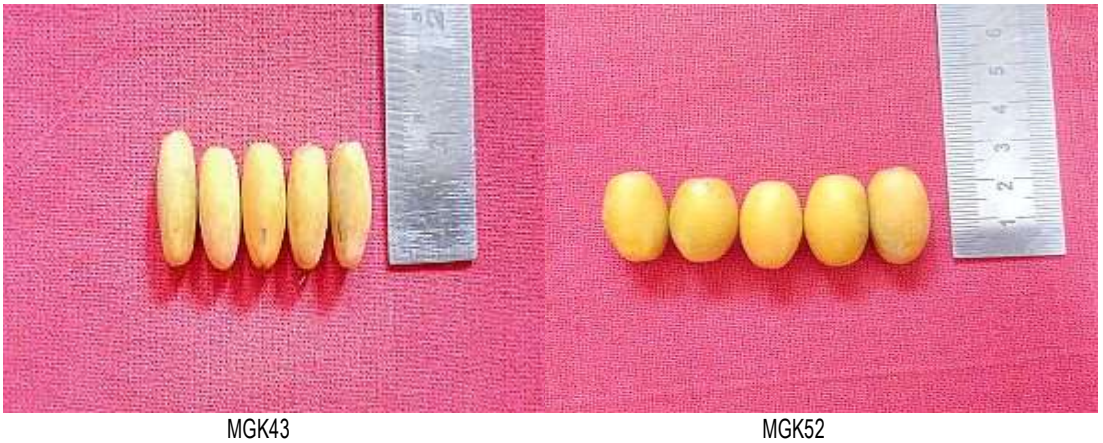
Results and Discussion

The significant variation was observed in khirni genotypes with respect to fruit characters presented in [Table-1]. Fruit ripening time varied from second week of March to fourth week of May. It may be due to inherent genetic nature. The maximum number of fruits per fascicle was observed in MGK61 (10.33) followed by MGK52 (7.67). The maximum fruit weight found in MGK64 (14.85g) followed by MGK58 (11.47g) and minimum fruit weight found in MGK43 (3.33g). The maximum fruit length observed in MGK16 (3.25cm), MGK8, MGK22, MGK26, MGK27, MGK28, MGK51 and MGK61 were at par with MGK16. Minimum fruit length observed in MGK31 (2.23cm). The fruit diameter was highest in MGK51 (2.11cm) followed by MGK65 (1.87cm) and fruit diameter was lowest in MGK5 (0.86cm). The maximum Pulp: seed ratio was recorded in MGK64 (10.64), MGK51 was also at par with MGK64. The minimum Pulp: seed ratio was recorded in MGK16 (1.57). Average Fruit yield per side of tree was maximum in genotype MGK63 (10.90kg), genotypes MGK22, MGK43, MGK45 and MGK59 were at par with MGK63 with respect to average fruit yield per side of tree. The minimum fruit yield was recorded in MGK65 (4.40kg). These results were similar in broad conformity with results of Malik et al. (2012) in Khirni. [Table-2] revealed significant variation with respect to fruit bio-chemical and seed characters. The maximum TSS was observed in MGK31 (31 °Brix) followed by MGK12 (27.67 °Brix) and minimum TSS was observed in MGK61 (19 °Brix). The highest Vitamin C was found in MGK31 (25.70 mg/100g), the genotypes MGK9, MGK14, MGK22, MGK25, MGK41, MGK45, MGK52, MGK63 and MGK64 were at par with MGK31 with respect to Vitamin C.

