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Fruit characterization of jackfruit (*Artocarpus heterophyllus* Lam.) local genotypes under coffee ecosystem of lower pulney hills in Tamil Nadu, India.

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Abstract

n experiment was conducted to evaluation of jackfruit (*Artocarpus heterophyllus* Lam.,) local genotypes under coffee ecosystem of lower pulney hills at Horticultural Research Station, Thadiyankudisai and its adjoining areas, Tamil Nadu Agricultural University, Coimbatore during year 2016-2017 with an objective to characterize the promising local genotypes for commercial cultivation and studies of genetic improvement with jackfruit, five fruits of each of thirty five genotypes were evaluated based on IPGRI, 2000 (Bioversity international) jackfruit descriptor. Fruit characters *viz.,* bearing habit, bearing position, clustering habit, shape, length, diameter, weight, stalk attachment, spine density per 25 cm^2, fruit rind weight and flake characters *viz.,* total weight of flakes per fruit, weight of individual flake with seed, weight of individual flake without seed, number of flakes per fruit, flakes: fruit ratio, rind: flakes ratio, flake length, flake width, shape of flake, flake colour. Results were evaluated by descriptive statistics *viz.,* mean, standard deviation, coefficient of variation, standard error of mean. It was concluded that a more variation of fruit character was found under lower pulney hills of Tamil Nadu, it will help to breeder for accounting potential fruit character in future.

Key words: Jackfruit, coffee ecosystem, pulney hills, genetic variability

Introduction

Jackfruit (*Artocarpus heterophyllus* Lam.), belonging to the family Moraceae, is a fairly large sized tree and bears the largest fruit among the edible fruits (Morton,1987). It is a large monoecious tree, producing often enormous multiple fruits that are cauliflorous

in bearing habit (Jarrett, 1959). Jackfruit gives more yield per tree than other fruit crops but is still not classified as a commercial fruit and is rarely grown on a plantation scale. It is one of the most drought tolerant, hardy fruit crops and traditionally, it is grown as a homestead tree. Jackfruit serves as a food for millions of poor people in the countryside during the season, where there is a scarcity of food. Therefore, this fruit is regarded as "poor man's food" in Eastern and Southern parts of India and it is the national fruit of Bangladesh.

Jackfruit is widely cultivated in India, Vietnam, Malaysia, Myanmar, Indonesia, Bangladesh, Sri Lanka, Brazil, West Indies, Pakistan and other tropical countries. In India, it is quite popular in Southern and Eastern states like Kerala, Karnataka, Andhra Pradesh, Tamil Nadu, West Bengal, Maharashtra, Assam, Andaman and Nicobar Islands (APAARI, 2012). The area under jackfruit cultivation in India is 1.51 lakh hectares and the production is 20.37 lakh MT. In Tamil Nadu, the estimated total area under cultivation is 2,930 hectares with an annual production of 46,600 MT and productivity of 15.90 MT per hectare (NHB, 2015).

It belongs to the genus *Artocarpus*, the third largest genus in the Moraceae family and comprises about 50 species natives to south-eastern Asia and Polynesia. Important species include breadfruit (*A. altilis*), dugdug (*A. mariannensis*) and breadnut (*A. camansi*). These three species represent some of the most important traditional subsistence trees of Pacific islands. Elsewhere in Southeast Asia and India, champedak (*A. integer*), lakoocha (*A. lakoocha*), marang (*A. odoratissima*), kwai muk (*A. lingnanensis*), and others are important fruit trees, all with culturally important uses, and many with other valuable products, such as timber.

To ensure this, on-farm conservation of germplasm for long term and sustainable use was suggested (Haque 2005). There is a need for enhanced utilization of the available genetic diversity for improving the productivity and quality of jackfruit. Therefore, the most important means is to exploit the wide variation among different types grown and to select trees of outstanding merits after a thorough survey in the growing region. Selected clones should be propagated vegetatively and a mother orchard has to be established for further multiplication. Such quantitative assessment for selecting superior genotypes present in the

population helps the breeder in choosing parents for breeding program. A systematic investigation on local types of jackfruit under lower pulney hills may lead to identification of superior ones. Hence, the present investigation was planned with the identification of good quality fruits under coffee ecosystem of lower pulney hills of Tamil Nadu, India.

