

COLLECTING GENETIC DIVERSITY OF AONLA (*PHYLLANTHUS EMBLICA* L.) GERMPLASM FROM UTTAR PRADESH

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Thirty three genotypes of aonla, identified during the exploration conducted in eastern part of Uttar Pradesh, exhibited wide range of variability in plant characteristics, morphological and chemical composition of the fruits and yield potentiality. Variability was also observed in fruit colour, juiciness, content of tannin and fibre in pulp. High significant correlation was observed between fruit length and fruit diameter with average fruit weight. Whereas, negative and significant correlation was observed between acidity with fruit length, fruit diameter and average fruit weight which is a desirable characteristic. The most notable genotype selected was a seedling tree in the village Deojani Ka Purwa in Pratapgarh district (MR/RD-89-9) bearing bigger size fruit of attractive colour. In vegetatively propagated elite variety Banarasi, few superior clones (MR/RD-89-9), MR/RD-89-30 and MR/RD-89-32) were identified to be most promising and ideal for adoption directly on the basis of profuse bearing and better fruit quality with colour.

Key words : Aonla, diversity, germplasm, augment, evaluate, promising genotypes

The aonla, known as Indian gooseberry (*Phyllanthus emblica* L.) is said to be indigenous to tropical South East Asia, particularly to central and south India (Firminger, 1947). It is one of the most important minor fruit crops of commercial significance, grown without much care (Bajpai and Shukla, 1985). It is highly nutritious having medicinal value and one of the richest sources of vitamin C. Commercial orcharding exists in Gujarat and Uttar Pradesh (Chundawat, 1990). However, rich diversity occur throughout the country including eastern Uttar Pradesh due to propagation by seed. It has been observed that seedling propagated tree has longer life and also less susceptibility to diseases. Only a few genotypes/landraces viz., 'Banarasi', 'Chakiya' and 'Francis', all seedling selections are popular and are under cultivation (Bajpai and Shukla, 1985; Chundawat, 1990). Several factors including deforestation and natural calamities pose great threat to its survival. Therefore, there is an urgent need to identify the germplasm, augment and to evaluate to select

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suitable types for direct use, donor types for improvement and to conserve for future use.

REGIONS SURVEYED AND SAMPLING STRATEGIES

An exploration was undertaken jointly by NBPGR and NDUAT, Faizabad during December, 1989. The area surveyed included Faizabad, Pratapgarh, Allahabad, Mirzapur and Varanasi district of U.P. lying between 81°0' to 82°5'E longitude and 23°5' - 27°0' N latitude. The exploration was undertaken when fruits were physiologically mature. Random as well as biased sampling (Sinha, 1981) to collect a particular genotype/landrace was followed. The Horticulture department and progressive orchardist were contacted in each district to collect first hand information (Arora, 1981) about the diversity of crop and accordingly route for exploration was followed. Ten fruits were randomly collected and qualitative and quantitative observations were recorded. The vitamin C and acidity were also analysed. Variability parameters were estimated for seven characters and correlation coefficient were computed.

EXTENT OF DIVERSITY

Thirty three genotypes of aonla identified during the exploration, showed wide range of variability in fruit morphological characteristics including vitamin C, tannin and fibre content in the pulp (Table 1 & 2). Among these, 14 genotypes are located in Pratapgarh, 3 in Allahabad, 7 in Mirzapur, 1 in Varanasi and 8 in Faizabad districts of Uttar Pradesh. Aonla cultivation is concentrated in Pratapgarh district, because of its semi-arid climate and deep sandy loam soil, rich in calcium which is suitable for its cultivation. In Allahabad, Varanasi, and Mirzapur districts, less number of orchards were observed. Most of the old plantations are of seedling origin and establish considerable variability as in shape, size, quality of fruits including vitamin C, tannin and fibre content in the pulp. It was also observed that seedling trees were less susceptible to disease and had also longer life. Less necrosis problem was noticed in the orchards having proper spacing and fruits receiving proper sunlight. Dense planting had serious problem of necrosis. Among the widely grown genotypes (*Banarasi*, *Chakiya* and *Francis*), *Chakiya* was observed to be more tolerant to disease and pest and physiological problems. However, *Banarasi* was widely acceptable genotype due to attractive colour, bigger fruit size and its suitability for various preparations including sweets (*Morabba*).

