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Phytochemical, Ecological and Morphological Study of *Hasoli* and *Char* Plants: An Overview

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Abstract: *Shiral, or Hasoli, is a member of the Malvaceae family and can be found all throughout India. It is often used for a wide range of ailments, including colds, diarrhoea, hepatitis, heat stroke, dyspepsia, wound healing, fever, and pesticides. This review gives a full summary. Of the phytoconstituents, traditional uses, and various activities present in the distinct portions of the Hasoli plant. An initial photochemical analysis of the crude methanolic extract of Hasoli stem bark revealed the presence of flavonoids, diterpenes, alkaloids, saponins, tannins, and phenols. This plant possesses qualities that kill cells, protect cells from damage, fight germs and fungi, relieve pain, stabilize membranes, stop diarrhoea, and break down blood clots. People have used Hasoli for a long time to cure wounds, hepatitis, fever, cold, diarrhoea, and heat stroke. Indian tribes use Char (Anacardiaceous), a magical herb, to treat many different kinds of sicknesses. The aim of the present review is to examine the literature for studies on the pharmacological properties, pharmacognostic evaluations, and phytochemical analyses of Char. The data gathered can help the researchers focus on the most significant areas of study that haven't been looked into yet. The plant's information has been collected from many different journals and publications. The review reached a conclusion concerning the particulars of pharmacological activities, phytochemical isolation, toxicity research, and other existing and emerging fields of study related to this plant, especially in the domain of phytomedicines and pharmaceuticals.*

Keywords: *Hasoli, Phytoconstituents, Pharmacological activity, Pharmacogenetic study Anacardiaceous, Char, and safety*

1. Introduction

The non-nutrient components of plants are the primary source of novel pharmaceuticals. These components are intricate, distinct, and unique. Plant extracts comprise phytochemical constituents that exhibit a diverse array of bioactive therapeutic properties. *Microcos* is the genus encompassing the 60 species under the *Tiliaceae* family. These plants are located in Africa, India, Malaysia, and Indonesia. The three primary species located in Southwest and West China are *Microcos chungii (Merr.) Chun, Microcos stauntoniana G. Don*, and *Microcos chungii (Merr.) Chun. Grewia nervosa*, commonly referred to as *Hasoli*, is a plant utilized for both culinary and medicinal purposes. These plants are either small trees or shrubs. In traditional medicine, the dried bark, roots, fruits, and leaves of *Microcos* species have been utilized. Utilized as insecticides, general tonics, and remedies for diarrhea and fever [1-5]. *Kathgua*, or *Fattashi*, is the indigenous designation for Hasoli (family: *Tiliaceae*), prevalent throughout Bangladesh. It typically develops independently as a small tree or shrub. This plant has historically been utilized to treat heat stroke, hepatitis, diarrhoea, wounds, fever, colds, and dyspepsia. It also exterminates insects. *Char* originates from the Indian subcontinent. It is an excellent tree species with diverse uses, belonging to the *Anacardiaceae* family. Indigenous wisdom asserts that nearly every component of the plant, including the roots, leaves, fruits, seeds, and gum, possesses

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significant medicinal properties. The deciduous tree *Char* produces edible seeds for human use. These seeds are referred to as *Charoli* or *Chironji*. In India, these almond-flavored seeds are typically utilized as a culinary spice [6, 7]. Applications in therapy. The tree's gum is utilized in traditional medicine for the treatment of leprosy. *Charoli* seeds are utilized in both Unani and Ayurvedic therapy. The roots are cold, pure, astringent, acrid, and induce constipation. They are effective in treating diarrhea [8]. Individuals employ the fruits to alleviate asthma and coughing. The seeds are beneficial for health and assist in expelling phlegm. The oil derived from kernels is utilized to eliminate blemishes and stains on the face. The sap from the leaves is beneficial for digestion, elimination, and libido (fig.1 & 2). After being combined with goat milk, the gum serves as an analgesic [9].

