GREWIA TILIFOLIA: A REVIEW ON PHYTOCHEMICAL AND PHARMACOLOGICAL PROPERTIES

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ABSTRACT

Grewia tilifolia belongs to the family Tiliaceae is a herb used in Ayurveda for various types of diseases and disorders. It is commonly known as Dhaman, Dhamni, Dhanuvriksha, Pharsa, and Dalmon. In India, it is particularly found in Punjab, Himachal Pradesh, Uttar Pradesh, Chennai, Andhra Pradesh, Mumbai, etc. About 40 Grewia species are found in India. Leaves, bark, roots, stem and fruits of the plant are used for the extraction of phytoconstituents. The main phytoconstituents present in the plant are: carbohydrate, phenolic compounds, flavonoids, alkaloids, triterpenoids, proteins, saponins, lipids, steroids and tannins. It is rich in various types of macronutrients and micronutrients like: calcium, nitrogen, phosphorus, magnesium, sodium, potassium, zinc, copper, manganese, etc. Its medicinal uses are: skin diseases, wounds, ulcers, diarrhea, cancer, inflammation, heart diseases, expectorant etc. Grewia plant are also used as antidote in snake bite and opium poisoning. It is also used in sprains, burning sensation, hyperdipsia, rhinopathy, ulcers, skin diseases, haematemesis, and general debility, etc. The present review is focused on the Phytochemicals, pharmacological and medicinal properties of the plant.

KEYWORDS: Grewia tilifolia, Phytochemicals, Stem, Fruits, Leaves, Medicinal value.

INTRODUCTION

Grewia tilifolia belongs to the family Tiliaceae. It is commonly known as Dhaman, Dhamni, Dhanuvriksha, Pharsa, and Dalmon. A moderate-sized to large tree found in the sub-Himalayan tract from Jumna to Assam and in central, western and southern India; the tree attains its best development in the valleys and slopes of the southern hills, attaining a bole length of about 30 ft and the girth of 7 ft. or more. In India, it is found particularly in Punjab, Himachal Pradesh, Uttar Pradesh, Chennai, Andhra Pradesh, Mumbai, etc. It is a notable
herb in Ayurvedic arrangement of drug and has been utilized in vitiated states of pita and Kapha.\cite{2} It is also used in burning sensation, cough, skin diseases, pruritus, wounds, ulcers, diarrhea, haematemesis, and general debility, cancer, nose bleeding, throat disorder, jaundice, inflammation, heart diseases, phlegm, expectorant, vulnerary, decongestant.\cite{3} The main phytoconstituents are carbohydrate, phenolic compounds, flavonoids, alkaloids, triterpenoid, proteins, saponins, lipids, steroids and tannins. The presence of phenolic compounds in the plants indicates that this plant possesses anti-oxidant property.\cite{4} The whole plant has gained importance for its medicinal value. Leaves, bark, roots, stem and fruits of the plant are used for the extraction of phytoconstituents.\cite{5} The present review is focused on the taxonomy, distribution, botanical description, secondary metabolite extraction, chemical constituents, pharmacological activity of *Grewia tilifolia*.\cite{6}

About 40 species occur in India (Table No: II) in which some of the species are well known for its timber, and some are edible and some of the species are used as cordage.\cite{7} It grows best in areas where annual daytime temperatures are within the range of 30 - 42°C, but can tolerate 7 - 47°C.\cite{8} Mature plants can be killed by temperatures of -5°C or lower, but young growth will be severely damaged at -1°C. It prefers a mean annual rainfall in the range of 1,000 - 2,500mm, but tolerates 750 - 4,000m.