The range, mean and variance of 33 genotypes for 7 characters are presented in Table 2. The range of fruit length varied from 2.31 cm (MR/RD-89-7) to 4.10 cm (MR/RD-89-9); diameter from 2.60 cm (MR/RD-89-28) to 4.85 cm (MR/RD-89-17); number of segment per fruit from 6.0 (number of genotypes) to 8.0 (MR/RD-89-17); percentage of TSS in juice from 10.0 (MR/RD-89-1) to

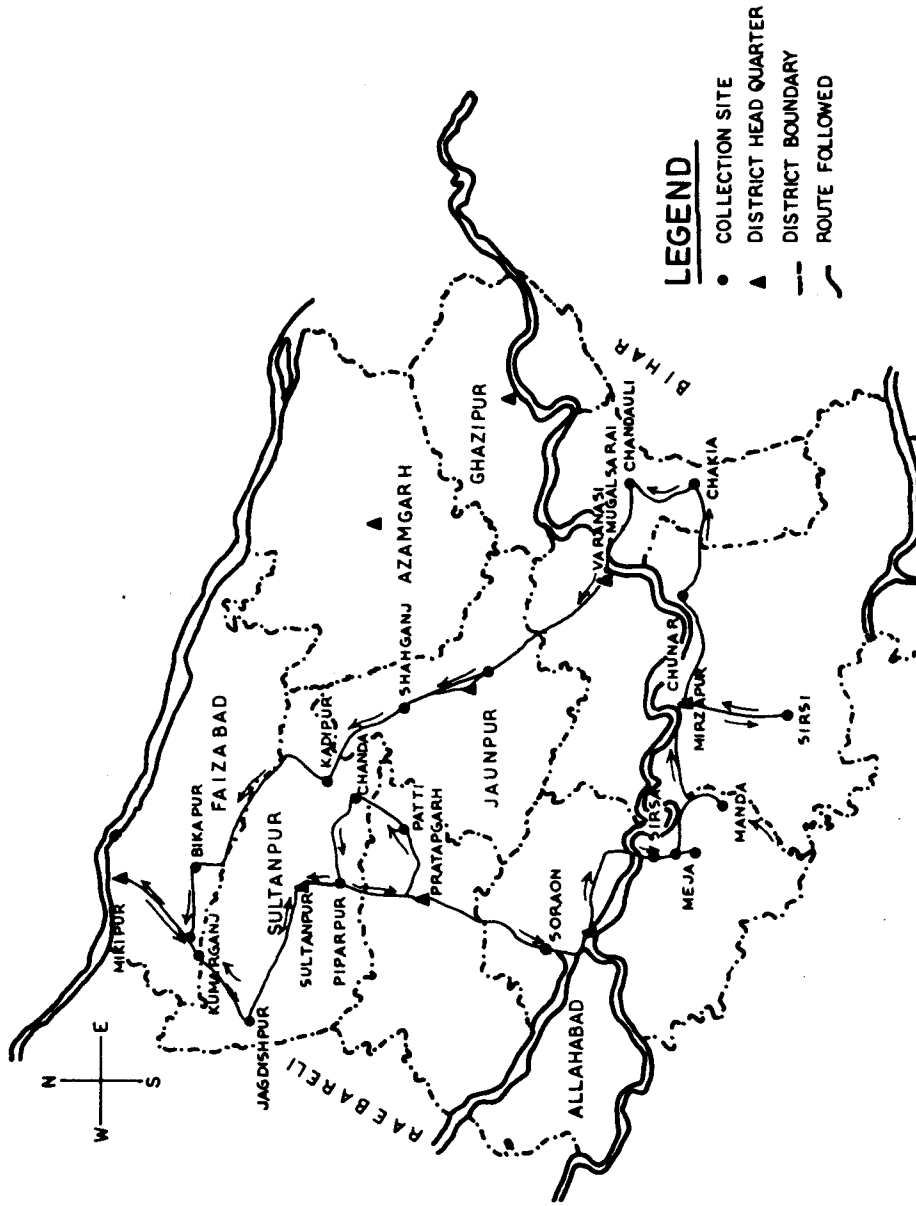


Fig. 1. Exploration and identification of *Phyllanthus emblica* germplasm in eastern Uttar Pradesh

