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Under-Exploited and Nutritionally Rich Wild Fruits of Telangana, India

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A B S T R A C T

Telangana is part of tropical region on east of India, endowed with rich biodiversity. It is need to emphasize about the occurrence of enormous biodiversity existing in well-known Deccan plateau of Indian subcontinent. The rich wealth of *flora and fauna* of this region has made it a paradise of nature as it houses rich genetic diversity. One of the most fundamental values of plant diversity is in supplying the food, protective foods and medicinal herbs, besides many industrial raw materials, for the benefit of mankind. Here comes an array of fruit crops into picture. The agro climatic conditions and edaphic factors of the region including Telangana are uniquely favourable for a number of fruit crops.

Introduction

State of Telangana encompasses an area of 1,12,077 km^2 (44,340 sq mi) and lies between the latitudes 15°46’00” N and 19°47’00” N, and longitudes 77°16’00” E and 81°43’00” E, bound by the states of Maharashtra and Chhattisgarh on the north, Karnataka on the west, and Andhra Pradesh on the south and east. Telangana is a semi-arid area and has a predominantly hot and dry climate. Summers start in March, and peak in May with average high temperatures in the 42°C (108°F) range. The monsoon arrives in June and lasts until September with about 755 mm (29.7 inches) of precipitation in a multimodal distribution pattern. A dry, mild winter starts in late November and lasts until early February with little humidity and average temperatures in the 22–23°C (72–73°F) range. The annual rainfall is between 900 and 1500 mm in northern Telangana and 700 to 900 mm in southern Telangana, from the southwest monsoons. A dry, mild winter starts in late November and lasts until early February with little humidity and average temperatures in the 22–23 °C (72–73 °F) range. Geographically the region can be divided into three main areas. They are: 1) Mid- Godavari basin, 2) Plateau of Telangana which is about 600 metres above mean sea level and 3) Mid- Telangana which is 150 to 300 metres above the mean sea level. Though industrial sector and mining are at playing important role in terms of employment generation, agriculture has been providing livelihood support to almost 73% of the population and is essential for the state to support the latter two

(https://finance.telangana.gov.in/downloads/SESOutlook2016.pdf). Various soil types abound, including chalkas, red sandy soils, dubbas, deep red loamy soils, and very deep black cotton soils that facilitate planting mangoes, oranges and flowers. Major soil series are coarse to medium textured, while some are medium to fine textured. These soils are well drained but have good water holding capacity, although dense vegetation and grass cover have contributed to high contents of organic matter (0.5 to 1.5 % organic carbon) in several soils. The pH of the soils is 4.5 to 6.5. Soils, in general, are productive with irrigation and fertiliser management (Gangapuram, 2014).

Since time immemorial, edible wild fruits have played a very vital role in supplementing the diet of the people of Indian Sub-continent. Apart from customary use as food, wild edible fruits have various health advantages as it potentially give immunity to many diseases. Accordingly, *Ayurveda*, the Indian Folk medicine was developed from wild fruits and plants. Major fruit crops like Mango, Litchi, Guava etc. are commercially cultivated while the wild edible fruits refer to species that are neither cultivated nor domesticated, but it come from their wild natural habitat and used as one of the sources of food (Beluhan and Ranogajec, 2010; Urvashi and Bhardwaj, 2015). Although the term ‘underutilized´ crop has been defined in various ways in world literature, most of these have been given importance to features, among others, like linkages with the cultural heritage of the locality, multiple uses, traditional crops in localized areas, and neglected by agricultural research and development agencies (Thakur, 2014). We believe this applies equally to fruit crops and tree spices. For the purpose of this paper, we have adopted the definition given by IPGRI- Underutilized crops are those marginalized by farmers and consumers due to agronomic, genetic, economic, environmental and cultural reason, which were once important and major crop in the community (IPGRI, 2000). UUF’s have poor shelf-life, un-recognized nutritional value, poor consumer awareness and reputational problems, therefore, also called as, “poor people’s food”. As the demand for food changes (re-discovery of nutritional and culinary value, therapeutic value–whole ethnobiology), UUF’s can overcome the constraints to the wider production and use by the poor people. Underutilized fruits have a distinctive past, current, or potential use value, but their use is currently limited relative to their economic potential (Gruère *et al.*, 2006; Mayes *et al.*, 2011). It may be useful to develop a check list of criteria for selecting UUFTS in India, so that work on them could be more focused.