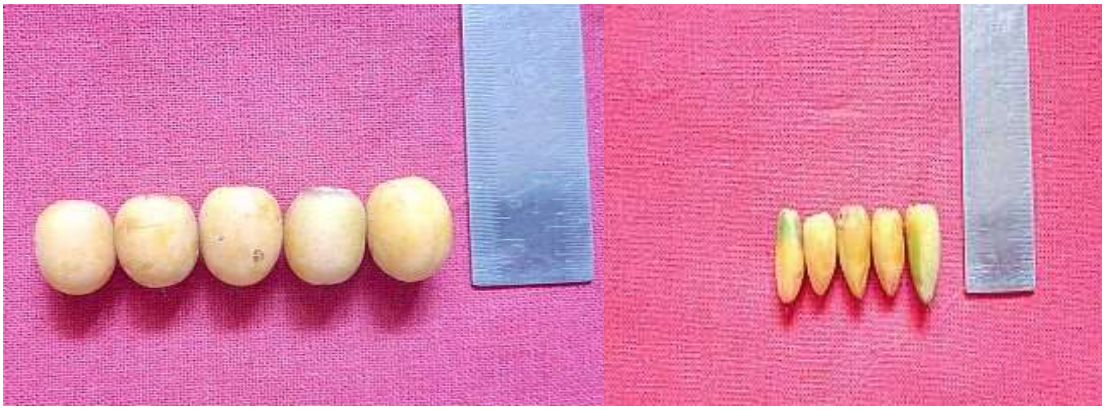
Table-1 *Variability in Khirni genotypes with respect to fruit characters*

	Number of fruits per fascicle	Fruit weight (g.)	Fruit length (cm.)	Fruit diameter (cm.)	Pulp: seed	Fruit yield per tree (kg)	Fruit ripening time
MGK3	4.33	9.42	2.79	1.39	7.61	6.53	Fourth week of March
MGK5	3	8.9	2.78	0.86	4.97	4.77	Fourth week of May
MGK6	3.33	4.4	2.83	1.67	2.09	5.37	Second week of May
MGK7	2.33	5.37	2.52	1.64	3.65	5.4	Fourth week of April
MGK8	1.67	5.37	3.01	1.23	3.83	5.27	Fourth week of April
MGK9	4	7	2.7	1.77	8.82	6.63	First week of May
MGK12	2	4.83	2.96	1.68	2.64	4.97	Second week of May
MGK14	6	7.37	2.54	1.72	2.55	6.97	First week of May
MGK15	4.67	4.77	2.52	1.72	2.47	7.83	Fourth week of April
MGK16	5.33	3.63	3.25	1.64	1.57	7.4	Fourth week of April
MGK17	3	9.23	2.64	1.72	4.07	5	First week of May
MGK22	4.67	4.8	3.05	1.64	3.05	9.63	Third week of May
MGK25	4.33	8.47	2.86	1.75	5.66	5.63	Fourth week of April
MGK26	7.33	4.57	2.98	1.7	2.84	7.3	Fourth week of April
MGK27	3	3.9	3.12	1.62	2.31	7.6	First week of May
MGK28	3	5.4	3.07	1.7	3.29	6.27	Fourth week of April
MGK31	3.67	7.15	2.23	1.42	3.35	5	Third week of March
MGK32	2	7.83	2.75	1.77	5.13	9	Third week of April
MGK34	5.33	5.53	2.86	1.66	3.59	5.97	Second week of April
MGK41	4.33	4.73	2.87	1.64	2.67	7.6	Second week of May
MGK42	3	6.2	2.89	1.7	4.24	6.2	Third week of April
MGK43	4.67	3.33	2.53	1.6	1.86	10	First week of May
MGK45	7	3.93	2.7	1.74	3.3	9.33	Fourth week of April
MGK51	3.33	10.2	3.22	2.11	9.37	7.13	Fourth week of April
MGK52	7.67	7.77	2.82	1.27	6.31	8.9	First week of May
MGK58	2	11.47	2.66	1.6	3.79	7.67	Second week of April
MGK59	5.33	7.47	2.75	1.73	2.22	9	Fourth week of April
MGK61	10.33	8.72	3.1	1.42	4.47	6.07	Fifth week of March
MGK63	3.33	10.23	2.33	1.73	6.86	10.9	Second week of March
MGK64	3	14.85	2.58	1.6	10.64	4.63	Fourth week of April
MGK65	3	9.42	2.87	1.87	2.28	4.4	First week of May
CD (5%)	1.73	1.41	0.27	0.16	1.16	3.47	
SE(m)	0.61	0.5	0.1	0.06	0.41	1.23	

