

FRUIT CHARACTERISTICS OF LITCHI GENOTYPES UNDER CHOTANAGPUR CONDITIONS

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Abstract

Litchi has narrow genetic base owing to greater use of asexual propagation. Cultivar synonymy on the basis of local nomenclature causes confusion in identifying a genotype for any specific purpose. There fore, 17 genotypes under study have been characterized on the basis of fruit shape index (FSI), specific gravity, seed shape index (SSI), flatness of seed, number of protuberances/cm² and other physico-chemical characters of fruit. The cultivars China, Purbi and Bombaiya-II found to have elongated fruit shape whereas Bedana, Swarna Roopa, Trikolia and Shahi posses roundish fruit shape. Regarding pulp %, the cultivars Bedana, D. Rose, Late Bedana, Green and Rose Scented has the high values. The cultivars Purbi, China, Swarna Roopa and Dehradun has thick peel. Widely spread protuberances was noticed in cultivars Swarna Roopa, Dehradun and Bedana. Bedana, Late Bedana and Swarna Roopa had smaller seeds. The cultivars Bombaiya-I, Bombaiya-II, Late Bedana, CHES-II, China and Purbi had slender seeds while Deshi, Bombaiya-I and Late Bedana has flat seeds.

INTRODUCTION

The litchi (*Litchi chinensis* Sonn.) is an important evergreen sub-tropical fruit tree specific to climatic requirement for its production. Litchi possesses a narrow genetic base for various agromorphological traits. Continuous vegetative propagation of commercial cultivars has further narrowed down the genetic base resulting in the restricted period of availability of fruits in the market. Cultivars have been classified on the basis of economic traits in China and on the basis of growth and flowering pattern in India (Arora *et al.* 1996; Singh, 1998). Rai and Vishal Nath (2001) reported a total of 51 genotypes being augmented from different litchi growing regions and maintained at HARP, Ranchi. Xuequin (1995) reported 20-25 main litchi types possessing characters of larger fruit size, small stone, thick and free aril of good quality with good flavor having canning quality from south China. However, cultivar synonymy does exit due to the insufficient information on characterization for different fruit morphological traits and delineation of the characters in its original name. Only few cultivars and be distinguished based on their fruits characters and maturity period, which creates

confusion in identifying the suitable cultivar for any specific region. Keeping this in view, a study was carried out to characterize the different litchi genotypes on the basis of physico-chemical characteristics of fruit under the Chotanagpur plateau region of eastern India.

MATERIALS AND METHODS

The study was carried out on 17 cultivars of litchi during 2000-2001 in Randomised Block Design with three replications consisting of one plant in each replication. Twenty fully ripened litchi fruits were randomly sampled from the tree canopy for the estimation of physico-chemical characteristics and determination of different parameters.

The peel thickness was measured with the help of screw gauge. Fruit shape index (FSI) was determined by dividing fruit length by width whereas specific gravity of fruit or seed determined by dividing fruit/seed weight with volume, Seed Shape Index (SSI) by dividing seed length with seed width and flatness of seed was calculated by dividing width of the seed by seed thickness. Number of protruberances/cm² on the skin was counted at the

region just below the shoulder. The Total soluble Solid (TSS) was determined with hand refractometer. The total sugar percentage was estimated by Lane and Eynon method (Ranganna, 1991). Titratable acidity in terms of citric acid equivalent was measured by titrating the juice against 0.1 N NaOH using phenolphthalein indicator. Ascorbic acid content was determined by using 2, 6-dichlorophenol indophenol dye (AOAC, 1970).

RESULTS AND DISCUSSION

Significant variation in different fruit characters was observed among the 17 litchi cultivars grown under the plateau region of Chotanagpur.

