Physicochemical Profiling for Selection of Promising *Annona* Genotypes

Y.S. Saitwal[1*], A.M. Musmade[1], V.S. Supe[1], V.R. Joshi[1] and C.A. Nimbalkar[2]

[1]*Department of Horticulture, MPKV, Rahuri, Dist., Ahmednagar-413 722, Maharashtra*
[2]*Department of Agricultural Statistics, MPKV, Rahuri Dist., Ahmednagar-413 722, Maharashtra*

Email: yssaitwal3@gmail.com

ABSTRACT: *Annona* is one of the favourite dry land fruit of Maharashtra, because it is hardy in nature and drought tolerant. One of the important bottlenecks to increase the area under production is unavailability of suitable and improved varieties. Among 101 genotypes collected from Western Maharashtra; twenty two genotypes were found superior for physicochemical characteristics. On the basis of two year data (2011 and 2012); the highest fruit pulp percentage was found in Island Gem (61.72) and SG-8 (60.46), but genotype SG-8 was superior for other fruit quantitative and biochemical characters. Dendrogram using average linkage on the basis of physicochemical characteristics revealed that genotype SG-8, Island Gem and Pink Mammoth formed distinct cluster from other genotypes. The *Annona* is highly perishable fruit, so shelf life is an important trait. The genotype SG-8 showed highest (five days) shelf life among selected genotypes. Hence, the genotypes collected from various regions had significant variation for various traits and can be evaluated physicochemically and promising one can be selected for further improvement programme.

Key words: *Annona* genotype, quantitative and biochemical characteristics, dendrogram

Annonaceous fruits are the most important delicious fruits and widely grown in India. Adaptability to varied soil and climatic conditions, freedom from pests and diseases, hardy nature and escape from animal damage are the positive features of the *Annona*. Owing to these features, custard apple has become naturalized in many tropical and subtropical parts of the world. In India, custard apple is grown in the states of Andhra Pradesh, Bihar, Karnataka, Maharashtra, Orissa, Rajasthan, Tamil Nadu and Uttar Pradesh. Out of them, Andhra Pradesh ranks first in the production. In Maharashtra, the area is mainly concentrated in dry hilly regions and wastelands of the Aurangabad, Pune, Dhule, Beed and Nagpur districts. Among the breeding method, seedling selection is a handy method of improving majority of fruit crops as these are perennial in nature. Orchards raised from seeds present an excellent opportunity for seedling selection, because of wide genetic variations. Cheema (1928) observed that the seedling selection method offers a considerable scope for improvement by taking advantage of genetic variations among the natural hybrids. Due to heterozygosity and cross pollination nature of *Annona*, there is a large genetic variation in leaf, inflorescence and fruit characters. All these factors offer a great scope for improvement through seedling progeny selection hence the present investigation was undertaken with a objective to select promising genotypes for further crop improvement.

Materials and Methods

Exploration: During this study, the exploration of four districts of Maharashtra (Ahmednagar, Aurangabad, Beed and Pune) were carried out and ninety (90) elite types were collected on the basis of morphological characters. Eleven promising genotypes were selected from the existing germplasm available at All India Coordinated Research Project on Arid Zone Fruits, Mahatma Phule Krishi Vidyapeeth, Rahuri for evaluation and comparison with collected genotypes.

Observations: All the genotypes presented in Table 1, were screened for selection of promising genotypes. All quantitative and biochemical characters were recorded for two seasons during year 2011 and 2012 as per Bioversity International and CHERLA (2008) *i.e.*descriptors for Cherimoya. Ten fully expanded and healthy leaves and ten flowers collected from marked and identified trees at bloom period and ten physiologically mature representative fruits at harvest were collected and observed for this study.

Data analysis: Two season data for fruit quantitative and biochemical characters were pooled and subjected to statistical analysis (Panse and Sukhatme, 1985). The cluster analysis was done as per Sneath and Sokal (1973) and Dendrogram was drawn using Average Linkage between groups; SPSS software packages were used to analyze the data.

Results and Discussion

On the basis of pulp percentage and shelf life, twenty two superior genotypes were selected from among 101 genotypes for further analysis. Pooled data of twenty two *Annona* genotypes for year 2011 and 2012 (Table 2) shows considerable variations between genotypes for quantitative and biochemical characters. Characters showing a greater quantity of range had higher coefficient of variation (CV), meaning a higher selection possibility for those characters for further selection procedure.

