

**Review Article****Anti-Diabetic & Antioxidant Studies of *Helicteres Isora* Roots**

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**ABSTRACT:**

Many indigenous medicinal plants possess promising therapeutic properties, but experimental demonstration of specific active compound is lacking. Recent research findings suggest that bioactive fractions derived from a reverberated medicinal plant, namely, *Helicteres isora* (L.) possesses many therapeutic properties. *Helicteres isora* L., commonly known as Indian Screw Tree is a highly valued medicinal plant in South-East Asia. Many indigenous medicinal plants possess promising therapeutic properties, but experimental demonstration of specific active compound is lacking. Recent research findings suggest that bioactive fractions derived from a reverberated medicinal plant, namely, *Helicteres isora* (L.) possesses many therapeutic properties. *Helicteres isora* dried fruit solvent extracts were evaluated for their antioxidant and anticancer activity. Acetone fruit extract *H. isora* showed (96.44%) strong antioxidant activity compared to hexane, and iso-propyl alcohol (IPA). Acetone extract exhibited better cytotoxicity against human lung cancer cells (NCI-H460) whereas; acetone and crude protein extracts showed activity against reactive oxygen species.

**Introduction**

*Helicteres isora* Linn. is a shrub belongs to the family *Sterculiaceae* commonly known as 'East Indian Screw tree'. The plant genus consists of 45 species distributed in warmer regions of hemispheres; four species are reported to occur in India.

*Helicteres isora* is an important medicinal plant possessing remarkable nutritional and therapeutic activities. It is a tropical south-east Asian shrub cultivated throughout India. Different parts of the plant are traditionally used in Indian System of Medicine (ISM) to cure various ailments. Furthermore, recent research results have suggested that *H. isora* was a rich source of bioactive compounds such as polyphenols, tannins and alkaloids that exhibit therapeutic effects. Moreover, *H. isora* is reported to be a good source of carbohydrate, proteins, fiber, calcium, phosphorus and iron. Another report based on extraction and characterization studies has shown the presence of some antioxidant compounds such as ascorbic acid, flavonoids and phenolics (cucurbitacin B and isocucurbitacin B).

It is also reported that extracts of *H. isora* possess antibacterial, antidiabetic and anticancer activities. In view of the wide spectrum of therapeutic uses of *H. isora*, it was considered important to briefly outline present progress and point to future prospects of therapeutic applications of its bioactive fractions for treatment of diseases including cancer.



**Figure 1 :** picture showing (a) Shade dried leaves. (b) Fresh fruit. (c) Shade dried fruits of *H. isora* with seeds (on a centimetre scale). All the image are from our own collection.

### ***Helicteres isora* taxonomical classification.**

Kingdom: *Plantae*

Subkingdom: *Tracheobionta*

Division: *Magnoliophyta*

Class: *Magnoliopsida*

Subclass: *Rosidae*

Order: *Malvales*

Family: *Sterculiaceae* – large family of plants of order Malvales

Subfamily: *Helicteroideae*

Genus: *Helicteres* – genus of shrubs and small trees of tropical America and Asia having cylindrical fruits spirally twisted around one another

Species: *isora*



**Figure 2. *Helicteres Isora*. Plant**



**Figure 3. *Helicteres Isora* fruit**



**Figure 4. *Helicteres Isora*. flower**

### **General Information**

- **Part(s) used for medicinal purpose:** Stembark, Root juice, Fruit, Seed
- **Plant type / Growth Habit:** Sub-deciduous shrub
- **Duration:** Perennial
- **Distribution:** Throughout Central and Western India, especially in **Rajasthan, Punjab, Bihar, Bengal, Andaman**. Also found in Sri Lanka, Java, and northern Australia.
- **Habitat:** Dry forests
- **Flowering:** April to December
- **Fruiting:** October to June

