Original Research Article

Evaluation of Beal Genotypes for Biochemical Characters

P. Pavani[*], G. Harshavardhan, S. N. Das and B. K. Das

*Department of fruit science and horticulture technology, College of Agriculture,
OUAT, Bhubhaneswar, Odisha, India*

*Corresponding author

A B S T R A C T

Bael fruit is a tropical fruit native to Southeast Asia and belongs to Rutaceae family. It is an important indigenous fruit of India and it is important from religious, nutritional and medicinal considerations. The present study entitled "Evaluation of bael genotypes for biochemical characters" was undertaken to evaluate biochemical parameters in 20 Accessions of bael from Odisha in view of the large variability available in bael. 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. The results revealed that significant variation existed in respect of TSS, acidity, reducing and non-reducing sugars and ascorbic acid contents of the fruit. The maximum Total Soluble Solids (33.77 ^{0} brix) of fruit was recorded in Acc.19 whereas titrable acidity was maximum (1.11%) in Acc.1.So, studying these characters help in the process of selection and hybridization in any crop improvement programme.

Introduction

Bael (*Aegle marmelos* Correa) 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.,* 2005) 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 singh *et al.,* Kumar *et al.,* Pandey *et al.,* and *Nath et al.,* The present study entitled "Evaluation of Bael Genotypes for Biochemical Characters" aims to identify and screen superior accessions of bael and gather information on variability in bio-chemical characters.

Materials 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 biochemical 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 biochemical characters. The extents of variation in physico-chemical traits of fruits from different locations were recorded.

Moisture percentage of the pulp was calculated by completely drying the fresh pulp as suggested by Vijai kumar *et al.,* (2009).

Total soluble solids of the fruit were recorded with the help of a Hand Refractometer in degree brix. Initially the reading was adjusted to zero by placing few drops of distilled water on the prism of the refractometer. Juice was prepared from the ripe pulp and a few drops of the juice were placed on the prism of the refractometer. Necessary temperature correction was made and final TSS reading was observed. Three separate readings were recorded for a single juice sample and the average was taken (Ranganna, 1986).

The acidity of the ripe fruits of different accessions was estimated by using procedure described by Ranganna (2000) after ripening. A clear homogenized juice was taken in 100ml conical flask. One to drops of phenolphalein indicator was added to it. Then the diluted sample was titrated against 0.1N sodium hydroxide solution taken in a burette. The end point of titration was indicated by a faint pink colour. Titration was continued till three current readings were obtained. Percentage of acidity is calculated by using the formulae with the obtained titrated values. The acidity percentage of the juice in terms of citric acid was calculated adopting the following formula.

% citric acid = (Titre value x Normality of NaoH x meq wt. of acid x volume made up to / Volume of sample taken for estimation x Volume of sample taken x 1000) X 100

Note:
meq = milliequivlent
(Meq of citric acid = 0.06404)

Reducing sugars present in the juice was determined by following standard methods. First 10 ml of the juice was taken in a 100 ml volumetric flask and made up to the mark by adding distilled water. Then it was transferred to a 100 ml burette. Then 5ml each of Fehling's A and Fehling's B were taken in a

250 ml capacity conical flask along with 40 ml of distilled water and the contents were thoroughly mixed. It was placed over gas flame and heated. When the first bubble appeared, 2-3 drops of methylene blue were added and it was simultaneously titrated against the juice sample taken in the burette till the end point of a brick red colour, was obtained. The reducing sugar was calculated by the following formula assuming that 10 ml Fehling's solution A and B is equivalent to 0.05 g of glucose (A.O.A.C.1975).

$$\text{Reducing sugar \%} = \frac{0.05 \times \text{juice dilution}}{\text{Titre value} \times \text{Volume of sample taken}} \times 100$$

In order to determine the content of non-reducing sugar in the sample first total sugar content was estimated. For the conversion of non-reducing sugar to reducing form 10 ml of filtrate juice was taken in a 250 ml volumetric flask and 5 ml of 1N HCL was added to it followed by addition of 30 ml distilled water.

Then the content was heated for 4-5 minutes and then cooled (for inversion). Then it was transferred to a 250 ml conical flask and titrated against 1N NAOH solution taken in a burette after the addition of 2-3 drops of phenolphthalein indicator to the juice sample until a light pink colour end point was obtained. This was done to make the juice sample neutral in reaction. Thus the non-reducing sugar present in the juice was converted to reducing state. After this, the same procedure was adopted as followed in reducing sugar. Total sugar was calculated by the following formula. (A.O.A.C. 1975)

$$\text{Total sugar \%} = \frac{0.05 \times \text{juice dilution}}{\text{Titre} \times \text{Volume of sample taken}} \times 100$$

The percentage of non-reducing sugar in the juice sample was calculated by the formula,