Quantitative and qualitative characters: The Island Gem, SG-8 and Arka Sahan showed highest pulp percentage (Figure 2) with low seed values *i.e.* seed percentage and

number of seeds per fruit. Scheldeman *et al*. (1999) and Da Silva *et al*. (1999) reported significant variation for above characters in *Annona* genotypes. Shete *et al*. (1991) selected custard apple seedlings on the basis of quantitative characters and biochemical parameters. Shelf life in *Annona* fruit is one of the important breeding objectives and SG-8 recorded highest shelf life (5 days) among selected twenty two superior genotypes at ambient temperature. Girwani *et al*. (2011) reported similar results for fruit and quality characters.

Biochemical characters: The highest Total Soluble Solids (TSS) and Total sugars were recorded in SG-8 (26.95^{0}B, 24.96%) followed by SG-12 (26.55^{0}B, 24.00%) while lowest TSS was found in PT-1(18.73^{0}B) and lowest Total sugars in AJ-2 (17.01%). For good taste and flavour, TSS: acidity ratio should be high which was found highest in SG-12 (171.20).

Cluster analysis: Grouping of *Annona* genotypes based on quantitative and biochemical characters was performed and Dendrogram divided into three major clusters which further sub-divided into five clusters (Figure 1). The Island Gem, SG-8 and Pink Mammoth formed distinct clusters from remaining selected genotypes. Though Arka Sahan is interspecific hybrid, grouped in cluster 'E' in which popular genotypes Balanagar, Purandar selection and Hyderabad selection were present. Among cluster 'A' and 'B', SG-8 was superior for quantitative, biochemical characters and shelf life. Hence, physicochemical characterization and cluster analysis was helpful in selection of promising genotypes. Nimbalkar *et al*. (2004) performe the similar analysis for classificatory purpose.

