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Distribution of *Grewia* species in Kachchh Gujarat, India: Taxonomy, Traditional Knowledge and Economic Potentialities

Rahul Dev[1*], G. K. Sharma[1], Traloki Singh[2], Devi Dayal[1] and M. Sureshkumar[1]

[1]ICAR-Central Arid Zone Research Institute, Regional Research Station, Kukma, Bhuj, Gujarat 370105, India

[2]ICAR- Central Arid Zone Research Institute, Krishi Vigyan Kendra, Kukma, Bhuj, Gujarat 370105, India

*Corresponding Author E-mail: rahul2iari@gmail.com

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ABSTRACT

Grewia tenax (Forsk.) Fiori, and G. villosa Willd. (Tiliaceae) are locally known as Gangeti and Luska respectively. These are medium size shrub species with multipurpose uses. Its fresh and dry fruit are utilized as food by the local peoples, leaves as forage for livestock. Plant parts of G. tenax like fruit pulp and root bark are used to cure swelling and dysentery. While fruit of G. villosa is used to cure different ailments like stomach upset, cough, genitourinary infections etc. These species are abundantly distributed in arid and semiarid region of India and have multiple use in food and medicines. However, its systematic utilization and domestication for cultivation is limited and only scanty information about various aspect of species is available. Grewia species is studied in this paper for distribution of diversity, taxonomy, utilization potential. The information with respect to its geographical distribution in Kachchh and potential food values, fodder utilization and possibility of large scale cultivation of this underutilized, wild plant species has been discussed in detail.

Key words: *Grewia, Distribution, Food, Fodder, Medicine and Utilization*

INTRODUCTION

Underutilized wild fruit species have great economic, nutritional value as well as potential source of desirable quality traits. They provide food for human, fodder for animal and medicine and other ecological survives to human and their animals. These fruit have exceptionally good adaptation abilities to various biotic and abiotic stresses like heat tolerance, salinity/alkalinity tolerance, drought tolerance and resistance to various disease and pest[13]. Kachchh region of Gujarat holds rich diversity of plant genetic resources including rich natural wealth of wild fruit species distributed in various habitats like scrub forest, lower hills and valley of Dhinodhar and Tapkeshwari hill ranges, Runn of Kachchh and Banni grassland. Owing to traditional life-style and socioeconomic constraints of *Kachchhi* ethnic communities they depend mostly on the available natural resources and constantly bank upon their traditional knowledge to fulfill their basic daily needs like medicine, clothing, raw materials for house, food etc[22].

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In India, thirty one (31) species of genus *Grewia* are recorded[6]. The seven (7) *Grewia* species like *Grewia abutilifolia* Vent. ex Spreng, *Grewia damine* Sm., *Grewia flavescens* Juss, *Grewia subincqualis* DC., *Grewia tenax* (Forsk.) Fiori, *Grewia tiliaefolia* Vah*l* var. *tiliaefolia* and *Grewia villosa* Willd. are naturally distributed on sandy, clay, rocky and gravelly piedmont plains of Kachchh[23]. The fair diversity of *Grewia tenax* (Gangeti) and *G. villosa* (Luska) is reported previously from different habitats of Kachchh *viz.* Tapkeshwari hill range[16,22] Dhinodhar hill[21], Tharawada-Gandher Reserve[20], Western Kachchh[22], Narayan Sarovar Sanctuary[19] and Little Rann of Kachchh[14]. Genus *Grewia* contains many important multipurpose plant species, among them *Grewia tenax* and *G. villosa* are most important. Both are utilized as food, fodder, fuel wood, timer and formulation of different traditional medicines for treatment of different human and animal ailments. *Grewia tenax* and *G. villosa* species are closely related to Phalsa (*Grewia subincqualis* DC.), popularly eaten fruit in North India and well tolerant to harsh climatic conditions including salt and drought stress. From beginning, traditional knowledge is transmitted orally by old men but now, this knowledge in depleting among new generation which can hampers sustainable utilization and documentation of wild underutilized fruit species including *Grewia* species. Hence, this paper is an attempt to summarize information with respect to diversity distribution, documentation and analysis of traditional knowledge associated with potential food values, fodder utilization, and nutritional aspects of *Grewia tenax* and *G. villosa* by the local ethnic population of Kachchh region of Gujarat, India.

