

Grewia tenax (Forsk.) Fiori.- A TRADITIONAL MEDICINAL PLANT WITH ENORMOUS ECONOMIC PROSPECTIVES

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ABSTRACT

The plant *Grewia tenax* (Forsk.) Fiori. belonging to the family Tiliaceae, is an example of multipurpose plant species which is the source of food, fodder, fiber, fuelwood, timber and a range of traditional medicines that cure various perilous diseases and have mild antibiotic properties. The plant preparations are used for the treatment of bone fracture and for bone strengthening and tissue healing. The fruits are used for promoting fertility in females and are considered in special diets for pregnant women and anemic children. The plant is adapted to high temperatures and dry conditions and has deep roots which stabilize sand dunes. The shrubs play effectively for rehabilitation of wastelands. The plant parts are rich in amino acids and mineral elements and contain some pharmacologically active constituents. The plant is identified in trade for its fruits. Plant is also sold as wild species of medicinal and aromatic plant and is direct or indirect source of income for the tribal people. But the prolonged seed dormancy is a typical feature and vegetative propagation is not well characterized for the plant. Micropropagation by tissue culture techniques may play an effective role for plant conservation. The plant needs phytochemical and pharmacological investigations on a wider range which may have great scope in near future. Thus, efforts are needed to conserve, domesticate and cultivate the plant. This paper reviews the plant's medicinal aspects and chemical constituents, also provides brief information of plant bioprospecting and its manifest market values.

Keywords: *Grewia tenax*, Multipurpose plant, Traditional medicine, Source of income.

INTRODUCTION

Thousands of indigenous plants have been used by man from prehistoric times on all continents for relieving and curing ailments. In spite of tremendous development in the field of allopathy medicinal plants and their derivatives still remain one of the major sources of drugs in modern and traditional systems throughout the world playing a major role in medicinal therapy. In India about 7300 plant species are used in traditional health care systems. 90% of the medicinal plants come from natural habitats. There are many medicinal plants which find place in day-to-day uses, many of these, are used as herbal remedies. The expanding domestic and global demand of herbal products has put the native medicinal plant resources under significant stress. The plant genus "*Grewia*" is one of the best examples of multipurpose fruit species which are useful source of food, fodder, fiber, fuelwood, timber and a range of traditional medicines which cure a number of diseases. The genus was named by Carolus Linnaeus in honor of Nehemiah Grew, an English vegetable anatomist and physiologist, very famously known as the "Father of Plant Physiology" (1641-1712) from England.

This paper is focused on an important *Grewia* species *G. tenax* (Forsk.) Fiori. The plant is commonly known as Gangeran. The species is known for its edible fruits which are nutritionally balanced and rich in iron and calcium. The drupes also contain amino acids, mineral elements (K, Ca, Mn, Fe, Cu and Zn), tannin and pectic substances.

The plant is not only adapted to high temperatures and dry conditions, but has deep roots which stabilize sand dunes¹. The shrub plays effectively for rehabilitation of wastelands if grown along the trees².

The plant has high medicinal values and is widely used for the treatment of various common diseases. *G. tenax* Fiori is reputed to cure upset of stomachs, some skin and intestinal infections, cough, fever, diarrhoea, dysentery, jaundice, rheumatism and have mild antibiotic properties. The plant preparations are used for the treatment of bone fracture and for bone strengthening. Its root and fruits are well known household remedy for the treatment of osteoporosis, tissue and wound healing. Leaves and twigs of *G. tenax* are an important component of folk medicine for the treatment of trachoma, tonsillitis, infections and are used as a poultice to treat swelling.³⁻⁴ *Grewia's* extracts are also supposed to be helpful in curing hepatitis and other such diseases⁵. The plant species has free radical scavenging activities which may be responsible for the therapeutic action against tissue damage. The plant gum was found to improve the fluidity of paracetamol granulation and could be a

useful substitute binder in paracetamol tablet formulations⁶. The potential of *Grewia* gum as a film coating agent was investigated using praziquantel tablets⁷. The plant gum may serve as a good suspending agent for Ibuprofen pediatric formulation, requiring no further aid in suspension redispersibility⁸. Some other *Grewia* species are also known for their enormous medicinal values. *G. hirsuta* is used in the ayurvedic management of menopause and included in the class of drugs called "Rasayanas" that have an overall anti-aging effect in the body. The gum mucilage isolated from *G. optiva* had comparable binding ability and appears suitable for use as a pharmaceutical binder⁹. Some *Grewia* species have been found to have anti emetic activity¹⁰. In the experimental investigation some *Grewia* species (*G. sapida* Roxb., *G. pinnata* Roxb. and *G. nervosa* Lour.) were found to have 65 to 97% antioxidant activities¹¹. *G. hirsuta* Vahl. and *G. tenax* Forsk. are mentioned in different classical texts as medicinal plants of wound healing¹². Root and fruits of *G. damine* Gaertn. are used in powdered form and employed in prevention of the osteoporosis¹³. Herbal preparation of *G. hirsuta* Vahl. is given for the ayurvedic management of menopause¹⁴. The plant drug Nagbala has proprieties to pacify provocation of Vata and Pitta humor. Drug is useful as nervine tonic, brain tonic, demulcent, anti-acidic, expectorant, antipyretic, diuretic, aphrodisiac, carminative and cardiac tonic¹⁵. This herbal medicine Nagbala is used to boost the immune system of the body and maximize its potential in fighting the tumor. Ayurvedic medicine has the potential for a substantial contribution in the management of both early and advanced cancer¹⁶.

