Journal of Spices and Aromatic Crops
Vol. 14 (1) : 65-70 (2005)

Indian Society for Spices

Variability of fruit characters in *kokum* (*Garcinia indica* Choisy)

V N Kore, S R Nimbalkar & P M Haldankar

Department of Horticulture
College of Agriculture
Dapoli – 415712, Maharashtra, India.

Received 20 July 2004; Revised 05 January 2005; Accepted 08 February 2005

Abstract

The fruit characters of 22 genotypes of *kokum* (*Garcinia indica*) were studied at Dapoli (Maharashtra). The genotypes exhibited significant variation for all the fruit characters and the environmental coefficient of variation recorded for all the fruit characters was very low. The higher magnitudes of phenotypic and genotypic coefficient of variations indicated good amount of variation among the genotypes. Estimates of heritability and genetic advance were relatively higher for length, weight and volume of fruit, fresh rind weight, pulp weight and dry seed weight. The genotypes K-29, K-32, K-146, KN-1, KN-3, KN-4 and KN-5 were promising.

Key words: fruit characters, *Garcinia indica*, genetic advance, heritability, *kokum*, variability.

Considerable variation is observed in seedling progenies of *kokum* (*Garcinia indica* Choisy) as it is an obligatory cross-pollinated crop. The plants differ not only in all the parameters of growth but also in sex expression, size and shape of fruit and rind (Khanvilkar *et al.* 1986). The current investigation was aimed to assess the extent of variability and to understand genetic control over fruit components in seedling progenies of *kokum* for their implications in the improvement of the crop.

The study was conducted on 30 year-old *kokum* trees derived from seedlings at Department of Horticulture, College of Agriculture, Dapoli (Maharashtra) (17°45' N, 73°12' E, 240 m MSL) during 2003–04. The soil is lateritic, sandy to sandy loam and acidic in reaction with pH range of 5.6 to 6.5. Twenty-two genotypes constituted the experimental material (K-4, K-10, K-29, K-32, K-42, K-70, K-133, K-141, K-143, K-146, K-173, K-211, K-212, K-216, K-217, K-219, KN-1, KN-2, KN-3, KN-4, KN-5 and KN-6). The experiment was conducted in a randomized block design with two replications. Ten fully mature fruits from each genotype were randomly selected per replication to record observations on fruit length, breadth, weight, circumference, volume, fresh rind weight, dry rind weight, pulp weight, fresh seed weight, dry seed weight, dry kernel weight, seed number and filled seed number. The data was subjected to ANOVA (Panse & Sukhatme 1995) and biometrical analysis (Singh & Chaudhari 1985).

Significant variations were observed in length, breadth, weight, circumference and volume of *kokum* fruits from various genotypes (Table 1). KN-3 (4.31 cm) had maximum fruit length, whereas, it was the minimum in

K-133 (2.62 cm). Fruit breadth and weight were maximum in KN-1 (4.54 cm and 41.25 g, respectively) and minimum in K-4 (2.98 cm and 14.60 g, respectively). Maximum circumference and volume of fruit was recorded in KN-1 (14.60 cm and 40.05 ml, respectively) and minimum was recorded in K-4 (9.56 cm and 14.20 ml, respectively).

The variation in fresh rind weight, dry rind weight and pulp weight was statistically significant (Table 2). The fresh and dry rind weight was maximum in K-29 (17.20 g) and KN-1 (2.70 g) respectively, and minimum in K-4 (6.80 g and 1.18 g, respectively). The pulp weight was maximum in KN-1 (18.30 g) and minimum in K-4 (2.75 g).

Significant variation was also observed for fresh and dry seed weight, dry kernel weight, seed number and filled seed number (Table 3). Maximum fresh and dry seed weight were recorded in K-32 (8.70 g) and KN-1 (3.72 g), respectively, and minimum in