The following are some such criteria (modified from von Maydell, 1989).

They should be in demand or have potential for generating demand

They should be accepted by people, often something to do with cultural identity/ importance

They should have low risk or have risks that can be managed easily

They should be free from negative properties of effects

They should be adapted to local conditions, often vital in specific ecosystems

They should be easy and safe to establish, with low inputs

They should be fast growing and shorter gestation period

They should produce high yields and/or produce high quality produce

They should be compatible with other land uses

It is important to note here that different crops or crop categories are underutilized to very different degrees and in different aspects and suggest practical means to quantify these differences (Galluzzi and Noriega, 2014) and in different regions of a country.

Need of explore underutilized fruit crops

In Telangana region, there are wastelands of different kinds viz. sand dunes, ravines, acidic soils, marshy and marginal lands, which are unfit for supporting cultivation of high input demanding crops. Such lands can easily be put to use for growing low input crops in order to diversify the present day agriculture, which is so inevitable in view of the increasing population pressure and fast depletion of natural resources as well as the growing and changing human needs in the region.

The average productivity of the horticultural crops is just half of the national productivity. As grain farming is proving un-remunerative in the undulating topography of hilly tracts, which is deprived of irrigation facilities, despite government of India's has been putting forth endeavours to uplift the region, vast potential remains unexploited.

It becomes possible to exploit the untapped potential of the region through location specific horticulture and subsequently expanding the area under horticultural crops. Production of UUHC can also be increased through adoption of scientific technologies.

Apart from nutritive value, underutilized horticultural crops are particularly more important for medicinal properties and famous for the retentive value in Ayurvedic medicine. Mostly people are familiar with the medicinal properties of locally grown horticultural crops.

Potential uses of minor fruits

Many underutilized fruit species are nutritionally rich and are suitable for low input agriculture as they naturally occur either in wild or can sustain adverse climatic conditions of the growing regions. They can contribute significantly to maintain rich diversity and hence more stable agro-ecosystems.

Fruits have both restorative as well as curative properties *viz*. aromatic, cooling, digestive, stomachic, stimulant, astringent, emollient, useful in seasoning, maturation and fermentation of culinary, processed food and drinks.

There are few other fruits which possess specific properties such as diuretic, diaphoretic, sedative or stimulant to nerves, improver of peristaltic movements of intestine and liver ailment, cardio tonic, relieving cough, cold, bronchitis, asthmatic spasm, blood pressure *etc*. Some minor fruits contain essential oils in their peel, foliage or roots and exhibit carminative and germicidal properties. In addition to their therapeutical values, these fruits provide nutrition, strength and vigour to our body and restore loss of minerals and amino acids, thus protecting it against many deficiencies and diseases. The study revealed reported that the level of carotinoids varied from 7071 to 1485.00 µg/100g, which was recorded in *Artocarpus integrifolia* followed by *Spondias cythera, Spondias pinnata* and *Syzigium claviflorum.* Some of the other minor fruits found in the regions are fairly good source of ascorbic acid *viz*. *Artocarpus spp*. Bael, wood apple and aonla were found to be rich source of calcium (Singh *et al.*, 2003; Mazumdar, 2004; Mazumder *et al.*, 2000).