Besides this *G. tenax* Fiori plays a wide role in maintaining the ecological balance. The shrubs are used in apiculture; Bees visit the flowers for pollen and nectar. The Young leaves are consumed by livestock and have fairly good feed value. The plants have an aggressive root system which holds fast to the soil protecting it from water and wind erosion. Leaf litter from the shrub improves soil physical and chemical properties¹⁷. Ecologically, it can withstand environmental stress more easily than annual crops and thus makes an important contribution to sustainable production without needing expensive inputs of water or fertilizer. This is said to regenerate well, and is traditionally protected during clearing and favoured by farmers¹⁸. In the encyclopedia of ayurvedic medicinal plants, *G. tenax* is listed in 250 most important ayurvedic medicinal plants¹⁹.

But due to overgrazing, debarking by animals, encroachments, unsustainable utilization and other developmental activities, this persistent medicinal plant species is on the verge of extinction²⁰. The

species is also included in the list of important threatened medicinal plant species of Jharkhand²¹. The plant species is over exploited by the tribal people for their fruits which are common household food and are direct or indirect sources of income²². In Sudan *Grewia tenax* Fiori fruits are identified in trade as wild species of medicinal and aromatic plants²³.

As the plant is from arid zones, where drought and salinity stress are interrelated, this ecophysiological phenomenon causes many problems for seed germination and plant growth inducing physiological and biochemical disorders in metabolic processes of the plant. Prolonged seed dormancy is a typical feature of the *G. tenax* Fiori²⁴. But little is known about how to increase its propagation and early seedling establishment under the harsh conditions¹. Experimental investigations indicate that seeds of *G. tenax* possess non-deep physiological dormancy which can be overcome by heat stratification²⁵. *G. tenax* was also investigated for vegetative propagation by stem cuttings and significant stimulation of rooting was observed with IBA and IAA in promoting root formation²⁶. But, the plant being very useful and being among important medicinal plants need much more scientific efforts for its successful endurance. The wild plant has continuously been used to meet the growing commercial demand for its fruits. One major factor hampering development of this plant is the limited and scattered knowledge available on it²⁷. The purpose of this paper is to highlight the medicinal importance, nutritional values and phytochemical and pharmacological properties of *Grewia tenax* (Forsk.) Fiori. The article also provides brief information of plant bioprospecting and its apparent economic importance.

Plant Profile

Common name : White Crossberry, Phalsa Cherry, Raisin bush, Gangara, Gangu, kanger.

Hindi name : Gondni, Gangeran

Synonyms : *Chadara tenax* Forssk., *G. populifolia* Vahl.

Classification

Kingdom	:	Plantae
Division	:	Angiospermae
Sub-division	:	Dicotyledons
Class	:	Polypetalae
Series	:	Thalamiflorae
Order	:	Malvales
Family	:	Tiliaceae
Genus	:	<i>Grewia</i>
Species	:	<i>tenax</i>

Botanical Description

White Crossberry is a multistemmed shrub up to 2 m tall. It is a very close cousin of the Phalsa popularly eaten as a fruit in India. This is a suberect to erect shrub of up to 3 m in height. Stem with ash-grey bark and young twigs are stellate hairy. Leaves 3-5-costate, almost glabrous, hairy on both sides, sharply serrate, cuneate at the base, acute to obtuse, rarely emarginate at the apex. Petiole is 2-14 mm long, hairy and stipules linear-lanceolate, caducous. Flowers solitary or rarely paired, on solitary, antiphyllous, hairy peduncle, white, rarely yellowish-white, pedicel half as long as peduncle, stellate tomentose. Sepals are linear-oblong. Petals are linear, claw much smaller than limb, with somewhat reniform densely ciliate gland, bilobed at the apex. Stamens are numerous, filaments slightly shorter than style or subequal. Torus is angular. Ovary is 4-lobed, glabrous, rarely stellate hairy; style long, clavate. Drupe usually 2-4-lobed, lobes are 5-7 mm in diameter, glabrous, rarely with sprinkled stellate hairs, orange yellow with red-dish tinge. Flowering and fruiting is common in months of February to August.

