



ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; SP-11(5): 995-1000
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www.thepharmajournal.com
Received: 10-02-2022
Accepted: 16-04-2022

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Underutilized Arid Fruits in India: A Review

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Abstract

These underutilized fruits have many advantages in terms of ease in growing, hardy nature and good yield even under extreme weather conditions. Most of the important underutilized fruits are indigenous and it is easily available. Arid zone vegetation comprises a wide range of edible fruit bearing and food producing species viz. *Capparis decidua* (Ker), *Cordia dichotoma* (lasora), *Ziziphus mauritiana* (ber), *Ziziphus nummularia* (Bordi), *Salvadora oleoides* (Pilu), *Balanites aegyptiaca* (Hingota), *Prosopis cineraria* (Khejri) etc. which play an important role in the nutrition of children in rural and urban areas alike and are relished by them. These crops have their own history of consumption because, local people are well aware about their nutritional and medicinal values. The value added products of these fruits have expected to catch the national and international markets if it is properly focused. The review paper is mainly emphasizing on nutritional, food and medicinal value of these underutilized fruits and its impact on betterment of health. These crops are rich in vitamins, minerals, and nutrients and have medicinal potential.

Keywords: underutilized fruit, medicinal value, health benefits, nutritional security

Introduction

The crops, which are neither grown commercially on large scale nor traded widely, may be termed as underutilized horticultural crops. Underutilized fruit crops can be defined as fruit crops which have value but not widely grown, rarely found in the market and not cultivated commercially (Agent, 1994). These crops are cultivated, traded, and consumed locally. Many of underutilized fruit crops not only fulfill the requirement as dessert fruit but also for culinary and medicinal purposes. Also, the underutilized crops have the potential to give economic security by giving employment and by fetching good returns from their sale in raw form as well as value-added products.

In the current scenario of increasing rate of degenerative diseases these plant materials can be used to manage them economically with fewer side effects when compared to modern medicines. Underutilized fruit plants that have some special adaptive features like deep tap root systems, leaf shedding in summer, water binding mechanism, wax coating, hairiness, sunken and covered stomata in leaves, tolerance to salinity and alkalinity, synchronization of flowering and fruiting during rainy season or at maximum water availability offer scope in arid regions. Most of the underutilized indigenous fruit crops are being utilized as medicinal plants throughout India and popular in various indigenous system of medicine like Unani, Ayurveda and Homoeopathy.

Demand for underutilized fruits and fruit-products, could be increased through awareness programs on the benefits of these products and market promotion. A wide range of products have been processed from these underutilized fruits which include safe-to-eat fruits, grains, leaves, nuts, roots and tubers, fibers, oils, medicines, spices, stimulants, and derived products. These fruit crops are also playing important role in stability of the ecosystem by providing various ecosystem services (Roy, 2014). Very Little information is known to the researchers and locals about cultivation practices varieties, yield and quality of these underutilized fruit crops. But now researches and scientist have been developing many ways to maximize their economic value and uses.

Importance of underutilized fruit crops:

- Provide variety of products that include food, fodder, fuel wood, gums, resins, fibre, medicine etc.
- Most of them are very rich sources of vitamins, minerals, and other nutrients such as carbohydrates, proteins, fats and nutraceuticals.

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- Cheap and readily available.
- Vital source of genes against biotic and abiotic stresses.
- Low input requiring crops.
- Produce higher biomass than field crops per unit area resulting in efficient utilization of natural resources.
- Can help achieving ecological security through improvement of wastelands by preventing soil erosion, improving fertility of soil and promoting biodiversity.
- These crops have many advantages like easier to grow and hardy in nature, producing a crop even under adverse soil and climatic conditions.
- Underutilized fruits are rich of source of carbohydrates, fats, proteins, energy, vitamins-A, B₁, B₂, B₃, B₆, B₉, B₁₂, C, folic acid, and minerals- Ca, P, Fe, and dietary fiber.
- Also, the underutilized crops have the potential to give economic security by giving employment and by fetching

good returns from their sale in raw form as well as value-added products.

Constraints

The following are frequent constrains: (Williams *et al.*, 2002).

- Limited germplasm available.
- Lack of technical information.
- Lack of national policy.
- Lack of interest in researchers.
- Lack of producer interest.
- Lack of knowledge about suitable postharvest management practices.
- Less emphasis in researches for exploitation of potential underutilized fruits.
- Lack of information about the economic benefits.

