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## Plant profile, phytochemistry and pharmacology of Avartani (*Helicteres isora* Linn.): A review

Nirmal Kumar\*, Anil Kumar Singh

Department of Dravyaguna, Faculty of Ayurveda, Institute of Medical Sciences, Banaras Hindu University, Varanasi–221005, India

### PEER REVIEW

#### Peer reviewer

Prof. K.N.Dwivedi, Department of Dravyaguna, Faculty of Ayurveda, Institute of Medical Sciences, Banaras Hindu University, Varanasi–221005, India.

Tel: 91–8765550189

E-mail: kndbhu@gmail.com

#### Comments

This is a good review done on *H. isora* which supports its wide range of therapeutic applications. This is further supported by planned research works carried out by different research workers of its antioxidant, hypolipidaemic, cardio protective, anti peroxidative, antibacterial, anti cancer, anti nociceptive, hepatoprotective *etc.*

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### ABSTRACT

Plants are used as medicine since ancient time, in organized (Ayurveda, Unani & Siddha) and unorganized (folk, native & tribal) form. In these systems, drugs are described either in Sanskrit or vernacular languages. Avartani (*Helicteres isora* Linn.) is a medicinal plant which is used in several diseases. It is commonly known as Marodphali, Marorphali, Enthani *etc.* due to screw like appearance of its fruit. Avartani is used as a folk medicine to treat snake bite, diarrhoea and constipation of new born baby. In the research, antioxidant, hypolipidaemic, antibacterial and antiplasmid activities, cardiac antioxidant, antiperoxidative potency, brain–antioxidation potency, anticancer activity, antinociceptive activity, hepatoprotective activity, anti–diarrheal activity and wormicidal activity in this plant were reviewed.

### KEYWORDS

Avartani, Ayurveda, *Helicteres isora* Linn., Marodphali, Anti–diarrheal

## 1. Introduction

The definition of *Helicteres* is a large genus of tropical trees and shrubs (family Sterculiaceae) with axillary flowers and fruits consisting of five twisted carpels. The origin of *Helicteres* is NL, fr. Gk *heliktēres*, pl. of *heliktēr* anything twisted, fr. *helik–*, *helix* spiral. Isora is a Japanese name for boys meaning God of the seashore[1].

Avartani [*Helicteres isora* Linn. (*H. isora*)] is a medicinal plant which is used in several diseases. It is commonly known as Marodphali, Marorphali, Enthani *etc.* due to screw like appearance of its fruit. It is not described broadly in old text of Ayurveda, *i.e.* Samhitas and

Nighantu. This plant maybe comes from outside so that it is neglected by Ayurvedic authors. In the description of the Ayurvedic plant Murva, Avartani is also confused with Murva, but later it is confirmed with a separate plant rather than Murva (*Marsdenia tenacissima* W. & A.). The leaf of Avartani shows similarity with Parushaka (*Grewia asiatica* Linn.).

## 2. Avartani (*H. isora*)

The botanical name of Avartani is *H. isora*, which belongs to the family Sterculiaceae. It is commonly

\*Corresponding author: Dr. Nirmal Kumar (Junior resident), Department of Dravyaguna, Faculty of Ayurveda, Institute of Medical Sciences, Banaras Hindu University, Varanasi–221005, India.

Tel: +91–9935466464

E-mail: 28.nirmal@gmail.com

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known as Murva, Avartani, Avartaphala in Sanskrit, Marodphali, Marorphali, Enthani, Gomathi in Hindi, Kewad, Muradsheng in Marathi, *etc* (Table 1). The scientific classification of Avartani (*H. isora*) is shown in Table 2.

**Table 1**

Name of Avartani in different languages.

Languages	Names
Sanskrit	Murva, Avartani, Avartaphala
Hindi	Marodphali, Marorphali, Enthani, Gomathi
Marathi	Kewad, Muradsheng
Bengal	Antmora
Gujarat	Maradashingh, Maradashinghi
Tamil	Balampari
Telugu	Guvadarra
Kannada	Pedamuri
Malayalam	Ishwarmuri
Oriya	Murmuriya
English	East India screw tree, Indian screw tree

**Table 2**

Scientific classification of Avartani.

Kingdom	Plantae
Class	Angiosperms
Sub-class	Eudicots
Order	Malvales
Family	Malvaceae
Subfamily	Helicteroideae
Genus	<i>Helicteres</i>
Species	<i>H. isora</i>



**Figure 1.** Different parts of Avartani (*H. isora*).

A: A plant of Avartani; B: Flowering twig; C: Stem bark; D: Immature pod; E: A mature flower; F: A leaf; G: Mature pod of Avartani.

### 2.1. Occurrence and distribution

Avartani is found distributed in dry forests throughout Central and Western India, from Bihar as far West as Jammu and Western Peninsula.

### 2.2. Description

It is sub-deciduous small tree or shrub of about 1.5–3.0 m height. Young branches are rough with scattered stellate hairs. The leaves are serrate, obliquely cordate or ovate, shortly acuminate and rough above and pubescent beneath. The flowers are solitary or in sparse clusters with red reflexed petals, become pale–blue when old. The fruits are 5.0 cm long, greenish–brown, beaked and cylindrical with 5 spirally twisted carpels. The seeds are tubercled.

Fruits, seeds, bark and roots of the plant are used. The flowering time of *H. isora* is from April to December, and the fruiting time is from October to June<sup>[2]</sup> (Figure 1).