Geographical Distribution

The plant is native of Algeria, Botswana, Chad, Djibouti, Ethiopia, Iran, Kenya, Mali, Mauritania, Morocco, Namibia, Niger, Nigeria, Saudi Arabia, Senegal, Somalia, South Africa, Sudan, Tanzania, Uganda, Zimbabwe. The plant species is exotic to India and Pakistan. In India it is spread over Andhra Pradesh, Bihar, Gujarat, Haryana, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Punjab, Rajasthan, Tamil Nadu and West Bengal.

Biophysical limits

Common in arid and semi-arid plains Up to 0-1500 m height in Mean annual rainfall of 200-1000 mm in sandy, rocky and lateritic soils.

Propagation

Direct sowing is a preferred propagation method. Depulped seed is sown in pots which are initially placed under shaded conditions but exposed to direct sunlight after 1 month.

Ecology

G. tenax is highly drought resistant and occurs in the driest savannas at desert margins and regions of higher rainfall, where it grows in thickets on termite mounds in otherwise seasonally flooded country. *G. tenax* has often been cited as a prime candidate for domestication as a useful horticultural plant²⁸. *G. tenax* common plant species available in all seasons in semi-desert area potentially important as forage sources for honeybee. Bees and some other insects visit the flowers for pollen and nectar thus; plant can be used for apiculture.

Seed dormancy is a typical feature of *G. tenax* for seed survival under unfavorable climatic conditions²⁵. Intercropping with *G. tenax* may not affect crop growth adversely. The plant is soil improver as leaf litter from the shrub improves physical and chemical properties of soil¹⁷.



Products of Economic Importance

Food: The fruits consumed by man and animals contain a large amount of iron and can be made into a refreshing drink. Fruit storage can be extended by drying. The dead leaves are eaten, but only while they remain on the plant. Its fruits are thirst quencher in summer season. A drink is prepared by soaking the fruit overnight, hand-pressing, sieving, and sweetening²⁹.

Fodder: Young leaves are consumed by livestock, they are slightly palatable at the end of dry seasons, and have fairly good feed value.

Fuel: The branches are used as firewood, and can be used in charcoal making.

Fiber: Ligno-Cellulosic Fibre with good tensile strength is made by the bark, which is used to make ropes and for binding purposes in house construction³⁰.

Timber: *G. tenax* wood is used in making weapons such as clubs, bows, arrows and for other general purposes.

Poison: A mucilaginous bark preparation is used by women against hair vermin.

Medicinal products

Product with trade name	Cure
Kangra gogs anti dandruff shampoo	Removes dandruff, makes scalp free from infection, checks hair fall, and makes hair luster and shine.
Kangra gogs normal shampoo	Makes hair healthy, dense shine & beautiful, checks hair falling, provides nutrition and natural conditioning.
Tonigrow chewable tablets	Rich source of calcium, iron and variety of other vitamins and minerals.
Gincata tablets	Arthritic and rheumatic problems, Body coldness, Arteriosclerosis, Eye weakness caused by poor circulation, Vertigo, Anxiety and tension, As an antioxidant, Increased activity and energy in the elderly.
Rasayana prash	Micronutrients which improve health, immunity, vigor, vitality and give longevity as well as protection against stress.
Nerveus syrup and capsule	Effective brain tonic. It gives strength to the brain, improves concentration, memory & activates the mind.
Eronic syrup	Herbal iron tonic, which is ideal for iron deficiency and curing anemia.
Rhumogen oil	Ayurvedic pain relief oil used for pain in joints, body massage, bone strengthening and lessen swelling.
Herbadict tablets	Protects the vital organs of the body - like liver, kidney and brain cells from the toxic effects of alcohol and drugs.
Divya Laxmi Vilas ras	Advised for cough and cold
Dazzle topical pain reliver herbal oil	For the treatment of sports injuries, local muscular pain and inflammation, sprains, rheumatoid disorders.
Mukombero tonic	Increases libido and as an aphrodisiac.

Chemical Composition

The stem bark and leaves of *G. populifolia* are reported to constitute some phytochemicals like triacontan-1-ol, α - amyryrin, β -amyryrin, β -sitosterol, lupenne, erythrodiol, betulin and tetratriacont-21-ol-12-one³¹. The plant has been found to contain grewinol, tetratriacontane-22-ol-13-one. The seeds contain 5% of bright-yellow oil containing palmitic acid, stearic acid, oleic acid, linoleic acid and unsaponifiable³². In preliminary phytochemical studies plant extracts in different solvents were found to contain diterpenes, glycosides,

fats, alkaloids, glycosides, triterpenoids, sterols flavonoids, saponins, tannins³³⁻³⁴.