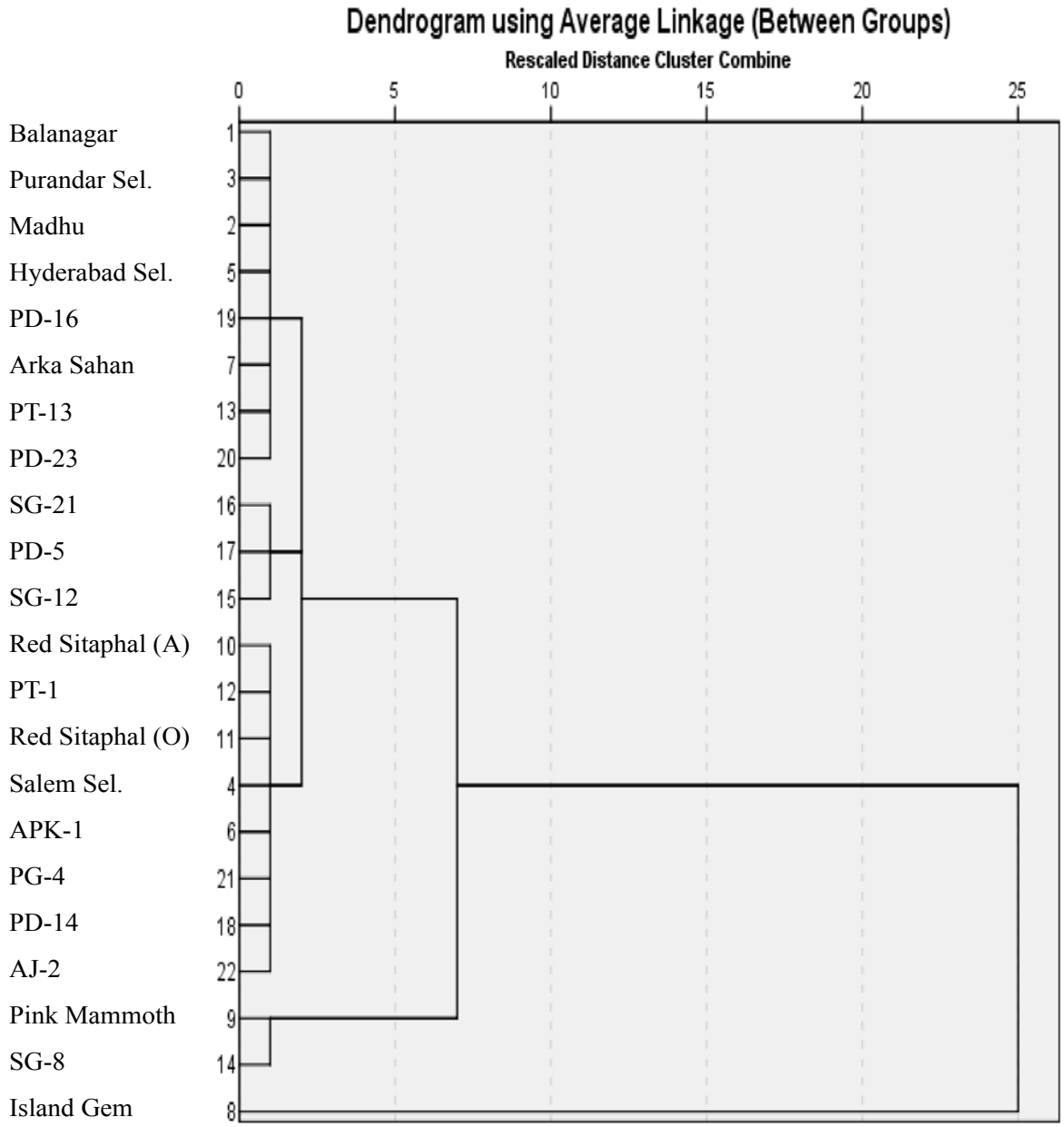

Fig. 1 : Dendrogram of grouping twenty two *Annona* genotypes based on qualitative and biochemical characters (Table 2) using average linkage between groups