Table 1 : Fruit characteristics of identified aonla germplasm

Collector's No. (MR/RD-89-)	Shape	Colour	Apex	Cavity	Ridges	Fruit stalk	Juiciness	Tanin content	Fibre content
1	R	YG	R	D	P	Thin	M	M	M
2	R	YG	R	D	P	Thin	M	M	M
3	FR	YG	F	VD	P	Thin	H	L	L
4	FR	LG	A	D	LP	Thin	M	M	M
5	R	LG	R	D	LP	Thin	M	M	L
6	R	LG	R	D	HP	Thin	H	M	M
7	R	LG	R	D	LP	Thin	M	H	M
8	R	WG	A	S	P	Thin	L	H	H
9	R	GY	R	S	P	Medium	H	L	L
10	R	YG	D	S	P	Medium	H	M	L
11	FR	Y	A	S	P	Thin	H	L	L
12	FR	YG	R	D	P	Thin	H	M	L
13	R	YG	R	D	P	Thin	H	M	L
14	R	YG	A	S	P	Thin.	H	M	L
15	FR	YG	R	S	LP	Medium	M	M	L
16	O	YGR	A	S	P	Medium	L	H	H
17	FR	YRT	A	S	P	Thick	H	L	L
22	FR	LG	R	S	P	Thin	H	M	L
23	R	WG	R	S	LP	Thin	L	H	H
28	R	YG	R	S	LP	Thick	L	H	H
30	FR	YG	R	D	P	Thick	M	M	M
31	R	LG	R	VD	P	Thick	M	M	M
32	FR	GY	R	VD	P	Medium	H	L	L
33	FR	YG	R	VD	P	Medium	H	L	M
34	FR	YG	R	VD	P	Medium	H	L	M
48	R	YG	A	VD	LP	Thin	H	M	L
49	R	YG	A	VD	LP	Thin	H	M	L
50	R	YG	A	VD	LP	Thin	H	M	L
51	R	YG	A	VD	P	Thin	H	M	L
52	R	YG	R	VD	P	Thin	H	M	L
53	R	YG	R	VD	P	Thin	H	M	L
54	R	YG	R	S	P	Medium	H	M	L
55	R	YG	R	VD	P	Medium	H	L	L

Where : F = flat, A = angular, D = deep, Vd = very deep, S = shallow, P = prominent, LP = less prominent, HP = highly prominent, R = round, FR = flattened round, O = oval, YG = yellowish green, LG = light green, Wg = whitish green, Y = yellow, YRGT = yellowish green with red ting, GY = golden yellow, YRT = yellow with red tings, L = less, M = medium, H = high.

15.50 (MR/RD-89-7); percentage of acidity from 1.30 (MR/RD-89-13) to 1.96 (MR/RD-89-28); content of vitamin C (mg/g) from 3.55 (MR/RD-89-3) to 9.40 (MR/RD-89-32) and average fruit weight from 12.3 g (MR/RD-89-7) to 52.6 g (MR/RD-89-30). Mean values and estimates of phenotypic variances were high for vitamin C content, average fruit weight, and T S S. Variability was also observed in fruit colour (light green, greenish, whitish, yellow, golden yellow, yellow with red tinge), shape (round, oblong, oval, oval with conical apex, round with depressed apex), base cavity (shallow, deep and very deep), ridges on fruit surface (less prominent, prominent and highly prominent), and content of juice, fibre and tannin in pulp (less, medium and high).

Table 2 : Values, range, mean and variances for seven characteristics of aonla germplasm

Collector's No.(MR/RD-89)	Fruit length (Cm)	Fruit diameter (Cm.)	No of segment	TSS (%)	Acidity (%)	Vitamin C (mg/g)	Average fruit weight (g)
1	3.75	4.06	6.0	10.0	1.53	5.80	38.0
2	3.25	3.90	6.0	12.5	1.46	4.70	30.1
3	3.65	4.40	7.2	14.0	1.33	3.55	43.0
4	3.80	4.17	6.0	14.0	1.92	5.30	40.0
5	3.32	3.90	6.0	14.0	1.67	5.20	31.3
6	3.86	4.54	6.0	14.5	1.62	6.25	42.7
7	2.31	2.86	6.0	15.5	1.90	4.80	12.3
8	2.87	3.05	6.0	13.5	1.83	6.00	17.0
9	4.10	4.81	6.0	10.5	1.64	6.55	51.0
10	3.77	3.42	6.0	13.0	1.79	4.35	41.3
11	3.85	4.75	6.6	14.5	1.60	6.80	41.2
12	3.82	4.10	6.0	10.5	1.49	4.90	41.3
13	3.30	3.75	6.0	13.0	1.30	4.70	29.1
14	3.70	4.05	6.0	12.0	1.33	4.80	39.2
15	3.75	4.80	6.0	14.5	1.40	5.10	35.6
16	2.80	3.10	6.0	12.5	1.90	4.90	21.2
17	3.70	4.85	8.0	14.5	1.68	7.14	50.0
22	3.70	4.68	6.0	14.0	1.49	6.10	36.8
23	2.70	2.95	6.0	14.0	1.90	5.90	16.4
28	2.50	2.60	6.0	13.5	1.95	6.10	12.3
30	3.93	4.83	6.0	14.0	1.85	5.83	52.6
31	3.40	3.60	6.6	13.0	1.60	4.50	35.2
32	3.76	4.46	6.0	13.0	1.79	9.40	45.0