Materials and methods

A study was conducted at Horticultural Research Station, Thadiyankudisai and its adjoining areas (Thandikudi and Pachalur), Tamil Nadu Agricultural University, Coimbatore (Tamil Nadu, India) during year 2016-2017. Horticultural Research Station, Thadiyankudisai is located at a latitude of 10^0 17' North and longitude of 77^0 42' East and altitude of 1100 m above MSL with an average annual rainfall of 1400 mm with a relative humidity of 60-90 %, maximum and minimum temperature of 30-40 ^oC and 15-25 ^oC respectively. Pachalur is located at an altitude of 1500 m above MSL. Thirty-five genotypes were evaluated based on IPGRI, 2000 (Bio-versity international) jackfruit descriptor.

The trees had been grown from seeds and were on average of 15 to 20 years old. Trees selected based on information provided by farmers about plant vigour and qualitative parameters. In this present study, majority of the genotypes fruits have throughout the year due to favourable environmental conditions in pulney region. The fruits were harvested and reported the observations during August 2016 to June 2017. The fruits were characterized for: bearing habit, bearing position, clustering habit, shape, length, diameter, weight, stalk attachment, spine density per 25 cm^2, fruit rind weight and flake characters *viz.,* total weight of flakes per fruit, weight of individual flake with seed, weight of individual flake without seed, number of flakes per fruit, flakes: fruit ratio, rind: flakes ratio, flake length, flake width, shape of flake, flake colour. The bio-chemical analyses and organoleptic evaluation were also carried out to judge the quality of fruits. Five fruits per tree were evaluated by statistical analysis *viz.,* range, standard deviation, standard error and coefficient of variation. Genotypes *viz.,* HRS TKD AH-1 to HRS TKD AH-30 were selected at HRS, Thadiyankudisai areas, HRS TKD AH-31 & HRS TKD AH-32 were selected at Thandikudi areas and HRS TKD AH-33 to HRS TKD AH-35 were selected at Pachalur areas of the farmer field.

Table 1. Genotypes and locations of trees under study

Genotypes number	Name of the Genotype	Source/Location
HRS TKD AH-1	Thadiyankudisai local 1	Horticultural Research Station, Thadiyankudisai
HRS TKD AH-2	Thadiyankudisai local 2	
HRS TKD AH-3	Thadiyankudisai local 3	
HRS TKD AH-4	Thadiyankudisai local 4	
HRS TKD AH-5	Thadiyankudisai local 5	
HRS TKD AH-6	Thadiyankudisai local 6	
HRS TKD AH-7	Thadiyankudisai local 7	
HRS TKD AH-8	Thadiyankudisai local 8	
HRS TKD AH-9	Thadiyankudisai local 9	
HRS TKD AH-10	Thadiyankudisai local 10	
HRS TKD AH-11	Thadiyankudisai local 11	
HRS TKD AH-12	Thadiyankudisai local 12	
HRS TKD AH-13	Thadiyankudisai local 13	
HRS TKD AH-14	Thadiyankudisai local 14	
HRS TKD AH-15	Thadiyankudisai local 15	
HRS TKD AH-16	Thadiyankudisai local 16	
HRS TKD AH-17	Thadiyankudisai local 17	
HRS TKD AH-18	Thadiyankudisai local 18	
HRS TKD AH-19	Thadiyankudisai local 19	
HRS TKD AH-20	Thadiyankudisai local 20	
HRS TKD AH-21	Thadiyankudisai local 21	
HRS TKD AH-22	Thadiyankudisai local 22	
HRS TKD AH-23	Thadiyankudisai local 23	
HRS TKD AH-24	Thadiyankudisai local 24	
HRS TKD AH-25	Thadiyankudisai local 25	
HRS TKD AH-26	Thadiyankudisai local 26	
HRS TKD AH-27	Thadiyankudisai local 27	
HRS TKD AH-28	Thadiyankudisai local 28	
HRS TKD AH-29	Thadiyankudisai local 29	
HRS TKD AH-30	Thadiyankudisai local 30	
HRS TKD AH-31	Thandikudi local 1	MST
HRS TKD AH-32	Thandikudi local 2	Sundara Moorthy, Thandikudi
HRS TKD AH-33	Thandikudi local 3	
HRS TKD AH-34	Pachalur local 1	Manohar, Pachalur
HRS TKD AH-35	Pachalur local 2	