Table.1 Potential uses of minor fruits

	Crude Protein g/ 100	Fat g /100	Crude fibre g/100	Carbohydrate g/100	Ca mg/100	K mg/100	Na mg/100	P mg/100	Fe mg/100	Vit C mg/100	Vit A (IU)
Aegle marmelos Correa	2.2	0.29	2.9	29	85	-	-	50	0.6	9.11	92
Cordia myxa L	1.9	1	2	16	20	26	-	26	5	-	-
Zizyphus mauritiana Lam	2	1	2	93	60	589	154	585	7	88	-
Averrhoa bilimbi L	1.04	0.33	2.8	6.73	4	133	2	12	0.08	34.4	61
Syzygiu mcumini Skeels	0.7	1.5	0.6	15	8	-	-	15	1.62	-	--
Grewia asiatica Mast	1.3	1.8	1.5	15	129	350	4	3.9	3.1	22	800
Feronia limonia L	7.1	0.3	-	17	4	-	-	9	0.5	3	0.61
Diospyrus melanoxylon Roxb.ExA	0.58		0.49	10.5	-	-	-	-		27	11
Phonix sylvestris L. Roxb.	2.3	0.51	1.82	87	184	854	14	16	5.26	3.56	-
Zyzyphus nummularia Lamk	2.9	-	-	-	-	-	-	-	-	-	500
Annona reticulata L	1.6	0.4	2.5	23.5	17	250	4	47	0.5	43	-
Phyllanththus embelica L	0.5	0.1	3.4	14	0.05		-	0.02	1.2	600	-
Artocarpus heterophyllus Lam	1.9	0.1		18.9	50	246	-	97	500	11	540
Averrohoe carrmbola L	0.75	-	0.7	9.4	-	-	-	-	-	-	560
Madhuca latifolia (Roxb.)	-	-	-	-	-	-	-	-	-	60	528

Source: USDA National Nutrient data base (http://www.nal.usda.gov/), Mitra *et al.*, (2008) and Anupam, (2013)

Table.2 Diversification of underutilized fruit crops

Common Indian English name of the Fruits	Scientific name andFamily	Description	Yield Fruit/ tree	Origin	Usage and Remark
Usirikaya Anola	*Phyllanththus embelica* L Phyllanthaceae	Medium sized tree with small leaves, fruit matures in Jan – Feb.	1500-2000 nos	India Throughout India	Wild and domesticated, sour, rich in Vit C and Ca, fruits each weighs 30-50 g
Regu Ber/Indian Plum	*Zyzyphus nummularia* Lamk	Thorny tree, matures in Jan - Feb	Eaten raw, 100kg fruits	India, S-E China	Cultivated, minor, good nutritive value, eaten fresh, 15 varieties are there
Bilimbi/Carambola Tree Sorrel	*Averrohoe carrmbola* L Oxilidiaceae	Big tree, elongated cucumber like fruits are in cluster, yellowish green when ripe,	500 fruits,	Indo-China,	Wild and domesticated, sour in taste, used as *chutney*, high Vit C
Sitaphalam Custard apple	*Annona squamosa* L Annonaceae	Shrub like tree, with small leaves, fruits have gritty structure with grainy pulp, matures in Sept-Oct	100 fruits,	Tropical America	Wild and domesticated, leaves have insecticidal properties, eaten raw, good taste,
Gondi/ Banka pallu Lasoda	*Cordia myxa* L Boraginaceae	Shrub, the fruit mature during July- August. Grow in different agroclimatic condition; It is a kind of a drupe, light pale to brown or even pink in colour. Used in *Ayurveda*. Tolerate arid weather	20 kg fruit	Asia/ Africa Different parts on India	Fully ripe fruit is quite sweet in taste having mucilaginous pulp and is fully enjoyed by children. The pulp in a half ripe fruit can even be used as an alternative to paper glue in office work.
Ramphal Custard apple	*Annona reticulata* L Annonaceae	Medium sized tree, bigger leaves, smooth fruit with hexagonal markings, grainy pulp, matures in Mar- April.	80-100	Tropical America	Wild and domesticated, fruits are eaten raw, preferred by children
Amra Hog Plum	*Spondius cythera* Sonn Anacardiaceae	Deciduous Tree, immature fruits are used in culinary art, July-Aug, immature fruits are eaten in culinary art, July Aug	30 quintal	Polynesia	Sour, used in Chutney, *Ayrvedic* properties,
Pagoda/ Maulsari Spanish Cherry	*Mimusops elengi* L Sapotaceae	Tree with dense leaf canopy, used as shade tree in gardens. The orange-red fruit is hairy. Matures in April – May. Small fruits, each weighing 10-15 g.	10 kg	South Asia	Wild and domesticated, having *Aurvedic* properties. It is eaten mostly by children.. The wood is extremely hard, strong and tough, and rich deep red in color.
Velakkaya Wood apple/ Elephant apple	*Feronia limonea* LSwingle Rutaceae	Big tree, fruits have a hard cover, matures Sept-Oct, succulent placenta and inner pericarp is eaten	1000 nos	India/ Sri Lanka	Wild and domesticated, sweet and sour, eaten fresh *Chutney*, bark has insecticidal properties.
Bilambu/Bael Stone apple	*Aegel marmelos* L Corr. Serr Rutaceae	Big deciduous tree, takes 11 months to mature in Mar- April, having hard shell, Numerous hairy seeds are encapsulated in a slimy mucilage, yellow pulp, one big fruit	500 nos	India	Widely used in *Ayurvedic* medicine, good laxative, mature and immature fruit is eaten, ripe fruit eaten fresh, Sacred tree for the Hindus. Thrives well in extreme high

