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Physico-chemical study of Aonla genotypes (*Emblca officinalis Gaertn*)

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Abstract

The present experiment entitled “physico-chemical study of Aonla genotypes (*Emblca officinalis Gaertn*)” was conducted during 2019–20 at Fruit Research Station, Imliya, Department of Horticulture, JNKVV, Jabalpur (M.P.). The maximum fruit weight (53g), fruit diameter (4.63), fruit length (4.14cm) and TSS (9.11 °brix) were recorded with JA 114. The Maximum pulp percentage (97.13%), acidity (1.66%) and ascorbic acid (566.87 mg/100g) were recorded JA 116 while highest stone weight (2.26g) in chakaiya, pulp: stone ratio (35.16) in JA 117, TSS: acid ratio (11.00) in JA101 and stone diameter (3.08) was recorded with Francis. The minimum pulp: stone ratio (15.36), fruit diameter (3.22cm) and stone diameter (1.85cm) under JA104. The minimum fruit length (2.49cm) and fruit weight (16.93g) were recorded with JA107, pulp percentage (93.43%) in JA 109, TSS (5.42 °brix) in JA 118, acidity (0.86%) in JA 112, ascorbic acid (453.12 mg/100g) in JA 103, stone weight (0.96g) and TSS: acid ratio were recorded with JA 116.

Keywords: Aonla, genotypes and Jawahar Aonla (JA)

Introduction

The Aonla (*Emblca officinalis Gaertn.*) Syn.-*Phyllanthus emblca* (commonly known as Indian gooseberry) Linnaeus is known for its medicinal and therapeutic properties from the ancient time in India and considered as a wonder fruit for health conscious population it belongs to family Euphorbiaceae. It is one of the important indigenous fruit of India subcontinent. In different parts of India it is known by different vernacular name such as Amla or Aonla in hindi, Dhatri, Dhatriphala or Amlaki in sanskrit, Amla or Amalaki in Bengali and Oriya, Nelli in Malayalam and Tamil, Amlakamu, Usirikai Usrika in Telugu, Amolphal in Punjabi, and Aonla, Myrobalan, Inaian Goosberry in English

Aonla is said to be indigenous to tropical South – Eastern Asia, particularly in central and southern India. It is also reported to be the native of India, Pakistan, Bangladesh, Srilanka, Malaysia, and China and to Islands. It is more popular in India and is commercially cultivated in Uttar Pradesh including the ravenous area in Agra, Mathura, Kanpur, Pratapgarh, Raibareli, Etawah, Fatehpur and semi – arid tracks of Bundelkhand. The major concentration of Aonla cultivation is in Pratapgarh district. The natural distribution of wild Aonla is found on the Himalayas, Chhota Nagpur, Bihar, Orissa, West Bengal, North Circars, Deccan, Karnatka, and in Western Ghats.

Aonla is basically sub-tropical plant and prefers dry sub-tropical climate. Tree growth is not influenced either by hot wind or frost. A mature Aonla tree can tolerant freezing as well as high temperature up to 44°C. It is a hardy fruit crop and is now being cultivated in variable soil conditions. Its deep root system and deciduous nature is helpful in providing vertical drainage and incorporation of around 10 t/ha of biomass for continuous improvement in physical, chemical and biological soil properties.

Aonla is highly nutritive and is one of the richest natural source of vitamin-C (600mg/100g of pulp). It is the second highest source of vitamin-C among fruits next only to Barbados cherry. The fruits contain tannins which is useful in protecting the ascorbic acid from oxidation. It is valued as an antiscorbutic diuretic laxative alternative and antibiotic. The fruit of Aonla are very extensively utilized by processing industry. It is an essential ingredient of chyawanprash and Triphala are popular ayurvedic medicine and in other products i.e. preserves, pickles, candy, jelly, jam, and squash. Fruits can also be dried and powdered to be used subsequently in the preparation of hair oils.

The stone, number on fruit size and weight of Tangerine cv. Khieo Waan and found that number of stone per fruit was significantly correlated with fruit size (diameter) and fruit weight (Ketsa, 1988)^[12].

Banarasi cultivar showed its highest TSS, ascorbic acid and lesser amount of acidity than other cultivar. The total sugar content was maximum in Chakaiya followed by Banarasi and the minimum total sugar found in *Desi* cultivar. Under rainfed condition of south west Haryana, Banarasi performed well superior to Chakaiya and *Desi*. In Chakaiya and Banarasi cultivar the TSS increased. The acidity and ascorbic acid content of the fruits were recorded in high range then it decreasesd significantly at later stage of maturity.

