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STUDY OF THE MORPHOLOGICAL CHARACTERS OF AONLA (*EMBLICA OFFICINALIS* GAERTN.) GENOTYPES

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ABSTRACT

Fourteen genotypes of aonla (*Emblica officinalis* Gaertn.) including check variety Chakaiya was collected from the Gwalior region of Madhya Pradesh. Different morphological and physical parameters was taken and result revealed that tree height (m) was max in KS1(9.7m) followed by KS3(9m),TR1(7.3m),TR2(7m) and SS1(6.3m).Fruit volume was maximum in SS3(36.67cm^3) and minimum in KS3 (9cm^3), specific gravity was max in SS2(1.05), Pulp: stone was maximum in TS4(26.4), which was more than that of Chakiya (17.16). Stone weight (g) was min in TS4 (0.76g) and KS4(0.85g) less than Chakaiya (1.79g). The genotypes *viz*., KS4, SS2, KS2 and TS3 can be considered ideal and promising genotype can be used for further breeding programmes to improve quality attributes.

Key words : Genotypes, Morphological, Parameters, Aonla, Chakiya.

Introduction

Aonla (*Emblica officinalis* Gaertn.), is "Indian gooseberry". It has chromosome number 2n = 28 and is a member of the Euphorbiaceae family. With the exception of Barbados cherries, it is the fruit with the highest vitamin-C content, having 500-600 mg of ascorbic acid per 100g of pulp. It plays an important role in traditional Ayurvedic treatment due to its multiple health advantages. When ripe, the fruit is small and spherical, and it turns a light greenish-yellow. Its flavor is often sour and astringent, but it can vary in intensity. Aonla is used in cuisine as well as medicine, imparting a tart flavor to foods and beverages.

It is a fruit indigenous to the tropical south- eastern Asia particularly in central and southern India (Firminger, 1947). It is one of the importantfruit of Indian subcontinent and they are grown in the states of Uttar Pradesh, Maharashtra, Gujarat, Rajasthan, Andhra Pradesh, Karnataka, Tamil Nadu, Himachal Pradesh etc. It is grown in an estimated area of 106 thousand ha and production of 1318 thousand metric tonne (Anonymous, 2024).

Aonla germplasm collection is critical for preserving genetic variety, which is required for the long-term viability of aonla farming and addressing issues such as pests, diseases and climate change. Germplasm collections are essential resources for breeding projects. Aonla trees are found throughout the country, and their quality and quantity vary due to seed propagation. There is a lack of scientific information on the different characteristics of aonla germplasm. A study was conducted in the Gwalior region (Madhya Pradesh) to determine several morphological characteristics of aonla germplasm.

Materials and Methods

Fourteen aonla genotypes, including one cultivar, namely, 'Chakaiya' was collected from region of Gwalior in Madhya Pradesh. These fruits were characterized based on their physico-morphological traits. The fourteen genotypes were considered as treatments and five fruits per replication was taken for recording the physico-morphological analysis in laboratory during 2023 to 2024 and the experiment was laid out in completely randomized design with fourteen treatments given in Table 1.

Table 1 : Details of Aonla genotypes.

Treatment	Genotype
T_1	TS1
T_2	KS2
T_3	TS3
T_4	TS4
T_5	TS2
T_6	KS4
T_7	Chakaiya
T_8	TS1
T_9	TS2
T_{10}	KS1
T_{11}	KS3
T_{12}	SS1
T_{13}	SS2
T_{14}	SS3

Physical parameters

The physical characters of fruit shape, colour, length, breadth, volume, specific gravity, seed weight, pulp weight, pulp: stone ratio, seed per stone, seed weight, no. of segment were observed. The length and breadth were taken with vernier callipers. Fruit volume with water displacement method and weight was taken with the electronic balance. Pulp weight and stone weight was calculated by removing stone from fruits, no. of segments and fruit shape was calculated by manual observation.

Morphological parameters

Tree morphological observations were taken that are tree shape, height and foliage density. Tree height was taken by placing long bamboo stick into the ground and then measuring it with tape.