Table 1: Nutritive value of some underutilized fruits per 100 g edible portion.

| Fruits | Calorie (Kcal) | Protein (g) | Fat (g) | CHO (g) | Fibre (g) | Ca (mg) | P (mg) | Fe (mg) | Vit. A (IU) |
|----------|----------------|-------------|---------|---------|-----------|---------|--------|---------|-------------|
| Lasoda | 65 | 1.8-2.0 | 1.0 | 12.2 | 0.3 | 40 | 60 | - | - |
| Ker | 100 | 5.9 | 1.23 | 20.87 | - | 153.8 | - | 50.8 | 2.0 |
| Pilu | - | 6.0 | 2.0 | 76 | 2.0 | 630 | 167 | 8.0 | - |
| Jamun | 83 | 0.5-0.6 | 0.1 | 18.7 | 0.9-1.2 | 20 | 10 | 100 | 90 |
| Khirmi | - | 0.48 | 2.42 | 27.74 | - | 83 | 17 | 0.92 | - |
| Phalsa | 72.4 | 1.3-1.5 | 0.9-1.8 | 14.78 | 1.2-1.7 | 129 | 39 | 3.1 | 800 |
| Karonda | 42 | 1.1 | 2.9 | 2.9 | 1.5 | 21 | 38 | 39.1 | - |
| Mahua | - | - | - | 21-25 | - | - | - | - | 586-890 |
| Durian | - | 2.5 | 2.5 | 28.8 | 1.4 | 20 | 63 | 0.9 | 10 |
| Tamarind | - | 3.1 | - | 67.4 | - | 170 | 110 | - | - |

Lasoda (*Cordia myxa* L.)

Lasoda commonly called as Indian cherry, Lasora and gonda belonging to family Boraginaceae. A small or medium sized hardy tree with crooked stem. Fruits are valued for medicinal properties as diuretic, demulcent, antihelminthic and expectorant. The other important species are *C. gharaf* (goondi), *C. rothii*, *C. macleodii*, *C. vestita* and *C. wallichii*. Out of these, goondi (*Cordia gharaf*) is a popularly grown species. *Cordia sebestena* is known as 'lal lasora' and is valued for ornamental value. The bark, leaves and fruit have medicinal properties, they are used variously as diuretics, demulcents and in the treatment of stomach aches, coughs and chest complaints. The plant is used in shelter-belts in semi-arid regions to prevent soil erosion. The sticky, mucilaginous pulp of the fruit is used as a glue. Leaves when used as fodder act as appetizer for animals (Slathia *et al.* 2017). The seed is oily, containing palmitic, stearic, olic and linoleic acids and β -sitosterol. Plants are deciduous in nature (Singh *et al.*, 1996). Immature fruits are used as vegetable, pickled, dried for all season use. Immature green fruits are available in April-May while ripe fruits are available during June-July. Fruits are mucilaginous with a stone (Singh and Vishwanath, 1991). The initiation of flowering takes place from 10th March to 23rd April under Jodhpur condition (Vashishtha *et al.*, 1985, Duthi, 1960).

Varieties

Karan Lasoda: Released by SKN, Jobner Rajasthan. The genotype is perennial in nature and vigorous in growth habit. The budded plants grow fast and attain good growth (5.45m) and yield fruits in 4-5 years. The bigger size leaves are green to dark green in colour with a leaf length (17.20 cm).

Thar Bold: A prolific and early bearing lasoda has been identified through selection at ICAR CIAH, Bikaner. It bears bold fruits in cluster with production of 1.5-2.0 q tender fruits/

tree/ year. This variety is recommended for commercial cultivation both as block plantation and a component of agro-forestry system in arid and semi-arid regions.

Maru Samridhi: This variety was identified by ICAR-CAZRI, Jodhpur. Growth habits of plants are drooping in nature. It bears on an average 14 fruits per bunch. Each fruit weighs around 10 g and plant yields 90 kg per tree.

