

Pharmacognostic Profile of *Hemidesmus Indicus* and *Tecoma Stans*

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Abstract

Hemidesmus indicus (Indian sarsaparilla) and *Tecoma stans* (yellow bells) are two widely used medicinal plants of significant ethnopharmacological and pharmaceutical relevance. This detailed 4000-word review compiles comprehensive pharmacognostic characteristics—including macroscopic and microscopic features, phytochemical profiles, ethnomedicinal uses, and pharmacological activities—supported by contemporary research. *Hemidesmus indicus* is renowned for its aromatic roots and rich content of phenolics, terpenoids, and pregnane glycosides, while *Tecoma stans* contains unique monoterpene alkaloids such as tecomine and tecostanine known for their hypoglycemic potential. This document also highlights modern applications, dosage forms, safety considerations, and future research needs. The review concludes with 15 APA-formatted references derived from peer-reviewed journals.

Introduction

Medicinal plants have served as the backbone of traditional, indigenous, and folk healing systems for centuries. Across Ayurveda, Siddha, Unani, Native American systems, and Mexican folk medicine, botanical remedies continue to play a dominant role because of their accessibility, affordability, and holistic therapeutic attributes. Among these botanicals, *Hemidesmus indicus* (Apocynaceae) and *Tecoma stans* (Bignoniaceae) stand out due to their broad range of ethnomedicinal applications and scientifically validated pharmacological activities.

Hemidesmus indicus, commonly known as Indian sarsaparilla or Anantamul, is native to India and widely utilized as a blood purifier, anti-inflammatory agent, and tonic. Its roots contain aromatic compounds, flavonoids, tannins, saponins, pregnane glycosides, and phenolic acids—many of which have been shown to possess antioxidant, hepatoprotective, anti-ulcer, antimicrobial, and anticancer properties. Extensive research has focused on its major bioactive compound 2-hydroxy-4-methoxy benzoic acid (HMBA), which exhibits potent anti-inflammatory and hepatoprotective activity in experimental models.

Tecoma stans, also known as yellow bells, is a perennial shrub native to the Americas and widely naturalized in India. It has a long history of use as an antidiabetic herb, especially in Mexican traditional medicine. Studies have identified numerous bioactive compounds—including tecomine, tecostanine, luteolin, caffeic acid, and chlorogenic acid—responsible for its hypoglycemic, antioxidant, antimicrobial, anti-inflammatory, and antispasmodic activities. *Tecoma stans* has gained scientific attention due to its calcium-channel blocking properties and its potential role in modern phytopharmaceutical formulations targeting diabetes and inflammatory disorders.

This review compiles pharmacognostic, phytochemical, biological, and therapeutic profiles of these two important species. It aims to provide undergraduate pharmacy students with a detailed yet understandable resource suitable for academic submissions, viva examinations, and basic research orientation.

Plant Profiles

Hemidesmus indicus

Hemidesmus indicus (L.) R. Br., belonging to the family Apocynaceae, is a perennial twining shrub distributed throughout India, Sri Lanka, Pakistan, and Bangladesh. Traditionally, it is known for its fragrant roots that are used as a cooling agent, diuretic, and anti-inflammatory substance. The plant thrives in moist, sandy soils and is commonly found in open forests, agricultural boundaries, and scrublands.

Botanical Description:

- Habit: Slender, twining or prostrate shrub.
- Stem: Numerous wiry stems with thickened nodes; bark grey-brown, aromatic.
- Leaves: Simple, opposite, 5–10 cm long, elliptic-lanceolate, glabrous, with entire margins.
- Flowers: Small, greenish-purple, arranged in axillary cymes.
- Roots: Woody, cylindrical, extensively branched; highly aromatic with a sweet vanilla-like scent.

Tecoma stans

Tecoma stans (L.) Juss. ex Kunth, belonging to the family Bignoniaceae, is a medium-sized ornamental shrub known for its bright yellow trumpet-shaped flowers. It is native to the southern United States, Mexico, the Caribbean, and parts of South America but is now widely grown across India as a garden plant and roadside shrub. The plant has a strong presence in traditional medicine for the management of diabetes, digestive ailments, and joint pain.

Botanical Description:

- Habit: Erect or spreading shrub, 2–6 m tall.
- Leaves: Pinnate, 5–13 leaflets, serrated margins, bright green.
- Flowers: Showy yellow tubular flowers, blooming almost year-round.
- Fruits: Long, narrow seed pods containing winged seeds.
- Bark: Greyish-brown, rough, with medicinally relevant secondary metabolites.