Taxonomy of the plant

Kingdom:	Plantae
Division:	Angiospermae
Sub-division:	Dicotyledons
Class:	Polypetalae
Series:	Thalamiflorae
Order:	Malvales
Family:	Tiliaceae
Genus:	***Grewia***
Species:	***G. tenax, G. villosa***

Botanical name :	*Grewia tenax* (Forsk.) Fiori	*Grewia villosa* Willd.
Synonyms :	*Chadara tenax* Forssk., *G. populifolia* Vahl.	*Grewia corylifolia*, *Grewia heynei*
Common Name :	Phalsa Cherry, White Crossberry, Raisin bush, Gangara, Gangu, Kanger	Round leaf grewia, mallow-leaved ross berry, mallow raisin, Hairy-Leaf Crossberry
Hindi Name :	Gondni, Gangeran	Baliogangarin, Gangeti, Lankas
Gujarati Name :	Gangeti	Luska

Botanical description, habitat and distribution

G. tenax is a multi-stemmed sub-erect to erect shrub up to 3 m tall. Stem bark is ash-grey in colour, branches are glabrescent, young twigs stellate hairy. Leaves 3-5 costate, Leaf-lamina up to 4-6 × 2-4 cm, hairy on both sides, petiole 2-14 mm long and hairy. Flowers occur solitary or rarely paired and pedicel together appearing like a jointed pedicel, 5-35 mm long. Flower colour are white, rarely cream to yellow, sometimes sweet scented. Sepals 8-16 mm long, greenish on the outside, Petals white oblong to narrowly lanceolate, 5-12 mm long. Stamens yellow and numerous, filaments white slightly shorter than style or sub-equal. Ovary 4-lobed, glabrous or glabrescent; style 10 mm long, glabrous. Fruit is drupe usually 1-4 lobed, 8-12 mm wide, the lobes 6-8 mm long, 5–6 mm wide, orange, yellow or red-dish tinge, shining, glabarous[12,26].

G. tenax commonly found in arid and semi-arid plains, piedmont plain, lowlands and lower mountains upto 1250 m a.s.l. and in regions with mean annual rainfall of 200-1000 mm. Plant prefers eroded rocky, sandy, gravelly, stony and lateritic soils. Common habitat of plant are tropical forest[8,17] piedmont plain, lowlands, farmer's field boundaries in association with *Ziziphus nummularia* (Rhamnaceae), *Grewia villosa* (Tiliaceae), *Salvadora oleoides* (Salvadoraceae), *Salvadora persica* (Salvadoraceae), *Prosopis juliflora* (Mimosaceae), *Acacia senegal* (Mimosaceae), *Euphorbia caducifolia* (Euphorbiaceae), *Premna resinosa* (Verbenaceae) etc[5,24].

G. tenax is widely distributed in Saudi Arabia Egypt, United Arab Emirates, Ethiopia, Iran, Afghanistan, Kenya, Morocco, Namibia, Niger, Nigeria, Somalia, Tanzania, Uganda, Zimbabwe[4,7,8,15], Oman, Yemen, Namibia, South Africa, Sudan, Pakistan and Sri Lanka[6,7,8,15]. In India, *G. tenax* found in Gujarat, Rajasthan, Andhra Pradesh, Bihar, Haryana, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Punjab, Tamil Nadu, Jammu & Kashmir, Himachal Pradesh, Delhi, West Bengal and Assam; and abundantly distributed in the arid north west region of India[6,24].

