

## Prospects and potential of aonla under Indian conditions

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### Introduction:

Aonla is one of the important indigenous fruits of Indian subcontinent. In different parts of India, it is known by different vernacular names such as Amla or aonla in Hindi, Dhatri, Dhatriphal or Amalaki in Sanskrit, Amla or Amlaki in Bengali & Oriya, Nelli in Malayalam and Tamil, Amlakamu in Telgu, Amophal in Punjabi and aonla, Myrobalan and Indian gooseberry in English. This fruit is known for its medicinal and therapeutic properties since time immemorial and it finds a prominent place in ancient Indian mythological literatures like Vedas, Askandpuran, Shiv-puran, Padmapuran, Ramayana, Kadambari, Charak Shanghita, etc. and known as Amritphal. Owing to its hardy nature, ability to survive in various kinds of wastelands, high productivity per unit area (15-20t/ha.), nutritive and therapeutic values and suitability to various kinds of cosmetic, medicinal, herbal and value added products, aonla is becoming an important fruit of 21<sup>st</sup> century.

According to Hindu mythology, it is considered auspicious to arrange one day meal

beneath the aonla tree during October-November when trees are laden with mature fruits. Hindu literatures also suggest that if the ripe fruits of aonla are eaten for forty days in the morning after fast, it restores health and vitality known as Kaya Kalp. It is a common practice in Indian families to prepare the aonla preserve with sugar and some times with saffron to give one or two pieces to children and old age people every morning. It is not only the source of nutrients and medicines, but cultivation of this fruit is highly remunerative in marginal lands. Initially, aonla used to grow in forests or as house hold tree but during last one and half decade, there has been large expansion in the area under aonla cultivation across the country, utilizing the waste lands. This has resulted in efficient utilization of resources leading to better income to the farmers, nutritional security coupled with enhanced employment generation and rehabilitation of waste lands.

### Origin and Distribution

The aonla originated in tropical Southeast Asia, particularly central or southern

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India, Pakistan, Bangladesh, Sri Lanka, Malaya, Southern China and Mascarene islands. Seedling trees are of common occurrence in mixed dry deciduous forests of India, ascending from sea level (western and eastern ghats, Aravalli, Vindhyaan hills) to 1300 m ASL, from northwest to eastern Himalayas.

phyllantine, beta siotosturol, linoleic acid, ellagic acid and lupeol. Aonla fruit contains a fair amount of polyphenols and tannins, which, retard the oxidation of vitamin ‘C’ and render its value as antiscorbutic in fresh as well as in dried condition.

It is not only a rich but also the cheapest source of vitamin ‘C’ and fair source

**Table 1: Area, production and productivity of aonla (year 1999-2000).**

Name of state	Area (ha.)	Production(t)	Productivity (t/ha)	Source
Uttar Pradesh	15,750	63,000	4.0	Hort. Directorate, U. P.
Gujarat	10,050	30,150	3.0	Hort. Directorate, Gujarat
Rajasthan	5,000	6,000	1.2	Hort. Directorate, Rajasthan
Maharastra	4,000	5,600	1.4	National Hort. Board
Haryana	600	3,100	5.2	-do-
Mizoram	70	200	2.9	-do-
Tamil Nadu	5,500	16,500	3.0	Expert Estimation
Andhra Pradesh	3,000	9,000	3.0	-do-
Karnataka	1,800	5,400	3.0	-do-
Bihar	1,350	4,050	3.0	-do-
Others	2,500	7,500	3.0	-do-
<b>Total</b>	<b>49,620</b>	<b>1,50,500</b>		

### Uses and Nutritional Value

The pulp of fruit is highly nutritious and one of the richest sources of vitamin ‘C’ Aonla fruits are acidic, acrid, cooling, refrigerant, diuretic and laxative. Normally, one aonla fruit contain 20 times vitamin ‘C’ in terms of antiscorbutic value than two oranges. The main constituents of aonla are tannins, polyphenolic compound 1,3, 6-trigalloylglucose, terehebin, corilagin,

of carbohydrates, carotene, thiamine, ribofalvin and minerals like calcium, iron and phosphorus.

Aonla is a rare example of an edible material, which is rich in tannins as well as ascorbic acid.

The chemical composition of aonla fruit is presented below in Table-2.