MST=Mohana Sundaram, Thandikudi

Results and discussion

In the present study, mean, standard deviations and coefficients of variation obtained for the physical traits of jackfruits are shown in Table 2. Jackfruit trees are normally producing fruits from March - August under Tamil Nadu conditions. In this study, based on the fruiting season (Table 2), the selected genotypes were grouped into early season (January-March), mid-season (April -June) and late season (July-August) genotypes. Among the genotypes, majority of the genotypes showed early season bearing habit. Genotypes namely HRS TKD AH-1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30 and 33 have recorded early season fruiting habit whereas HRS TKD AH-31, 32, 34 and 35 are mid-season bearers. Khaleque (2012) reported that fruits of mid harvesting time were larger while those in late season were small. Similar findings were reported by Kumar and Singh (1996), Murugan (2007), Sarker and Zuberi, (2011), Manikandan (2015) and Aseef (2016) in jackfruit, Podgornik *et al.* (2010). Regarding bearing habit, regular or alternate or irregular bearing habits are normally noticed. In the present study, all 35 genotypes are found regular in bearing habit. Mitra and Maiti (2002) reported that all the surveyed trees were regular in bearing habit in West Bengal. Murugan (2007) and Manikandan (2015) also observed similar findings with respect to bearing habit of jackfruit.

With respect to fruit bearing position (Table 3), remarkable variations were noticed in the genotypes under study. Jackfruit is generally known for cauliflorous bearing and the common fruit-bearing positions are bearing on 'main trunk', on 'primary branches' and on 'secondary branches'. Among the 35 genotypes, 24 genotypes had bearing on main trunk followed by nine genotypes on primary branches. Fruits developing from main trunk and primary branches are having good size and quality compared to the fruits in the other higher order branches. This might be due to strong action of sink at main trunk and primary branches. Besides, bearing in higher order of branches are not preferred since it often results in drudgery in harvesting of fruits. Ullah and Haque (2008) reported that maximum number of fruits were borne on primary branches (33.0%), followed by trunk (31.5%) and secondary branches (12.3%) in jackfruit. Similar

Table 2. Physical traits of 35 local genotypes of jackfruit under coffee ecosystem of lower pulney hills