Results and Discussion

A perusal of observations for the growth parameters among the selected aonla genotypes exhibited substantial variations. The tree shape (Table 2) of the studied genotypes has categorized in three groups, *viz*.; spreading (TS1, TS2, TS3, TS4, KS4, TR1, TR2, SS2 and Chakaiya); drooping (KS2, SS3) and upright type (KS3, KS1, SS1). Plant height was maximum in (KS1) followed by (KS3) and minimum plant height was TS4 and TS3, respectively. The less vigorous/ dwarf genotypes are considered suitable material for high density planting. The results of the present investigation are in accordance with the previous findings in the arid conditions (Shukla *et al*., 2010). These findings suggested that, besides the genetic background of the aonla genotypes, the prevailing agro-climatic conditions are also determining factor for growth characteristics.

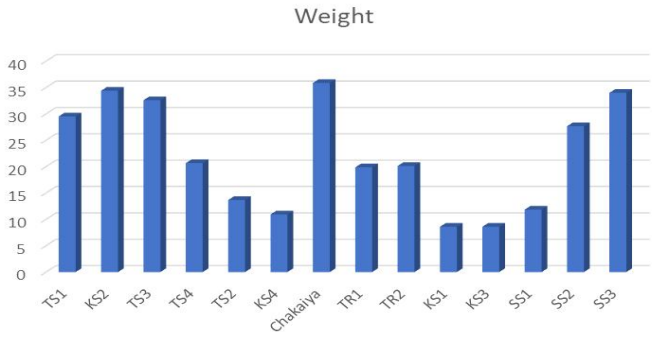

Fig. 1 : Weight of different Aonla genotypes.

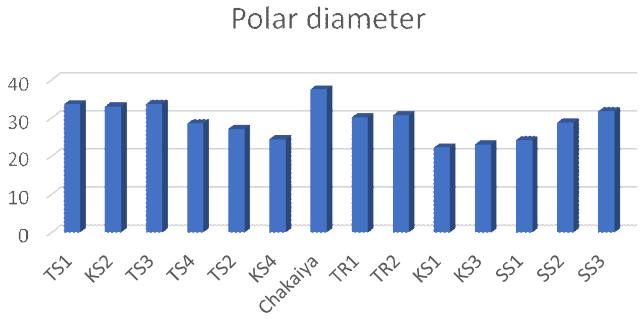

Fig. 2 : Polar diameter of different Aonla genotypes.

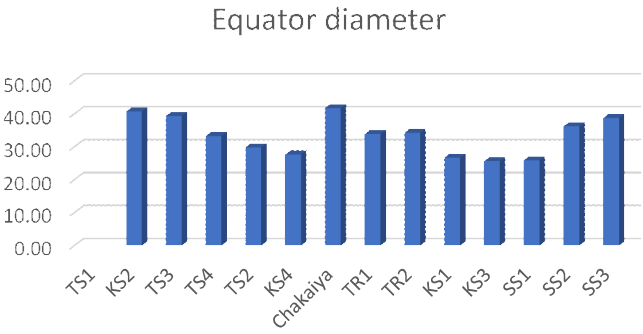

Fig. 3 : Eqator diameter of different Aonla genotypes.

The evaluated genotypes exhibited significant variation for the different fruit physical attributes. The maximum fruit weight (34.4g) was found in TS2 followed by SS3 (34g) while minimum (8.6 g) in KS1(Fig. 1). The fruit polar diameter (Fig. 2) was(33.73mm) measured higher in TS3 which was statistically at par with Chakaiya (37.53mm) and was lowest, however the minimum fruit polar diameter (22.3mm) was measured in KS1. Similarly, fruit equator diameter was measured maximum (40.6mm) in TS2 at par with Chakaiya (41.73mm) while minimum (25.6mm) in KS3 (Fig. 3). Fruit weight has also been observed to have higher genetic inheritance, thus having better potential for genetic improvement and being a key criterion for selecting new promising cultivars (Singh *et al*., 2012).