		may weigh 1kg			and low temperature
Bilati Amra Hog Plum	*Spondius pinnata* Kurz Anacardiaceae	Deciduous Tree, immature fruits are used in culinary art, July-Aug, fruit is bigger than *S cythera*,	40quintal	Tropical Asia	Sweet and sour, eaten raw with salt, used in Chutney, immature fruits are eaten in culinary art, July-Aug
Chinthapandu/Imli Tamarind	*Tamarindus indica* L Leguminoseae	Big tree,20-25 m ht, elongated ripe fruits matures in Mar-April, provides good shade	5-10 qtl	India	Sour taste, raw consumption is less, used in culinary art, chutney, rich in K, Ca, P and Vit C
JangliBadam/Manjiponaku Wild Indian Almond	*Sterculia foetida* L Sterculiaceae	The branches are whorled and usually horizontal, with palm like leaves gracefully up-curved and crowded at the ends with large. Fruit is an aggregate of follicle of 1-5, scarlet, boat shaped, woody. The seeds are edible after toasting and taste like chestnuts,	100 nos	East Africa/ Tropical	The seed contain oil used as medicine; the timber is used for making furniture and the bark for rope.
Seemachinrhakaya/Ganga imli Sweet Tamarind	*Pithecellobium dulce* (Roxb.) Benth Fabeace	Big tree also known as Madras thorn, drought resistant, gives fruiting in April – May.	100kg	Mexico/ Central America	Wild, fruits are like tamarind pod with reddish coating, pulp is spongy, eaten mostly by children
Ippa puvvu Mahua	*Madhuca latifolia* (Roxb.) Sapotaceae	Big tree, culturally associated with native people of lateritic belts, flowering stats from Feb-Mar, fallen flowers are collected by native people, fruits mature in Jun- July.	100 kg	India	Wild, ripe fruits are not popular, eaten by cattle. Seed is used for edible oil; flowers are used in various ways. Mostly the dried flowers are used for distillation of "Mahua Liquor"
Tendu/ Kendu	*Diospyrus melanoxylon* Roxb.Ex.A Ebenaceae	Medium sized tree, round shaped yellow fruits mature in April-May	2-15kg	India	Wild, eaten fresh, sold in the local market, leaves are use in wrapping *BIDI* (a kind of local cigar)
Neredu pandu Jamun Wild Jumun	*Syzygium cuminii* L Skeels Myrtaceae	Big tree with dense foliage proving shade along the road side, soft black fruit with skin and pulp not separable.	50 kg	India	Highly perishable, eaten fresh, rich in Iodine, seed is used to cure diabetes, leaves used as fodder, one of sacred fruits of the Hindus.
Kharjura/Khejur Wild Date	*Phonix sylvestris* L Roxb Arecaceae	Date palm tree, thrives well in drought condition, fruits matures in May- June, small brown cloured fruit having less flesh,	50 kg	India	Wild cultivated and domesticated. sweet xylem sap is collected during winter months for making molasses and alcoholic drink
Konda Usiri/Hariphal Star Gooseberry	*Phyllanthus acidus* L Skeels Phyllanthaceae	Medium sized tree, small pendulous ribbed fruits grow in clusters from branches, like grapes. Fruits appear simultaneously with the flowers and produce fruit twice a year.	15 -50 kg	Malay/ Madagascar India	Wild and domesticated, Eaten raw with salt, rich in vit C, used as pickles.
Busarakaya/Rasbhari Cape Gooseberry	*Physalis peruviana*L Solanaceae	Herb, small seedy berries with papery calyx, resembling a miniature spherical yellow tomato. it is about the size of a marble about 1–2 cm in diameter. Like a	1-2 kg	Peru/ Columbia	Recently introduced and cultivated in small pockets, rich in Vit C, used in folk medicine, used as jam

