International Journal of Basic and Applied Biology
p-ISSN: 2394-5820, e-ISSN: 2349-2539, Volume 3, Issue 2; April-June, 2016, pp. 170-172

http://www.krishisanskriti.org/Publication.html

Variability Studies in Aonla Wild Genotypes for Fruit Character from the North-Eastern Region of India

P.P. Singh[1] an A.K. Singh[2]

[1,2]ICAR (Central Institute for Arid Horticulture, Bikaner)

Abstract—*The widespread 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 2014-156. 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- 2.28 cm), fruit breadth (1.27-2.44 cm), fruit girth (4.16 to 7.22 cm), stone weight (0.29 to 0.95 g), specific gravity(1.02-1.45),TSS of juice (10.00-21.30 ^{o}Brix), P^{H}(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 physico-chemical attributes than the rest of the genotypes.*

1. INTRODUCTION

Aonla, euphorbiaceae member, indigenous to central and southern India (Firminger, 1947). Aonla fruit has medicinal value such as diuretic, laxative and antibiotic. Aonla is quite hardy, prolific bearer, highly remunerative even without much care and due to that it becomes crop of commercial importance. The fruits are mainly utilized as raw or used for preparation of different *ayurvedic* and *unani* medicines (Agarwal and Chopra, 2004), pickle and other products. The production and cultivation of aonla in India ranks first in the world. There are several improved cultivars have been developed in the country which still do not perform well due to one or another reason into particular region due to lacks of certain desirable qualities. A wide range of genetic diversity of aonla has been depicted naturally in north eastern region of India, particularly in lower Assam, Meghalaya and Tripura by Yadav *et al*(2001). There are large number of wild elite germplasm available in the Himalayas, Chota Nagpur, Bihar, Orissa, West Bengal, North Circars, Deccan, Karnataka and in Western Ghats (Rawat and Uniyal, 2003) and forest of Khasi and Garo hills of Meghalaya. Introduction of novel quality traits into *E. officinalis* through genetic transformation is possible only if reliable germplasm for development of promising cultivar is available. Keeping these facts in background an exploration was carried out with an aim of effective utilization of genetic resources available in this region and was evaluated for their quality attributes and also to identify better quality genotypes from the wild germplasm available in the north eastern region.

2. MATERIALS AND METHODS

The different states of north eastern region were explored and collected fruits of 20 aonla germplasm during the winter season of the year of 2014. Fruits of *P. emblica* were collected from different sites (Table 1) ranging elevations 750 to 1850 msl. Fruits of aonla were randomly selected from each bulked fruit lot of the each genotype tree after discarding the damaged fruits. The bulk sample of all the parent trees for each site was then put into cotton bags and tagged where they were collected and subjected to physico chemical analysis in laboratory. The observation on three replicates of samples, each consisting of 20 fruits, the physical and morphological characters in terms of fruit shape, colour, styler end, and stem end cavity and seed shape were observed. Fruit length, diameter and breadth were measured using vernier callipers. The vitamin C and total phenols content were estimated in mg/100g of fruit juice. The fruit weight was taken on electric weighing balance. Standard methods were fallowed to estimate the qualitative parameters.

3. RESULT AND DISCUSSIONS

Results of study on physical characters of the fruits depicted in table 2 considerably varied with respect to size, weight, specific gravity and stone weight. The fruit weight ranged between 1.39 –5.88g being maximum in T_1 followed by T_{17} (5.71g) and T_{10} (5.04g) whereas the same was minimum in T_{18} followed by T_6 (1.50 g) and T_4 (2.11g). The highest fruit length was observed in genotype T_{13} (2.28 cm) followed by T_1 (2.10 cm), T_7 (1.94cm)and T_{12} (1.91cm), whereas it was lowest in T_6 (1.27 cm) followed by T_{18} (1.36 cm) and T_4 (1.39 cm). The

fruit breadth was observed maximum in T_{13} (2.44 cm) closely followed by T_7 (2.32 cm) and T_{17} (2.31cm) whereas T_{18} exhibited minimum value (1.27 cm) followed by T_6 (1.38 cm) and T_{20}(1.51 cm). The fruit girth was measured the highest in T_7 (7.22 cm) followed by T_{17} (7.12 cm) and T_1(6.80 cm) and it was least in T_{18} (4.16 cm) followed by T_6 (4.38 cm) and T_{20} (4.72 cm). The specific gravity ranged between 1.02- 1.45 and same being minimum in T_{20}(1.02) followed by T_3 (1.06), T_{11}(1.07) and T_4 (1.08). The stone weight per fruit ranged between the 0.29 -0.95 g, the highest stone weight was recorded in theT_{14} (0.95 g) followed by T_{13} (0.85 g) and same was recorded the lowest in T_{20} (0.29 g) followed by T_{18} (0.28 g).Similar kind of variability in fruit shape, fruit physical characteristics were observed by Chandra *et al.,* 2009 in aonla genotypes among the Garo Hills of Mesghalaya. Morphological variation in fruit characters of *P. emblica* among populations could have been a result of differences in their genetic make up and environmental conditions (Murali, 1997).

