American Journal of Essential Oils and Natural Products

Available online at www.essencejournal.com

AJEONP

American Journal of Essential Oils and Natural Products

ISSN: 2321-9114
https://www.essencejournal.com
AJEONP 2024; 13(1): XX-XX

Received: 02-07-2025
Accepted: 15-07-2025

**Siti Mariam Binti Rahman**
School of Natural Product Research, Faculty of Life Sciences, University of Malaya, Kuala Lumpur, Malaysia

**Corresponding Author:**
**Siti Mariam Binti Rahman**
School of Natural Product Research, Faculty of Life Sciences, University of Malaya, Kuala Lumpur, Malaysia

# Essential phytoconstituents and bioactive potentials of *Helicteres isora* in natural product research

**Siti Mariam Binti Rahman**

**Abstract**
*Helicteres isora* L. (Malvaceae), known popularly as the Indian screw tree, has gained increasing scientific attention due to its wide range of ethnomedicinal applications and rich secondary metabolite profile. Traditionally employed in the management of diarrhea, dysentery, diabetes, wounds, and respiratory ailments, the plant has been a component of classical Ayurvedic and folk medicine for centuries. Recent research indicates that its fruits, roots, bark, and stems harbor phenolics, flavonoids, tannins, triterpenoids, phytosterols, neolignans, and cucurbitacins that contribute to multiple biological activities. Antioxidant, antidiabetic, antimicrobial, anti-inflammatory, analgesic, cytoprotective, and hepato-renal protective properties have been reported across *in vitro* and *in vivo* models. Despite such promising results, there remains a gap in comprehensive standardization, isolation of bioactive compounds, and clinical evaluation. This paper reviews essential phytochemical classes of *H. isora*, critically evaluates its reported pharmacological activities, and highlights the safety profile and future potential of the species as a natural product resource.

**Keywords** *Helicteres isora*, phytoconstituents, antidiabetic, antioxidant, pharmacology, natural product research

## Introduction
Natural products are well known as valuable reservoirs of therapeutic molecules and lead compounds in modern drug discovery. Medicinal plants used in folk systems often provide clues to molecules with diverse biological actions, and the validation of such plants is central to bridging traditional knowledge with contemporary pharmacological research. Among several Indian medicinal plants, *Helicteres isora* L. occupies a unique position. Its twisted fruits are widely recognized and have historically been prescribed as an astringent remedy for bowel complaints. Beyond these uses, the plant has figured in local traditions for management of fever, skin diseases, diabetes, and general debility (Suthar *et al*., 2009) [1].
In recent years, the species has been increasingly explored by phytochemists and pharmacologists. Studies have revealed a rich chemical matrix comprising phenolic acids, flavonoid glycosides, rosmarinic acid derivatives, neolignans known as helicterins, triterpenoids such as betulic acid, sterols like β-sitosterol, and even cucurbitacins with cytotoxic potential (Rattanamaneerusmee *et al*., 2018; Bilal *et al*., 2025) [6, 2]. These phytoconstituents collectively underpin the broad spectrum of bioactivities attributed to the plant.
The current review aims to consolidate knowledge about essential phytoconstituents and bioactive potentials of *H. isora*, presenting a coherent picture for postgraduate students and researchers. It also identifies methodological gaps that future investigations need to address.

## Objectives
The objectives of this review are threefold. First, to provide a consolidated description of the botanical and ethnomedicinal background of *Helicteres isora*. Second, to critically summarize the phytochemical profile of the species, emphasizing compounds with proven pharmacological interest. Third, to review the bioactive potentials demonstrated in experimental models, discuss safety and toxicological data, and reflect on research gaps that must be bridged for the plant to advance from laboratory evidence to translational applications.