Name of the genotypes	Fr.L	Fr.D	Fr.W	SpD	FRW	TWFl/F	WFlS	WFl	NFl/F	Fl:FR	R: FlR	Fl.L	Fl.W	NFr/T	Y/T
HRS TKD AH-1	18.47	26.43	6.37	61.53	3.13	3.24	32.47	21.26	96.32	0.50	1.03	4.83	3.27	28	178.36
HRS TKD AH-2	24.95	19.61	4.97	57.36	1.98	2.79	34.37	25.81	64.71	0.56	1.40	6.26	4.79	47	233.59
HRS TKD AH-3	27.23	20.35	3.64	50.37	2.16	1.48	14.35	7.76	92.45	0.40	0.68	4.66	4.87	51	185.64
HRS TKD AH-4	15.71	18.83	3.83	48.91	1.69	1.98	23.16	14.73	77.90	0.51	1.17	3.87	3.15	31	118.73
HRS TKD AH-5	38.46	44.53	7.81	93.46	2.29	5.52	27.85	18.91	189.29	0.70	2.41	5.73	3.61	128	625.76
HRS TKD AH-6	24.63	17.21	5.25	46.38	2.25	2.73	34.28	12.36	81.23	0.52	1.21	6.81	3.94	96	474.00
HRS TKD AH-7	31.55	25.62	7.12	51.45	3.93	3.19	20.77	13.83	143.86	0.44	0.80	4.54	4.21	35	249.29
HRS TKD AH-8	28.31	31.46	4.94	66.40	2.87	2.07	21.83	14.29	126.47	0.41	0.72	7.86	6.37	61	301.34
HRS TKD AH-9	16.91	23.86	4.28	72.17	2.67	1.61	36.27	24.69	42.68	0.37	0.60	6.75	5.14	93	364.04
HRS TKD AH-10	15.59	20.34	5.73	53.33	2.74	2.99	31.62	18.15	63.76	0.52	1.09	5.69	3.20	44	252.12
HRS TKD AH-11	22.67	17.27	6.06	47.63	3.12	3.07	24.69	16.45	113.89	0.50	0.98	5.84	4.11	34	206.04
HRS TKD AH-12	26.39	22.30	5.99	40.83	2.62	2.94	33.24	26.41	96.58	0.48	1.12	7.91	6.14	55	329.45
HRS TKD AH-13	21.42	27.63	5.53	61.39	2.49	3.04	44.68	31.07	67.24	0.54	1.22	6.66	4.83	86	415.58
HRS TKD AH-14	33.38	68.57	6.97	55.12	2.89	4.08	25.04	17.41	159.31	0.58	1.41	5.63	2.70	48	334.56
HRS TKD AH-15	20.72	25.87	4.63	51.97	2.47	2.16	35.43	21.14	58.87	0.46	0.87	4.94	3.23	62	287.06
HRS TKD AH-16	17.34	27.93	3.94	69.16	1.64	2.30	29.98	21.04	51.18	0.58	1.40	5.97	3.42	49	193.06
HRS TKD AH-17	26.86	25.33	7.68	38.30	3.96	3.72	26.89	19.35	136.53	0.48	0.93	5.65	4.86	31	238.08
HRS TKD AH-18	35.92	27.65	3.51	56.84	1.66	1.85	38.55	25.79	38.88	0.52	1.11	4.67	3.79	42	147.42
HRS TKD AH-19	30.24	27.41	6.72	44.28	3.35	3.37	31.73	23.09	99.75	0.50	1.00	6.59	6.02	67	420.24
HRS TKD AH-20	21.42	29.23	5.80	40.63	2.71	3.70	48.51	39.17	74.51	0.63	1.36	6.81	3.72	74	409.20
HRS TKD AH-21	34.73	36.89	6.17	50.62	3.56	2.61	20.91	13.26	110.35	0.42	0.73	4.88	3.77	83	512.11
HRS TKD AH-22	32.11	56.95	4.83	52.37	2.75	2.08	47.06	30.15	66.95	0.43	0.75	5.94	3.13	48	231.84
HRS TKD AH-23	17.26	28.47	5.03	64.20	2.10	2.93	39.85	28.18	64.70	0.58	1.39	7.18	5.27	58	291.74
HRS TKD AH-24	43.67	28.72	7.27	76.73	3.43	3.84	36.09	22.57	103.28	0.52	1.11	6.92	7.11	118	607.14
HRS TKD AH-25	29.46	33.61	6.74	53.48	4.36	2.38	24.68	15.89	81.69	0.35	0.54	6.22	3.57	87	516.38
HRS TKD AH-26	26.95	19.44	6.12	62.41	2.88	3.24	33.87	24.12	106.19	0.52	1.12	4.87	3.64	53	324.36
HRS TKD AH-27	33.27	24.84	8.13	47.59	4.23	3.90	40.22	26.39	95.63	0.47	0.92	7.43	5.94	66	536.58
HRS TKD AH-28	20.73	32.19	6.97	70.27	3.27	3.77	44.94	33.37	73.55	0.53	1.15	4.39	3.76	103	520.91
HRS TKD AH-29	31.59	39.24	3.78	32.13	2.17	1.61	39.66	29.02	33.64	0.42	0.74	5.36	4.91	56	211.68
HRS TKD AH-30	37.32	30.11	8.46	41.75	4.35	4.11	28.09	18.46	137.43	0.48	0.94	5.73	3.84	77	601.42
HRS TKD AH-31	38.49	31.29	9.31	57.94	5.38	3.93	48.15	34.39	79.56	0.42	0.73	6.84	5.74	98	672.38
HRS TKD AH-32	29.37	46.92	7.56	36.11	4.20	3.36	36.64	25.37	83.81	0.44	0.80	5.86	4.97	121	704.76
HRS TKD AH-33	43.21	78.35	9.69	29.83	5.88	3.81	57.48	41.83	90.14	0.39	0.64	8.23	6.73	145	854.05
HRS TKD AH-34	19.52	26.88	5.70	55.37	2.44	3.26	31.57	21.68	93.25	0.57	1.33	5.91	3.85	86	440.20
HRS TKD AH-35	33.93	29.53	6.94	62.67	3.73	3.21	44.84	31.33	70.34	0.46	0.86	6.29	4.72	79	518.26
Mean	27.70	31.16	6.09	54.31	3.06	3.02	33.99	23.10	90.45	0.49	1.03	5.99	4.46	69.71	392.02
SE of mean	1.32	2.29	0.26	2.22	0.17	0.14	1.59	1.30	5.78	0.01	0.05	0.18	0.19	5.03	30.58
SD	7.85	13.55	1.59	13.14	1.00	0.87	9.45	7.72	34.21	0.07	0.34	1.06	1.14	29.80	180.93
CV (%)	28.33	43.48	26.10	24.19	32.67	28.33	27.80	33.41	37.82	14.28	33.00	17.69	25.56	42.74	46.15