Grewia villosa is a deciduous shrub or small trees, 2 - 5 m in height. Stems are ash-grey in colour with very distinctive leaves, young parts covered with pale silky hairs. Leaves almost round, opposite, cordate to subcordate at base and more hairy below, 5 prominent veins. Flowers yellow-red-brown, in small clusters. Cymes umbel, 4-6 flowered, axillary or leaf-opposed; Sepals 5, lanceolate, 8 - 10 × 1.5 - 2 mm, acute at apex, Petals 5, oblong densely hairy Stamens 25 - 30, filaments *c.* 5 mm long, Ovary subglobose densely villous, style 4-lobed. Fruit is soft drupes and hairy when ripe, red brown, about 1 cm in diameter, 1-2 seeds per drupe[18]. *Grewia villosa* is mostly distributed in India, Pakistan, Tropical Africa, Arabia, Egypt, Cape Verde Isles and East Indies and in India it is found in Andhra Pradesh, Gujarat, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Punjab, Rajasthan, Tamil Nadu and Uttar Pradesh[6,18].

MATERIAL AND METHODS

The sixteen comprehensive botanical surveys were conducted and observations were recorded on 150 informants in different habitats and *Kachchhi* ethnic communities of Kachchh, Gujarat in monsoon and post monsoon season of the year 2015 to 2016. Data collection was made using Key Informants Interview, Participatory Rural Appraisal (PRA), House Hold Survey and Focus Group Discussion. First-hand field data and observations were collected. The information on traditional use of *Grewia* sp. were asked as well as the data were also added through scrutiny of available literature on these species. The village elders, head-men and other experienced persons of the village were selected as key informants. Traditional plants healers and *Hakims* were interviewed using a semi-structured questionnaire. Questions were focused on the traditional utilization of the different plant parts of the *Grewia* sp. Focus Group Discussion in each village were held with farmers, pastoralists and local *Hakims.*

Species specific collections were made on targeted area, selected by screening of available literature. Exploration were conducted at the time of fruit ripening to collect seed material and repeat visits were also made in areas where mature fruits were absent in previous visits. Additionally vegetative propagated materials like hard wood cuttings were also taken. Random sampling strategy was applied to collect maximum diversity from wide area while, intensive biased sampling was followed in some specific areas where morphological variations was considerable.

Forests and wastelands of the selected villages were surveyed for the distribution of *Grewia tenax* and *G. villosa*. Random sampling strategies were used for collection of plant materials. The major occupations in the selected villages are animal husbandry and farming with supplementary irrigation. Identification and authentication of plant material were carried out through available

literature and from Gujarat Institute of Desert Ecology (GUIDE), Bhuj, Gujarat.

RESULTS AND DISCUSSION

The survey on biodiversity distribution and traditional knowledge related to two wild *Grewia* sp. divulges wide genetic diversity in the natural habitats. In the present investigation fair diversity of *G. tenax* and *G. villosa* were recorded from 40 and 27 collection sites of 6 blocks (Bhuj, Mandvi, Nakhatrana, Rapar, Bhachau and Abdasa) of Kachchh Gujarat India, respectively. Wide distribution of *G. tenax* (72.71%) and *G. villosa* (49%) was found in the surveyed habitats. The *G. tenax* was found distributed in scrub forest of Nakhatrana taluka namely foothill and valley of Dhinodhar hilly region, Nani Aral, and on piedmont plain and field boundary of Moti Aral, Barapar, Devisar, Virani while, wild population was distributed in the region up-to Chari-Dhand Wetland Conservation Reserve which is located on the edge of arid Banni grasslands. Natural population of both *Grewia* species were also reported in Mandvi and Naliya region mainly in the lower scrub forest of Tapkeshwari hill region which stretched from Bhuj to Mandvi block, and on field boundary of cultivated farmers lands, forest area of Kotada Chakar, Nana Reha and Mota Reha as well as in Kothara and Naliya grass land of Abdasa block. In addition to *G. tenax*, and *G. villosa*, the fair diversity of other *Grewia* species like *G. tiliifolia* was also found in Kachchh region of Gujarat. Flowering starts in August-September and Main fruiting season for both species was September – October. An additional flowering and fruiting can occurs in the month of April - June same year with good management practices. Generally fruits are harvested manually when fruit color changes gradually from green to bright red or orange. However, green fruit of *Grewia tenax* more preferred by locals for consumption as they are tastier than ripened one. The harvested fruits can be stored for long period because its fruits contains less moisture[3].