**Plant Profile of *Helicteres Isora* :-** *H. isora* is a large shrub or small tree having hairy, ovate

shaped leaves with serrate margins . It belongs to the Sterculiaceae family. The fruits are compound pod, twisted like screw with pointed end , hence gratifying the name Indian Screw Tree. Flowers are orange-red in color. The plant is found throughout India; from Punjab to Bengal, Jammu to South India. Usually, the shrub/tree grows in dry deciduous forests of central and western India up to 1500 m on the hill slopes. It is widely found flora of Central and Western India. **Roots and Bark:** The root decoction/juice and the paste are reported to be traditionally used in ISM against diabetes, diarrhea, emphysema, stomach afflictions and asthma . It is also claimed to be used as expectorant, astringent, antilactagogue, to reduce gripping and a cure for snakebite. The extract from the root and bark possess insulin uptake sensitizing properties, Hypolipidemic activity and has the potential for use in the treatment of type-2 diabetes . According to literature, the extract is used as anthelmintic; for treatment of gastro-spasm on Java Island; and as an antispasmodic, antipyretic, anti-diarrheic and anti-dysenteric in Saudi Arabia.

TABLE. 1: PHYTOCHEMICAL SCREENING OF THE FRUIT AND BARK OF *HELICTERES ISORA*

SR.NO	PHYTOCHEMICALS	OBSERVATION	INFERENCE
1.	Carbohydrate	Reddish violet ring at the junction of two liquids was obtained in Molisch's Test	+
2.	Proteins	Violet color obtained in biuret reaction and deep orange color developed in xanthoproteic reaction	+
3.	Polyphenols	Blue color developed with ferric chloride	+
4.	Tannins	White precipitate with lead acetate was obtained	+
5.	Flavonoids	Deep blue color	+
6.	Alkaloids	Yellow brown precipitate	+
7.	Saponins	A honey comb like froth formed	+
8.	Steroids	The upper layer red and the sulphuric layer showed a yellow color with a green fluorescence	+

Figure 5. Powdered form of plant *HELICTERES ISORA*

**Bioactive Compounds and Their Therapeutic Efficacy.** The therapeutic value of the medicinal plant/herb lies in bioactive compounds they possess and their specific physiological action on the human body. Preliminary qualitative studies on various extracts suggested presence of phenolics, flavonoids, glycosides, tannins, carotenoids, ascorbic acid and saponins in different parts of *H. isora*; concentrations may vary according to season or part studied. Among various identified bioactive compounds /antioxidants of *H. isora*, cucurbitacin, rosmarinic acid, gallic acid and kaempferol are

notable antioxidants. They are already established anticancer agents with free radical scavenging activity, when isolated from other different herbs. In addition, our previous research finding confirmed that the herbal formulation-Triphala contains a major polyphenolic fraction of gallic acid (50%). In our recent investigations, it was found that gallic acid is one of the antioxidant present in *H. isora* [results unpublished]. Moreover, the chemical composition of various parts of *H. isora* with regard to its major constituents matches the criteria of a good antioxidant reservoir.

Table 2: Major bioactive compounds isolated from *H. isora*

S. No.	Plant Part	Bioactive Compound	Class	Ref.
1.	Root	cucurbitacin b, isocucurbitacin b	Steroid	[8]
		$\beta$ -sitosterol, betulinic acid, oleanolic acid, daucosterol, isorin, 3 $\beta$ 27diacetyloxylup20(29)en-28-oic methyl ester		[24]
		Catechol, Gallic acid	Polyphenols	[23]
2.	Bark/stem	$\beta$ -sitosterol; 10-methyl, 4-isopropenyl and dodecahydro- ethanophenanthrene	Phytosterols (plant sterols); terpene	[25]
3.	Leaves	Gallic acid, Caffeic acid, vanillin, p-Coumaric acid	Polyphenols	[23]
4.	Fruits	Rosmarinic acid and their derivatives; isoscutellarein and their derivatives;	Lactic acid	[15,26]
		D-glucopyranosyl isorinic acid with rosmarinic acid;	Neolignans	[27]
		Helisterculins A and B, Helisorin Gallic acid, Caffeic acid, vanillin, p-Coumaric acid	Polyphenols	[23]