HRS TKD AH - Horticultural Research Station, Thadiyankudisai. *Artocarpus heterophyllus*, SE- Standard Error, SD-Standard Deviation, CV- Coefficient of Variation

FrL: Fruit length (cm), FrD: Fruit diameter (cm), FrW: Fruit weight (kg), SpD: Spine density per 25 cm2, FRW: Fruit rind weight (kg), NFL/F: Number of flakes per fruit, TWFl/F: Total weight of flakes per fruit (kg), WFlS: Weight of individual flake with seed (g), WFl: Weight of individual flake without seed (g), Fl:FR: Flakes: fruit ratio, R:FlR:Rind: flakes ratio, Fl.L: Flake length (cm), Fl.W: Flake width (cm), NFr/T: Number of fruits per tree per year and Y/T : Yield per tree (kg)

results were reported by Haque (2005), Manikandan (2015) and Aseef (2016) in jackfruit.

Regarding fruit clustering habit (Table 3), considerable variation was found among the genotypes. Most of the genotypes had cluster bearing habit than the solitary bearing habit. Genotypes namely HRS TKD AH-1, 2, 3, 5, 6, 8, 9, 10, 11, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35 have recorded cluster bearing habit. All the fruits in a cluster did not reach maturity simultaneously. As there is earliness in male flower production which is not good for the effective pollination of later forming females, the females that open earlier receive effective pollination and set better fruits. The size of cluster fruits was also lesser than that of solitary ones. This may be due to competition for food reserves among the developing fruits in a cluster. The first formed fruits deplete more nutrients than the later formed one. Cluster bearing trees are giving more number of fruits per tree than trees with solitary bearing. Similar results were reported by Manikandan (2015) and Aseef (2016) in jackfruit.

Fruit shape of jackfruit is one of the critical characters for consumer preference. The fruits from the presently selected genotypes could be classified into different fruit shapes (Table 3), namely 'obloid', 'spheroid', 'ellipsoid', 'clavate', 'oblong' and 'irregular'. Among the different shapes, ellipsoid (51.42 %) was the most-observed fruit shape followed by 'spheroid' (17.14 %) and 'oblong' (14.28 %).

Table 3. Frequency distribution of the jackfruit genotypes for fruiting season, fruit bearing position, fruit clustering habit, fruit shape, fruit-stalk attachment, flake shape and flake colour

Characters		No. of trees	Frequency (%)
Fruiting season	Early season	31	88.57
	Mid-season	04	11.42
Fruit bearing position	Main trunk	24	68.57
	Primary branches	09	25.71
	Secondary branches	02	5.71
Fruit clustering habit	Solitary	03	8.57
	Clusters	32	91.42
Fruit shape	Obloid	01	2.85
	Spheroid	06	17.14
	Ellipsoid	18	51.42
	Clavate	03	8.57
	Oblong	05	14.28
	Irregular	02	5.71
Fruit-stalk attachment	Depressed	32	91.42
	Flattened	00	0.00
	Inflated	03	8.57
Flake shape	Cordate	05	14.28
	Obovate	03	8.57
	Twisted	11	31.42
	Rectangular	13	37.14
	Oblong with curved tip	03	8.57
Flake colour	Creamy white	05	14.28
	Deep yellow	05	14.28
	Yellow	10	28.57
	Light yellow	15	42.85