Table 1. Variation in fruit characters of different genotypes in *kokum**

Genotype	Weight (g)	Length (cm)	Breadth (cm)	Circumference (cm)	Volume (ml)
K-4	14.60	2.92	2.98	9.56	14.20
K-10	22.85	3.38	3.48	11.19	22.19
K-29	32.45	3.45	4.08	13.23	31.75
K-32	30.95	3.70	3.85	12.68	30.31
K-42	24.75	3.14	3.63	11.97	24.17
K-70	21.05	3.11	3.47	11.19	20.75
K-133	16.30	2.62	3.22	11.36	15.75
K-141	27.15	3.27	3.74	11.97	26.59
K-143	24.80	2.89	3.83	12.21	24.47
K-146	32.35	3.61	3.55	12.91	31.91
K-173	20.00	3.45	3.32	10.11	19.50
K-211	25.00	3.21	3.67	11.71	24.35
K-212	22.70	2.79	3.69	11.71	22.08
K-216	22.95	3.00	3.62	11.68	22.35
K-217	25.00	3.24	3.72	11.88	24.46
K-219	27.90	3.14	3.73	12.24	26.86
KN-1	41.25	3.09	4.54	14.60	40.05
KN-2	22.96	3.48	3.40	10.98	22.43
KN-3	35.98	3.79	4.09	13.03	35.26
KN-4	32.22	3.78	4.00	12.79	31.15
KN-5	33.52	4.31	3.90	12.25	32.60
KN-6	26.06	3.54	3.57	11.54	25.47
Mean	26.49	3.31	3.68	11.94	25.85
Range	14.60–41.25	2.62–4.31	2.98–4.54	9.56–14.60	14.20–40.05
SE±m	1.60	0.06	0.12	0.34	1.57
SD	6.41	0.39	0.33	1.07	6.25
CV(%)	24.19	11.68	9.01	8.98	24.20
CD (P=0.05)	4.69	0.16	0.36	1.00	4.61

* Mean of 10 fully mature fruits

Table 2. Variation in fruit characters of different genotypes in *kokum**

Genotype	Fresh rind weight (g)	Dry rind weight (g)	Pulp weight (g)
K-4	6.80	1.18	2.75
K-10	11.90	1.40	6.25
K-29	17.20	1.99	7.70
K-32	12.45	2.00	9.80
K-42	12.10	1.95	6.45
K-70	9.75	1.62	5.90
K-133	8.35	1.45	3.50
K-141	10.95	1.74	7.75
K-143	10.90	1.71	6.60
K-146	12.70	1.99	11.65
K-173	11.35	1.82	4.45
K-211	11.40	1.70	6.80
K-212	10.55	1.75	6.25
K-216	9.65	1.75	5.65
K-217	11.90	1.82	6.65
K-219	12.85	1.78	8.85
KN-1	14.90	2.70	18.30
KN-2	10.45	1.60	7.06
KN-3	15.45	2.04	13.78
KN-4	16.55	2.51	8.27
KN-5	16.05	2.14	11.70
KN-6	12.30	1.86	6.76
Mean	12.11	1.84	7.86
Range	6.80–17.20	1.18–2.70	2.75–18.30
SE±m	0.70	0.09	0.82
SD	2.62	0.34	3.50
CV (%)	21.64	18.23	44.50
CD (P=0.05)	2.04	0.27	2.40

* Mean of 10 fully mature fruits

K-173 (3.80 g and 1.34 g, respectively. Maximum dried kernel weight was recorded in KN-1 (2.22 g) and minimum in K-173 (0.70 g). The highest seed number and filled seed number was recorded in KN-4 (7.85) and KN-1 (6.65), respectively, and lowest in K-32 (5.65) and K-173 (2.30), respectively.

The genotypic and phenotypic coefficients of variation for fruit characters were almost similar in magnitude for all the fruit characters studied (Table 4). The environmental coefficient of variation was very low. This suggested that these characters are not much influenced by environment and as such the selection on the basis of phenotypic observations can be reliable. Further, there was a good amount of variation in all the fruit characters at genotypic as well as phenotypic level. The magnitude of heritability for fruit length, pulp weight, fruit weight, volume of fruit, fresh rind weight and dry rind weight were very high which indicated scope for selection of better genotypes for these characters. The moderately high genetic advance for these characters confirmed the same. Hence, there is good scope for exploiting variation by selection on *per se* performance basis for these fruit characters. The genotypes K-29,