The chemical attributes of different genotypes presented in table 3 revealed that there were significant variability observed among all the genotypes. The total soluble sugar ranged between 10-21.30°Brix. It was recorded the maximum in T_4 (21.30°Brix) followed by T_3 (18.00 °Brix) and T_{16} (17.50 °Brix) and the minimum was exhibited in T_2 (10.0 °Brix) and $T_{11}$and T_5 (11.0). The pH among all the genotypes were varied from 2.53 - 3.27. The fruits of T_{20} had maximum pH value (3.27) followed by T_8 (3.14) and T_5 (3.08) whereas the same was recorded the minimum in T_4 (2.53) followed by T_{17} (2.57) and T_{12} (2.65). The maximum fruit acidity recorded in T_{18} (3.95%) followed by T_5 (3.63%) and T_7 (3.62%) among all the genotypes, whereas minimum acidity was measured in T_6 (1.84%) followed by T_{19} (1.90%) and T_8(2.15%).The fruits of genotype T_4 had higher amount of total sugar (13.15%) followed by T_{14} (12.73 %), T_3(11.47%) and least amount of total sugar was exhibited in T_{19} (8.15%) followed by T_7 (8.55%) among all the genotypes. The estimated value for vitamin C content was higher in genotype T_{12} (1428.50 mg/100 ml of juice) subsequently by T_{19}(1366.00 mg), T_{16} (1267.84 mg), T_2 (1267.84 mg) and for the same least value was calculated in genotype T_{20}(375.00 mg) , T_7 (446.42 mg) and T_{15} (467.28 mg). The estimated phenol content was highest in genotype T_{16} (4516.20 mg) followed by T_{15} (2913.47 mg) T_{18} (2312.15 mg) and least was found in the genotypes T_5 (944.85 mg) T_4(1000.25 mg) and T_2(1190.49 mg). The calculated value for the TSS /acid ratio was maximum in T_{16} (9.72) followed by T_8 (7.44) ,T_{15} (7.24) and T_{14} (6.85)whereas the minimum value was obtained from the genotype T_5 (3.03) followed by T_{12}(3.91), T_{10} (3.60) and T_2(3.67).Significant variations have also been observed in the different physio-chemical constituents of selected genotypes by the Kumar *et al.*(2013) and Bala *et al.*,(2014) in northen region of India (U.P), and Pandey *et al.,* (2013) in aonla genotypes from Madhya Pradesh.

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Table 1: Variability in fruit physical attributes of different genotypes

Treatments	Fruit length (cm)	Fruit breadth (cm)	Fruit girth (cm)	Fruit weight (g)	Specific gravity	Stone weight/fruit (g)
T_1	2.10	2.19	6.80	5.88	1.11	0.65

T_2	1.69	1.86	5.78	3.12	1.28	0.60
T_3	1.87	2.04	6.24	4.72	1.06	0.53
T_4	1.39	1.53	4.97	2.11	1.08	0.41
T_5	1.41	1.51	5.04	2.04	1.30	0.63
T_6	1.27	1.38	4.38	1.50	1.00	0.51
T_7	1.94	2.32	7.22	6.78	1.21	0.79
T_8	1.83	1.87	6.08	3.69	1.20	0.51
T_9	1.54	1.64	5.22	2.51	1.45	0.36
T_{10}	1.89	2.17	6.50	5.04	1.16	0.51
T_{11}	1.56	2.08	5.94	3.78	1.07	0.52
T_{12}	1.91	2.23	6.68	5.69	1.19	0.84
T_{13}	2.28	2.44	6.80	6.37	1.11	0.85
T_{14}	1.80	1.88	5.94	4.03	1.13	0.95
T_{15}	1.55	2.03	6.06	3.74	1.10	0.47
T_{16}	1.67	2.12	6.34	4.56	1.18	0.51
T_{17}	1.82	2.31	7.12	5.71	1.22	0.46
T_{18}	1.36	1.27	4.16	1.39	1.33	0.28
T_{19}	1.73	2.29	6.60	5.02	1.22	0.69
T_{20}	1.44	1.51	4.72	2.12	1.02	0.29
CDat 5%	0.18	*0.19*	0.55	0.67	0.12	0.09

Table 2: Variability in fruit chemical attributes of different genotypes

Treatments	**TSS(°Brix)**	**P^H of fruit juice**	**Acidity (%)**	**Total sugar (%)**	**Vitamin C mg/100 ml**	**Phenol mg/100 ml**	**TSS/acid ratio**
T_1	11.00	3.05	2.94	08.75	732.13	1353.59	3.74
T_2	10.00	2.92	2.72	07.50	1267.84	1190.49	3.67
T_3	18.00	2.82	2.89	11.42	665.56	1387.80	6.22
T_4	21.30	2.53	3.45	13.15	532.98	1000.25	6.17
T_5	11.00	3.08	3.63	8.82	467.98	0944.85	3.03
T_6	12.00	2.89	3.10	09.62	889.12	1439.50	3.87
T_7	14.00	2.75	3.62	8.55	446.42	1303.54	3.86
T_8	16.00	3.14	2.15	10.80	643.89	1742.72	7.44
T_9	13.15	2.75	3.32	10.43	785.67	1961.24	3.90
T_{10}	14.50	2.82	3.95	8.86	665.81	1434.45	3.60
T_{11}	13.50	2.87	3.20	10.14	794.54	1473.60	4.21
T_{12}	11.50	2.65	3.60	8.62	1428.50	1373.48	3.19
T_{13}	12.30	3.00	3.12	9.22	839.20	1942.54	3.94
T_{14}	17.00	2.81	2.48	12.73	755.89	2012.23	6.85
T_{15}	16.30	2.90	2.25	11.42	467.28	2913.47	7.24
T_{16}	17.50	2.83	1.80	11.25	1267.85	4516.20	9.72
T_{17}	14.70	2.57	2.50	8.62	651.78	1342.52	5.88
T_{18}	13.10	2.95	2.67	10.45	899.46	2312.15	4.90
T_{19}	12.20	2.84	1.94	8.15	1366.00	1621.80	6.28
T_{20}	15.20	3.27	2.85	10.51	375.00	1462.34	5.33
CD at 5%	1.42	0.27	0.31	1.08	80.12	150.60	0.48