**PHARMACOLOGICAL EFFECT OF HELICTERES ISORA LINN..**

**ANTIMICROBIAL ACTIVITY..**

Antimicrobial activity from aqueous and alcoholic of fruits of *H. isora* against a number of bacterial strains .. The fruit aqueous extract of *H. isora* showed prominent antibacterial activities against *E.coli*, *staphylococcus epidermidis*, *Salmonella typhimurium* and *Protous vulgaris*; moderate activity against *Enterobacter aerogenos*, *Staphylococcus aureus*. *Salmonella typhi* and least activity against *Pseudomonas aeruginosa*.

**Anti-diarrheal activity**

The fruits are demulcent and astringent and are useful in the gripping of bowels and flatulence of children. The bark is useful in dysentery and diarrhoea.

**Anticancer activity.**

The drug has a potent action against human breast cancer. The cytotoxic activity of the drug is due to the presence of alkaloids and flavonoids. Our further plan is to isolate and evaluate these active principles and elucidate exact mechanism of action.

**Antinociceptive activity**

*Helicteres isora* root extract were studied for antinociceptive activity on acetic acid-induced Writhing test in mice, at a dose of 250 mg/kg. Petroleum ether, chloroform and aqueous Ethanol extracts have shown significant activity.

**Wormicidal activity**

The pods are fried and given to children to kill intestinal worms

**Hepatoprotective activity**

*H. isora* demonstrated hepatoprotective activity against carbon tetrachloride induced liver damage in rats. The parameters studied were serum total bilirubin, total protein, alanine transaminase, aspartate transaminase and alkaline phosphatase activities. Results of biochemical studies of blood samples of CCl4 treated animals showed significant increase in the levels of serum markers and decrease in total protein level reflecting the liver injury caused by CCl4.

**CARDIOTONIC ACTIVITY:**

Cardiotonic activity of *H.isora* with digoxin on isolated frog heart. It is interesting to know that *H. isora* has rapid onset of action compared to digoxin.

**TABLE 3: possible scientific basis of plants part of plant *H.isora***

Plant parts	Disease	Ethno-medicinal use	Possible Scientific basis
1. BARK	Diarrhea	Bark boiled with water taken orally thrice per day	Antimicrobial activity/ Antispasmodic action
2. FRUITS	Diabetes	1 fresh fruits each taken orally	<b>Antioxidant activity/ Anti-hyperglycemic and hypolipidemic effects</b> Decreased level of glucose, glycosylated hemoglobin and plasma glycoproteins; Increase in levels of plasma insulin, hemoglobin
	Gastrointestinal problems	Approx. 5 g fruit powder with salt is to be taken thrice daily with water	Antioxidant activity/ Antimicrobial effects
	Weakness in new born baby	1) Fruit paste mixed with mustard oil and turmeric paste is used for massaging in new born baby to cure profound weakness. 2) Fruits are fried in mustard oil, used on new	Antioxidants activity / Antispasmodic action



		born baby to remove body pain.	
	Post-delivery weakness	Fruit powder along with other herbs and spice mixed sweet dish is given to women after child birth. It may be given to them during pregnancy.	Antioxidant activity/ Antispasmodic action
	Sores of ear	Fruits are made into liniment for sores of ear	Antioxidant activity/ Antimicrobial activity
<b>2.1. SEEDS</b>	Dysentery	5 g seed powder boil with water; taken twice a day	Antimicrobial activity for diarrhea and dysentery due to amoebiasis.
<b>3. ROOT</b>	Diabetes	Fresh root juice taken twice a day	Anti-hyperglycemic activity
	Cut and wounds	Fresh root paste with turmeric paste is applied externally	Antioxidant activity/ Antimicrobial activity
	Diarrhea	Root decoction	Antioxidant activity/ Antimicrobial activity
<b>4. LEAVES</b>	Scabies	Paste is applied externally twice per day till cure on infection area of scabies	Antimicrobial properties
	Skin infections	Fresh leaf paste applied thrice a day	Antioxidant activity/ Antimicrobial properties
	Snakebite	Fresh leaf paste applied on affected area	Free-radical scavenging activity might be playing an important role in inflammation.