i) Traditional uses of *Grewia tenax* (Forsk.) Fiori

The medicinal use *Grewia tenax* (Forsk.) Fiori is pesented in the Table 3. Different parts of plant are traditionally used by *Kachhchi* people for treating different human and livestock ailments. Fruit pulp is used to treat swelling in the body. For this purpose seeds are extracted form ripen fruits and remaining pulp is applied externally on the affected parts by gentle application. Root bark and root powder are used for diarrhea and dysentery. Root and root bark are dried in the shade and crushed into fine powder. This 5-10 gram powder boiled in the water is taken orally in the morning for 3-4 days to get relief from dysentery. Roots are also used in treating the problems related to female reproductive systems. The green fruits are used by animal herder mainly maldhari ethnic community and village kids. While green leaves and tender twings are browsed by their livestock's given after chopping during lean period when other fodder source are scare. Seeds and green leaves used at the time of the animal delivery. Crushed fresh leaves and seeds are given by Maldhari communities in Banni region after calf delivery for easy expel of placenta. Ripen fruits are important source of iron and are given to pregnant women to cure anemia caused by iron deficiency. Leaves and twigs are important component of folk medicine for the treatment of trachoma, tonsillitis, infections and are used as a poultice to treat swelling[10]. It is widely used for the treatment of various common diseases such as stomachs upset, cough, fever, diarrhea, dysentery, jaundice and rheumatism[9]. Fruits of *G. tenax* significantly increased Haemoglobin and are considered as a simple safeguard against iron - deficiency and often used in special diets for pregnant women and anemic children[11,12]. Its root and fruits are well known household remedy for the treatment of osteoporosis, tissue and wound healing. Its fruits are thirst quencher especially during summer season. A drink is prepared by soaking the fruit overnight, hand-pressing, sieving, and sweetening used as refreshing drink during the

hot summer season in Sudan[24]. A porridge called "Nesha" was also prepared from this drink, by the addition of custard and flour, the Nesha is served during the fasting month of Ramazan and is also fed to lactating mothers to improve their health and lactation[2].

The fruit is a rich source of carbohydrates, protein, vitamins and minerals and the species is nutritionally balanced[1]. The fruits also contain amino acids, mineral elements (K, Ca, Mn, Fe, Cu and Zn), tannin and pectic substances[24]. *G. tenax* fruits are a good source of nutritional components and essential nutrients, including minerals and amino acids, and have functional properties. Chemical composition of different parts of *G. tenax* as determined by Aboagarib *et al*.[3] is provided in Table 1.

Table 1: Nutritional composition of different plant part of *G. tenax*

Content	Seeds	Peel	Pulp
Crude protein (%)	7.21±0.33	2.12±0.03	3.58±0.12
Carbohydrate (%)	59.56±1.78	70.74±0.18	87.09±0.76
Crude fats (%)	10.7±0.09	1.7±0.01	0.2±0.01
Copper (mg/100g)	1.35±0.01	0.78±0.003	0.27±0.001
Chromium (mg/100g)	0.02±0.002	0.02±0.001	0.01±0.003
Lead (mg/100g)	0.01±0.005	0.01±0.001	0.015±0.002
Manganese (mg/100g)	1.70±0.04	0.62±0.03	0.28±0.03
Potassium (mg/100g)	400±0.11	502.5±0.09	300±0.11
Sodium (mg/100g)	5.82±0.03	19.32±0.02	11.57±0.13
Iron (mg/100g)	3.65±0.07b	3.25±0.05	4.00±0.11

**on a dry-weight basis*

ii) Traditional uses of *Grewia villosa* Wild.