Out of these shapes, spheroid and obloid are generally preferred in the market. Genotypes namely HRS TKD AH-12, 14, 18, 22, 23 and 31 have recorded 'spheroid' fruit shape, whereas HRS TKD AH-2 have recorded 'obloid' fruit shape. Similar variations were observed by Mitra and Mani (2000), Muthulakshmi (2003), Reddy *et al.* (2004), Murugan (2007), Nipa (2013), Manikandan (2015) and Aseef (2016) in jackfruit.

Fruit-stalk attachment (Table 3), of fruits showed a good variation among the genotypes. Out of the 35 genotypes, majority of the genotypes had 'depressed' (91.42 %) fruit-stalk attachment followed by 'inflated' (8.57 %) attachment. Genotypes namely HRS TKD AH-1, 2, 3, 4, 5, 6, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 22, 23, 24, 25, 26, 27, 28, 30, 31, 32, 33, 34, 35 have recorded 'depressed' stalk attachment whereas HRS TKD AH-7, 21, 29 had 'inflated' stalk attachment. 'Depressed' fruit-stalk attachment sometimes leads to accumulation of rain water at the stalk end during rainy season, possibly causing fruit rot. Similar observations regarding fruit-stalk attachment were made by Murugan (2007), Manikandan (2015), Sarker *et al.* (2015) and Aseef (2016) in jackfruit.

The quantitative characters of fruits like fruit weight, fruit length, diameter, fruit rind weight and spine density per 25 cm2 registered greater diversity among the genotypes. Fruit weight is an important trait which decides yield, quality and market potential. Even though wide variations may be available ranging from 2.00 to 20.00 kg, as per our objective, those genotypes having fruits weighing from 3.51 to 9.69 kg were shortlisted and observed. Fruits of small and compact size will be ideal for nuclear family whereas big sized fruits are suitable for chips making. Genotypes namely HRS TKD AH-2, 3, 4, 6, 8, 9, 10, 13, 15, 16, 18,22, 23 and 29 have recorded such smaller size fruit. Wangchu *et al.* (2013) also reported genotypes with fruits weighing 2-3 kg, suitable for a family of five, based on consumer preference. Similar findings of lower fruit weight were reported by Mitra and Mani (2000), Nipa (2013), Manikandan (2015) and Aseef (2016) in jackfruit.

Similarly, wide variations were observed in fruit length and diameter. Conventionally, majority of the fruits will be 'ellipsoid' and 'oblong' where the fruit length will be more. In the case of obloid and spheroid shapes, the fruit diameter will be more. The prime objective of this study is to select fruits weighing 3-5 kg on an average with spheroid shape. Accordingly, the genotypes namely HRS TKD AH-12, 14, 18, 22, 23 and 31 have recorded 'spheriod' fruit shape. Similar results of fruit length and diameter were reported by Muthulakshmi (2003), Reddy *et al.* (2004), Sarker and Zuberi (2011), Manikandan (2015) and Aseef (2016) in jackfruit. Regarding fruit rind weight, considerable variation was recorded among the 35 genotypes. Higher rind weight was not generally preferred as it will affect the percentage of edible portion. At the same time, thicker rind will help to protect fruits from post-harvest damages. The genotypes namely HRS TKD AH-25, 27, 30, 31, 32 and 33 have recorded high rind weight whereas HRS TKD AH-2, 4, 16 and 18 had recorded low rind weight. Similar results were reported by Mitra and Maiti (2002), Senjam *et al.* (2012), Wangchu *et al.* (2013), Manikandan (2015) and Aseef (2016) in jackfruit.

