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Ajeesh BR
College of Agriculture, Kerala Agricultural University, Padannakkad (P.O), Kasargod district, Kerala, India

Nimisha C
College of Agriculture, Kerala Agricultural University, Padannakkad (P.O), Kasargod district, Kerala, India

Madala A
College of Agriculture, Kerala Agricultural University, Padannakkad (P.O), Kasargod district, Kerala, India

Rajagopalan A
College of Agriculture, Kerala Agricultural University, Padannakkad (P.O), Kasargod district, Kerala, India

Giridharan MP
College of Agriculture, Kerala Agricultural University, Padannakkad (P.O), Kasargod district, Kerala, India

Variability in fruit characters of jackfruit types in Kasargod district of Kerala

Ajeesh BR, Nimisha C, Madala A, Rajagopalan A and Giridharan MP

Abstract
A study was carried out to assess the variability and to identify promising jackfruit types in selected firm fleshed jackfruit types available in Kasargod district. Around 400 jack trees in farmers field was surveyed and characterized based on IPGRI descriptor. The variability of selected 7 types such as KJ 121 (fruiting more than thrice in a year), KJ 182 (clustering habit), KJ 185 & KJ 186 (early ripening), KJ 224& KJ 356 (high TSS content) and KJ 397 (gumless nature) were studied for 2 seasons (2015-16 and 2016-17). The results revealed that, the mean number of fruits per tree varied from 15 to 218.5 and the mean fruit weight varied from 2.08 to 9.17 Kg. Jack fruit types, KJ 224 and KJ 356 showed consistent yield with 49 and 74 fruits per tree per year respectively. The highest TSS content and total sugar percentage were recorded by KJ 182(31.19° B) & (24.83 %) followed by KJ 356 and KJ 224.

Keywords: Jackfruit, variability, fruit characters, Kasargod

Introduction
The jackfruit (*Artocarpus heterophyllus* Lam.) native to Western Ghats of India, is grown in Southern and North Eastern region of the country. The fruit is rich in carbohydrate and also a good source of carotene, thiamine, pectin and minerals like iron, phosphorus and calcium (Radha and Mathew, 2007) [9]. There are two types of jackfruits, Koozha type (soft fleshed) and Varikka type (firm fleshed), among which Varikka types are commercialized because of its superiority in taste and fruit quality. According to Prasannakumariamma and Kumaran (2011) [8], firm fleshed (Varikka) types of jackfruit is preponderant in Northern Kerala compared to Southern Kerala.

Mitra and Mani (2000) [6] reported that wide variability existed in fruit yield, fruit weight, fruit shape, flake colour, number of flakes, number of seeds, TSS, and total sugars among the jackfruit types. Breeding method widely employed in jack is to select superior tree from existing variable population (Menon and Peter, 2011). Magdalita *et al.* (2011) [5, 4] reported that on-site selection based on individual tree performance is the most efficient approach towards variety development.

In present study, lots of trees in a naturally available populations were surveyed and characterized. The selected seven types are studied further to check the variability in fruit quantitative and biochemical characters during two consecutive season (2015-16 & 2016-17).

Materials and Methods
Survey, identification and characterization of elite Jackfruit types
The survey was made by visiting the farmers who possessed promising jack trees in homestead by information got from Krishi Bhavans of Kasargod district. All together 400 jackfruit types were surveyed from various parts of Kasargod district (Nimisha, 2016) [7]. Among the jackfruit types surveyed, most promising 30 types were selected for further characterization based on bearing habit, yield, fruit size, TSS, special characters such as gumlessness, clustering habit, etc.

Selected 30 jack types were characterized based on descriptor of jackfruit developed by IPGRI (2000). From each tree, minimum two mature fruits were collected and fruit descriptors were recorded after ripening of fruits. Out of the 30 characterized jackfruit types, 7 types with superior characters were selected for further variability studies and selection.

Evaluation of selected promising Jackfruit types
From each tree, two mature fruits were collected and the traits recorded during two consecutive seasons in 2015-16 and 2016-17. The traits recorded were fruit weight, number of flakes per fruit, weight of flakes per fruit, seed weight, flakes percentage, rind percentage, perigone percentage, TSS, total sugar content, reducing and non-reducing sugar content.

Correspondence
Ajeesh BR
College of Agriculture, Kerala Agricultural University, Padannakkad (P.O), Kasargod district, Kerala, India

Total Soluble Solids (TSS) of jackfruit pulp was measured using Hand refractometer and values are expressed in °B (°Brix). Reducing sugar, non-reducing sugar and total sugar percentage were determined by following a procedure described by AOAC (1984) [1].

The data collected during characterization were subjected to statistical analysis. Coefficient of variation was calculated to find out the extent of variation in fruit characters as per the method described by Rangaswamy (1995) [10]. The fruit biochemical data were analyzed using single factor ANOVA.