Fig. 1 *Hasoli* plant

Fig. 2 *Char* seeds

***Hasoli* plant**

A little tree or shrub with nearly glabrous branches. The stipules and petioles are arranged alternately with the leaves. The stipules are 0.5 to 0.8 cm in length and may be deeply incised, falcate, or linear to lanceolate in shape. The petiole is pulvinate, measuring 0.2 to 0.7 cm in length, and has some pubescence. It is densely covered with stellate hairs at the base of the lamina. The dimensions are 5–25 × 2.5–7(–10) cm, featuring a heart-shaped or rounded base, subtly serrated or crinkled edges, and an elongated acuminate or caudate apex [10]. It resembles leather, containing three nerves originating from the base, along with five to six pairs of lateral nerves that are distinctly visible on the underside, grouped in a transverse and parallel configuration [11].

The inflorescences consist of terminal or axillary panicles about 10–15 cm in length, featuring triflorous cyme-like units adorned with minute stellate hairs. Four to six deeply incised involucre bracts encircle the cymes. The peduncle, around 0.5 cm in length and covered in dense hair, is roughly equivalent in length to the bracts. The bracteoles are elongated and narrow, measuring approximately 0.7 cm in length, and possess minimal hair coverage. The flowers possess little pedicels measuring approximately 0.2 cm in length, which are adorned with hairs. The sepals exhibit a smooth inside and possess few hairs on the exterior. They are spatulate, measuring around 0.8 × 0.3 cm, featuring a sharp tip and an undulating edge. They possess a lackluster yellow hue. The petals are around 0.3 × 0.1 cm and exhibit a yellow-white coloration. The lower portion is glandular and covered in tomentum, whilst the base is truncated and the upper section is sinuate. The *androgynophore* is conical in shape and is around 0.1 cm in length. It lacks a superior section. The base has few hairs, the anthers are yellow, and numerous stamens possess filaments of 0.2 to 0.4 cm in length. The spherical, smooth ovary comprises three cells, each containing one or two ovules. Its diameter is around 0.1 cm. The style measures around 0.4 cm in length and tapers as it ascends. The stigma possesses three arms, characterized by a flat side and a curved side [15]. The fruits are smooth and either round or obovoid, measuring 0.8 to 1 cm in diameter. Upon full maturation, they become black and possess a fibrous endocarp. Three to six pyrenes are either round or trapezoidal and are unattached to the fruit. The period from May to February is characterized by the blooming of flowers and the ripening of fruit (fig. 3) [16].

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Fig. 3 Flowers and fruits of *Hasoli*

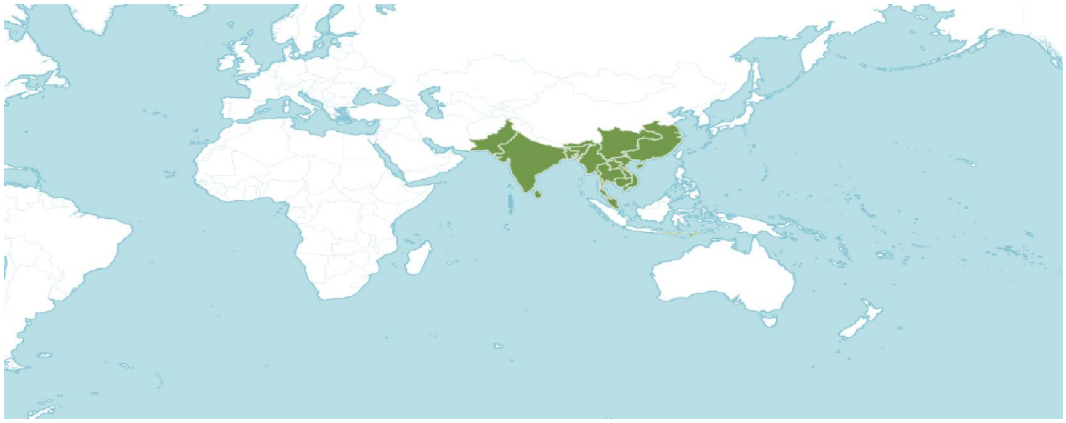

Fig. 4 Habitat of *Hasoli*

It is prevalent in the Andaman Islands, Assam, Bangladesh, Cambodia, South-Central China, Southeast China, the Eastern Himalayas, Hainan, India, Laos, the Lesser Sunda Islands, Malaya, Myanmar, the Nicobar Islands, Pakistan, Sri Lanka, Thailand, and Vietnam (fig. 4) [5].