Jackfruit is botanically known as 'sorosis', consisting of fertilized individual flowers developing into flakes and unfertilized flowers developing into perigones. Generally, fruit size depends on number of flakes. Higher the number of perigones, greater will be the percentage of non-edible portion. In the present study, wide diversity was noticed in number of flakes, flake length, width, total weight of flakes per fruit, weight of individual flake with seed and without seed. Individual flakes with higher weight are commercially important especially when jackfruit is sold in minimally processed form. Total weight of flakes and individual flake weight can be considered for selection of elite jackfruit types. In the present study, the genotypes namely HRS TKD AH-5, 7, 8, 11, 14, 17, 21, 26 and 30 have registered higher number flakes per fruit whereas HRS TKD AH-5, 14, 20, 24, 27, 28, 30, 31 and 33 have recorded higher total weight of flakes per fruit. The genotypes namely HRS TKD AH-13, 20, 22, 28, 31, 33 and 35 have recorded higher individual flake weight. Manikandan (2015) and Aseef (2016) also reported similar findings.

More than the fruit shape, flake shape is more important trait in jackfruit as in South India, retail markets of jackfruit flake is picking up which has got a direct appeal with the consumers. The flake shape had considerable variation among the genotypes studied. Majority of the genotypes had 'rectangular' flake shape followed by 'twisted' shape. Genotypes *viz.,* HRS TKD AH-1, 5, 7, 10, 13, 14, 15, 18, 22, 26, 30, 34 and 35 were rectangular in flake shape. Murugan (2007) reported that the rectangular shape of flakes is ideal for market and also noticed that the major percentage of the surveyed jackfruit genotypes exhibited rectangular shape of flakes.

Regarding flake colour, remarkable variation was observed in the genotypes. Flake shape and colour are also important characters in the retail marketing of jackfruit by which the consumers are

