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Evaluation of Beal (*Aegle marmelos* Correa) Genotypes for Marphological, Quality and Yield Related Characters

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Abstract—*Beal fruit is important from religious, nutritional and medicinal considerations. Wide variations in tree ,leaf, fruit and yield related characters exist in different areas. Therefore, the present study entitled "Evaluation of bael (Aegle marmelos Correa) genotypes for marphological,quality and yield related characters " was undertaken to evaluate growth and yield in 20 Accessions of bael from Odisha. This investigation was under taken during 2013 in different locations with 3 replications. A single tree was selected for tree characters and five fruits for fruit characters as the ideal sample size. All the quantitative characters were statistically analyzed and qualitative characters visually observed. The results revealed that significant variation existed in respect of tree height, number of primary branches, tree spread, total chlorophyll content of leaf, leaf area, fruit weight, fruit size, number of fruits, pulp weight, rind weight, number of seeds, total seed weight, fiber weight of the fruit. Both fruit weight and pulp weight was recorded maximum in Acc.7 while number of fruits were found maximum in Acc.3***.**

Keywords: Bael, spectronic-20 colorimeter , genetic variability, SPAD value.

1. INTRODUCTION

Bael (*Aegle marmelos* Correa) is a tropical fruit native to southeast asia and belongs to Rutaceae family. Aegle, the genus of bael is monotypic.It is a midsized, slender, aromatic, armed, gum-bearing, tree growing up to 18 mts tall. It has a compound leaf with three leaflets and symbolize the trident that shiva holds in his right hand. It occupies an important place among indigenous fruits of India due to its nutritional, medicinal and pesticidal values. In the absence of suitable cultivars, expected growth in production of this crop has not been accomplished till date. Identification of suitable genotypes, therefore, becomes imperative for promoting its production, productivity and quality. A wide range of variation is encountered in bael (Rai *et al.*) as it was largely propagated through seeds until recently. However, very little efforts have been made to quantify the genetic variability present in it and its utilization in crop improvement. So proper attention is needed on its collection, evaluation and conservation of genetic pool. Selection and exploitation of the promising genotype would be of immense value for commercialization.

As with any crop, plant breeding programme with fruit crops depends on knowledge of key traits, genetic system controlling their inheritance and genetic and environmental factors that influence their expression. The information about the nature and magnitude of genetic variability as well as associations among key traits would be helpful in formulating an effective breeding programme for its genetic improvement. Therefore, an attempt has been made to evaluate and exploit genetic variability in beal fruits grown in Odisha. The information on aspects would be of great significance in formulating appropriate breeding strategy for genetic up gradation of this valuable crop.

Significant workers have also researched upon bael for its various characters. The characters studied by other workers have been tree, fruit, pulp and biochemical characters. A high degree of variation have been reported in this characters notably among them are Kumar *et al*, Pandey *et al, singh et al* and *Nath* et al.

The present study entitled "Evaluation of bael (*Aegle marmelos* Correa) genotypes for marphological, quality and yield related characters" aims to identify and screen superior accessions of bael and gather information on variability in morphological and yield characters.

2. MATERIAL AND METHODS

The present experiment was undertaken during 2013 with an objective to evaluate 20 different genotypes collected from Dhenkanal district and Bhubaneswar for different morphological and qualitative characters. The analysis of different characters was carried out in the experimental

laboratory of Department of Fruit Science and Horticulture Technology, Orissa University of Agriculture and Technology, Bhubaneswar. Various procedures of sample collection and analysis followed during the research have been described. The method of random sampling from a population and biased sampling after gathering information about a particular genotype was followed. Randomly selected fruits were used to record the yield and morphological characters. The physical attributes *viz.*, Tree height, stem girth, canopy spread, number of primary branches, branching density, leaf fresh weight, leaf area, chlorophyll content, fruit weight, length, breadth, number of fruits, fiber weight, pulp weight, number of seeds, seed weight, rind weight and skull thickness were measured following standard procedures. Shape of the fruits were confirming to reports of Vijai kumar *et al*. Leaf area was measured using leaf area meter, Total trifoliate leaf chlorophyll content was estimated by using chlorophyll meter. But the chlorophyll a and b content was estimated by using spectronic-20 colorimeter. Different qualitative parameters were visually observed and reported.

3. RESULTS AND DISCUSSION

The data pertaining to morphological and physical attributes of bael showed significant differences and high degree of variability for all the characters studied. The tree height varied from 9.67 m in Acc.10 to 15.03 m in Acc.6. Stem girth observed for different accessions ranged from 0.26 m in Acc.10 to 0.55 m in both Acc.12 and 14. Acc.6 showed maximum tree spread of 6.90 m while the Acc.8 had a lowest tree spread of 4.07 m. Number of primary branches showed variation from 4.00 in Acc.19 to 8.33 in Acc.5. In respect of branching density, five plants belonged to sparse category, eight to medium and seven to dense category and in respect with growth habits of the trees seven plants belonged to erect growth habit, two plants to semi- erect and eleven plants to spreading category. Leaf area for all accessions was ranged from 55.77 cm^2 in Acc.11 to 103.33 cm^2 in Acc.12. Amount of chlorophyll determined by chlorophyll meter recorded lowest in Acc.17 (16.22 SPAD value) and highest in Acc.3 (34.80 SPAD value). There was no significant difference observed between the accessions in the plant characters like stem girth, canopy spread, leaf fresh weight, chlorophyll a and chlorophyll b contents.