Taxonomical Classification

Table 1. Taxonomical Classification

Taxonomy	
Kingdom	Plantae
Division	Tracheophytes
Subdivision	Spermatophytes
Order	Malvales
Family	Malvaceae
Subfamily	Grewioideae
Genus	*Microcos*
Species	*Microcos paniculata*

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***Char* Plant**

Subdeciduous trees can reach a height of 18 meters, with bark thickness ranging from 10 to 12 mm. The surface is black or dark brown, textured, and features deep, tiny fissures like crocodile skin. The leaves are simple, arranged alternately, and include stipules. The petiole measures 12 to 22 mm in length, exhibiting thickness and a smooth texture. The lamina is 10–23.5 cm in length and 5–12 cm in width, typically rectangular, including either a rounded or pointed base and a blunt or notched apex. The edge is complete, exhibiting a smooth upper surface and a dense covering of hairs on the lower side, with a leathery texture. There exist 10 to 20 pairs of lateral nerves that are pinnate, conspicuous, and pubescent. There are also considerable secondary laterals. The intercostal muscles are pronounced and exhibit a reticular configuration. The flowers exhibit a greenish-white hue and possess both male and female reproductive structures.

During the summer, the tree possesses either no leaves or a minimal quantity for a short duration. The flowers exhibit a greenish-white hue and blossom from January to March. The fruits mature from May to June.6 The fruits become red upon complete maturation. The procedure commences in mid-April and concludes in mid-June, although requiring just 15 to 20 days for fruit collection. The harvesting season may vary, allowing fruit to be collected in several agro-climatic zones (fig. 6) [18].

Fig. 5 Flowers and fruits of *Char*

Scientific classification Kingdom:
Kingdom Plantae, Phylum Tracheophyta
Class :*Magnoliopsida*
Order: Sapindales
Family: *Anacardiaceae*
Subfamily : *Anacardioideae*
Genus: *Buchanania*
Species: *B. lanzan*
Binomial nomenclature: *Buchanania lanzan*
Synonyms - *Buchanania latifolia ROXB.: almondette, cheronjee, cuddapah almond.*
Overview
Common Names: *Almondette, cheronjee, cuddapah almond*
Hindi Names: *Achar, char, charoli, charoli-kernel, chiraunji, chironji;*
Kannada Names: *Chaara pappu, chaaruvaala, chalaali, char, charoli.*
Sanskrit Names: Akhatta, bahulavalkala, Cara, chara, charaka, dhanu, dhanushpatta;
Tamil Names: Modama, moraimaram, morala, mudaikkai, mudaima

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Utilized Components: roots, leaves, fruits, seeds

Habitat

India possesses seven recognized species of *Buchanania. B. lanzan* (sometimes referred to as *B. latifolia*) and B. fruits from axillaries (also known as *angustifolia*) are also consumable. *B. lanceolata* is classified as an endangered species. It is located in the verdant forests of Kerala. *B. platyneura* is endemic to the Andaman Islands. This group also includes *B. lucida, B. glabra, and B. acuminata* [17]. Char is the most significant and extensively distributed species in India. Mr. Hamilton, a forester who initially identified this species in Burma in 1798, designated the genus *Buchanania*. It originated in the Indian subcontinent and is currently present in India, Nepal, Burma, and several other nations [18].