Aonla fruits as 3.4% fiber, 81.2% moisture, 600mg/100g ascorbic acid. Fruit of Krishna has TSS of 11.5° brix, 40g fruit weight, 475 mg/100g ascorbic acid. *Desi* cultivar reported to have 14.8° brix TSS, 458.9 mg/100g and fruit weight 12.90g.

The average fruit length as 3.94 cm, fruit weight as 32.9g, fruit diameter as 3.74 cm, pulp as 97.5%, stone 2.50%, moisture content as 87.4%, crude fiber as 6.6%, TSS 10%, 416mg/100g of ascorbic acid. NA-7 also observed with fruit weight 40.9g, fruit length 4.19 cm, fruit diameter 3.99cm, 6.6% crude fiber, 252.72 mg/100g ascorbic acid. It was further noticed that delay in harvest leads to increase in TSS and ascorbic acid of the fruit.

Materials and Methods

The present experiment entitled physico-chemical study of Aonla genotypes (*Emblica officinalis* Gaertn) was conducted during 2019–20 at Fruit Research Station, Imliya, Department of Horticulture, JNKVV, Jabalpur (M.P.) During the study, 20 genotypes were selected from the existing plant population for detailed study on the basis of fruiting behavior and size of fruits. Selected genotypes were tagged to study their physico-chemical characteristic of fruits. The experiment was laid out in Randomized block design with three replications. Treatment details are given below:

Treatments	Genotypes/Varieties
T ₁	Jawahar Aonla (JA) 101
T ₂	Jawahar Aonla (JA) 102
T ₃	Jawahar Aonla (JA) 103
T ₄	Jawahar Aonla (JA) 104
T ₅	Jawahar Aonla (JA) 105
T ₆	Jawahar Aonla (JA) 106
T ₇	Jawahar Aonla (JA) 107
T ₈	Jawahar Aonla (JA) 108
T ₉	Jawahar Aonla (JA) 109
T ₁₀	Jawahar Aonla (JA) 110
T ₁₁	Jawahar Aonla (JA) 111
T ₁₂	Jawahar Aonla (JA) 112
T ₁₃	Jawahar Aonla (JA) 113
T ₁₄	Jawahar Aonla (JA) 114
T ₁₅	Jawahar Aonla (JA) 115
T ₁₆	Jawahar Aonla (JA) 116
T ₁₇	Jawahar Aonla (JA) 117
T ₁₈	Jawahar Aonla (JA) 118
T ₁₉	Chakaiya
T ₂₀	Francis

The Following observations were recorded of Aonla genotypes:

A. Physical parameters

Fruit weight (g), Stone weight (g), Pulp (%), Pulp Stone ratio, Fruit diameter (cm), Stone diameter (cm), Fruit length (cm).

B. Biochemical parameters

TSS (°Brix), Acidity (%), Ascorbic acid content (mg/100g), and TSS: Acidity ratio.

Result and Discussion

Physical parameters

The maximum fruit weight (53 g) was recorded under JA 114 followed by Francis (51.93 g) which was statistically at par with each other. The minimum fruit weight (16.93 g) were recorded under the JA 107.

The maximum stone weight (2.26 g) was noted in Chakaiya followed by Francis (2.02 g) which was statistically at par with each other. The minimum weight (0.96 g) was recorded under JA 106 and JA 116.

The maximum pulp% (97.13%) was observed in JA 116 followed by JA 114 (95.37%) which was statistically at par with each other, whereas minimum pulp% were recorded under JA 109 (93.43%).

The maximum pulp:stone ratio (35.16) was recorded under JA 117 followed by JA 114 (33.46) which was statistically at par with each other. The minimum pulp:stone ratio (15.56) was recorded in JA 104.

The maximum fruit diameter (4.63 cm) was recorded under JA 114 followed by Francis (4.34 cm) which was statistically at par with each other. The minimum fruit diameter (3.22 cm) was observed in JA 104.

The maximum stone diameter (3.08 cm) were recorded under Francis followed by Chakaiya (2.81 cm) which were statistically at par with each other, whereas minimum stone diameter (1.85 cm) were recorded under JA 104.

The maximum fruit length (4.14 cm) was recorded in JA 114 followed by Francis (4.03 cm) which was statistically at par with each other. The minimum fruit length (2.49 cm) was recorded under JA 107.