**Table No. I: Different species of *Grewia*.**

<table>
<thead>
<tr>
<th><em>Grewia adolfi-frederici</em> Burret</th>
<th><em>Grewia elmeri</em> (Merr.) P.S.Ashton</th>
<th><em>Grewia lanceifolia</em> Roxb</th>
<th><em>Grewia retinervis</em> Burret</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Grewia ambongensis</em> Baill.</td>
<td><em>Grewia elyseoi</em> Cavaco &amp; Simoes</td>
<td><em>Grewia langsonensis</em> Gagnep</td>
<td><em>Grewia retusifolia</em> Kurzl</td>
</tr>
<tr>
<td><em>Grewia amicorum</em> Sted.</td>
<td><em>Grewia eriocarpa</em> Juss</td>
<td><em>Grewia macropetala</em> Burret</td>
<td><em>Grewia sahafariensis</em> Capuron &amp; Mabb</td>
</tr>
<tr>
<td><em>Grewia amplifolia</em> Baill.</td>
<td><em>Grewia falcata</em> C.Y.Wu</td>
<td><em>Grewia malacocarpa</em> Mast</td>
<td><em>Grewia saligna</em> Baill</td>
</tr>
<tr>
<td><em>Grewia asiatica</em> L.</td>
<td><em>Grewia faucherei</em> Danguy</td>
<td><em>Grewia maroana</em> Aug.DC.</td>
<td><em>Grewia tannifera</em> Hochr.</td>
</tr>
<tr>
<td><em>Grewia baillonii</em> R.Vig.</td>
<td><em>Grewia gracillima</em> Wild</td>
<td><em>Grewia nervosa</em> (Lour.) Panigrahi</td>
<td><em>Grewia tenax</em> (Forssk.) Fiori</td>
</tr>
<tr>
<td><em>Grewia baronii</em> R.Vig.</td>
<td><em>Grewia helicterifolia</em> Wall. ex G.Do</td>
<td><em>Grewia nossibeesnis</em> Baill</td>
<td><em>Grewia urbaniana</em> Lauterb.</td>
</tr>
<tr>
<td><em>Grewia calophylla</em> Kurx ex Mast</td>
<td><em>Grewia herbacea</em> Hiern</td>
<td><em>Grewia ogadenensis</em> Sebsebe</td>
<td><em>Grewia voloina</em> Capuron</td>
</tr>
</tbody>
</table>
Grewia carrissoi
Exell & Mendonca

Grewia inmac
Guillaumin

Grewia pachycalyx K.
Schum

Grewia woodiana K.Schum.

Grewia densa
K.Schum

Grewia kacockhamnos
K.Schum

Grewia palodensis
E.S.S Kumar &al.

Grewia yunnanensis
H.T.Chang

Grewia denticulata
Wall. Ex Prain

Grewia kaptiriensis De
Wild.

Grewia pamanziana R.Vig.

Grewia zizyphifolia Baill.

Taxonomy of the plant

Kingdom: Plantae

Sub Kingdom: Spermatophyta

Division: Angiospermae

Sub-division: Dicotyledons

Class: Dicotyledonae

Subclass: Polypetalae

Series: Thalamiflorae

Order: Malvales

Family: Tiliaceae

Genus: Grewia

Species: G. tilifolia

Nutrients present in Grewia tilifolia

Grewia tilifolia contain macronutrients and micronutrients as well. Macronutrients present in the plant are calcium, nitrogen, phosphorus, magnesium, sodium, potassium etc. Micronutrients found in the plant are iron, Zinc, Copper, manganese, etc.\(^9\)

Table No. II: Nutrient present in Grewia species.

<table>
<thead>
<tr>
<th>Nutrients</th>
<th>Concentration (mg/100 g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium</td>
<td>109.4</td>
</tr>
<tr>
<td>Nitrogen</td>
<td>0.96</td>
</tr>
<tr>
<td>Phosphorous</td>
<td>2.52</td>
</tr>
<tr>
<td>Magnesium</td>
<td>402</td>
</tr>
<tr>
<td>Sodium</td>
<td>239.3</td>
</tr>
<tr>
<td>Potassium</td>
<td>1302</td>
</tr>
<tr>
<td>Iron</td>
<td>31.13</td>
</tr>
<tr>
<td>Zinc</td>
<td>5.4</td>
</tr>
<tr>
<td>Copper</td>
<td>2.3</td>
</tr>
<tr>
<td>Manganese</td>
<td>2.7</td>
</tr>
</tbody>
</table>
Phytochemical properties

*Grewia tilifolia* contain chemicals like D-erythro-2-hexenoic acid γ-lactone, Gulonic acid, γ-lactone, Betulin, Friedelin, Lupeol, Tannins, Flavonoids, Hemicelluloses, Phenolics, and lignin. It also contain constituents like β-Sitosterol, stigmasterol.