Fruit physical parameters

Fruit length in different genotype of litchi varied from 2.77 (Swarna Roopa) to 3.67 (Bombaiya-II) (Table-1). It is apparent from the data that the fruit length in cultivar Deshi, Kasba, Bombaiya-II, Bombaiya-I, Late Bedana, Green, Rose Scented, CHES-II and China were significantly higher than the other varieties. Fruit width was the maximum in cultivar Bedana (3.4 cm) followed by Bombaiya-I (3.25 cm) while the minimum values (2.52 cm) were recorded in cultivar Dehradun. Bedana and Bombaiya-I showed significantly higher fruit width among the litchi genotype. Arora (1998) reported variability in litchi genotypes with respect to fruit size, seed size and aril characteristics in various diversity regions. With respect to fruit shape index, maximum values (1.2) have been observed in cultivar China followed by 1.19 in cultivar Purbi and 1.17 in Bombaiya-II which indicates an elongated fruit shape. Cultivar Bedana recorded the minimum value (0.9) followed by Swarna Roopa (0.95), Trikolia (1.00), Shahi (1.01) which can be anticipated with the roundish shape of the fruit which is in conformity with the findings of Rai *et al.* (2001). Fruit weight among the litchi cultivars varied from 14.34 (Trikolia) to 20.34 (Bombaiya-I). The cultivars Kasba, Bombaiya-II, Green, Rose Sented, Bedana and Shahi have shown significantly higher fruit weight in comparison to other cultivars under study. Data presented in Table-I shows a significant variation in fruit volume of different litchi genotypes. Cultivar Kasba recorded

the maximum fruit volume while Trikolia registered the minimum fruit volume. The specific gravity of the fruit also varied significantly, being the maximum in Green (1.34). Pulp (Aril) is the edible portion of the litchi fruit which was significantly higher in Bedana followed by Bombaiya-I, Green, Rose Scented and Shahi. The pulp percentage in the fruit ranged from 53.84 to 77.09 being significantly higher in Bedana, D' Rose, Late Bedana, Green, and Rose Scented. Significant difference was observed among the cultivars with regard to peel weight which ranged from 1.42 (D' Rose) to 3.50 (Purbi) while the peel percentage ranged from 8.88 to (D' Rose) to 21.97 (Trikolia). The peel thickness was significantly higher in Purbi, China, Swarna Roopa and Dehradun while Green, D' Rose and Rose Scented had the thinnest peel. Menzel and Simpson (1991) used skin protuberances as a major key for classifying litchi genotypes. The number of protuberances/cm² on the skin is a measure of skin roughness. The genotypes differed significantly with regard to number of protuberances/cm² which ranged from 10.25 (Swarna Roopa and Dehradun) to 15.50 (Ajhauli and Shahi).

Quality parameters

All the cultivars differed significantly with respect to their fruit quality. The percentage of total soluble solid was significantly higher in Purbi followed by Late Bedana, D' Rose, Kasba, and Rose Scented. However, the minimum percentage of TSS was recorded in Bombaiya-II (17.2). The total sugar percentage was maximum in D' Rose (16.80) which was at par with Kasba and China. With regard to titratable acidity, it was the maximum in Dehradun (0.75%) and the minimum in CHES-II (0.28%). Cultivar Dehradun had the maximum ascorbic acid content (71.47 mg/100g), while it was the minimum in Bedana (12.94 mg/100g).

Seed characteristics

Data pertaining to different seed characters are presented in Table-2. The average seed weight was the highest in Bombaiya-I (4.33g) while significantly lower seed weight was recorded in cultivar Bedana (1.59g) and Late Bedana (1.64g) had significantly lower seed weight (1.59g and 1.64g). The significantly lower value of percentage seed weight was recorded in cultivars Bedana

Table 1: Morphometric characteristics of litchi fruits.