MGK16 MGK31



MGK43 MGK52



MGK63 MGK65

Fig-1 Photographs of fruits of some promising genotypes

Table-2 *Variability in Khirni genotypes with respect to seed and fruit biochemical characters*

	Seed weight (g.)	Germination percentage	Seed color	Seedling vigour at 90DAS	Seedling Vigour at 120DAS	Seedling vigour at 150DAS	Total soluble solids (°Brix)	Vitamin C (mg/100g)	Carotene Mg/100g)
MGK3	1.10	72.67	3	398.2	462.33	738.77	23.33	20.47	4.50
MGK5	1.50	58.33	1	306.83	413.6	623.27	20.63	17.57	4.17
MGK6	1.43	72.67	2	396.53	523.07	779	24.00	21.03	5.33
MGK7	1.13	71.33	1	351.6	351.53	580.07	22.67	21.30	4.93
MGK8	1.13	57.67	1	295.8	376.5	669.8	23.33	20.77	5.00
MGK9	0.74	73.00	2	330.8	428.03	718.5	27.07	25.00	5.83
MGK12	1.33	87.00	3	272.97	400.5	751.13	23.67	21.87	5.23
MGK14	2.10	88.33	1	454.63	590.1	948.43	27.67	25.43	6.10
MGK15	1.43	72.00	3	248.8	366.2	627.5	24.67	23.17	5.08
MGK16	1.43	70.00	3	135.04	243.27	521.8	25.67	23.83	5.43
MGK17	1.83	64.67	1	227.93	342.57	553.57	23.67	22.50	5.07
MGK22	1.20	80.67	1	178.87	307.5	619.57	27.33	24.90	5.94
MGK25	1.30	81.00	3	305.93	433.2	757	24.00	23.33	5.38
MGK26	1.20	80.67	2	303.67	443	743.93	23.80	22.97	6.10
MGK27	1.23	56	3	104.4	174.07	375.6	22.33	20.33	5.08
MGK28	1.33	64.67	1	226.53	348.83	580.77	24.67	23.50	5.43
MGK31	1.67	82.33	3	391.7	553.5	783.6	31.00	25.70	5.07
MGK32	1.27	82.33	3	232.43	414.83	732.03	21.80	18.13	5.94
MGK34	1.17	63.67	2	249.7	368.7	578.4	23.67	22.33	5.38
MGK41	1.30	76.00	1	227.57	371.23	602.27	25.00	23.67	5.35
MGK42	1.19	74.67	1	186.93	311.4	609.17	22.67	20.63	4.77
MGK43	1.20	73.00	1	407	562.03	858.2	23.33	21.47	5.75
MGK45	0.90	62.00	1	185.7	311.1	521.5	27.33	25.10	6.26
MGK51	1.03	71.00	1	216.47	366.27	714.03	22.67	19.53	4.83
MGK52	1.07	75.00	2	477.1	645.97	969.4	26.00	24.57	5.14
MGK58	2.40	70.67	1	387.93	505.47	741.5	21.67	20.07	5.58
MGK59	2.37	76.33	2	237.03	364.47	663.53	22.67	20.73	5.13
MGK61	1.90	63.00	1	204.47	344.5	605.33	19.00	15.20	3.57
MGK63	1.32	81.00	3	396.87	544.4	903.83	28.33	25.50	6.47
MGK64	1.40	71.00	3	279.97	405.4	651.63	24.50	23.37	5.22
MGK65	2.57	69.33	1	203.6	324.13	572	22.00	18.57	4.93
CD(5%)	0.31	6.15		187.69	194.75	202.16	1.15	0.87	0.37
SE(m)	0.11	2.18		66.36	68.85	71.48	1.15	0.87	0.37