Chemical Parameters

The maximum TSS (9.11 °brix) were recorded in JA 114 followed by JA 109 (8.18 °brix) was statistically at par with each other. While minimum TSS (5.42 °brix) was recorded under JA 118.

The maximum acidity (1.66%) was noted in JA 116 followed by JA 101 (1.42%) which was statistically at par with each other. The minimum acidity (0.86%) recorded in JA 112.

The maximum ascorbic acid (566.87 mg/100g) was observed in JA 116 followed by JA 118 (520.60 mg/100g). while minimum ascorbic acid (453.12 mg/100 g) was recorded under JA 103.

The maximum TSS: acidity ratio (11.00) was observed in JA 101 followed by JA 114 (10.12) which was statistically at par with each other. The minimum TSS: acidity ratio (3.93) was recorded under JA 116.

Discussion

The weight of the fruit (32.53g) fruit diameter (3.93 cm) fruit length (3.23 cm) was recorded higher in Chakaiya as compared to *Desi*. Pulp: stone ratio is depends on size of the fruit. Chakaiya was found to be superior followed by *Desi* as regard pulp: stone ratio. The cultivar Chakaiya showed higher specific gravity (1.07 g/ml) as compared to *Desi* (1.05 g/ml) Premi *et al.*, 2002)^[17]. The maximum weight of the fruit were significantly recorded in JA 114 followed by Francis, whereas minimum fruit weight was found in JA 107. Maximum fruit volume was significantly recorded in Francis followed by

Chakaiya whereas minimum fruit volume was found in JA 110. The variation in fruit weight and volume may be due to varied potency of cell division, enlargement and development of inter and intra cellular spaces in different cultivars of Aonla. Similar findings have also been reported by (Bharati 2015) [3].

The effect of stone, number on fruit size and weight of Tangerine cv. Khieo Waan and found that number of stone per fruit was significantly correlated with fruit size (diameter) and fruit weight. Similar findings have also been reported by (Ketsa, 1988) [12].

The physical parameters viz, fruit size, weight, stone weight, specific gravity, moisture content etc. in five cultivars of Aonla during growth and development. They observed that Banarasi and Chakaiya have maximum and minimum fruit size and weight respectively where as Krishna and Kanchan cultivars gave maximum and minimum stone weight respectively. Similar findings have also been reported by (Ojha and Pathak, 1992) [14].

Total sugar, reducing sugar, ascorbic acid was highest in osmo air dried Aonla browning and tannin content were least. Indirect solar drying is found better than direct solar drying (Pragathi *et al.*, 2000) [16]

The differential decrease in acidity among cultivars of Aonla namely Chakaya, Krishna, NA-7, NA-10 during storage. Minimum acidity was recorded in cv Krishna (1.73%) followed by NA-10 (1.83%) on 10th day of storage while maximum acidity content was recorded in NA-7 (2.56%) followed by cultivar Chakaiya (2.09%). Similar findings have also been reported by Neeraj *et al.* (2002) [13]

The physico-chemical composition of two cultivars of Aonla fruits namely Chakaiya and *Desi* and found a gradual increase in average fruits weight, stone weight, pulp to stone ratio, TSS and ascorbic acid with the advancement of maturity up to 5th November. The maximum total phenol content was found in immature fruits. It was inferred from the observation that Aonla fruits attained maturity in the first fortnight of January and hence this period might be the optimum harvesting stage. Similar findings have also been reported by Gupta *et al.* (2003) [8].

The seven cultivars namely Krishna, Kanchan, NA-6, NA-7, NA-10, Francis, Chakaiya. Fruit weight was maximum in cv. Krishna followed by NA-10 and NA-6. The minimum fruit weight was recorded in cv. Kanchan. Maximum acidity, ascorbic acid, total mineral, total phenol content were recorded in NA-6. Similar findings have also been reported by Jaiswal *et al.* (2007) [3].

Aonla was found scattered through Jhorat district of Assam. Fourteen ripe fruits are selected and analysed for physico chemical trait such as stone weight (0.37-1.66g), pulp:stone ratio (3.2114), pulp weight (2.83g - 9.41g), TSS (12^o brix-19^o brix), acidity (2.29%-4.61%), ascorbic acid (400 mg/100g-800 mg/100g) and reducing sugar (3.67%10.98%) Similar findings have also been reported by Hazarika *et al.* (2009) [1]. fruits of Chakaiya variety can be used for development of value added products because this variety had a lower content of phenols,TSS, ascorbic acid compare to wild varieties. Similar findings have also been reported by Poonam *et al.* (2009) [15].