Macroscopy

*Grewia tilifolia* is a shrub or small tree which can grow up to 12 feet high. Its bark is greyish-white or greyish-brown.\[^{10}\] Leaves with serrated margins vary from broadly heart-shaped to obliquely ovate.\[^{11}\] The flowers are yellow about 2 cm in length, and borne in densely crowded (rarely solitary) axillary cymes.\[^{12}\] The fruits are edible, rounded, small dark blue to almost black when ripe, sweetish and somewhat acid, with a fairly good flavor and each drupe contains a rather large seed.\[^{13}\]

![Figure No. 1: Flower, Leaf and Bark of Grewia tilifolia.](image)

The sapwood is white to pale yellow, heartwood is reddish brown with darker streaks marked by white spots. It is dull, with smooth touch, heavy, strong, elastic, straight or some time wavy grain in the radial plane and it is medium textured.\[^{14}\]

The wood is durable both in open and under cover; it does not require any antiseptic treatment. It is easy to saw and work and takes a high polish.\[^{15}\] The data for its comparative suitability as timber, expressed as percentages of the same properties of teak are: weight-115; stiffness-110, shock-resisting ability-145; retention of shape- 60; shear- 140; and hardness, 155. The wood is considered as excellent fuel wood. The calorific value of sapwood is 5,337 calories and heartwood is 5,246 calories.
Transverse section of Leaf of *Grewia tilifolia*

In the midrib portion there is a hemispherical bulge on the upper side. The hypodermal region contains 8-10 layers of lamellar collenchymas.[16] The arc-shaped vascular bundle is covered by a continuous sclerenchymatous pericycle, which is 1-2 layered on both the lateral sides of the vascular bundle, 4-5 layered on the upper side and 8-9 layered on the lower side. The ground tissue is composed of mucilage canals separated by walls of 1-2 cells in thickness.[17] There are 8-10 canals on the lower side. Mucilage canals are also there within the pericycle on upper side. They occur in batches of 3-4 each on either side of the vascular bundle.[18] On either side of the vascular bundle there are two patches of sclerenchyma also on the upper side of tracheids.[19] The tracheids consist of 12-13 rows interrupted by ray cells. The ray cells are filled with brown colour tannin contents.[20] The cells of the phloem are in 6-7 layers. The lower hypodermis consist 5-6 layers of lamellar collenchymas.[21] The trichomes are multicellular, both stellate and glandular, seen mainly in lower epidermis.[22] The stellate trichomes are 2-5 armed and glandular trichomes present with a unicellular stalk and a multicellular head. The lower epidermis contain stomata also.[23]

Transverse section of stem of *Grewia tilifolia*

The outer epidermis is wavy containing trichomes of different sizes and lumen sizes. The hypodermis consist of lacunar collenchyma often containing mucilage cavities on the lower half.[24] The cortex is full of mucilaginous cavities. The medullary rays consist of mucilage canals and parenchymatous cells containing starch pains.[25] The outer bast fibres are gelatinous fibres and inner are libriform fibres.[26] The phloem rays are mostly uniseriate to biseriate. The active phloem is 8-10 layered interrupted by phloem rays and smaller mucilaginous canals.[27] The secondary xylem is differentiated to broad rings of fibretreacheids alternating with rings of libriform fibres.[28] The vessels present are mostly isolated. In the protoxylem region there are many parenchyma cells.[29] This region is covered by a single layer of fibres. The pith consist of parenchyma mixed with mucilaginous cavities.[30]
Uses of *Grewia tilifolia* plant\(^{[31]}\)

1. Its timber is used for shafts, poles, frames, panels, masts, oars, tool handles, agricultural implements, bent parts of carts and carriages, spokes, felloes, horizontal bars, etc.
2. It is an ornamental timber suitable for furniture.
3. It is used for picker arms in textile mills and for shuttles, rabbet tube, bobbins, etc.
4. It is used as side props in mine shafts and galleries.
5. The bark yields a fibre used for cordage.
6. It has been tried for its suitability as a paper making material
7. Leaves and twigs are lopped for fodder.
8. The leaves contain 1% tannin and are sometimes employed as a soap substitute for washing hair.