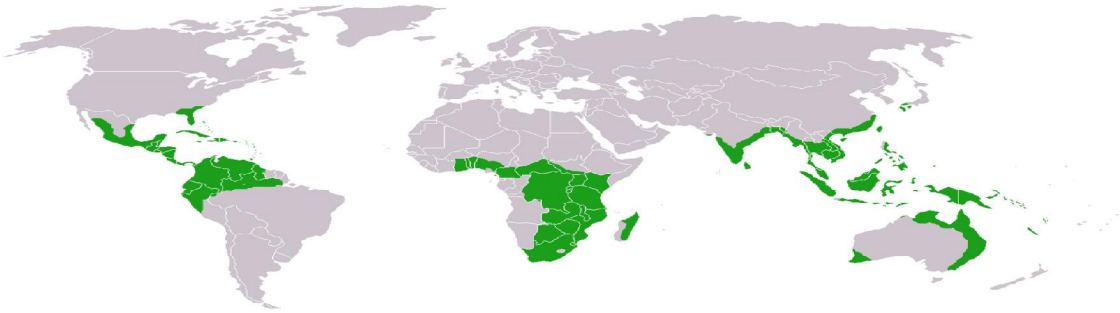

Fig. 6 Habitat of *Char* plant

Photochemistry and pharmacological study of *Hasoli* plant

Mei Q et al. (2010) investigated the anti-inflammatory characteristics of the water extract from Hasoli to validate its therapeutic applicability. They utilized multiple inflammatory models, including animals exposed to xylene-induced auricular edema and acetic acid-induced augmentation of capillary permeability, to evaluate the anti-inflammatory effects. The results demonstrated that all three dosages of Hasoli greatly reduced the increase in capillary permeability, while both high and medium doses of the plant notably mitigated ear edema [20].

Aziz MA et al. (2015) employed a proteinase inhibitory test, a *Pheretima postmortem* model, and an α-amylase inhibitory assay to evaluate the anti-inflammatory, anthelmintic, and antidiabetic activities of the aqueous extract of *Hasoli* fruits (FAE). FAE had significant ($P<0.05$) anti-proteinase activity in the proteinase inhibitory experiment, attaining 41.05% proteinase inhibition at 250 µg/mL, with an IC50 of 285.47 mg/mL. *Pheretima posthumous* experienced paralysis and subsequently succumbed at 34.24 and 55.25 minutes, respectively, following the treatment of 50 mg/mL of FAE. Furthermore, the extract demonstrated substantial ($P<0.05$) inhibition of α-amylase, with an IC50 value of 1367.56 mg/mL [21].

Rahman MA (2011) utilized an ethanolic extract of desiccated *Hasoli* leaves to examine possible cytotoxic and analgesic effects in animal models. Their investigation indicated that delivering oral doses of 250 and 500 mg/kg of body weight equivalent to acetic acid to mice significantly diminished writhing. 25 mg/kg of body weight of the widely used medication diclofenac sodium. The crude ethanolic extract of the chosen plant demonstrated the most pronounced cytotoxic action against brine shrimp (LC50 = 60 µg/ml and LC90 = 120 µg/ml) [22].

Sarker MA et al. conducted a phytochemical analysis of the methanolic extract of *Hasoli* stem bark in 2016. Flavonoids, diterpenes, alkaloids, saponins, tannins, and phenols were identified. They have also investigated the mechanism by which the methanolic extract functions in vitro to dissolve blood clots and stabilize membranes. The in vivo analgesic and antidiarrheal properties were assessed using castor oil and acetic acid writhing-inducing methods, respectively. Phytochemical study identified flavonoids, diterpenes, alkaloids, saponins, tannins, and phenols at doses of 400 mg/kg and 200 mg/kg, respectively. The chosen plant extract demonstrated the highest inhibition of diarrhoea, with rates of 63.30% and 56.70%, during the assessment of *Hasoli*'s anti-diarrheal efficacy. Research on analgesic efficacy revealed that dosages of 500 mg/kg and 250 mg/kg resulted in pain inhibition of 41.36% and 32.0%,

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respectively. Demonstrated a 46.64% reduction in discomfort compared to ibuprofen, a widely used analgesic. The membrane stabilization investigation indicated that a higher dosage resulted in enhanced suppression of hemolysis. A similar outcome was observed in thrombolytic activity, indicating that the thrombolytic efficacy of the plant extract augmented with greater dosages [23].