## Botanical and Ethnomedicinal Background
*Helicteres isora* is a shrub or small tree growing up to six meters in height, distributed widely

across India, Sri Lanka, Nepal, Bangladesh, and parts of Southeast Asia. It prefers dry deciduous forests and open scrubland. The leaves are ovate with serrated margins, the flowers reddish, and the fruits strikingly twisted, resembling screws, which inspired its common name. Ethnomedicinally, fruits are used for diarrhea, dysentery, and constipation; bark poultices are applied on wounds and skin lesions; and root extracts are administered for diabetes and fever (Suthar *et al*., 2009) [1]. These uses reflect an interplay of astringent, demulcent, antimicrobial, and metabolic activities that later scientific studies have partly corroborated.

**Phytochemical Profile**

Phytochemical investigations have shown the presence of diverse classes of compounds. Fruits are rich in phenolics and flavonoids including rosmarinic acid and its glycosylated derivatives. Neolignans, designated helicterins A-F, have been isolated from aqueous fruit extracts (Rattanamaneerusmee *et al*., 2018) [6]. Roots yield betulic acid, sitosterol, and cucurbitacin B, while bark demonstrates tannins, saponins, alkaloids, and glycosides (Bilal *et al*., 2025) [2]. These molecules are believed to act synergistically to provide antioxidant, antimicrobial, and antidiabetic effects. Stem studies have similarly identified phenolics and flavonoids, contributing to its pharmacological relevance (Latif *et al*., 2024) [4].

Extraction techniques usually involve hydroalcoholic solvents, followed by fractionation with chloroform, ethyl acetate, or n-butanol to separate compounds by polarity. Analytical approaches include total phenolic and flavonoid estimation using Folin-Ciocalteu and $AlCl_3$ methods, chromatographic fingerprinting via HPTLC, HPLC-DAD, and GC-MS, and compound isolation with structural elucidation using NMR and MS techniques.

**Fig 1:** Field photograph of Helicteres isora shrub showing its natural growth habit in dry deciduous forest conditions.

Figure 1 depicts the natural growth habit of Helicteres isora in its native dry deciduous forest environment. The shrub shows its characteristic serrated ovate leaves and screw-like fruiting bodies, which are important diagnostic features for pharmacognostic identification. Such field documentation supports accurate authentication of the species and provides ecological context that may influence its phytoconstituent profile.

**Pharmacological Activities**

One of the most consistently reported activities is antioxidant potential. *In vitro* assays such as DPPH and FRAP have demonstrated strong radical-scavenging capacity of fruit extracts, with acetone extracts showing $IC_{50}$ values in the single-digit microgram range (Rattanamaneerusmee *et al*., 2018) [6].

Antidiabetic activity has been highlighted in both *in vitro* enzyme inhibition assays and *in vivo* diabetic models. Suthar *et al*. (2009) [1] reported enhanced glucose uptake in rat diaphragm preparations, while Bilal *et al*. (2025) [2] demonstrated that chloroform fractions significantly reduced blood glucose in alloxan-induced diabetic rats. These extracts also normalized liver and kidney biochemical markers, suggesting systemic metabolic protection.

Antimicrobial properties are attributed to tannins and triterpenoids. Tambekar *et al*. (2008) [3] found that aqueous and alcoholic fruit extracts inhibited a spectrum of Gram-positive and Gram-negative bacteria. Anti-inflammatory and analgesic activities have been reported for stem and bark extracts, with inhibition of edema and significant pain-relief activity in animal models (Latif *et al*., 2024) [4]. Wound-healing properties have also been described, likely due to combined antioxidant and astringent mechanisms.

Safety studies indicate relatively low toxicity. Aqueous bark extract showed no mortality at 2000 mg/kg in rats, and subacute administration over 28 days produced no adverse hematological or histopathological changes (Preliminary Toxicity Study, 2007). Similarly, stem extracts were tolerated in mice up to several grams per kilogram (Latif *et al*., 2024) [4].