(DAS-Days after sowing)

Table-3 *Estimation of Genotypic coefficient of variation (GCV), Phenotypic coefficient of variation (PCV), Heritability (h2) and expected genetic advance as % over mean*

	GCV (%)	PCV (%)	H^2 (%)	Expected genetic advance as % over mean
Number of fruits per fascicle	43.7	50.5	75	78.04
Fruit weight	37.61	39.61	90.17	73.58
Fruit length	8.03	9.98	64.67	13.30
Fruit diameter	13.11	14.38	83.12	24.62
Pulp: seed	53.81	56.36	91.15	105.82
Fruit yield per tree	18.27	35.78	26.08	19.11
Total soluble solids	9.03	12.21	54.67	13.75
Vitamin C	11.04	13.01	72.03	19.31
Carotene	9.06	15.20	35.48	11.11
Seed weight	29.75	32.60	83.27	1.33
Germination percentage	12.74	13.77	85.52	24.26
Seedling vigour at 90days after sowing	23.79	46.87	25.76	24.87
Seedling vigour at 120 days after sowing	19.12	35.02	29.80	21.50
Seedling vigour at 150 days after sowing	16.11	24.30	43.96	22.01

The lowest Vitamin C was recorded in MGK61. The carotene content was maximum in MGK63 (6.47 mg/100g), the genotypes MGK9, MGK14, MGK22, MGK26,MGK28, MGK32, MGK45, MGK58 were at par with MGK63 with respect to carotene content. The carotene content was minimum in MGK61 (3.57 mg/100g). Singh et al. (2006) also reported similar results in Khirni with respect to TSS, Vitamin C and carotene content [7]. The maximum seed weight was recorded in MGK65 (2.57g), MGK58 and MGK59 were at par with MGK61 with respect to seed weight. The maximum germination percentage was found in MGK14 (88.33%), the genotypes MGK12, MGK31, MGK32 were at par with MGK14 with respect to germination percentage. The minimum germination percentage was found in MGK27 (56%). The three different types of seed color were observed and various scores were assigned to different seed colors *i.e*., 1 – Light brown, 2 – Dark brown and 3 – Black. Fifteen genotypes had shown light brown seed color, Six genotypes had shown dark brown color and ten genotypes had shown black seed color. Seedling vigour at 90, 120 and 150 days after sowing was maximum in MGK52 and seedling vigour at 90, 120 and 150 days after sowing was minimum in MGK27. The similar results of germination percentage was reported by Wani Saleem and Latief Ahmed (2013) in *Madhuca indica* [8,9]. Table 3 indicated higher PCV value than GCV value for all the studied characters. The maximum GCV and PCV was observed for Pulp: seed ratio, and minimum GCV and PCV was observed for fruit length. High heritability was recorded for the characters Pulp: seed ratio (91.15%), fruit weight (90.17%), germination percentage (85.52%), seed weight (83.27%). High genetic advance was found for characters Pulp: seed ratio (105.82%), number of fruits per fascicle (78.04%), fruit weight (73.58%). High heritability combined with high genetic advance was recorded for pulp: seed ratio, fruit weight, number of fruits per fascicle indicating these characters can be improved by selection [9,10].

Conclusion

Results of this study conducted revealed that genotypes MGK52, MGK63 and MGK43 are promising genotypes with respect to yield and other characters. There is a need for further improvement in these characters.

Application of research: Khirni is widely used as a rootstock for khirni due to various internal and external factors it has low germination rate and seedling vigour. It is also erratic bearer. Hence, in this study we observed some of the promising genotypes.

Research Category: Study of various characters and calculation of genotypic coefficient of variation and phenotypic coefficient of variation. These are very important for improvement through selection.

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