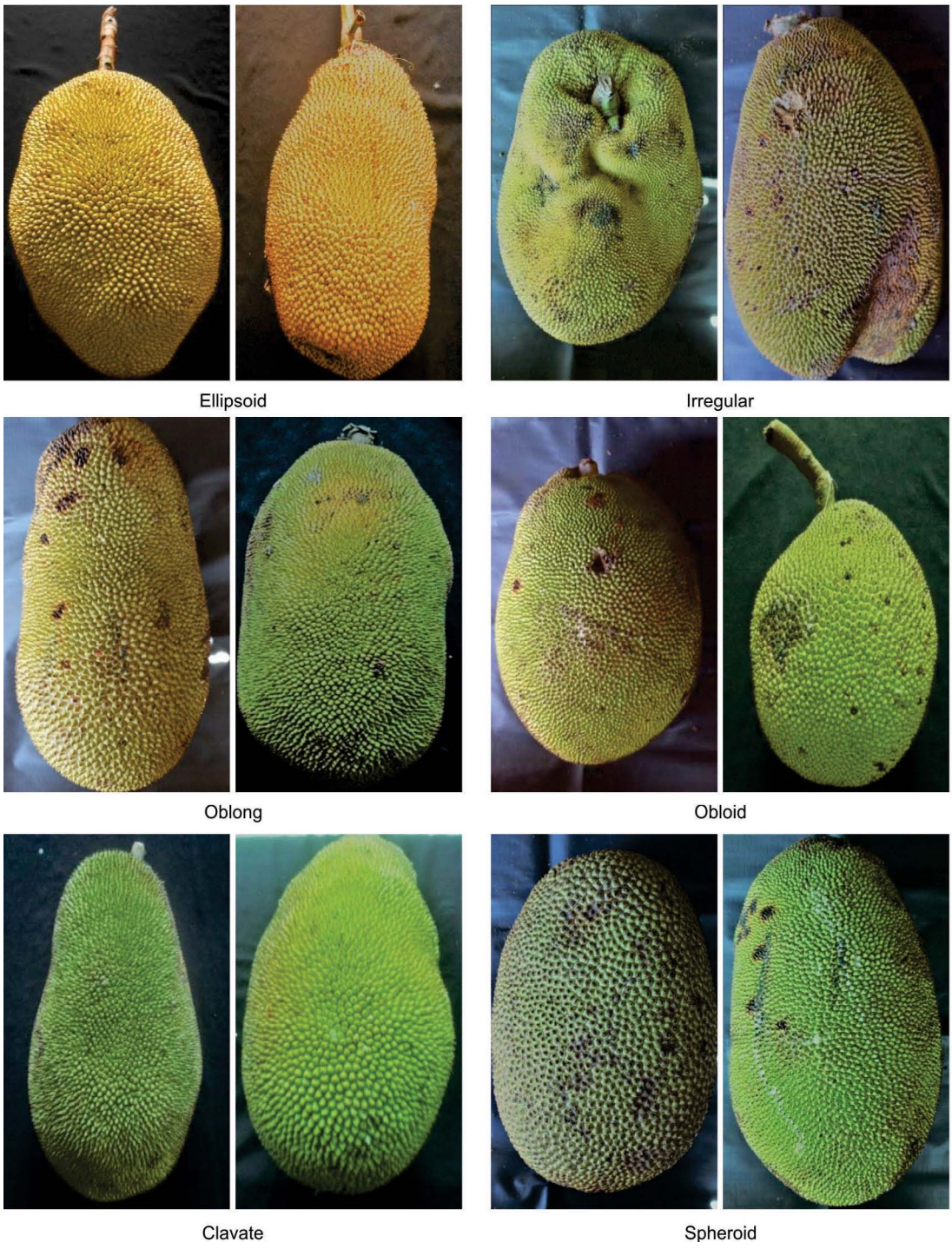

Plate 1. Diversity in fruit shape

directly attracted (Jagadeesh *et al.* 2010). Among the different colours of flake, yellow, deep yellow and coppery red colour flakes are mostly preferred by consumer. The present study revealed that the genotypes *viz.,* HRS TKD AH-2, 6, 7, 12, 13, 21, 22, 24, 28 and 35 exhibited yellow colour. Mitra and Mani (2002), Muthulakshmi (2003), Murugan (2007), Senjam *et al.* (2012), Nipa (2013), Wangchu *et al.* (2013), Manikandan (2015) and Aseef (2016) also reported similar findings.

The quality of jackfruit is normally judged by the TSS content of ripened flakes. In this study, total soluble solids, total sugars and reducing sugars, non-reducing sugars, titrable acidity, ascorbic acid content, carotene content and protein content of the genotypes expressed remarkable variations. Genotypes namely HRS TKD AH-5, 6, 7, 9, 11, 13, 17, 18, 20, 23, 25, 26, 28, 29, 30,31, 32, 33 and 35 have registered higher total soluble solids, total sugars and reducing sugars, non-reducing sugars whereas HRS TKD AH-3, 4, 24 and 28 registered lower titrable acidity and ascorbic acid content. Genotypes *viz.,* HRS TKD AH-5, 9, 24, 26, 29 and 35 had higher protein content. The genotypes like HRS TKD AH-5, 8, 9, 18, 20, 25, 27 and 32 had higher carotene content.

In a breeding programme, yield is the most important trait by which a genotype or variety will be evaluated. In the case of jack, trees with more number of fruits and high fruit weight generally

produce high yield. In the present study, wide variation was recorded in number of fruits per tree and yield per tree per year. Genotypes *viz.,* namely HRS TKD AH- 5, 6, 9, 24, 28, 31, 32 and 33 have recorded higher number of fruits per tree whereas HRS TKD AH-5, 21, 24, 25, 27, 28, 30, 31, 32, 33 and 35 recorded higher yield per tree. Similar variations in number of fruits per tree and yield per tree per year were reported by Ramakrishna *et al.* (2006), Nipa (2013), Wangchu *et al.* (2013), Manikandan (2015) and Aseef (2016) in jackfruit.

The organoleptic test is the final judgment for acceptance of the fruit quality of the selected genotypes. The present study revealed remarkable variation by organoleptic evaluation in all the characters of flakes. Genotypes namely HRS TKD AH-2, 4, 5, 11, 12, 15, 18, 23, 24, 25, 26, 28, 31, 32, 33 and 35 have higher score for overall quality of flakes. This may be due to genetic nature of the genotypes and growing environment. Similar findings were reported by Murugan (2007), Manikandan (2015) and Aseef (2016) in jackfruit.

In a nutshell, based on the yield and yield contributing attributes, the genotypes namely HRS TKD AH-5, 9, 17, 24, 28, 31, 32 and 33 were found promising which need close observations in subsequent years for promotion.

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