**Discussion**

The available literature on *Helicteres isora* clearly demonstrates that this plant harbors an abundance of bioactive molecules capable of producing pharmacological effects relevant to modern health challenges such as diabetes, oxidative stress, and infectious diseases. The antidiabetic potential is especially notable, with multiple studies showing significant hypoglycemic effects in experimental models, likely mediated through inhibition of carbohydrate-digesting enzymes and improvement of insulin sensitivity. Antioxidant and anti-inflammatory actions provide a mechanistic rationale for its hepatoprotective and renoprotective activities as observed in toxicant-induced injury models.

However, the existing evidence base has limitations. Many studies rely on crude extracts without standardization, making reproducibility and inter-laboratory comparison difficult. Quantification of marker compounds and validation of analytical methods are often missing. Mechanistic studies at the molecular level remain superficial, and pharmacokinetic data on absorption and metabolism are absent. Human clinical trials are virtually nonexistent. For the plant to progress into translational research, standardized extracts anchored to well-defined phytoconstituents such as rosmarinic acid derivatives or cucurbitacins must be developed. In parallel, mechanistic exploration at the signaling pathway level and long-term toxicity profiling are essential.

From a postgraduate researcher's perspective, *H. isora* provides an attractive model to learn comprehensive pharmacognosy—from authentication and extraction to phytochemical analysis, bioassay correlation, and safety evaluation. It also offers the chance to generate publishable data by addressing obvious gaps such as compound-specific bioactivity mapping, pharmacokinetics, and the design of combination formulations.

## Conclusion

*Helicteres isora* is a botanically distinctive and pharmacologically rich species. Its ethnomedicinal claims are substantiated by preclinical evidence showing antioxidant, antidiabetic, antimicrobial, anti-inflammatory, and organ-protective activities. The phytochemical diversity, including phenolics, flavonoids, neolignans, triterpenoids, sterols, cucurbitacins, and tannins, provides a solid foundation for further natural product research. Despite this promise, translation into clinical or commercial application is hindered by lack of standardization, inadequate mechanistic studies, and absence of clinical evaluation. With systematic research focusing on these gaps, *H. isora* can emerge as a valuable contributor to phytopharmaceutical development and integrative medicine.

## References

1. Suthar M, Rathore GS, Pareek A. Antioxidant and antidiabetic activity of *Helicteres isora* Linn. fruits. Indian Journal of Pharmaceutical Sciences. 2009;71(6):695-699.
2. Bilal H, Khan M, Shah S, Ghias M, Khan A, Zahoor M, Ullah R, Iqbal Z, Shah A. Protective effect of *Helicteres isora* on hepatorenal toxicity and diabetes in animal models. Open Chemistry. 2025;23(1):20250133.
3. Tambekar DH, Khante BS, Chandak BR, Titare AS, Boralkar SS, Aghadte SN. Evaluation of phytochemical and antibacterial potential of fruits of *Helicteres isora* Linn. Research Journal of Microbiology. 2008;3(3):164-167.
4. Latif MA, Asaduzzaman F, Yasmin F, Motaher M, *et al*. Study of antioxidant, cytotoxic, and analgesic properties of the stem of *Helicteres isora* Linn. Mediterranean Journal of Basic and Applied Sciences. 2024;8(2):1-20.
5. Kadus PA, Giramkar AA, Nirmal SA. A review on: Avartani (*Helicteres isora*). Int J Agric Nutr. 2023;5(1):55-58. DOI:10.33545/26646064.2023.v5.i1a.100
6. Rattanamaneerusmee K, *et al*. Chemopreventive and biological activities of *Helicteres isora* fruit extracts. Research in Pharmaceutical Sciences. 2018;13(6):543-551.
7. Preliminary toxicity and phytochemical studies of aqueous bark extract of *Helicteres isora* Linn. International Journal of Pharmacology. 2007;3(1):96-100.
8. Potential use of *Helicteres isora* in diabetes mellitus. Pharmacognosy Communications. 2023;13(4):163-170.