Table 3. Variation in seed characters of different genotypes in *kokum**

Genotype	Fresh seed weight (g)	Dry seed weight (g)	Dry kernel weight (g)	Seed number fruit^{-1}	Filled seed number fruit^{-1}
K-4	5.05	1.82	1.02	6.10	4.80
K-10	4.70	1.71	1.04	6.20	3.35
K-29	7.55	2.52	1.66	7.05	5.45
K-32	8.70	2.95	1.70	5.65	4.85
K-42	6.20	2.39	1.53	6.85	4.95
K-70	5.40	1.96	1.15	6.85	4.80
K-133	4.45	1.63	1.01	6.00	3.85
K-141	8.45	2.84	1.60	6.75	4.65
K-143	7.30	3.02	1.94	7.30	6.00
K-146	8.45	3.04	1.35	7.35	5.30
K-173	3.80	1.34	0.70	6.00	2.30
K-211	6.80	2.56	1.51	6.80	4.95
K-212	5.90	2.20	1.35	6.75	5.50
K-216	7.65	2.70	1.44	7.70	4.95
K-217	6.45	2.32	1.43	6.65	4.60
K-219	5.90	2.06	1.43	6.80	4.55
KN-1	8.05	3.72	2.22	7.75	6.65
KN-2	5.45	2.05	1.18	5.85	4.60
KN-3	6.75	2.20	1.24	6.00	4.85
KN-4	7.40	2.43	1.36	7.85	4.30
KN-5	6.40	2.01	1.26	7.35	5.65
KN-6	7.00	2.50	1.49	6.80	5.25
Mean	6.54	2.36	1.39	6.75	4.83
Range	3.80–8.70	1.34–3.72	0.70–2.22	5.65–7.85	2.30–6.65
SE±m	0.50	0.18	0.14	0.20	0.39
SD	1.36	0.55	0.33	0.64	0.89
CV(%)	20.87	23.28	23.65	9.54	18.47
CD (P=0.05)	1.45	0.53	0.42	0.60	1.14

* Mean of 10 fully mature fruits

K-32, K-146, KN-1, KN-3, KN-4 and KN-5 were promising among the genotypes studied. Little information is available on variability of fruit characters of *kokum*. In nutmeg (a dioecious tree spice like *kokum*) Haldankar *et al.* (2004), reported low environmental coefficient of variation for fruit characters and higher estimates of heritability and genetic advance.

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Table 4. Genetic parameters for fruit characters in *kokum*

Particulars	Weight	Length	Breadth	Circum-ference	Volume	Fresh rind weight	Dry rind weight	Pulp weight	Fresh seed weight	Dry seed weight	Dry kernel weight	Seed number	Filled seed number
Mean sum of squares for treatments	82.98**	0.30**	0.22**	2.50**	78.22**	13.74**	0.23**	23.78**	3.72**	0.63**	0.22**	0.83**	1.59**
Mean sum of squares for error	5.06	0.01	0.03	0.23	4.92	0.97	0.02	1.33	0.49	0.06	0.04	0.08	0.30
Phenotypic variance	44.02	0.15	0.13	1.37	41.57	7.35	0.12	12.56	2.11	0.34	0.13	0.45	0.94
Genotypic variance	38.96	0.15	0.10	1.14	36.65	6.39	0.10	11.22	1.62	0.28	0.09	0.37	0.64
Environmental variance	5.06	0.01	0.03	0.23	4.92	0.97	0.02	1.33	0.49	0.06	0.04	0.08	0.30
Phenotypic coefficient of variation	25.04	11.79	9.62	9.82	24.95	22.38	18.90	45.17	22.20	24.90	25.77	9.98	20.14
Genotypic coefficient of variation	23.55	11.56	8.39	8.96	23.42	20.86	17.53	42.70	19.45	22.47	21.39	9.05	16.64
Environmental coefficient of variation	1.48	0.23	1.23	0.87	1.52	1.52	1.38	2.46	2.75	2.43	4.38	0.92	3.50
Heritability	88.51	96.07	76.10	83.16	88.17	86.87	85.95	89.38	76.77	81.42	68.87	82.34	68.24
Genetic advance	12.10	0.77	0.56	2.00	11.71	4.85	0.62	6.53	2.29	0.98	0.51	1.14	1.37
Genetic advance on % mean basis	45.65	23.34	15.07	16.83	45.31	40.06	33.47	83.16	35.11	41.77	36.56	16.93	28.31

** Significant at 1% level

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