**Table 2: Chemical composition of aonla fruits**

Constituents	Amount (%)	Constituents	Amount (mg/ 100 g pulp)
Moisture	77.1 – 82.20	Iron	1.20
Protein	0.50	Nicotinic acid	0.20
Fat	0.10	Vitamin C	200 – 1814
Minerals	0.5 – 0.70	Carotene	0.01
Fibre	1.9 – 34	Thiamine	0.03
Carbohydrate	14.10 – 21.89	Riboflavin	0.05
		Niacin	0.18
Calcium	0.012 – 0.050	Tryptophan	3.00
Phosphorous	0.020 – 0.026	Methionine	2.00
		Lysine	17.00

### Botanical description

Aonla belongs to the genus *Emblica* of the family Euphorbiaceae and order Euphorbiales characterized by its usually indehiscent fruits. It is medium sized much branched tree occupying height of 10-20 m. In the tropical regions, it is supposed to be an evergreen tree but behaves as deciduous tree due to complete defoliation of leaves. Stem is smooth, greenish grey to brown, exfoliating bark, which peels off in thin flakes like that of guava. It is characterized by phyllanthoid branching habit with two types of shoots. On the basis of growth characteristics, these have been characterized as long and short shoots. These shoots are referred to as branches or branchlets. The indeterminate shoots are longer and continue to put new growth in season but do not bear the flowers, irrespective of period of their emergence. However, determinate shoots appear on the nodes of indeterminate shoots and their number at each

node may vary from 3 to 5 in different cultivars.

The internodes are much shorter in the determinate shoots. These nodes are barren, floriferous with imbricate leaves. First few proximal nodes on the determinate shoots are barren (without leaves), which are reduced to dark brown scarios cataphylls. Succeeding nodes are with green but reduced leaves. Subtending cymules of male flowers are flowered by nodes each with cymules of one central female flower (rarely two) and several lateral males, distal half floriferous, determinate, shoots are normally sterile with typical leaves.

Fruits are depressed, round globose or oblate, indented at the base. A capsular (drupaceous) berry with fleshy exocarp, smooth to obscurely 6 lobed, initially light green becoming dull greenish yellow or rarely brick red as it matures, 2-5 cm in diameter, skin thin, tunas or semi-translucent, flesh

crispy, juicy, stone containing 6 small seeds, the edible part of the fruit is mesocarp and the endocarp forms the hard stone, which encages the seeds.

### Genetic diversity

Aonla is naturally spread, due to seed propagation, creating lot of variation in existing population in respect to tree vigour, fruiting behaviour, yield and quality characters. Great diversity in *Emblica officinalis* Gaertn. is available in the forest area of Vindhyan hills, lower hills of Uttarakhand and Himachal Pradesh, Chhattisgarh, Jharkhand, Madhya Pradesh, Rajasthan and Bihar. Madhya Pradesh forests in the districts of Sheopur, Betul, Belaghat, Satna, Chitrakoot and Panna have rich diversity. Local tribes of the regions harvest the fruits before they reach full maturity, Besides this, they harvest the fruits at immature stage, boil them and dry the segments in sun. This dried product is locally known as 'Amrethi'. This prevents the natural germination of seeds in the forest area. The villagers/forest tribes cut the branches along with fruits and very often they chop the whole tree for fruit harvesting. This is a matter of great concern. Looking into this problem. Madhya Pradesh Government has now declared seedling aonla as endangered species in the state (Wizmin, 2000). Considering great diversity in M.P., an exploration was planned

to collect the superior types having bigger fruit size, good yield potential, high vitamin 'C' content along with high content of total phenols. A total of forty six germplasm accessions were collected and seven accessions were found most promising. The details of these accessions are given in Table 3 (Pandey *et al.*, 2006).

### Climate

Aonla is a subtropical plant and prefers dry subtropical climate. Tree growth is influenced by hot wind or frost. However, its cultivation is now quite successful and becoming popular in coastal regions as well as at higher altitude up to 1500 m asl. Frost during winter is injurious to plant. In Rajasthan, Gujarat and Maharastra, extremely high temperature coupled with desiccating winds during summer is very common and sometimes it causes excessive blossom and pin head drop. A mature aonla tree can tolerate freezing as well as high temperature up to 44°C. Temperature above 45°C and low humidity even for few days may show injurious influence and adversely affect the bearing. Low temperature around 7-10°C is conducive for floral bud initiation, however warm temperature and humid atmosphere is conducive for fruit growth and development. Dry spell in rainy season results in heavy dropping of fruitlets and prolong fruit dormancy. However, in the dry spell of 2002-

03 during July- August, aonla showed better tolerance when compared with other fruit plants. Among varieties, Chakaiya showed better tolerance to drought as compared to Banarsi and Francis.

## Soil

Aonla is hardy fruit crop and is now cultivated in various kinds of soil conditions. Aonla can withstand in the marginal lands from slightly acidic to saline/ sodic having pH 6.0-9.5, ECe 5 dSm<sup>-1</sup> and ESP 30-40. Now-a-days, its cultivation is becoming more common in waste lands like *rakkar*, calcareous, morum soils with rocky substratum in Bundelkhand (UP, MP). In red laterite soils of Maharastra and Tamil Nadu, aonla is showing even better performance as compared to tamarind. Aonla can be adopted successfully for rehabilitation programme. Introduction of aonla in the natural rangelands of Bundelkhand showed its suitability for rehabilitation, particularly through popularization of agri-silvi horticulture land use system. Presently, it has been identified as an ideal crop for various kinds of wastelands, viz. moisture stress, eroded, ravines, uplands, riverbeds and areas with undulating topography.