		tomato, it is bright yellow to orange in color, good shelf life			
Tati chettu Asian Palmyra palm/ Toddy palm	*Borassus flabellifer* L Arecaceae	Branch less palm, matures in July-Aug, the ripened fibrous outer layer of the palm fruits can also be eaten raw, boiled, or roasted. Immature fruit is cut and three jelly like seeds are eaten after removing the thin layer. The white kernel of the germinated seed is also eaten..	200 fruits,	Indian subcontinent	The inflorescence is cut and the xylem sap (juice) is collected by hanging earthen pot. The juice so collected early morning is a refreshing drink and light alcoholic drink is made from t he juice. Ripened fruit has fibrous outer layer, tolerate drought, eaten fresh by tribal people, the yellow pulp is processed.
Bilati Gaab Indian Persimmon/ Velvet apple	*Diospyros blancoi* A.DC Ebenaceae	Dioecious tropical tree, grows well from the sea level to the 2,400 feet above the sea level, Sapota like fruits with reddish velvety layer, medium sized	80-100 nos	Philippines	Wild and domesticated,eaten fresh, timer is very hard called *iron wood*
Deoa Monkey Jack	*Artocarpus lakoocha* Roxb Moraceae	Big tree. The orange-yellow male flowers and reddish female flowers grow separately on the same trees. Velvety, dull yellow syncarp fruits are nearly round or irregular	70 kg / 250 fruits	India	Sweet sour pulp, like jack fruit, generally eaten fresh. Used as chutney. Each fruit contains 20–30 seeds that are fleshy with thin seed coat, leaves used as fodder
Jamrul/Jaman Star Apple/ Wax apple	*Syzygium samarengense* (Blume) Merrill & Perry Myrtaceae	Evergreen tree with big leaves, berry bell shaped fruit matures in June-July (rainy)and in Jan – Feb(winter) for second flush, winter fruits are sweeter than rainy season size varies	40 kg, one big fruit weigh 60 g	Malay, Andaman Island	Fruits are bell shaped, different colours-purple, and reddish, white. It does not taste like apple, finds a good market
Cuddapah almond, Chironji,	*Buchanania lanzan* Sperg. *Anacardiaceae*	Medium size tree, upto 40-50 ft. high with a straight trunk	5-10	India	Kernel is rich in protein content (20-30%) and has high oil content (40-50%), which is highly nutritious.
Panasa pandu Jack fruit	*Artocarpus heterophyllus* Lam Moraceae	Big tree. The orange-yellow male flowers and reddish female flowers grow separately on the same trees.	100 Kg/ 200 fruits	India	Ripe fruit is naturally sweet, with subtle flavoring

Source: Roy *et al.,* (1998), Chadha (2001), Peter (2007) and Malik *et al.,* (2010).