Ascorbic acid content was observed significantly higher in the squash prepared from NA-7, NA-6, and Chakaiya was 159 mg/100ml, 153.10 mg/100ml, and 150.01 mg/100ml respectively. Higher pH was found in NA-7 was 3.68

followed by NA-6 was 3.54. Similar findings have also been reported by Choudhary *et al.* (2013) [5].

The chemical and nutritional profiles of fresh Aonla fruits of five varieties viz. Banarasi, Chakaiya, Kanchan, NA-7 and *Desi*. Fruits of variety Banarasi were the largest in size and had maximum weight, while fruits of *Desi* variety had the least values with maximum firmness. Moisture content of variety NA-7 was the highest. The fruits of *Desi* variety were reported to have the maximum ash, fat and fibre contents. Varietal differences significantly ($p < 0.05$) influenced the acidity, ascorbic acid, total polyphenol, total sugar and pectin contents. It was observed that iron and zinc contents were significantly higher in Chakaiya variety while sodium and potassium contents were higher in Kanchan variety. Similar findings have also been reported by Parveen *et al.* (2015) [18].

The wide spread survey was made to explore the Aonla germplasm and also to determine variability studies in Aonla wild genotypes for fruit character from north-eastern areas of India i.e., Assam, Nagaland, Meghalaya and Manipur during the year of 2014-16. These genotypes were collected from the varied altitude ranging from 800-1850 m above mean sea level. Aonla genotypes were found almost all part of north eastern region, but the intensity varied from place to place according to agro-climatic conditions. Indian gooseberry accessions showed considerable variability with respect to morphological and physico-chemical characters. Wide variability with respect to fruit weight (1.39 – 5.88g), fruit length (1.27- 2.28cm), fruit breadth (1.27-2.44cm), fruit girth (4.16 to 7.22cm), stone weight (0.29 to 0.95g), specific gravity (1.02-1.45), TSS of juice (10.00-21.30°Brix), pH (2.53-3.27), acidity (1.84-3.95), total sugar (8.15-13.15%), Vitamin C (375.00 -1428.50 mg/100 ml of fruit juice), Phenol content (944.85-4516.20 mg/100g of juice) and TSS/acid ratio (3.03-9.72) were observed among the genotypes. The genotype T-12 and. T-14, were found superior in terms their physicochemical attributes than the rest of the genotype. Singh *et al.* (2016).

The physico chemical composition of Aonla and found that average weight of the fruit, stone and pulp were 33.59 g, 8.80% and 91.20%. While average fruit length and width of fruit was found 3.19 cm and 4.19 cm. Edible portions of fruit contain 10% TSS, 2.25% acidity, 546.75mg /100g, 2.60% reducing sugar, 2.23% non reducing sugar, 4.83% total sugar Gaurav *et al.* (2017) [6].

The Pulp:stone ratio was recorded significantly highest in JA 117 followed by JA 114. Whereas minimum pulp:stone ratio observed in JA 104. The difference in Pulp:stone ratio was may be due to genetic differences, weight and size of the fruit and weight and size of the stone (Chiranjeevi *et al.* 2018) [4].

The fruit diameter was recorded significantly maximum in JA 114 followed by Francis. The minimum fruit diameter was noted in JA 104. This difference was due to genetically characteristics of varieties and rate of enlargement of mesocarp cells of fruits as well as micro-climatic factors. This observation is in accordance with the results obtained by (Balasubramanyam and Bangaruswamy 1998) [2].

The decrease in total acidity content in Aonla at final stage fruit maturity might due to rapid utilization of organic acids into their salts and sugars either by invertase (Hawker 1968) [9]. Ascorbic acid was recorded significantly maximum in JA 116 followed by Chakaiya. The minimum ascorbic acid was found under JA 112. The vitamin-C content increased consistently in linear order with the advancement of harvest

maturity. The variation in vitamin-C content may be associated with inherited characters of Aonla cultivars. These findings are in agreement with those of (Bharati 2015) [3].

TSS/acid ratio (3.03-9.72) were observed among the

genotypes. The genotype T-12 and T-14, were found superior in terms their physicochemical attributes than the rest of the genotype (Singh *et al.* 2016).