#### Anti-diabetic activity of *H. irosa*.

Diabetes mellitus is a major disease characterized by derangement in carbohydrate, fat and protein metabolism, affecting nearly 10% of the population. In the recent past many hypoglycaemic agents are introduced, still the diabetes and the related complications continue to be a major medical problem not only in developed countries but also in developing countries. Many Indian medicinal plants are reported to be useful in diabetes.

#### Medicinal Uses of *Helicteres isora* (Marorphali)

According to **the doctrine of signatures**, the shape, appearance of plant part itself suggests its use. The pods of Maror phali are **twisted like intestine** and it is mainly used in treatment of **intestinal complaints** such as colic, flatulence diarrhea, and dysentery. Other important medicinal use include in **diabetes and locally in otorrhoea (discharge from ear)**.

1. The **fruit and bark** of Marorphali are **astringent in gripes, anti-diarrheal and anthelmintic**. They are used most commonly in treatment of intestinal complaints such as **griping in the bowels and flatulence, diarrhea, dysentery and worm infestation**.

2. In one clinical study, 37 patients of intestinal amoebiasis were treated with a combination of Bekh-e-Madaar (root-bark of *Calotropis procera* 125 mg) + Marorphali (1000 mg), thrice daily for

one month. The clinical efficacy was found close to that of Metronidazole.

3. The root juice is given in diabetes, empyema, snakebite, stomach trouble.

4. The roots and stem barks are expectorant, demulcent, astringent, and constipating.

5. They are useful in colic, scabies, gastric problems, diabetes, diarrhea and dysentery. The powdered seeds are used to cure ulcers in ears, dysentery and stomachache.

6. *Mucuna pruriens* seed powder is used as an aphrodisiac to improve the quality of the sperms, their total count.

7. They are also used for improving physical stamina and strength. According to Ayurveda, seeds are astringent, laxative, anthelmintic, aphrodisiac, alexipharmic and tonic. It improves sexual health. It is also used in intestinal worms and colic.

8. It is extensively used for general physical strengthening, anti-aging, blood sugar stabilization, injury healing, urinary tract rejuvenation. It also enhanced brain functioning potency, bone healing, kidney rejuvenation.

9. It improves immune system, arthritis, hypertension, obesity and many other diseases. Shilajit is also effective in piles and fistula related problems.

10. It works as an aphrodisiac agent and helps in increasing sperm count.

11. It is use to maintain physical, sexual and mental strength and to maintain youth and long life.

12. Effective in treating kidney, and lower back pain  
Threaten abortion, Leucorrhoea, Seminal debility  
Efficient in treating dryness of the lungs and  
throat, consumptive diseases (lingering cough, dry  
cough), tuberculosis and blood-tinged sputum.

13. Snakebite.

\* Fresh leaf paste applied on affected area.

\* Fruit paste mixed with mustard oil and turmeric is  
used for massaging in new born baby to cure  
profound weakness.