Genotypes	Fruit length (cm)	Fruit width (cm)	Fruit shape Index	Fruit weight (g)	Fruit volume (cc)	Specific gravity of fruit	Pulp weight (g)	Pulp (%)	Peel weight (g)	Peel (%)	Peel thickness (mm)	Protruberances /cm ²
Deshi	3.39	3.07	1.10	17.90	15.52	1.15	12.40	69.26	2.42	13.47	0.65	11.75
Kasba	3.44	3.13	1.16	18.51	18.31	1.01	12.47	67.25	2.91	15.75	0.72	11.75
D. Rose	3.44	2.98	1.12	17.01	15.05	1.06	11.67	72.42	1.42	8.88	0.51	13.50
Bombaiya-II	3.67	3.10	1.17	18.22	17.12	1.06	12.35	70.19	2.54	13.95	0.57	11.75
Bombaiya-I	3.48	3.25	1.11	20.34	17.42	1.18	13.46	66.13	2.31	11.37	0.60	12.75
Late Bedana	3.40	3.08	1.11	16.39	15.85	1.03	12.45	75.90	2.29	13.98	0.73	11.25
Green	3.38	3.04	1.11	18.77	14.02	1.34	13.67	72.78	1.89	10.08	0.50	12.50
Rose Scented	3.40	3.05	1.10	18.44	16.25	1.13	12.89	72.29	1.93	11.06	0.52	13.00
CHES-II	3.52	3.15	1.14	16.68	16.67	0.99	10.72	64.26	2.61	15.67	0.73	13.25
Bedana	3.08	3.40	0.90	19.34	17.50	1.12	15.01	77.09	2.74	14.57	0.78	10.50
China	3.57	2.97	1.20	17.74	16.90	1.08	10.87	61.25	3.09	17.48	0.97	14.75
Ajhali	3.05	2.85	1.06	17.73	17.20	1.03	11.65	65.78	2.65	14.92	0.80	15.50
Purbi	3.32	3.05	1.19	17.86	17.60	0.99	10.76	60.08	3.50	19.53	0.98	12.50
Swarna Roopa	2.77	2.90	0.95	16.46	15.92	1.03	10.74	62.47	3.43	20.92	0.94	10.25
Dehradun	3.00	2.52	1.13	17.18	18.15	0.95	11.85	69.00	2.25	13.37	0.94	10.25
Trikolia	2.90	2.77	1.00	14.39	14.07	1.03	8.12	53.84	2.87	21.97	0.76	13.75
Shahi	3.10	2.82	1.01	18.21	15.80	1.15	14.34	69.22	2.04	13.37	0.86	15.50
Mean	3.29	3.01	1.08	17.72	16.43	1.08	12.09	67.60	2.52	14.73	0.74	12.62
CD at 5%	0.31	0.23	0.105	2.14	1.30	0.15	2.34	5.35	0.53	3.49	0.06	0.99

Table 2 : Fruit quality of litchi genotypes.

Genotypes	T.S.S. (%)	Total Sugar (%)	Acidity (%)	Ascorbic acid (mg/ 100 g)
Deshi	17.72	11.54	0.36	24.22
Kasba	18.75	14.71	0.45	23.42
D. Rose	18.90	16.80	0.49	26.34
Bombaiya-II	17.02	12.94	0.29	27.30
Bombaiya-I	18.07	14.18	0.34	26.37
Late Bedana	19.15	10.42	0.37	13.45
Green	17.75	12.64	0.44	27.26
Rose Scented	18.45	13.58	0.36	26.02
CHES-II	17.27	10.63	0.28	26.82
Bedana	17.45	14.13	0.32	12.94
China	17.82	14.92	0.46	37.95
Ajhauli	17.85	13.89	0.37	38.67
Purbi	19.82	13.89	0.41	31.27
Swarna Roopa	17.70	12.31	0.29	38.30
Dehradun	17.25	11.59	0.75	71.47
Trikolia	17.15	12.43	0.33	33.62
Shahi	18.27	11.59	0.30	36.67
Mean	18.02	13.07	0.39	30.71
CD at 5%	1.50	2.25	0.18	12.94

followed by Late Bedana and Swarna Roopa which is an indicator of higher edible portion and better quality. The lower biomass partitioning to the seed in cultivars Bedana and Late Bedana might have resulted in higher pulp percentage, while higher peel percentage in cultivar Swarna Roopa contributed towards the low pulp percentage. With regard to seed volume, cultivar Ajhauri had the largest seed (3.92 cc) followed by Bombaiya-II while cultivar Late Bedana (1.27 cc) had the smallest seed. Singh (1992) also reported smaller seed size in Bedana and Swarna Roopa and bolder seed in cultivar China. The specific gravity of the seed