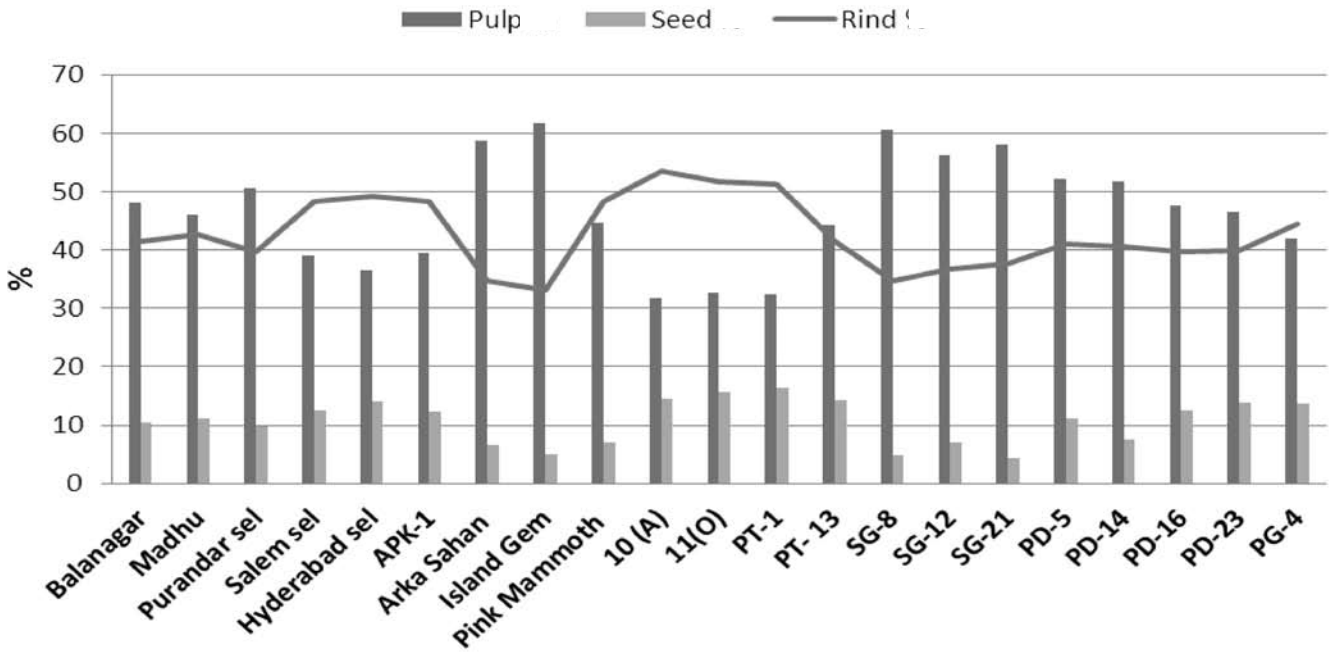

Fig. 2 : Rind, pulp and seed (%) of genotypes

Table 1 : The studied *Annona* genotypes and their pedigree

Source of *Annona* genotypes	Genotype code	Pedigree
Balanagar	1	Selection from Mahboobnagar
Madhu	2	Selection from Balanagar at MPKV, Rahuri
Purandar selection	3	Selection from local types in Purandar
Salem selection	4	Selection from local types in Tamil Nadu
Hyderabad selection	5	Selection from local types in Andhra Pradesh
APK-1	6	Selection from local types in Tamil Nadu
Arka Sahan	7	Interspecific hybrid between Island Gem (*Annona atemoya*) and Mammoth (*Annona squamosa*)
Island Gem	8	Selection of *Annona atemmoya* at Australia
Pink Mammoth	9	Selection of *Annona atemmoya* at Australia
Red Sitaphal (A)	10	Selection at Australia
Red Sitaphal (O)	11	Selection at Australia
Pathardi, Dist., Ahmednagar	PT-1 to PT-17	Local collection from Pathardi
Sawargaon, Tal. - Ashti, Dist., Beed	SG-1 to SG-21	Local collection from Sawargaon
Purandar, Tal. - Saswad, Dist., Pune	PD-1 to PD-30	Local collection from Purandar
Pemgiri, Tal. - Sagamner, Dist., Ahmednagar	PG-1 to PG-8	Local collection from Sagamner
Ajanta, Dist., Aurangabad	AJ-1 to AJ-14	Local collection from Ajanta

Table 2 : The pooled data of quantitative and biochemical characters for selected twenty two genotypes of *Annona*