Grewia villosa Wild., is mostly found in lower parts of Dhinodhar and Tapkeshwari hill and forest lands. The medicinal uses of *Grewia villosa* Wild., by the different ethnic communities of Kachchh region are given in Table 3. The dry fruit is used for treatment of stomach ache. The dried fruit grinded in fine power and this powder diluted in water and orally taken for stomach problem like ache, dysentery etc. The mixture of the root, of three *Grewia* species, (*G. villosa* (Wild), *G. tenax* forsk and *G. flavascens* (Juss)) is used for the treatment of tuberculosis, syphilis and smallpox[25].

Fresh fruits and leaves are given to animal for easy expel of placenta after birth of calf. Ripen fruits are preferred by animal herder as well as small kids during the fruiting season and for later use fruit is dried and stored. Other than its medicinal properties it is highly valued for its animal fodder value. Both green leaves and tender twings are used to feed animals. Leaves are good source of crude protein and provide green fodder during off season. Fruits of *Grewia villosa* are edible and nutritional value of fruit is given in the Table 2.

Table 2: Nutritional composition of different plant part of *G. villosa*

Characters	Fruit	Seed	Leaves
Ca%	0.4	0.30	104.86
Mg%	0.33	0.18	55.64
Na%	0.08	0.02	-
K%	1.25	0.65	88.94
N	-	-	101.95
P	-	-	10.99
Cu (ppm)	0.46	0.39	-
Fe (ppm)	24.31	8.90	-
Protein	6.7	-	-
Carbohydrate	84.0	-	-
Reducing sugar	10.4		
Starch	22.8		
Elhassan and Yagi. 2010; Saleem *et al.,* 2012			

Table 3: Traditional uses of *Grewia tenax* (Forsk.) Fiori and *Grewia villosa* Willd. by the ethnic communities of Kachchh, Gujarat

Fruits	Used for	Part used	Uses	Method of uses
Grewia tenax (Forsk.) Fiori	Human	Fruit pulp	Swellings	Fruit pulp from ripe fruit applied externally on swelled parts thrice a day.
		Root bark	Dysentery	Root bark powder are boiled in water and taken orally twice in a day.
		Roots	Female reproductive system problems	Root decoction is given orally.
		Root powder	Dysentery	Boil one teaspoon of root powder in water and one glass should give for 2-3 days.
		Leaves	Fever and Hepatitis	Green leaves boiled in water and decoction is given two times a day.
		Root and leaves paste	Fracture	The root and leaves paste applied externally to the fractured area of body.
		Green Fruit	Food use for man and animals	Unripe green fruits are eaten by cow herder and village kids.
	Livestock	Green leaves	Fodder	Green twings and leaves are palatable fodder for goat, cattle and other animals.
		Seed and green leaves	Animal delivery	Crushed green leaves given to animal for easy expel of placenta after delivery.
Grewia villosa	Human	Fruit	Food use	Ripe fruit are eaten by villagers and kids.
		Dry fruits	Stomach ache	Dried fruit powder taken with water.
		Root	Antidiarrhoeal Cough and body pain	The 1-2 teaspoon roots powder are mixed in a glass of water and taken orally for diarrhea. Crushed root are boiled in water and juice taken orally to treat cough and body pains.
		Root and bark	Urinary infections	Root and bark powder taken with water to treat urinary infections.
	Livestock	Fruit	For animal delivery	Fresh fruit used after delivery for easy expel of placenta

CONCLUSION

It can be concluded from the study that *Grewia sp.* are well adapted to local harsh climatic conditions and widely distributed in different habitats in Kachchh region due to its hardy nature. They provides valuable food, fodder, nutrients and medicines. The plant preparation of *G. tenax* are used for treatment of stomach upset, cough, fever, diarrhea, dysentery, jaundice, hepatitis and rheumatism. While, *Grewia villosa* is utilized for correcting various human and livestock ailments like diarrhea, dysentery, cough, body pain, infection etc. Their leaves and twigs provide palatable fodder for livestock especially during dry periods of the year. Due to paramount importance of *Grewia species* they deserve special emphasis on its documentation, genetic improvement and systematic utilization in arid and semiarid regions of India. Systemic work on domestication, improvement and standardization of production technology are required for food and fodder supplement to people and their livestocks of the region.

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