Traditional uses\(^{[32]}\)

1. It is useful in vitiated conditions of pitta and kapha.
2. It is also used in burning sensation, hyperdipsia, rhinopathy, ulcers, skin diseases, haematemesis, and general debility
3. It is used as an antidote in Snake bite. Leaves are used to prevent secondary poisoning. It is used in the form of leaf or bark decoction and infusion.

Figure No.2: Transverse section of leaf and stem of *Grewia tilifolia* respectively.
4. It is also used as an antidote in opium poisoning.
5. The paste of the fresh leaves is used to treat burns.
6. The powder of Bark is used as an aphrodisiac.
7. The root powder of the plant is mixed with equal quantity of water and this preparation is used at night for curing the sprain.
8. The stem bark is used to treat dysentery.

**MEDICINAL VALUE**

**Antioxidant Property:** The methanolic extract of *Grewia tiliifolia* is found to be having potential free radical scavenging activity against various radical systems. The different radical systems like superoxide radical, hydroxyl radical, nitric oxide radical were used for evaluating the antioxidant activity of the test drug. The *Grewia tiliifolia* extract at 50, 100, 200, 250 µg/ml concentrations were used against all the radicals. The radical scavenging activity was expressed in terms of % of inhibition as mentioned in the methodological part. The increasing concentration of test extract increases the inhibition %. The activity of the extract is found to be varying according to the chemical nature of radicals. The reason may be the due to the different phytomolecules that are present in the crude extract acts on different way against the radicals.\[^{33}\]

**Anticancerous Property:** Benzene extract of the *Grewia tiliifolia* leaf has significant antiproliferative effect against A549 cells without causing any harmful effect to the normal human lung (L132) and PBMC cells. Bio-assay guided fractionation revealed the presence of phytostéols (β-sitosterol and daucosterol) which significantly inhibited the growth of A549 cells both alone and in combination. This study warrants that these phytosterols in alone or in combination can be considered as safe and potential drug candidates for lung cancer treatment.\[^{34}\]

The methanolic extract also found to have antiproliferative activity demonstrated in three different cancer cell lines i.e., MCF7 (breast cancer cell line), HepG2 (hepatocancer cell line) and A549 (lung cancer cell line). The Growth inhibition of 50% (GI50), Total Growth Inhibition (TGI) and lethal concentration 50% (LC50) of *G. tiliaefolia* extract evaluated against all the three cancer cell lines. The efficacy of the extract is found to be highest against MCF7 cells and then followed by HepG2 cells and A549 cells.\[^{35}\]
Antibacterial Property: The petroleum ether extract shows good antibacterial activity against all the clinical strains of bacteria having inhibition zones of 8.7-17.8 mm for the strains of Pseudomonas aeruginosa and 6.6-11.2 mm for the strains of Klebsiella pneumonia. The chloroform and methanolic extracts were effective against both the species of bacteria and their clinical isolates.\[36\]

Hepatoprotective/radioprotective activity: The methanolic extract obtained from the stem bark of Grewia tilifolia have resulted in the isolation of g-lactones, having hepatoprotective activities. The fruit that contains anthocyanin-type cyanidin 3- galactoside, vitamins C and A, minerals, carotenes and dietary fibers was found responsible for radioprotective effect.\[37\]

Analgesic and antipyretic activity: The aqueous extract of Grewia tilifolia leaves shows analgesic and antipyretic activity. Antipyretic activity of the extract studied using yeast induced hyperpyrexia in Wistar rats. Morphine and paracetamol at the dose of 10 and 150mg used as standard drugs for the analgesic and antipyretic activity respectively. The effect observed was comparable to that of paracetamol.\[38\]

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