Genotypes/ characters	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Balanagar	9.82	4.51	1.44	2.99	0.86	7.78	8.60	26.10	240.27	43.05	1.48	0.65	41.60	48.02	10.39	0.24	25.95	108.15	4.75	21.11	2.49	23.60	3
Madhu	12.32	5.36	1.56	2.90	0.84	8.74	9.46	27.20	259.85	44.10	1.50	0.68	42.68	46.05	11.07	0.26	25.85	101.30	4.61	21.08	2.38	23.45	3
Purandar sel	9.51	4.62	1.71	2.98	0.85	7.86	8.30	27.00	242.96	40.60	1.38	0.56	39.60	50.61	9.79	0.25	25.10	102.40	4.62	20.80	2.15	22.95	3
Salem sel	7.86	4.10	1.28	2.80	0.75	6.83	7.45	22.20	176.53	35.50	1.50	0.70	48.39	39.03	12.58	0.23	24.90	108.25	4.61	20.67	2.10	22.77	3
Hyderabad sel	8.64	3.82	1.40	2.80	0.70	8.38	8.45	24.10	228.35	37.75	1.65	0.74	49.28	36.59	14.14	0.24	24.88	103.65	4.50	20.50	2.12	22.62	3
APK-1	7.20	3.52	1.06	2.88	0.70	6.49	7.00	21.80	161.99	36.63	1.52	0.72	48.23	39.49	12.28	0.24	24.85	103.50	4.53	21.27	2.03	23.30	3
Arka sahan	9.14	5.38	1.04	3.35	0.98	7.12	8.55	29.20	264.46	21.58	1.90	1.20	34.82	58.70	6.50	0.29	25.45	87.75	4.76	21.24	2.20	23.44	4
Island gem	14.68	7.20	1.36	3.70	1.05	11.95	12.20	37.10	652.03	19.95	1.92	1.25	33.21	61.72	5.07	0.29	25.85	90.75	4.83	21.01	2.53	23.54	4
Pink Mammoth	12.28	7.60	1.32	3.64	1.00	10.36	12.03	33.80	448.64	34.45	2.27	1.16	48.39	44.57	7.05	0.24	26.48	110.30	4.96	18.90	3.30	22.20	4
10 (A)	7.20	3.16	1.60	2.57	0.95	5.91	6.80	22.40	146.81	53.15	1.47	0.62	53.62	31.81	14.58	0.34	20.16	60.15	4.80	16.48	1.50	17.98	2
11(O)	5.96	2.88	1.42	2.40	0.94	5.64	6.45	21.60	128.86	54.70	1.49	0.65	51.62	32.62	15.77	0.35	20.10	57.35	4.82	16.23	1.50	17.73	2
PT-1	8.60	4.21	1.58	2.60	0.77	5.86	7.15	21.20	145.19	44.20	1.45	0.60	51.23	32.38	16.40	0.31	18.73	60.35	5.06	15.55	1.51	17.06	2
PT- 13	8.52	4.34	1.42	2.82	0.75	7.25	7.70	28.25	217.44	44.08	1.28	0.52	41.44	44.24	14.32	0.15	20.18	134.50	4.56	16.26	2.36	18.62	2
SG-8	11.60	5.38	1.86	3.10	0.98	8.21	9.30	35.00	388.55	31.29	1.30	0.55	34.70	60.46	4.85	0.29	26.95	92.90	4.76	22.29	2.67	24.96	5
SG-12	11.68	5.32	1.80	2.90	0.85	7.95	9.05	33.00	313.66	37.82	1.80	0.90	36.69	56.24	7.08	0.16	26.55	171.20	4.54	21.71	2.29	24.00	4
SG-21	11.60	4.30	1.74	2.91	0.84	7.46	8.86	30.95	317.42	33.16	1.40	0.65	37.68	58.09	4.23	0.27	25.60	94.75	4.55	19.36	1.91	21.27	4
PD-5	9.20	4.25	1.40	2.80	0.75	7.80	8.75	33.95	289.04	40.30	1.50	0.58	41.05	52.06	11.07	0.27	26.00	96.25	4.63	19.01	3.07	22.08	4
PD-14	11.10	4.21	1.38	2.75	0.70	7.55	9.05	32.95	136.36	40.36	1.51	0.54	40.71	51.78	7.51	0.26	25.48	99.85	4.60	18.55	3.13	22.62	4
PD-16	10.50	3.91	1.30	2.85	0.76	7.05	8.45	28.81	217.92	46.01	1.70	0.72	39.78	47.70	12.53	0.22	24.15	112.30	4.51	19.12	2.08	23.44	3
PD-23	8.00	4.21	1.24	2.72	0.63	8.15	8.75	26.95	195.21	46.94	1.80	0.74	39.82	46.42	13.77	0.17	22.73	133.80	4.41	17.77	2.51	17.44	3
PG-4	8.75	4.41	1.30	2.70	0.63	6.90	7.65	24.10	181.13	44.29	1.60	0.62	44.42	41.96	13.62	0.27	25.15	95.00	4.52	21.18	1.77	17.45	3
AJ-2	8.72	4.42	1.30	2.75	0.68	7.20	9.05	26.15	150.69	50.23	1.60	0.59	41.70	42.76	15.50	0.25	25.20	100.80	4.55	20.92	2.16	17.01	3
Min	5.96	2.88	1.04	2.4	0.63	5.64	6.45	21.2	128.86	19.95	1.28	0.52	33.21	31.81	4.23	0.15	18.73	57.35	4.41	15.55	1.5	17.01	2
Max	14.68	7.6	1.86	3.7	1.05	11.95	12.2	37.1	652.03	54.7	2.27	1.25	53.62	61.72	16.4	0.35	26.95	171.2	5.06	22.29	3.3	24.96	5
Mean	9.68	4.60	1.43	2.91	0.82	7.66	8.59	27.90	250.15	40.01	1.59	0.72	42.76	46.51	10.91	0.25	24.38	101.15	4.66	19.59	2.26	21.34	3.22
SEm±	0.44	0.24	0.05	0.07	0.03	0.30	0.30	1.03	26.04	1.86	0.05	0.05	1.25	1.94	0.82	0.01	0.51	5.33	0.03	0.43	0.11	0.58	0.17
CV (%)	21.51	24.40	15.12	10.75	15.30	18.51	16.53	17.35	48.83	21.77	14.53	29.39	13.77	19.56	35.25	19.91	9.80	24.72	3.50	10.30	21.82	12.75	25.17

1- Leaf length (cm), 2- Leaf width (cm), 3- Petiole length (cm), 4- Petal length (mm), 5- Petal width (mm), 6- Fruit length (cm), 7- Fruit width (cm), 8- Fruit girth (cm), 9- Fruit weight (g), 10- Number of seeds, 11- Seed length (cm), 12- Seed width (mm), 13- Rind (%), 14- Pulp (%),15- Seed (%), 16- Acidity (%), 17- Total Soluble Solids (^{0}B), 18- Total Soluble Solids: Acidity, 19- pH, 20- Reducing sugars (%), 21- Non-reducing sugars (%), 22- Total sugars (%), 23- Shelf life (days)

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