% of Non-reducing sugars = (Total sugar % - % of Reducing sugars) x 0.95

In order to estimate the ascorbic acid, first a dye solution was prepared by addition of 42 mg sodium bicarbonate (dissolved in distilled water) and 52mg 2,6-dichloro phenol indophenols and the volume was made up to 200 ml by adding distilled water. Then stock solution and working standard solution were prepared. Then 5 ml of standard solution was taken in a 100 ml volumetric flask and 10 ml of 4% oxalic acid was added to it. The sample was titrated against the dye until an end point of pink colour persisting for a few minutes was observed. Ascorbic acid was calculated by using the following formula: (Srivastava and Sanjeev kumar, 1994)

$$\text{Amount of Ascorbic acid (mg/100mg)} = \frac{\text{Titre} \times \text{Dye factor} \times \text{Volume made upto 100}}{\text{Volume of filtrate taken} \times \text{Volume of sample taken}} \times 100$$

Where,

$$\text{Dye factor} = \frac{0.5}{\text{Titre of dye solution}}$$

Sugar/acid ratio is estimated as a ratio of percentage of total sugar to the percentage of total acid.

Results and Discussion

The data pertaining to biochemical attributes of bael showed significant differences and high degree of variability for all the characters studied. Wide variations in bio-chemical composition of fruits were observed. The TSS content varied from 25.62° B in Acc.11 to 33.77° B in Acc.19. The accessions 1, 2, 3, 4, 5, 8, 12, 14, 16 and 20 had TSS content more than 30.8° B.

Table.1 TSS, acidity, ascorbic acid and moisture content of the pulp

Acc. No	TSS (^{0} brix)	Acidity %	Ascorbic acid mg/100g	Moisture content %
Acc-1	31.40	**1.11**	29.00	50.74
Acc-2	33.00	0.45	23.62	45.50
Acc-3	30.96	0.99	17.57	52.84
Acc-4	32.73	0.63	17.37	54.05
Acc-5	33.61	0.84	18.01	52.42
Acc-6	27.10	0.91	18.49	51.83
Acc.7	26.67	0.96	12.24	52.55
Acc-8	33.69	0.73	13.85	48.86
Acc-9	28.07	0.43	18.18	50.43
Acc-10	26.01	0.88	14.32	49.27
Acc-11	25.62	1.10	22.34	37.15
Acc-12	31.20	0.75	23.84	52.14
Acc-13	28.86	0.40	18.53	51.16
Acc-14	32.88	0.94	18.32	49.43
Acc-15	30.56	0.47	12.23	46.56
Acc-16	32.13	0.60	12.59	49.40
Acc-17	26.58	0.32	14.99	50.26
Acc-18	30.53	0.63	18.63	48.99
Acc-19	33.77	0.50	18.11	46.78
Acc-20	32.13	0.73	15.41	51.72
CD(0.05)	2.97	0.23	5.93	4.38

Table.2 Reducing sugars, non-reducing sugars, total acidity, TSS / acid ratio

Acc. No	Reducing sugars %	Non reducing sugars %	Acidity %	TSS/acid ratio
Acc-1	7.40	7.32	1.11	13.75
Acc-2	9.24	5.33	0.45	25.08
Acc-3	7.65	3.64	0.99	11.24
Acc-4	7.95	5.76	0.63	12.63
Acc-5	6.05	5.56	0.84	16.55
Acc-6	4.57	6.53	0.91	12.23
Acc.7	6.92	3.79	0.96	10.53
Acc-8	5.43	4.72	0.73	10.90
Acc-9	11.32	4.64	0.43	22.46
Acc-10	12.66	4.25	0.88	19.33
Acc-11	12.54	3.55	1.10	14.85
Acc-12	9.83	4.73	0.75	19.84
Acc-13	14.7	5.07	0.40	46.67
Acc-14	10.85	3.42	0.94	15.69
Acc-15	10.98	4.33	0.47	33.93
Acc-16	12.37	5.79	0.60	30.51
Acc-17	5.46	5.99	0.32	37.47
Acc-18	17.7	6.93	0.63	40.31
Acc-19	13.19	4.11	0.50	35.40
Acc-20	15.23	3.24	0.73	25.52
CD(0.05)	1.19	1.28	0.23	7.90

The titrable acidity was found minimum in Acc.17 (0.32 %) and maximum (1.11 %) in Acc.1. The non-reducing sugars ranged from 3.24 % in Acc.20 to 7.32 % in Acc.1. The reducing sugar was found maximum in Acc.20 (15.23 %) and minimum in Acc.6 (4.57 %). The vitamin 'C' was the highest in Acc.1 (29.00 mg/100g) and lowest in Acc.15 (12.23 mg/100g). The TSS/acid ratio ranged from 23.96 to 84.73 among the various types. The highest TSS/acid ratio was found in Acc.17, while minimum in Acc.11.

The findings from the present experiment shows that Acc.2, 4, 16 and 19 were very encouraging for fruit quality character.

Acknowledgement

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