differed significantly among the cultivars within a range of 0.88 g/cc to 1.31 g/cc. With respect to seed length, cultivar Bombaiya-I had the longest seed (3.02cm) while cultivar Swarna Roopa had the shortest seed (1.80 cm). The seed width was maximum in cultivar Shahi (1.60 cm) and minimum in Late Bedana (1.16). The seed thickness was the maximum in cultivar Trikolia (1.46 cm) while it was the minimum in cultivar Late Bedana. (0.83 cm).

In order to facilitate the description of seed, different seed shape indices were hypothesized e.g. Seed shape Index (SSI) and flatness of seed. Significant variation was observed among the cultivars with regard to seed shape index which ranged from 1.2 (Bedana) to 2.0 (Bombaiya-II). A high SSI is an indication of slender seed which was observed in cultivars Bombaiya-I, Bombaiya-II, Late Bedana, CHES-II, China and Purbi. Though the length of seed in cultivars Late Bedana was significantly lower, the lower width of the seed puts in under the category of slender seed. Similarly, the cultivars differed significantly with respect to flatness of seed. Flatness of seed has also been mentioned as a key for identifying litchi genotypes by Rai *et. al.* (2001). In the present study the flatness was higher in case of cultivars Deshi, Bombaiya-I and Late Bedana indicating flat seed. A lower value of flatness was observed in case of Trikolia, Dehradun, Swarna Roopa, Purbi, Ajhauri, Bedana, CHES-II, Rose Scented, Green, Bombaiya-II, D' Rose and Kasba indicating a cylindrical seed.

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Table 3 : Fruit quality of litchi genotypes.

Genotypes	Seed wt (g)	Seed (%)	Seed volume (cc)	Sp.gr. of seed (g/cc)	Seed length (cm)	Seed width (cm)	Seed thickness (cm)	Seed shape index	Flatness of seed
Deshi	3.07	17.23	2.56	1.20	2.39	1.53	1.26	1.57	1.27
Kasba	3.13	16.99	2.83	1.10	2.42	1.44	1.27	1.67	1.13
D. Rose	2.98	18.68	2.63	1.13	2.32	1.50	1.27	1.52	1.18
Bombaiya-II	3.26	19.05	3.05	1.06	2.41	1.37	1.20	1.74	1.14
Bombaiya-I	4.33	21.99	3.57	1.20	3.02	1.59	1.23	2.00	1.29
Late Bedana	1.64	10.08	1.27	1.31	2.06	1.16	0.83	1.92	1.39
Green	3.20	17.11	2.57	1.24	2.30	1.45	1.25	1.57	1.16
Rose Scented	3.51	19.11	2.27	1.29	2.43	1.55	1.31	1.55	1.18
CHES-II	3.27	19.62	2.77	1.18	2.71	1.40	1.18	1.92	1.18
Bedana	1.59	8.26	1.81	0.88	1.91	1.23	1.05	1.20	1.17
China	3.79	21.29	3.07	1.22	2.88	1.46	1.19	1.97	1.22
Ajhauri	3.42	19.29	3.92	0.88	2.27	1.56	1.32	1.55	1.18
Purbi	3.70	21.46	2.27	1.31	2.65	1.40	1.19	1.90	1.17
Swarna Roopa	2.31	14.24	1.81	1.27	1.80	1.23	1.06	1.68	1.16
Dehradun	3.32	17.87	2.57	1.29	2.29	1.45	1.25	1.53	1.16
Trikolia	3.28	22.49	2.77	1.23	2.48	1.54	1.46	1.60	1.05
Shahi	3.57	19.65	2.73	1.29	2.39	1.60	1.32	1.49	1.21
Mean	3.13	17.91	2.67	1.18	2.40	1.44	1.21	1.69	1.19
CD at 5%	0.52	3.46	0.30	0.22	0.33	0.11	0.13	0.32	0.13

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