## Varietal improvement

The variety improvement programme on aonla has been limited only to selection of

superior types from the existing seedling population (Pareek, 2001; Shukla *et al.*, 2004).

➔ The limiting factors for aonla improvement are

- ✓ highly heterozygous nature,
- ✓ perennial growth habit,
- ✓ long juvenile phase,
- ✓ complex taxonomy,
- ✓ cross and self-incompatibility,
- ✓ higher number of staminate flowers on the determinate shoot and
- ✓ tiny flower size (Pathak *et al.*, 1993).

Variety improvement programme in aonla should have the following major objectives.

- i) To develop dwarf tree stature for medium and high-density orchards.
- ii) To develop precocious and prolific bearing cultivars.
- iii) To develop excellent fruit quality for processing and other value added products.
- iv) To develop cultivars having higher content of vitamin 'C', total phenols and high anti oxidant properties.
- v) To develop cultivars with resistance to biotic stress i.e., pests and diseases.
- vi) To develop cultivars with resistance to abiotic stresses like frost, heat, drought and sodic soils.

For achieving these objectives, Shukla *et al.*, (2004) suggested the following breeding

techniques, which can be exploited for variety improvement in aonla.

- i) Selection from diversity area in the forest and aonla orchards.
- ii) Selection from seedlings obtained from open pollinated population of known cultivars.
- iii) Induction of variability through combination of breeding techniques including mutation followed by selection.
- iv) Selection from clonal variation.
- v) Hybridization with specific objectives.
- vi) Polyploid breeding.

#### **Cultivars**

Aonla cultivars are generally known on the basis of size, colour or after the name of the place. Banarasi, Bansi Red, Francis and Chakaiya were the known aonla cultivars. All these cultivars have their own merits and demerits. Banarasi is shy bearing and prone to heavy fruit drop; Francis through prolific bearer has serious incidence of fruit necrosis. Chakaiya, the most popular cultivar has comparatively small size fibrous fruits with a tendency to bear in alternate years .

#### **Kanchan (NA-4)**

It is a seedling selection from Chakaiya. The cultivar is heavy and regular bearer (7.7 female flowers/branchlet). Fruits are medium sized with higher fibre content, preferred by industry for pulp extraction and

manufacture of various products. It has a mid season maturity (mid November to mid December) and has been adopted very well in the arid and semi-arid regions of Gujarat and Maharashtra.

#### **Krishna (NA-5)**

Krishna is a seedling selection from Banarasi. It is an early maturing genotype, which matures during mid October to mid November. The fruits are large, triangular, conical, skin is smooth, whitish green to apricot yellow with red spot on exposed portion. Flesh is pinkish green, less fibrous and highly astringent with moderate keeping quality. It is an ideal variety for preparing candy and juice.

#### **Narendra Aonla-6**

This is a selection from Chakaiya cultivar. It has a mid season maturity (mid November to mid December). Bearing is heavy. Fruits are most attractive and shining, medium to large size, flattened and very low in fibre content. This is an excellent variety for making preserve, candy and jam.

#### **Narendra Aonla-7**

It is a seedling selection from Francis. It is precocious and prolific regular bearer (9.7 female flowers/branchlet). Incidence of necrosis has never been observed in this cultivar. It has mid season maturity. Fruits are of medium to large size with conical apex. Fibre content is slightly higher than NA-6.

This variety has adopted well in the states of Rajasthan, Bihar, Madhya Pradesh, Andhra Pradesh and Tamil Nadu. The major constraint with NA-7 is its brittle branches, which often break due to heavy fruit load. Hence, staking to the fruited branches is desirable. This is a good variety for making chyavanprash, chutney, pickle, jam and squash.

#### **Narendra Aonla-10**

This is a chance seedling selection from cultivar Banarasi, which bears profusely. Fruits are attractive, medium to large in size and flattened round in shape. Skin is rough, yellowish green with pink tinge. Flesh is whitish green, fibre content is higher and phenolic content is lower. This is an ideal cultivar for commercial growing because of its higher productivity, early maturity, suitability for dehydration and pickle making. However, it has a tendency of alternate bearing.

Apart from these cultivars, Anand-1, 2 and 3 have been selected as promising strains from Gujarat.

#### **Anand-1**

Trees are tall with upright growth habit. It is a moderate bearer having 1-2 female flowers per branchlets. Fruits are small and rough with fibrous and hard flesh.

#### **Anand-2**

Trees are tall with upright growth habit. It is a moderate bearer having 2-2.5

female flowers per branchlet. Fruits are small to medium, skin rough with medium keeping quality.

#### **BSR-1**

This is also a seedling selection from Tamil Nadu. It is self fruitful, gives crop round the year, small fruit size (27.0g), high vitamin 'C' content (620.00mg/100g), fibrous and low moisture content, heavy bearing. This variety has high demand in Ayurvedic industries.