Bioprospecting Studies

In the overall chemical investigation for primary metabolites of *G. tenax* plant, parts was analyzed to contain protein, fat, fibre, ash, saccharides, essential amino acids and minerals like S, K, Mg, Ca, Na, Zn, Fe, Mn, Cu etc.³⁵.

Column chromatography of the ethyl acetate fraction have resulted in the isolation and structure elucidation of eleven compounds as β -sitosterol, β -sitosteryl acetate, β -amyryrin, β -amyryrin acetate, 5 α ,8 α -epidioxyergosta-6,22-diene-3 β -ol, 5 α ,8 α -epidioxyergosta-6,9(11),22-trien-3 β -ol α - taraxerol, betulin, stigmaterol, oleanolic acid and stigmaterol-3-O- β -D-glucoside³⁶.

Medicinal importance

Leaves and twigs of *G. tenax* are important components of folk medicine for the treatment of trachoma, tonsillitis, infections and are used as a poultice to treat swelling³⁻⁴. Because of its high iron contents, fruits of *G. tenax* are often used in special diets for pregnant women and anemic children. *G. tenax* plant is used for the treatment and prevention of iron deficiency anaemia. Porridge, called *Nesha*, is prepared by boiling fruit pulp of *G. tenax* and millet flour given to lactating mothers³⁷. Ointment of whole plant extract applied locally for hard tissue repair and bark paste of *G. tenax* can be applied as plaster³⁸. A preparation of *G. tenax* fruit powder mixed with milk is given for the treatment of bone fracture and swelling³⁹.

Pharmacology

In the course of screening work with various plant extracts for their carcinolytic activities, *G. tenax* extract was found to have anti-tumour activities when injected in rats bearing Rhabdomyosarcoma⁴⁰. The effect of aqueous extract of *G. tenax* fruit was examined on the variation of *in vitro* iron absorption. The incubation of freshly prepared rat everted gut sac in Ringer medium containing FeSO₄ in the presence of extract at different concentrations favors significantly the iron transfer from the mucous side toward the serous one. Maximum of iron absorption was recorded in the presence of aqueous extract at 10 mg/ml and 5 min of incubation time in stomach, duodenum and jejunum⁴¹.

DISCUSSION

The current report shows that *Grewia tenax* (Forsk.) Fiori. is a multipurpose wild fruit plant which is used as common household food and makes a substantial contribution to the food security of the tribal people in many parts of not only India but all over the world. The plant has high medicinal values and is used for indigenous treatment of numerous diseases including fever, diarrhoea, dysentery, nausea, anaemia, osteoporosis, rheumatism, bone fractures, body weakness and for bone strengthening and muscular strengthening. The plant solves all its purposes of food, fodder, fuel, fibre and timber. The plant plays a fine role in ecological management. The deep rooted plant stabilizes soil from water and wind erosion and is promising as a dune fixing plant in desert reclamation. The shrub has high growth rate, ability to withstand biotic pressure, conserve soil and moisture, improve soil productivity and has the potential to provide products useful to the local people as well as industry. Despite its well-recognized potential and high prices on local markets, there are no commercial plantations worldwide. Wild plants have continuously been used to meet the growing commercial demand for its fruits. In terms of their socio-economic value, the plant is described as prime candidate for domestication and commercialization as new crops in semi arid and arid zones of country. Many other *Grewia* species also have similar importance as well. *G. asiatica*, *G. hirsuta*, *G. damine*, *G. lasiodiscus*, *G. optiva*, *G. biloba*, *G. bicolor*, *G. tiliifolia*, *G. flavescens* and many more species are well known medicinally and economically. These species are the part of trade of medicinal and aromatic plants and are the income source particularly for the resource poor families. *Grewia* species are the plants which may not be freely available in future due to overexploitation, habitat destruction or lack of domestication and cultivation.

In spite of this, the fruits and plants are exploited from the wild and there have been little or no focused efforts to domesticate and cultivate these species. *G. tenax* species is traditionally grown from seeds. On the other hand, vegetative propagation plays a key role in domestication and improvement programs as a means of large-scale multiplication of superior genotypes, the retention of desirable characteristics, the creation of a uniform rootstock, and the ability to mass-produce identical plants quickly and efficiently are all advantages of asexual propagation. Micropropagation by tissue culture techniques may play an effective role for plant conservation. The plant *Grewia tenax* also needs phytochemical, pharmacological and morphogenic investigations on a wider range which may have great scope in the near future. Recently, there has been an increased interest in finding alternative, potentially high-value cash crops to improve the income of small farmers. So, efforts must be taken to conserve this *Grewia* species and also for the conservation of traditional knowledge for sustainable management of biodiversity.

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