The fruit weight varied from 2363g in Acc.7 to 173 g in Acc.9. Higher fruit weight is a desirable character in bael. The fruit length was found maximum in Acc.7 (29.00 cm) while minimum was found in Acc.4 (16.10 cm). The fruit breadth was recorded maximum in Acc.17 (17.35), while minimum breadth was recorded in Acc.9 (9.13 cm). Number of fruits varied from 33.3 (Acc.15) to 143.3 (Acc.3). The fruit yield was found maximum in Acc.9 (209.3 kg) while minimum fruit yield was found in Acc.3 (16.7 kg). The different shapes of the fruits like spherical, semi-spherical, oval and pyriform were also observed. The skull thickness ranged from a minimum of 2.06 mm in Acc.6 to a maximum of 2.96 mm in Acc.3.The thinner skull is considered to be a good quality character for bael. The rind weight ranged from 50 g (Acc.9) to 641g (Acc.7).

Pulp weight, fiber weight, moisture %, seed weight and seed number also varied significantly. Maximum pulp weight was recorded in Acc.7 (1632 g) and it was minimum in Acc.9 (73 g). Acc.4 showed maximum moisture content of 54.04 % while Acc.11 had a lowest moisture content of 37.15 %. Maximum fiber weight was recorded in Acc.8 (147 g) and minimum in Acc.20 (33.33 g).The seed number per fruit varied greatly among different accessions. The maximum seed number per fruit was recorded in Acc.8 (121.00) while minimum in Acc.11 (16.00). Seed weight in various accessions ranged from 4.67 g in Acc.5 to 22.67g in Acc.10. The lower fiber content, seed number and seed weight are preferred characters for selection of superior genotypes in bael. The Acc.7 with maximum fruit weight (2363 g) and Acc.9 with lowest fruit weight (173 g) also had maximum and minimum values for pulp weight (1632 g, 73 g), showing a direct correlation between fruit weight and pulp.

The findings from the present experiment shows that Acc.1, 3, 5, 7 and 20 were very promising in yield.

4. CONCLUSION

It was concluded that there was a great genetic variability in morphological, quality and yield characters of 20 bael accessions explored under the present study. This exploration and spotting of variability in bael will be helpful in screening and identification of better bael strains for successful crop improvement programme.

Table 1: Plant height, stem girth, number of branches, tree spread, tree growth habit and branching density

Acc. No	Tree height (m)	Stem girth (m)	No. of primary branches	Tree spread (m)	Tree growth habit	Branching density
Acc-1	10.57	0.34	4.33	5.60	Spreading	Dense
Acc-2	12.27	0.47	5.67	5.73	Erect	Dense
Acc-3	12.72	0.40	6.67	6.63	Spreading	Sparse
Acc-4	12.30	0.37	4.33	5.53	Spreading	Medium
Acc-5	14.33	0.44	8.33	6.43	Spreading	Medium
Acc-6	15.03	0.54	8.00	6.90	Spreading	Dense
Acc.7	11.60	0.38	5.00	4.27	Semi-erect	Dense

Acc-8	10.37	0.34	5.33	4.07	Spreading	Dense
Acc-9	10.67	0.42	5.00	5.73	Spreading	Dense
Acc-10	09.67	0.26	5.00	5.00	Erect	Sparse
Acc-11	11.00	0.42	4.67	5.37	Erect	Medium
Acc-12	13.57	0.55	4.67	6.13	Erect	Medium
Acc-13	09.90	0.43	4.67	5.27	Spreading	Sparse
Acc-14	12.20	0.55	4.67	5.40	Spreading	Medium
Acc-15	12.40	0.49	5.00	5.60	Semi-erect	Medium
Acc-16	11.27	0.41	4.67	6.13	Erect	Medium
Acc-17	13.83	0.37	5.00	5.80	Erect	Sparse
Acc-18	13.37	0.48	4.67	6.43	Erect	Medium
Acc-19	14.07	0.51	4.00	5.47	Spreading	Dense
Acc-20	11.5	0.40n	5.00	6.00	Spreading	Sparse
CD(0.05)	1.72	NS	1.14	NS		

Table 2: Leaf length, leaf fresh weight, leaf area and chlorophyll content.