Table 1: Physico study of Aonla genotypes (*Emblica officinalis* Gaertn)

Treatment	Fruit Weight (g)	Stone Weight (g)	Pulp%	Pulp:Stone ratio	Fruit Diameter (cm)	Stone Diameter (cm)	Fruit Length (cm)
T ₁	22.50	1.50	93.33	21.30	3.67	2.18	2.86
T ₂	20.20	1.50	92.25	19.43	3.26	2.02	2.85
T ₃	30.23	1.00	93.75	29.36	3.79	2.16	3.34
T ₄	17.10	1.00	91.50	15.56	3.22	1.85	2.96
T ₅	24.33	1.13	93.58	23.36	3.59	2.10	2.77
T ₆	26.60	0.96	94.16	22.57	3.86	2.41	3.21
T ₇	16.93	1.53	94.54	18.03	3.31	2.06	2.49
T ₈	25.53	1.23	94.28	20.03	3.57	2.01	2.68
T ₉	27.96	1.26	93.43	20.93	3.87	2.37	3.11
T ₁₀	19.50	1.03	94.67	18.33	3.48	2.11	2.70
T ₁₁	33.53	1.06	95.63	32.30	4.11	2.44	3.34
T ₁₂	34.36	1.26	94.86	27.63	4.24	2.15	3.43
T ₁₃	25.60	1.00	95.11	24.53	3.24	2.18	2.57
T ₁₄	53.00	1.33	95.13	33.46	4.63	2.15	4.14
T ₁₅	19.30	1.10	94.78	18.40	3.46	2.05	2.66
T ₁₆	35.10	0.96	97.17	28.43	4.09	2.75	3.44
T ₁₇	36.43	1.13	95.14	35.16	4.10	2.76	3.47
T ₁₈	23.50	1.00	94.92	22.26	3.57	2.47	2.81
T ₁₉	39.56	2.26	94.55	17.72	4.25	2.81	3.04
T ₂₀	51.93	2.02	94.48	23.09	4.34	3.08	4.03
S.Em ±	1.926	0.081	0.619	0.577	0.101	0.088	0.143
CD at 5%	5.535	0.233	1.780	1.658	0.291	0.253	0.411

Table 2: Chemical study of Aonla genotypes (*Emblica officinalis* Gaertn)

Treatment	T.S.S (°Brix)	Acidity (%)	Ascorbic acid (mg/100g)	TSS: Acidity ratio
T ₁	6.38	1.42	506.08	11.00
T ₂	8.17	0.95	483.61	7.93
T ₃	6.46	1.17	485.60	9.22
T ₄	7.43	0.89	479.62	7.35
T ₅	6.18	1.23	479.18	8.95
T ₆	8.09	1.03	492.26	7.85
T ₇	5.54	1.27	487.98	4.36
T ₈	7.24	1.01	517.71	7.16
T ₉	8.18	1.08	470.56	7.57
T ₁₀	6.25	1.29	484.77	4.84
T ₁₁	8.12	0.88	498.85	9.22
T ₁₂	8.17	0.86	460.54	9.20
T ₁₃	7.65	1.20	479.44	6.37
T ₁₄	9.11	0.90	496.46	10.12
T ₁₅	8.16	1.39	463.80	5.87
T ₁₆	6.54	1.66	550.44	9.93
T ₁₇	7.86	1.17	510.72	6.71
T ₁₈	5.42	1.30	500.70	4.16
T ₁₉	8.14	1.35	522.34	6.02
T ₂₀	8.06	1.06	505.33	7.60
S.Em ±	0.322	0.033	13.23	0.566
CD at 5%	0.927	0.094	38.04	1.627



Jawahar Aonla 101



Jawahar Aonla 102



Jawahar Aonla 103



Jawahar Aonla 104



Jawahar Aonla 105



Jawahar Aonla 106

Plate 1: Genotypes of Aonla



Jawahar Aonla 107



Jawahar Aonla 108



Jawahar Aonla 109



Jawahar Aonla 110



Jawahar Aonla 111



Jawahar Aonla 112

Plate 2: Genotypes of Aonla



Plate 3: Genotypes and Varieties of Aonla

Conclusion

The present experiment entitled Physico chemical study of Aonla genotypes (*Emblica officinalis* Gaertn) was conducted during 2019–20 at Fruit Research Station, Imliya, Department of Horticulture, JNKVV, Jabalpur (M.P.). It was concluded that the maximum physico- chemical characteristics of Aonla genotypes i.e. fruit weight, fruit diameter, fruit length and TSS were recorded with JA 114. The Maximum pulp%, Acidity and Ascorbic acid were recorded JA 116 while highest stone weight in chakaiya, pulp stone ratio in JA177, TSS acid ratio in JA101 and stone diameter was recorded with Francis.

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