Photochemistry and pharmacological study of *Char* plant

Table 2. Medicinal uses of different plant parts of *Char* plant

Medicinal Uses	Parts used	Reference
Skin problem	Leaves	[24],[25]
Remove spots from skin and blemishes	Seed oil	[26]
Anti-snake venom activity	Bark	[27],[24]
Wound healing property	Root	[24]
Alzheimer's,	Kernel	[24]
Blood dysentery	Seed oil	[26]
Reduce mycotoxin	Bark	[28],
Wound healing property	Root	[24]
Memory booster	Kernel	[24]
Skin problem	Leaves	[24]
Depurative	Bark	[29]
Constipating	Bark	[29]
Brain tonic	Bark	[30]
Cardiotonic	Bark	[30]
Glandular swelling	Bark	[30]
Intrinsic hemorrhage	leaf decoction	[29]
Fever and burning sensation.	leaf decoction	[29]
Blood dysentery	Powder of the bark	[31]
Antidiabetic	Leaf Extract	[31]
Wound healing activity	Ethanolic Leaf Extract	[31]
Adaptogenic activity	Methanolic Extract	[31]

This study utilized the polyphenolic content of *Char* to assess the antioxidant activity of the alcoholic extracts. Seeds were generated by traditional extraction methods, such as Soxhlet extraction and cold maceration. We found out how much phenolic and flavonoid was in each extract. The Soxhlet extract had the least of these parts, while the cold macerated extract had the most. You can use the DPPH and FRAP tests to assess how well something functions as an antioxidant. The DPPH test showed that cold macerated extract was a better antioxidant than Soxhlet extract. It stopped 50% of the activity at a concentration of 273.62 ± 1.61 µg/mL, while Soxhlet extract stopped 50% of the activity at 670.7 ± 4.03 µg/mL. We also examined at how effectively these extracts may lower anything. The findings demonstrated that, in contrast to the Soxhlet extract, the cold macerated extract displayed a substantial reduction in capacity. The cold macerated alcoholic extract had more phenolic and flavonoid chemicals, which made it a better antioxidant [32].

Char leaf extract exhibited antibacterial and antifungal properties comparable to well-known antibiotics such as Fluconazole (10 mg), ampicillin, penicillin-G, and streptomycin (10 units/disc). The methanol leaf extract of Char exhibited superior antibacterial activities compared to extracts from petroleum ether, chloroform, and water. *E-Coil* was the best in killing germs. *Coli*,. *aeruginosa*, and *S. aureus* were studied, and it was found that *Aspergillus* species were more sensitive to antifungal action than Penicillium [33].

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Diabetes mellitus is a chronic metabolic condition characterized by elevated blood glucose levels and impaired metabolism of fats, proteins, and carbohydrates. It is caused by not enough insulin or insulin not working as well as it should. Hyperlipidemia is a metabolic outcome linked to both clinical and experimental diabetes. We use streptozotocin-induced kind I and II diabetic rats to test the methanolic extract of *Char* to see if it may lower blood sugar and cholesterol levels. For 21 days, the methanolic extract of Char at doses of 100 and 200 mg/kg p.o. significantly ($p < 0.05$) reduced blood glucose levels in a dose-dependent manner. As a result, it was shown that the active components of this plant, including glycosides, carbohydrates, sterols, and flavonoids, may be responsible for its antidiabetic and antihyperlipidemic properties [34].

Peptic ulcer disease is a dangerous digestive disease that demands a treatment plan that is made just for you. The effectiveness of *Char* root extract in ethanol for preventing ulcers is being tested. Researchers have examined the ethanolic root extract's capacity to stop ulcers in mice and rats that had pylorus ligation-induced ulcers at different levels (200 and 400 mg/kg). The ethanolic extract was found to stop the buildup of gastric secretions caused by pylorus ligation. It also had dose-dependent protective effects and significantly protected against ulcers in both models. So, the extract works to treat and stop stomach ulcers [35].

2. Conclusion

This review aims to deliver a comprehensive examination of the historical uses, botanical attributes, phytochemical composition, pharmacological effects, quality control, and toxicological aspects of *Hasoli* and *Char* leaf, fruit, bark, and root extracts as recorded in recent decades. The new research findings will enhance the understanding of the biological mechanisms of this medicinal plant and will be crucial for the future development of innovative herbal products and functional foods.

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