#### Dosage of *Helicteres isora*

1. The recommended dose of *Helicteres isora*  
decoction is 50-100 ml.

2. The powder of fruit, bark is taken in dose of 3-6  
grams.

**\*There are no known side-effects. Avoid use in  
pregnancy and breast feeding.**

#### CONCLUSION:

In the present investigation it was observed that  
different plant parts of *Helicteres isora* L. varied in  
their phytochemical constituents. The high phenolic  
content was positively correlated with free radical  
scavenging activity of the extracts. These results  
were supported by quantitative assays as well as  
phenolic profiling of extracts using RP-HPLC.  
Present paper gives a brief account of diverse  
medicinal uses of *Helicteres isora* (L.). Both  
laboratory and epidemiologic studies have provided  
considerable evidence that each and every part of  
the plant *H. isora* possesses medicinal properties.  
Studies have suggested that alcoholic and acetone  
extracts of fruits showed strong antioxidant and  
free radical scavenging activities by the bioactive  
compounds. Studies on animal models and clinical  
set up are lacking for evaluation of anti-  
inflammatory and anti-cancer effects. Extensive  
research is required to

identify targets in cells for anti-cancer, anti-  
inflammatory, anti-diabetic and hepatoprotective  
effects. We strongly advocate that further detailed  
cohort studies are warranted both at laboratory  
and clinical level for the development of herbal  
formulation(s) containing *H. isora* alone or in  
combination with other herbals to fight against  
several diseases including cancer.

#### REFERENCES

- Laakso M. Cardiovascular disease in type 2  
diabetes: challenge for treatment and  
prevention. *J Int Med* 2001;249:225-35.
- Quinn L. Type 2 diabetes: epidemiology,  
pathophysiology and diagnosis. *Nurs Clin N Am*  
2001;36:175-92.
- Habif S, Turgan N, Mutaf I, Aytaclar F, Hamulu  
F, Bayindir O, et al. Plasma catalase, glutathione  
peroxidase and selenium levels in adult diabetic  
patients. *Turk J Med Sci* 1997;27:139-41.
- Hasanian B, Mooradian AD. Antioxidant  
vitamins and their influence in diabetes  
mellitus. *Curr Diabetes Rep* 2002;2:448-56.
- Calzada F and Mata R: Hippocrateine III: A  
sesquiterpene alkaloid from *Hippocratea*  
*excelsa*. *Phytochemistry* 1995; 40(2):583-585.
- Navarrete A, Trejo-Miranda J and Reyes-Trejo L:  
Principles of root bark of *Hippocratea excelsa*  
(Hippocrataceae) with gastroprotective activity.  
*Journal of Ethnopharmacology* 2002; 79:383-  
388.
- Mena-rejon GJ, Perez-Espadas AR, Moo-Puc R,  
Cedillo-Rivera R, Bazzocchi IL, Jimenez-Diaz IA  
and Quijano L: Antigiardial activity of  
triterpenoids from the root bark of  
*Hippocratea excelsa*. *Journal of Natural*  
*Products* 2007; 70(5):863-865.
- Ogbole OO, Ekor MN, Oluremi BB, Ajaiyeoba  
AA, Gbolade AA, Ayoola AM and Adeyemi AA:  
Anti-inflammatory and antimicrobial activities  
of *Hippocratea indica* root bark and *Poga*  
*oleosa* fruits. *African Journal of Traditional*  
*Complementary and Alternative Medicines*  
2007; 4(3):372-376.
- Alanis AJ. Resistance to antibiotics: are we in  
the post antibiotic era? *Arch Med Res* 2005; 36  
: 697-705. Coates A, Hu Y, Bax R, Page C. The  
future challenges facing
- the development of new antimicrobial drugs.  
*Nat Rev Drug Discov* 2002; 1 : 895-910. Clemett  
D, Markham A. Linezolid.
- Drugs* 2000; 59 : 815-27; discussion 828. Shriram  
V, Jahagirdar S, Latha C, Kumar V, Puranik V,  
Rojatkar 12. S, et al. A potential plasmid-curing  
agent 8-epidiosbulbin E acetate from *Dioscorea*  
*bulbifera* L. against multi-drug resistant  
bacteria. *Int J Antimicrob Agents* 2008; 32 : 405-  
10.
- Mooradian AD. Increased serum conjugated  
dienes in elderly diabetic patients. *J Am Geriatr*  
*Soc.* 1991;39:571-4. [PubMed]
- Velazquez E, Winocour PH, Kesteven P, Alberti  
KGM, Laker MF. Relation of lipid peroxide to  
macrovascular disease in Type 2 diabetes.  
*Diabetic Med.* 1991;8:752-8. [PubMed]
- Salah N, Miller NJ, Paganga G, Tijburg L, Bolwell  
GP. Polyphenolic flavanols as scavengers of  
aqueous phase radicals and as chain-breaking  
antioxidants. *Arch Biochem Biophys.*  
1995;322:339-46. [PubMed]