(Table 2. *contd.*)

33	3.71	4.40	6.0	14.0	1.40	5.17	41.2
34	3.75	4.40	6.0	14.0	1.35	7.50	40.0
48	3.58	3.90	6.0	14.0	1.46	7.17	31.0
49	3.46	3.75	6.0	12.0	1.45	4.88	26.3
50	3.78	4.06	6.0	12.0	1.70	5.15	31.1
51	3.45	3.98	6.0	11.0	1.60	4.75	31.4
52	3.68	4.50	6.0	11.5	1.45	5.20	41.7
53	3.23	3.80	6.0	13.0	1.60	5.40	24.7
54	3.61	3.76	6.0	13.5	1.60	4.27	28.0
55	3.92	4.62	6.0	14.0	1.40	6.50	44.0
Range	2.31	2.60	6.0	10.0	1.30	3.55	12.3
	4.10	4.85	8.0	15.50	1.95	9.40	52.6
Mean	3.51	4.02	6.15	13.14	1.61	5.51	34.64
SE±	±0.08	±0.11	±0.08	±3.85	±0.04	±2-.45	±2.40
Variance	0.19	0.39	0.19	489.66	0.04	138	03

In character association analysis (Table 3), some of the most important combinations showed positive and significant relationship such as fruit length, fruit diameter with average fruit weight. However, negative and significant correlation was recorded between acidity with fruit length, diameter and average weight which is desirable in the crop. The accessions having such combinations can be utilized directly as well as a donor parent to improve fruit size and its quality. The variability existing in the population can be exploited in selection programme.

Table 3 : Correlation coefficient for 7 characters of aonla germplasm

Characters	Fruit length (Cm)	Fruit diameter (Cm)	No. of Segments/ fruit	TSS Brix (%)	Acidity (%)	Vitamin C Content (mg/g)
Fruit diameter (cm)	0.875**	1.000				
Number of segment/fruit	0.108	0.245	1.000			
TSS (Brix) (%)	-0.226	-0.005	0.239	1.000		
Acidity (%)	-0.472**	-0.489**	-0.069	0.178	1.000	
Vitamin C content (mg/g)	0.092	0.215	0.062	0.327	0.125	1.000
Average fruit weight (g)	0.911**	0.884**	0.306	0.133	0.355*	0.143

**Significant at 1% level

PROMISING SELECTIONS

MR/RD-89-9 : It is a tree located in the village Deojani Ka Purwa in Pratapgarh district. The tree is semi spreading and bears round, attractive golden yellow fruits with fruit length of 4.1 cm, and diameter 4.8 cm and weight 51.0 g. The tree showed field tolerance to necrosis, a serious problem in aonla cultivation. Fruit has round apex, shallow cavity, prominent ridges, contains high amount of juice and less of tannin and fibre.

MR/RD-89-17 : It is a clonal selection from **Banarasi** variety located in Allahabad district. The tree is about 80 years of age and of spreading habit. It bears flattened round fruits having angular apex, shallow cavity, prominent ridges and golden yellow with red tinge on surface. It is highly juicy with less tannin and fibre content. It has 8 segments and average weight of 50 g and contain high vitamin C (7.14 mg/g).

MR/RD-89-30 : The tree has semi spreading and tall growth habit. It has profuse bearing of large sized fruits (52.6g), with fruit length 3.9 cm, diameter 4.8 cm, number of segment 6, and good amount of vitamin C (5.83 mg/g). The fruits are greenish yellow, round apex, deep cavity, prominent ridges and contains high juice and less amount of tannin and fibre.

MR/RD-89-32 : It is a clonal selection from Varanasi variety having profuse bearing. The tree is semi spreading and tall. It bears flattened round, greenish yellow fruits having round apex, very deep cavity, prominent ridges, highly juicy and less amount of tannin and fibre. The fruit is 3.76 cm long, 4.46 cm in diameter, 6 segments, 45.0 g in weight with low acidity (1.79%) and high amount of vitamin C (9.4 mg/g).

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