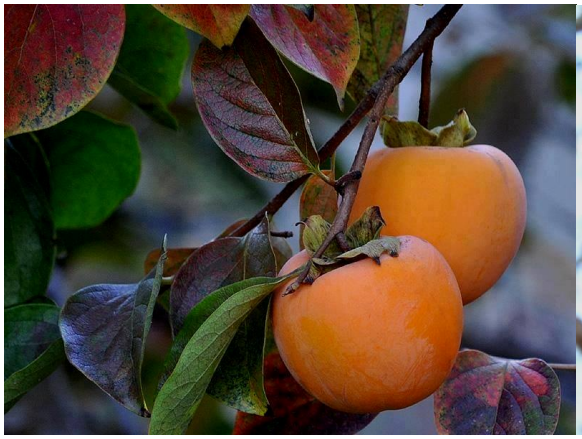
Fig.1 Need of explore underutilized fruit crops

Annona squamosal

Pithecellobium dulce

Artocarpus heterophyllus

Diospyros melanoxylon



Madhuca indica

Averrohoe carrmbole

Phyllanthus acidus

Feronia limonea

Grevia asiatica

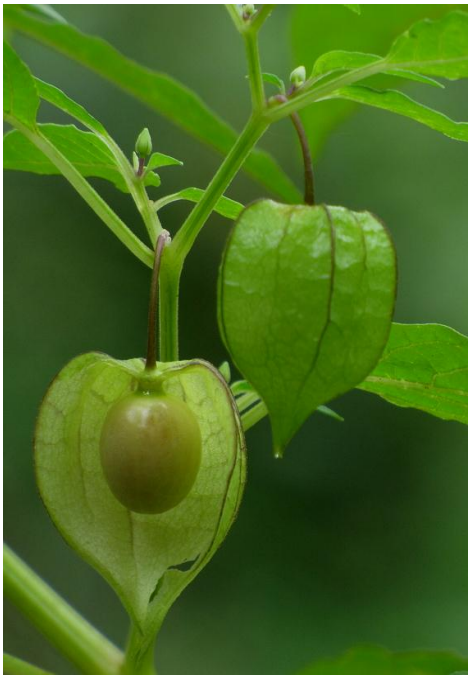
Cordia myxa

Zyzyphus nummularia

Mimusops elengi

Syzygium cuminii

Physalis peruviana



Zyzyphus oenoplia

Spondius cythera

Diversification of underutilized fruit crops

Telangana is being rich in plant diversity, has a very large number of non-traditional or underutilized fruit crops. Different agro-ecological/phyto-geographical regions hold rich diversity in both the cultivated and the wild horticultural crops. Diversity among UUFs in the Telangana region is discussed below in table 1. This table includes only species that are native to South Asia or those that were introduced long ago and have naturalised in India (Table 2).

Constraints in utilization and marketing of UUF's

Overall, the slow progress and poor popularity in the effective development and utilization of underutilized crops results from a number of constraints which are summarized below:

Lack of information on production, nutritional quality, consumption and utilization of many of the underutilized plant products which are unpopular compared to major fruits.

Lack of awareness on economic benefits and market opportunities.

Lack of technology for value addition through village level food processing.

Lack of improved quality planting material.

Lack of technology to reduce the gestation period and enhance the fruit production.

Lack of interest by researchers, agriculturists and extension workers.

Lack of producer interest.

Low yield.

Post-harvest and transport losses.

Non-existence of marketing network and infrastructure facility for underutilized fruits.

Lack of national policy.

Lack of credit and investment.

Non-availability of scientific resources for testing, valuation and post-harvest management of different underutilized fruits.

Disorganized communities.

The wise and proper utilization of underutilized horticultural crops can prove to

be a promising solution after realizing their health and employment potential. The underutilized crops can be a rich and easily available source of major and minor nutrients in sufficient amounts to prevent and cure deficiency disorders. They are the source of ayurvedic medicine because of having therapeutic properties. It is also established fact that seasonal, locally available, and cheap fruits and vegetables can also keep the population healthy and nutritionally secure rather than costly off season ones. They can fetch self-employment opportunities through marketing of raw fruits. Along with it, employment can be generated by value added product preparation through processing. Hence, it can be concluded that exploitation of underutilized fruit crops can provide a way to nutrient and economic security of tribals. Also, tribals can earn their livelihood through use of underutilized fruit crops.

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