Fruit volume was maximum in aonla genotype of SS3 (36.67) followed by TS3 (35.33), which was not more than Chakaiya (35.67) and the minimum fruit volume was of KS3 (9.00) as shown in Fig. 6. The variation in fruit

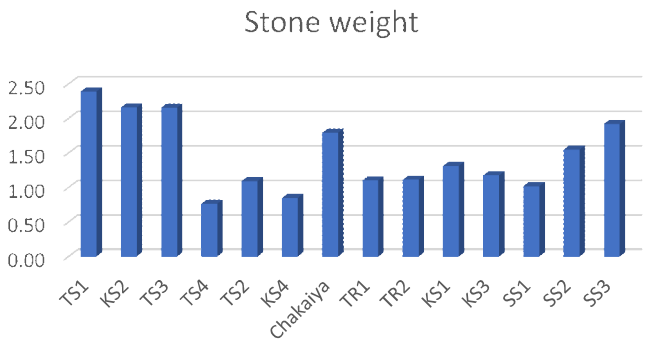

Fig. 4 : Stone weight of different Aonla genotypes.

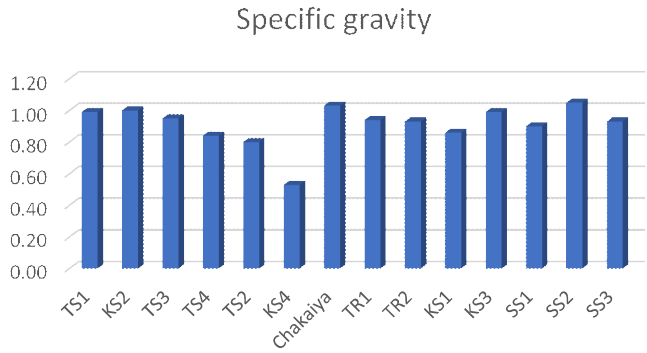

Fig. 5 : Specific gravity of different Aonla genotypes.

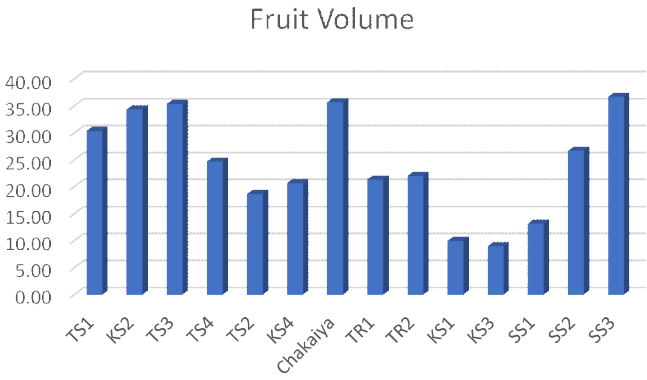

Fig. 6 : Fruit volume of different Aonla genotypes.

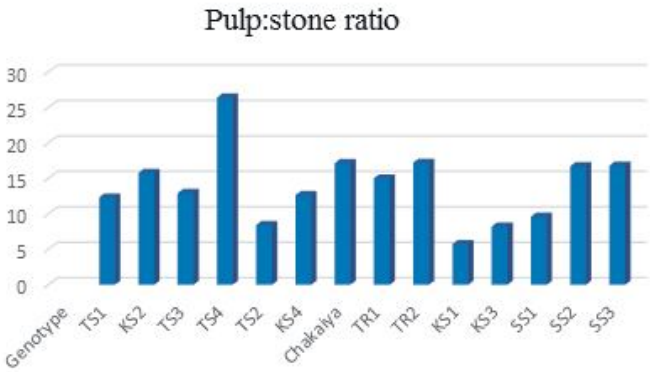

Fig. 7 : Pulp: Stone ratio of different Aonla genotypes.

weight and volume may be due variation in cell division, enlargement and development of intra cellular spaces in different cultivars of aonla. Similar findings have also been reported by Bharti (2015).

The pulp: stone ratio was maximum in TS4 (26.4) followed by TR2 (17.19) which is at par with Chakaiya (17.16) as shown in however minimum pulp: ratio was of genotype KS1 (5.74) and KS3 (8.22) (Fig. 7).