15. Feillet-Coudray C, Rocke E, Coudray C, Grzelkowska K, Azais-Braesco V, Dardevet D, et al. A Lipid peroxidation and antioxidant status in experimental diabetes. Clin Chim Acta. 1999;284:31–43. [PubMed]
16. Drymock W, Warden CJH, Hooper D. In: Pharmacographica Indica. Kegan P, Treneb, editors. London: Trubner and Co; 1890. p. 232.
17. Al Yahya MA. Phytochemical studies of the plants used in traditional medicine of Saudi Arabia. Fitoterapia. 1986;57:179–82.
18. Burkill IH. A Dictionary of the Economic Products of the Malay Peninsula Publication Governments of Malaysia and Singapore. Kuala Lumpur; 1966. p. 1153.
19. Eisai PT. Medicinal Herb Index in Indonesia. 2nd ed. Indonesia; 1995. p. 77.
20. Kirtikar KR, Basu BD. Indian Medicinal Plants. 2nd ed. Dehradun: International Book Distributors; 1995. pp. 371–2.
21. Singh SB, Singh AK, Thakur RS. Chemical constituents of the leaves of *Helicteres isora*. Indian J Pharm Sci. 1984;46:148–9.
22. Qu WH, Li JG, Wang MS. Chemical studies on the *Helicteres isora*. Zhongguo Yaoke Daxue Xuebao. 1991;22:203–6.
23. Bean MF, Antoun M, Abramson D, Chang CJ, Mc Laughlin JL, Cassady JM. Cucurbitacin B and Isocucurbitacin B Cytotoxic components of *Helicteres isora*. J Nat Prod. 1985;48:500–3. [PubMed]
24. Kusumoto IT, Shimada I, Kakiuchi N, Hattori M, Namba T, Supriyatna S. Inhibitory effects of Indonesian plant extracts on Reverse Transcriptase of an RNA Tumour Virus (I) Phytother Res. 1992;6:241–4.
25. Otake T, Mori H, Morimoto M, Ueba N, Sutardjo S, Kusumoto IT, et al. Screening of Indonesian plant extracts for anti-human immunodeficiency virus – Type 1 (HIV) activity. Phytother Res. 1995;9:6–10.
26. Tezuka Y, Terazono M, Kusumoto TI, Hatanaka Y, Kadota S, Hattori M, et al. Phytoconstituents of some Indonesian plants and their antioxidant activity. Helv Chim Acta. 2000;83:2908–19.
27. Kamiya K, Saiki Y, Hama T, Fujimoto Y, Endang H, Umar M. Flavonoid glucuronides from *Helicteres isora*. Phytochemistry. 2001;57:297–301. [PubMed].
28. Hirota Y. The effect of acridine dyes on mating type factors in Escherichia coli. Proc Natl Acad Sci USA 1960; 46 : 57-64.
29. Watanabe T, Nishida H, Ogata C, Arai T, Sato S. Episome- mediated transfer of drug resistance in Enterobacteriaceae. VII. Two type of naturally occurring R factors. J Bacteriol 1964; 88 : 716-26.
30. Trevors JT. Plasmid curing in bacteria. FEMS Microbiol Rev 1986; 32 : 149-57.