Results and Discussion
In the present experiment observations were taken on number of fruits per tree, weight of fruit, number of flakes per fruit, weight of flakes per fruit, rind percentage, perigone percentage and seed weight per fruit, total soluble solids, total sugar and reducing sugar. Each characters shown various degrees of coefficient of variation. The coefficient of variation shown a wide range from 4.16% (in non-reducing sugar content in ripe flake) to 123.18 % (in number of fruits per tree). High variability exists among jacktypes in number of fruits per tree (84.34% in 1st year and 123.18 % in 2nd year) followed by number of flakes per fruit (81.36% in 1st year and 56.61 % in 2nd year) in both seasons (Table 1).

Among the studied characters, TSS, total sugar and non reducing sugar shown comparatively less coefficient of variation, indicating retention of fruit quality characters in consecutive years (Table 2).

Average number of fruits per tree ranges from 15 to 218.5.

Highest number of fruits were seen in KJ 182 (218.5 fruits per tree) followed by KJ 121 (82 fruits per tree). Highest flake % is observed in KJ 356 (40.99%), followed by KJ 397 (40.87%), KJ 186 (39.71%) and KJ 182 (33.94%).

Quality characters would play major role in acceptance of fruit by the consumer. The analysed data in Table 2 indicated that the higher TSS was recorded in KJ 186 and KJ 356 (31°B) in first year, which was on par with that of KJ 182 and KJ 224 (30.5°B). During second year, highest TSS was recorded in KJ 182 (31.87°B) which was on par with that of KJ 185 (31.07°B), KJ 224 (29.93°B), KJ 356 (29.73°B), KJ 397 (29.73°B) and KJ 186 (29.07°B). TSS content varied from 24 (KJ 121) to 31 (KJ 186 and KJ 356) °Brix during first season and 25 (KJ 121) to 31.87 (KJ 182) °Brix during second season of study. Jagadeesh et al. (2010) [3] in an evaluation of 30 jackfruit selections from coastal zones of Karnataka reported a variation of TSS from 16.13°B (UDK-7) to 35°B (UKH 22) and also noticed that total sugar content ranged from 18.10 % (UKB-25) to 25.10 % (UKH-22).

Highest total sugar percentage was observed in KJ 356 followed by KJ 224 in both seasons of study, which was on par with KJ 182, KJ 186, KJ 224 and KJ 356.

Through the study, it is clear that there are much usable variability present in the studied population, which can be successfully used in the future crop improvement programmes. Among the jack types, KJ 182 (Cluster type) recorded more number of fruits with high TSS content. KJ 224 and KJ 356 (high TSS content) gave consistent yield during two seasons.

Table 1: Yield and variability observed in fruit characters of jackfruit types under Kasargod condition during 2015-16 and 2016-17

Jack type	Number of fruits per tree			Fruit weight (Kg)			Flakes (%)		
	2015-16	2016-17	Mean	2015-16	2016-17	Mean	2015-16	2016-17	Mean
KJ 121	44	120	82	4.9	4.67	4.75	25.31	17.98	21.65
KJ 182	112	325	218.5	2.31	1.84	2.08	36.36	31.52	33.94
KJ 185	6	26	16	6	8.192	7.1	26.33	31.15	28.74
KJ 186	6	24	15	12.02	6.32	9.17	48.09	31.33	39.71
KJ 224	51	47	49	6.31	6.93	6.62	30.58	30.88	30.73
KJ 356	73	75	74	9.21	8.2	8.7	43.21	38.78	40.99
KJ 397	25	10	17.5	10	6.06	8.03	37.52	44.22	40.87
Mean	45.28	89.57		7.25	6.03		35.34	32.27	
CV	84.34	123.18		42.48	36.81		24.08	25.12	

Table 2: Fruit quality characters of jackfruit types under Kasargod condition during 2015-16 and 2016-17

Jack type	TSS (°Brix)			Total sugars (%)		
	2015-16	2016-17	Mean	2015-16	2016-17	Mean
KJ 121	24	25	24.5	22.28	20.91	21.59
KJ 182	30.5	31.87	31.19	24.95	24.71	24.83
KJ 185	26	31.07	28.54	22.29	21.61	21.95
KJ 186	31	29.07	30.04	23.95	23.26	23.61
KJ 224	30.5	29.93	30.21	25.4	24.11	24.76
KJ 356	31	29.73	30.37	25.6	26.04	25.82
KJ 397	25	26.73	25.87	24.77	23.75	24.26
Mean	28.28	29.06		24.17	23.48	
CV	11.07	8.32		5.75	7.49	
CD (0.05 %)	4.58	3.8233		6.27	3.323	

Table 3: Jack fruit types under study and their special characters

Sl. No.	Jackfruit type	Special characters
1	KJ 121	Fruiting thrice a year
2	KJ 182	Fruiting in clusters with medium sized fruits, high TSS
3	KJ 185	Very early ripening (January), high TSS
4	KJ 186	Very early ripening, very high TSS
5	KJ 224	High TSS, medium sized fruits
6	KJ 356	High TSS
7	KJ 397	Gumless, high TSS

Plate 1A: Jack type KJ 121

Plate 1B: Jack type KJ 182

Plate 1C: Jack type KJ 185

Plate 1D: Jack type KJ 186

Plate 1E: Jack type KJ 224
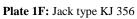

Plate 1F: Jack type KJ 356

Plate 1G: Jack type KJ 397

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