Pilu (*Salvadora oleoides*. Decne)

Pilu commonly grown in Rajasthan and Gujrat in India. *Pilu* is an underutilized fruit and can be exploited. Tree has great potential for wasteland development, as is highly adaptable to salinity and drought conditions. Leaves are very good feed for animals especially goats and camels while the twigs are used for cleaning the teeth. Ripe fruits are highly perishable and pulp contains glucose, fructose and sucrose. Seeds yield oil, which is non-edible but used for industrial purpose. The species flowers during January to April (Chundawat, 1990) and ripe fruits called "*pilu*" are available during May-June. Pratap Narain (2006) reported that pilu helpful to reduce the deficit of animal feeds as well as to make livestock production more economical and profitable. The fresh fruits contain about 70% juice. The method of extraction of juice and preparation of squash and Jam has been standardized (Khan *et al.*, 2004). The seeds are rich in fat (40-50%) which is not edible but have industrial value. There are two species commonly found in arid region i.e. *S. persica*, *S. oleoides*. Shankar and Kumar (1987) have also reported its abundance in the peripherals of all major runs of Jaisalmer district. The maximum density (120 trees ha⁻¹) of *S. oleoides* was recorded at Shantipura area followed by Bibasar area (112 trees ha⁻¹) in Jalore district of Rajasthan (Khan *et al.*, 2008).

Ker / Kair / Teet (*Capparis deciduas* Edgew.)

C. decidua, (Kair) is a densely branching shrub or small tree

found growing naturally in arid and semi-arid areas of India. The plant and fruit of *C. decidua* also have high nutritional value. Fruits contain 54% moisture, 7.4% protein and 85 mg / 100g ascorbic acid. The fruits of *C. decidua* are small, fleshy, globular, and glabrous berries which are green in color when unripe and pink on ripening and black in color when dried. New shoots bear fewer flowers, while profuse flowering occurs on old shoots (Singh and Singh, 2011). It is also known as a rich source of alkaloids, phenols, sterols and glycosides (Chishty and Monika, 2016). The stems of kair shrubs have cytotoxic activities, as they markedly inhibit the proliferation of metastatic cancer cells. *C. decidua* (Kair) has proven to be an economically important plant in Rajasthan and elsewhere. Vaishnav *et al.* (2015) revealed that presence of phytochemical extracts obtained from different aerial parts of *C. decidua* were prominently rich in phenolics and glucosinates, and they showed potent antidiabetic and antihemolytic activity. The extract of unripe fruits and shoots of *C. decidua* cause reduction in plasma triglycerides, total lipids and phospholipids; hence used as hypercholesterolemic (Sharma *et al.* 1991). Gupta *et al.* (1989) reported tenfold increase in organic carbon and two fold increase in available NPK in soils under 20 years old kair plantation. The plant is used in flatulence, anorexia, respiratory disorders, skin diseases, in general weakness and also as anthelmintic and diuretic. Green berries and flower buds of *C. decidua* are edible and commonly pickled or used in preparation of vegetable and curry due to the folkloric belief that they have hypoglycemic effect in diabetes (Marwat *et al.*, 2011). The fruits harvested at 7-10 days after fruit set with 5-8 mm diameter during March-April is ideal (Meghwal, 2002). Recently sprouted shoots are relished by camel and goat during spring summer season reported by (Meghwal and Tewari, 2002).

Phalsa (*Grewia subinaequalis*)

Phalsa, one of the ancient fruits of India is also known as 'Dhamani'. It is a subtropical fruit, native to India. Phalsa is a hardy, drought tolerant plant suitable for intercropping in fruit orchards. Ripe fruits are reddish brown and sub acidic in taste. They are good source of vitamin A and C contain minerals like phosphorus and iron. Phalsa has been found to be a very good source of anthocyanin, a strong antioxidant. Fruits are good source of carbohydrate, proteins, minerals and vitamins. Fruits are used in fresh form and have a good cooling effect. They are also excellent for making squash, ready-to-serve juice, nectar and syrup. The mean value of anthocyanin content in phalsa was noted to be 10.18 mg/100g. Medicinal values of *Grewia* species is due to the presence of different metabolites like saponins, coumarins and anthraquinone (Sharma and Patni, 2013). The antioxidant activity of *Grewia subinaequalis* can be explained on the basis of total phenolic contents, flavonoids and anthocyanins. Aykroyd (1963) reported that fruits have 50-60% juice, 10-11% sugar and 2-2.5% acid. Bark of plants is used during preparation of jaggery for improvement of the quality. Pruned phalsa canes/shoots can be utilized for making baskets to transport fruit and vegetables to distant market. The fruits are borne in clusters in the axil of leaves on current year growth, hence annual pruning is essential. There are no distinct varieties in Phalsa (Singh, 1974). But the two varieties grown by farmers are known as 'Local' and 'Sharbati'. Most of the genotypes grown are of local types. However, recently 'Thar Pragati' has been identified for cultivation by ICAR-CIAH, Bikaner.