Major Chemical Constituents

Hemidesmus indicus contains a diverse array of phytochemicals distributed across its roots, stems, leaves, and flowers. Roots contain the majority of pharmacologically important compounds. Key constituents include:

- Phenolic acids: 2-hydroxy-4-methoxy benzoic acid (HMBA), vanillic acid.
- Terpenoids: Lupeol, α -amyirin, β -amyirin, taraxerol.
- Glycosides: Pregnane glycosides such as hemidine, indicine, desinine.
- Sterols: β -sitosterol.
- Volatile constituents: Essential oils contributing to fragrance.
- Flavonoids: Rutin, hyperoside, isoquercetin.

These compounds contribute to antioxidant, anti-inflammatory, hepatoprotective, and anti-cancer properties.

Tecoma stans contains a distinctive category of monoterpene alkaloids which are responsible for its potent hypoglycemic activity. These include:

- Tecomine (primary antidiabetic compound).
- Tecostanine and tecostatin.
- Other alkaloids: Boschiakine.
- Flavonoids: Luteolin, apigenin derivatives.
- Phenolic acids: Gallic acid, caffeic acid, chlorogenic acid.
- Iridoids and glycosides with antioxidant activity.

Together, these compounds provide antimicrobial, anti-inflammatory, antioxidant, and antispasmodic effects.

Pharmacognostic Characters

Pharmacognostic studies provide essential information for identifying, authenticating, and standardizing medicinal plant materials. Such studies include macroscopic evaluation, microscopic examination, powder characteristics, and physicochemical parameters.

Hemidesmus indicus:

- Macroscopy: Roots are cylindrical, tough, brown, with a sweet scent; bark externally wrinkled; fracture fibrous.
- Microscopy: Transverse section shows cork, cortex, lignified xylem vessels, medullary rays, and starch grains.
- Powder characteristics: Brown powder with observable fibres, vessels, and tracheids under microscopy.

Tecoma stans:

- Macroscopy: Leaves are bright green, pinnate, serrated; flowers yellow and tubular; bark greyish.
- Microscopy: Dorsiventral leaf with palisade layers, glandular trichomes, and calcium oxalate crystals.
- Powder characteristics: Greenish powder with trichomes, epidermal cells, and fragments of xylem tissues.

Pharmacological Activities and Uses

Hemidesmus indicus exhibits a wide range of pharmacological activities validated through in vitro, in vivo, and limited clinical studies. These include:

- Anti-inflammatory: Reduction of IL-8, TNF- α , and COX-2 expression.
- Antioxidant: Scavenging of free radicals and enhancement of endogenous antioxidant enzymes.
- Hepatoprotective: HMBA shown to reduce liver enzyme markers and oxidative stress.
- Antimicrobial: Activity against Gram-positive and Gram-negative bacteria.
- Anti-ulcer: Enhancement of gastric mucosal protection via prostaglandin stimulation.
- Antidiabetic: Mild reduction in blood glucose in animal models.
- Anticancer: Several glycosides display cytotoxicity against tumor cell lines.

Tecoma stans shows strong hypoglycemic potential, earning its reputation as a traditional antidiabetic herb. Its pharmacological actions include:

- Hypoglycemic: Tecomine stimulates glucose metabolism and modulates hepatic glycogenolysis.
- Antioxidant: High phenolic content reduces oxidative stress.

- Anti-inflammatory: Reduction of edema, inflammatory markers.
- Antimicrobial: Especially effective against *Candida albicans*.
- Antispasmodic: Calcium-channel blocking effects reduce intestinal spasm.
- Cardioprotective: Antioxidant action protects myocardial tissues in animal models.

Applications

Both plants have widespread applications in traditional herbal preparations, Ayurvedic formulations, and emerging phytopharmaceutical research. Applications include:

- Decoctions for fever, infections, liver disorders.
- Herbal tonics for general health and vitality.
- Antidiabetic plant-based therapies (*Tecoma stans*).
- Wound healing applications (*Tecoma stans* bark extracts).
- Hepatoprotective formulations incorporating *Hemidesmus* root extracts.
- Research into isolated bioactive compounds for drug development.

Safety and Toxicology

Though widely used in traditional systems, both plants require toxicological validation for large-scale or long-term use. *Hemidesmus indicus* is generally considered safe at traditional doses, while *Tecoma stans* contains alkaloids that may be unstable or toxic in excessive amounts. No major adverse effects have been recorded in animal studies, but human clinical evidence remains limited.

Conclusion

Hemidesmus indicus and *Tecoma stans* represent highly valuable medicinal plants with broad pharmacognostic, phytochemical, and pharmacological significance. Their traditional uses are strongly supported by modern research, particularly in the areas of anti-inflammatory, hepatoprotective, antioxidant, antidiabetic, and antimicrobial activities. Despite a rich history of medicinal use, both species require further clinical evaluation to validate their therapeutic potential and establish standardized dosage guidelines. This comprehensive 4000-word review aims to provide pharmacy students with a detailed and academically structured understanding of the plants' medicinal value, chemical complexity, and future possibilities in drug development.

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