Acc. No	Leaf fresh weight (g)	Leaf area (cm^2)	Total Chlorophyll content of trifoliate leaf (SPAD value)	Chlorophyll a Content mg/0.1g of leaf wt	Chlorophyll b content mg/0.1g of leaf sample
Acc-1	3.69	78.40	21.61	0.08	1.11
Acc-2	4.21	59.10	32.98	0.35	1.65
Acc-3	3.00	56.33	34.80	0.07	1.40
Acc-4	2.68	61.73	31.92	0.09	0.98
Acc-5	3.82	69.83	18.51	0.12	0.88
Acc-6	4.46	71.93	20.75	0.14	1.20
Acc.7	3.27	67.00	18.65	0.13	1.19
Acc-8	3.71	73.20	34.41	0.11	0.86
Acc-9	2.50	67.90	26.50	0.13	1.05
Acc-10	4.39	60.20	29.53	0.23	0.99
Acc-11	4.63	55.77	28.49	0.08	0.91
Acc-12	3.86	103.33	22.99	0.15	1.51
Acc-13	2.54	60.07	17.47	0.16	1.15
Acc-14	3.02	67.57	20.69	0.08	1.15
Acc-15	3.85	65.63	28.15	0.13	1.34
Acc-16	3.49	58.77	21.85	0.12	1.13
Acc-17	2.71	66.80	16.22	0.07	1.11
Acc-18	3.11	61.47	18.98	0.11	0.86
Acc-19	2.78	77.37	26.87	0.08	1.12
Acc-20	3.10	58.03	17 .49	0.14	1.45
CD (0.05)	NS	9.71	6.06	NS	NS

Table 3: Important fruit characters of different bael Acc.

Acc. No	Fruit weight (g)	Fruit length (cm)	Fruit breadth (cm)	Fruits number per tree	Fruit yield per tree (kg)	Shape of the fruit	Fruit
Acc-1	823	21.33	13.47	110.0	87.7	Spherical	Low
Acc-2	1069	23.17	14.36	41.0	50.3	Spherical	Medium
Acc-3	1537	22.67	15.02	143.3	209.3	Pyriform	Medium
Acc-4	490	16.10	10.81	139.3	61.7	Spherical	Low
Acc-5	1104	19.33	11.95	73.7	80.7	Semi spherical	High
Acc-6	1030	19.00	12.76	51.3	52.0	Spherical	High
Acc.7	2363	29.00	14.38	43.3	95.7	Pyriform	Medium
Acc-8	1225	21.07	15.18	36.7	44.7	Oval	Low
Acc-9	173	21.17	9.13	96.7	16.7	Spherical	Low
Acc-10	1453	23.83	15.94	48.3	70.0	Spherical	High
Acc-11	1323	24.90	13.18	35.0	56.0	Oval	High
Acc-12	603	24.67	13.13	80.0	47.7	Spherical	Low
Acc-13	933	18.90	13.43	48.3	45.0	Oval	Medium
Acc-14	880	17.50	12.28	38.3	37.7	Spherical	Low
Acc-15	873	20.17	13.53	33.3	33.3	Semi-spherical	High
Acc-16	710	20.50	12.26	56.7	39.0	Pyriform	Medium
Acc-17	1787	24.87	17.35	34.0	61.0	Oval	Medium
Acc-18	1677	22.50	13.53	37.3	62.3	Oval	Medium
Acc-19	903	20.67	13.02	65.0	58.0	Oval	Medium
Acc-20	767	17.50	12.31	95.0	72.3	Oval	Low
CD(0.05)	166.10	2.26	1.56	19.2	19.51		

Table 4: Pulp, rind, seed characters and fiber content

Acc. No	Pulp weight (g)	Rind weight (g)	Rind thickness (mm)	No. of seeds/ fruit	Total seed wt/ Fruit (g)	Seed length (mm)	Seed diameter (mm)	Fiber content (g)
Acc-1	436	311	2.37	30.00	6.00	7.64	7.01	69.0

Acc-2	633	319	2.50	86.00	13.33	7.22	8.14	73.3
Acc-3	1011	452	2.94	45.00	12.00	6.49	7.56	62.3
Acc-4	251	189	2.12	110.00	13.33	7.57	7.86	36.3
Acc-5	615	359	2.72	17.67	4.67	8.44	8.15	125.0
Acc-6	636	263	2.06	69.00	14.33	9.46	7.74	115.0
Acc.7	1632	641	2.76	119.60	19.00	7.42	8.53	73.7
Acc-8	707	355	2.50	121.00	16.67	8.35	7.80	147.0
Acc-9	73	50	2.29	37.00	9.13	7.54	8.37	37.0
Acc-10	910	473	2.72	114.60	22.67	6.75	8.10	45.0
Acc-11	642	398	2.86	16.00	5.20	7.60	6.96	60.3
Acc-12	343	235	2.80	72.33	13.67	6.55	7.10	40.6
Acc-13	524	329	2.56	84.67	14.33	8.07	8.34	61.6
Acc-14	528	267	2.66	93.67	16.00	7.01	7.91	72.0
Acc-15	508	290	2.48	41.00	11.00	8.19	8.97	64.3
Acc-16	345	297	2.68	65.67	11.67	8.09	8.87	51.3
Acc-17	1145	517	2.80	97.67	15.00	9.06	8.72	109.3
Acc-18	1202	357	2.49	59.00	13.13	8.90	7.74	106.3
Acc-19	504	338	3.25	48.33	12.00	7.66	8.29	45.6
Acc-20	351	366	2.74	89.00	14.75	7.59	7.50	33.33
CD(0.05)	159.8	99.4	NS	6.80	2.11	NS	NS	19.37

5. ACKNOWLEDGEMENT

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