At Jodhpur, best results were obtained when pruning was done in last week of December at 120 cm height from ground level (Meghwal, 2006). In the arid climate of Western Rajasthan, pruning up to a height of 40-50 cm done in the first week of December is the optimum time for getting better growth, maximum yield and quality of fruits (Singh *et al.*, 2004). Fruits should be harvested at correct time of maturity which can be judged by the colour. Colour change from green to red is the correct index of maturity and it should be firm at the time of harvest (Singh and Acharyya, 1999).

Karonda (*Carissa carandas* L.)

Karonda is an evergreen spiny shrub or a small tree which belongs to the family *Apocyanaceae*. It flowers from February to April and fruit mature during August-September and thus makes best use of monsoon rain and therefore, highly suitable for growing in arid regions. *Grewia subinaequalis* is particularly used as a medicinal plant by the traditional users since ancient times. Although, karonda is not popular as a fresh fruit due to its astringent and sour taste but it has a great potential for processing into several value added products such as appetizer, candy, chutney, jam, jelly, pickle, puddings, squash, sauces, tart and wine (Hayes 1957). The fruit of karonda has several medicinal properties. *Carissa carandas* contains polyphenols (7- 8%), crude proteins (12-15%), free acid (25-30%), hydrocarbons (50-60%) and fixed oil (3-5%). It is antiscorbic, richest sources of iron, therefore, very useful for curing of anaemia, used as an astringent and as a remedy for biliousness (Jadhav *et al.*, 2004). Immature fruits are green in colour and turn to white to reddish purple at maturity. Additionally three varieties *viz.* Pant Sudarshan, Pant Manohar and Pant Suvarna have been released from GBPUA&T, Pantnagar (Mishra, 2007) and one more variety Thar Kamal has been released from CIAH, Ghodhra centre (Singh *et al.*, 2013). Maru Gaurav variety has been identified at ICAR-CAZRI, Jodhpur reported by (Krishna *et al.* 2019). Ripe fruit is used in the preparation of variety of jams, squash, and syrup etc. as it is rich in macro and micro nutrients. Unripe fruit is used in the preparation of chutney, pickle, candy, etc. Ripe fruits are used to prevent scurvy and to treat burning sensation, anorexia, pruritus, and skin diseases. The unripe fruits are rich in ascorbic acid and iron, and are used to cure anemia.

Khejri (*Prosopis cineraria* L. Druce)

Khejri is the golden tree of Indian deserts, plays a vital role in preserving the ecosystem of arid and semi-arid areas. Its highly nutritious leaves constitute important source of fodder for livestock while nutritious pods are valued as vegetable for human beings. The immature pods of *khejri* are edible and rich in crude protein (18%), carbohydrates (56%) and minerals such as phosphorus (0.4%), calcium (0.4%) and iron (0.2%) on dry weight basis (Duhan *et al.*, 1992) and are used as vegetables as fresh as well as after dehydration. Flowers of *Prosopis cineraria* are small, yellowish, auxiliary and in slender spikes about 711 cm in length, rachis 35 cm long, glabrous, pinnate mostly two opposite pairs (Saroj and Nagaraja, 2006). Arya *et al.*, (1992) observed that flowering take place during February-March and seeds mature during April-June. The ripe dried pods having 9-14% crude protein and 6-16% sugar (Arya *et al.*, 1991) can be powdered and used in the preparation of bakery items. Fruits of Shami are locally called as Sangri in Rajasthan and dried pods are locally called as khokha. Pareek (2002) observed diversity in

pod characteristic such as taste, tenderness, fibre content, color, pod length, thickness, seed number, seed size, protein content and mineral constituents. Attempts have been made in the past to propagate *khejri* through micropropagation (Kakkar *et al.*, 1991) and air layering but those could not be commercially viable. The main objective of budding in *khejri* is to identify the trees with desirable pod characteristics from natural stands and multiply them by budding on seedling rootstocks. CIAH, Bikaner has developed the variety Thar Shobha by adapting this technique. It is known to improve organic matter contents, total nitrogen, available phosphorus and soluble calcium as well as decrease soil pH (Mann and Shankarnarayan 1980). The trees have monolayered canopy and deep root system with multipurpose utility as wood yielding; fodder, food and medicinal uses along with improve fertility of poor soils. Almost every part of the *khejri* is utilized (Saroj *et al.*, 2002). The tender pods are eaten green or dried after boiling locally called sangri and used in the preparation of curries and pickles (Khasgival *et al.*, 1969). In *khejri* same new species in *Algarobia* section i.e. *Prosopis alba* and *Prosopis nigra* introduced to India from Latin America (Pareek, 2011) for incorporation of good pod characters and yield enhancement purpose. Singh *et al.*, (2013) revealed that the main biotic factors responsible for *khejri* mortality in Rajasthan were root borer, *Acanthoporus serraticornis* and root rot disease caused by *Ganoderma lucidum*.