Pulp weight (Fig. 8) of aonla genotype KS2 (32.24g) was maximum followed by TR2 (17.19g) but pulp weight of chakaiya (34.07g) was more than that of genotypes and minimum pulp weight was of KS1(7.2g). Pulp weight of chakaiya was more than the genotypes and the similar findings have also been reported in (Shukla *et al.*, 2015)

The specific gravity (Fig. 5) was maximum in T_{13} (1.07) followed by T_6 (0.85) and the minimum fruit genotype value was in T_6 (0.72) and T_5 (0.78) were as the weight of Chakaiya was (1.03). Similar findings were observed by Bakshi *et al.* (2015). The stone weight was maximum in T_1 (2.39g) followed by T_2 (2.16g) and

Table 2 : Morphological characterization of aonla genotypes.

Genotypes	Tree Shape	Foliage density	Fruit Shape	Fruit Colour
TS1	Spreading	Sparse	Round	Yellow green
KS2	Drooping	Dense	Flattened round	Yellow green
TS3	Spreading	Sparse	Flattened round	Yellow green
TS4	Spreading	Sparse	Round	Light green
TS2	Spreading	Sparse	Round	Light green with red tinge
KS4	Spreading	Dense	Oval	Light green with red tinge
Chakaiya	Spreading	Sparse	Flattened round	Light green
TR1	Spreading	Dense	Round	Yellow green
TR2	Spreading	Dense	Round	Yellow green
KS1	Upright	Sparse	Round	Light green
KS3	Upright	Sparse	Oval	Light green
SS1	Upright	Dense	Oval	Light green
SS2	Spreading	Dense	Flattened round	Yellow green
SS3	Drooping	Sparse	Round	Yellow green

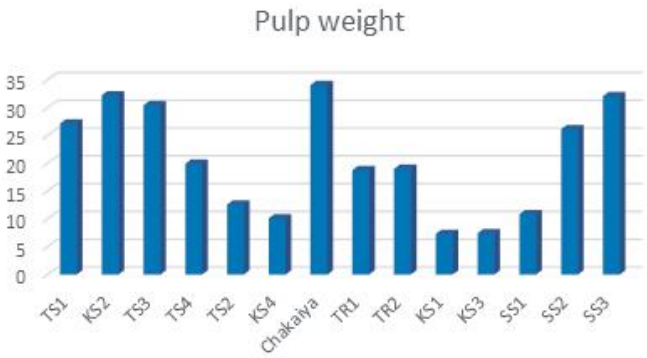

Fig. 8 : Pulp weight of different Aonla genotypes.

Table 3 : Morphological characterization of aonla fruit genotypes.

Genotypes	No. of seed per stone	No. of segments	Plant height (m)
TS1	6	6	5.8
KS2	4-6	6	5.6
TS3	5	6	4.8
TS4	6	6	4.5
TS2	6	6	6.09
KS4	6	6	5.9
Chakaiya	4-5	6	4.85
TR1	6	6	7.3
TR2	5	6	7
KS1	6	6	9.7
KS3	6	6	9
SS1	6	6-8	6.3
SS2	6	6-7	5.8
SS3	6	6	4.7

minimum weight was in aonla genotype was of T_4 (0.76g) and T_6 (0.85g) the weight of Chakiya stone was (1.79g).

The stone weight (Fig 4) was maximum in T_1 (2.39g) followed by T_2 (2.16g) and minimum weight was in aonla genotype was of T_4 (0.76g) and T_6 (0.85g) the stone weight of Chakaiya stone was (1.79g). The stone weight of Chakaiya was approximately near with Bakshi *et al.* (2015).

Variation in physical fruit character of aonla may be due to differences in their genetic makeup and prevailing agro-climatic conditions i.e. nutrient, soil, light, water and altitude under the plants are grown (Murli, 1997).

Conclusion

Their was significant variability among aonla genotypes in the study for morphological and physical attributes. Based on the study, it can be concluded that maximum tree height (m) was recorded in (KS1). Tree shape was spreading, drooping and upright and the foliage density was sparse and dense. Different physical characters were studied and it can be concluded that maximum weight (g) was in (KS2), max fruit volume (ml) in (TS3), specific gravity in (SS2), min. stone weight in (KS2), pulp weight (KS2), pulp: stone ratio (TS4), specific gravity (SS2), maximum fruit length and diameter was in (TS3 and KS2). TS4 was best in most of observation followed by SS3. Among these KS2, TS3 were good genotypes consecutively.

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