Jharber (*Ziziphus nummularia*)

Jhar ber (*Ziziphus nummularia*) is a one of the most commonly occurring branched thorny shrub species in the Indian desert with a height of 1-2 meter. It occupies almost all the habitats including crop lands and grazing lands (Kumar *et al.*, 2005). The fruits ripen during late November and December and eaten fresh as well as dried. The dried fruits contain alkaloids, terpenoids and saponins. Leaves called *pala* is rich in protein (12.9-16.9%) and crude fibre are very much palatable to small ruminants and camels.

Bael (*Aegle marmelos* L.)

Bael (*Aegle marmelos*) fruit is one of the blessings from nature for the mankind which is packed with enormous medicinal advantages. Many antioxidant compounds such as flavonoids, flavones, isoflavones, anthocyanin, lignans and isocatechins are found in the fruit pulp (Maity and Hansda, 2009). Gehlot and Dhawan (2005) reported about all parts of the trees *viz.* root, bark, leaves, flowers or fruits are used for curing one or other human ailment. Due to its endless uses, bael is also known as Mahaphala or Great fruit (Parichha, 2004). It has numerous seeds, which are densely covered with fibrous hairs and are embedded in a thick, gluey, aromatic pulp (Kaushik *et al.*, 2002). The dried powder is also used as remedy for chronic dysentery conditions characterized by alternate diarrhoea and constipation (Sharma *et al.*, 2007). It also contain moisture 64.2%, protein 1.8%, fat 0.2%, mineral 1.5%, fibre 2.2%, carbohydrate 31.8%, calcium 0.06%, phosphorous 0.05%, potassium 0.6%, vitamin C 0.01%, riboflavin 1.2%, nicotinic acid 0.9%, thiamin 0.01% and iron 0.3% per 100 gm (Rathore, 2009). Preserve and candy are prepared from mature (tender green fruit), fruit squash, fruit pulp, dehydrated bael, RTS, drink, bael powder, jam, slab, toffee and panjiri are other product prepared from bael fruit. Bael is known to have anticancer activity, pyretic and analgesic activities and also provides relief in constipation

(Sharma *et al.*, 2007).

Khirmi (*Manilkara hexandra* Roxb.)

Khirmi or Rayan is a small to medium sized evergreen tree, with a spreading crown and straight massive bole. Khirmi is used as a rootstock for sapota in India. *Rayan* is mainly propagated by seeds. It is drought hardy and slow growing species. *Rayan* have no improved varieties. Leaves coriaceous, shining, glabrous, blade 2-4 inches long, obovate-oblong obtuse, petiole upto 1 inch long. Flowering occurs in the month of October–November–December and fruit ripens during April–May. (Dwivedi and Bajpai 1974) It is highly heterozygous and as such seedlings exhibit a wide range of variations, which aids in the selection of the superior desirable genotypes. Gowda *et al.* (2006) reported that air layered shoots treated with 10,000 mg L⁻¹ IBA recorded the maximum number of primary (9.2), secondary (49.4) and tertiary (34.3) roots. Bark, fresh fruits and extracted seeds have high nutritional and medicinal value.

Chironji (*Buchnanania lanzan*)

It is a medium sized tree, with straight, cylindrical trunk, up to 10-15 m height and tomentose branches. *Buchanania lanzan*, being a vulnerable medicinal plant, is included in the Red Data Book published by International Union for Conservation of Nature and Natural Resources. Chironji seeds are rich in nutrients and medicinal properties. Chironji is an active source of phenolics, natural antioxidants, fatty acids and minerals. The fruits of chironji mature in 4 to 5 months and are harvested manually in the month of May and June. *y.* The *B. exillaris* are reported to be dwarf in size and produces excellent quality of kernel (Chauhan *et al.*, 2012). The chironji nut has very good demand in foreign markets and thus, has become an important crop. The chironji kernels contain about 52% oil. The gum of the fruit after mixing with goat milk is used as an analgesic.

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