### 2.3. Ayurvedic guna (properties) and Ayurvedic karma (action)

The Ayurvedic guna (properties) are given in Table 3. Ayurvedic karma are atisaraghna (anti–diarrheal), sula–prashmana (analgesic), krimighna (wormicidal), rakta–shodhaka (blood purifier), Mutra–sangrahniya (urine conservative)<sup>[3]</sup>.

**Table 3**

Ayurvedic guna (properties).

Guna	Laghu, Ruksha
Rasa	Kasaya
Vipaka	Katu
Virya	Sita

### 2.4. Folklore

In Konkan, the fruits are used as a remedy for snake bite. The fruits are used in diarrhoea as well as constipation of new born baby<sup>[4]</sup>. In the aqueous extract of its root, one

teaspoonful tid is given for 3–7 d for the treatment of dog-bite in Uttar Pradesh[5]. Tribals of Singbhum district of Bihar use the fruits as an amulet in neck to treat disease of malnutrition, which is locally known as Dubli disease among children[6].

### 3. Phytoconstituents

#### 3.1. Fruit

Satake *et al.* isolated three new compounds which are 4 $\beta$ -D-glucopyranosyl rosmarinic acid (2), 4,4 $\beta$ -D-glucopyranosyl rosmarinic acid (3) and 2R-O-(4 $\beta$ -D-glucopyranosyl caffeoyl)-3-(4-hydroxyphenyl), lactic acid named as 4 $\beta$ -D-glucopyranosyl isorinic acid (4) were isolated together with rosmarinic acid (1) from the fruit of *H. isora* (Sterculiaceae), an Indonesian medicinal plant[7]. The structures of these compounds, including the absolute stereochemistry of (4), were elucidated by spectroscopic analysis and chemical means. Compound (3) had greater scavenging activity against superoxide anion produced with xanthine and xanthine oxidase than rosmarinic acid (1)[7].

#### 3.2. Leaves

Ramesh *et al.* resulted in the isolation and characterization of a new flavones methyl ether, 7,4 $\beta$ -dimethyl isoscutellarein *i.e.* (5,8-dihydroxy-7,4 $\beta$ -flavones) along with kaempferol-3-O-galactoside (trifolin) and herbacetin-8-O-glucuronide (hibifolin) from the leaves of *H. isora*[8].

#### 3.3. Stem bark

Saraswatiibhai led to the identification of chloroplast, pigments, phytosterols, hydroxyl carboxylic acid, orange-yellow colouring matter, saponins, phlobotannis, sugar and lignins[9].

#### 3.4. Seed

A preliminary study of phytoconstituents of seeds by Nair and Grampurohit showed the presence of phytosterols, fixed oils and fats, phenolic compounds and tannins and amino acid and carbohydrates[10].

#### 3.5. Root

Cucurbitacin B and isocucurbitacin B have been isolated

from its root[11].

## 4. Pharmacological activity

### 4.1. Antioxidant activity

Kumar *et al.* reported the antioxidant and anticancer activity using various solvent extracts (hexane, IPA and acetone) and crude protein[12]. Dot plot assay confirmed the presence of antioxidant activity. Acetone fruit extract of *H. isora* showed 96.44% strong antioxidant activity compared to hexane, and 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. The investigation revealed the antioxidant and anticancer activity of *H. isora* dried fruit extracts[12].

### 4.2. Hypolipidaemic activity

Kumar *et al.* reported that the continuous treatment with the bark extract of *H. isora* brought down the above lipid parameters in the diabetic rats to almost normal levels[13]. The effect of bark extracts of *H. isora* on serum high density lipoprotein, low density lipoprotein, very low-density lipoprotein has been studied. The treatment with *H. isora* bark extract carried down these lipoproteins in the diabetic rats to nearly normal levels. Cholesterol and phospholipids levels were significantly lowered ( $P < 0.05$ ) in streptozocin induced diabetic rats. But the treatment of *H. isora* bark extract significantly increased these erythrocyte cholesterol and phospholipids levels in the diabetic rats, which were normalized after 21 d of treatment. The ratio of cholesterol and phospholipids was significantly higher ( $P < 0.05$ ) in streptozotocin induced diabetic rats. The treatment of bark extract reversed the increased levels of these lipid ratios and normalized soon after[13]. Boopathy Raja *et al.* studied that the fruit of *H. isora* has the active principle to counteract the hyperlipidemic condition occurring in streptozotocin induced diabetic rats[14].

### 4.3. Antibacterial and antiplasmid activities

Shriram *et al.* reported organic extracts of *H. isora* as a new and safe plasmid curing agent[15]. These finding resulted in the possibility of a new type of combination between antibiotics and potential drugs effective against plasmid encoded multiple antibiotic resistance. The concentrations of the curing agents used in this study were sub inhibitory,

since bacteria were already resistant to these concentrations of compound. It can be assumed that bacteria are less likely to develop any mechanism to counter the plasmid curing property of the acetone extract of *H. isora*<sup>[15]</sup>.

#### 4.4. Cardiac antioxidant and antiperoxidative potency

Kumar *et al.* reported that the activities of cardiac antioxidant enzymes were significantly decreased in diabetic control rats<sup>[16]</sup>. They presented significant increases in the diabetic rats treated with hemagglutination inhibition (HI). Administration of HI to normal rats increased the antioxidant levels with no other significant differences. The effect produced by HI was comparable with that of tolbutamide. The results show that the antioxidant effect of aqueous extract of HI (200 mg/kg, *p.o.*) was significantly higher than that of in the tolbutamide treated rats<sup>[16]</sup>.

#### 4.5. Brain antioxidation potency

Kumar *et al.* concluded that in diabetes, brain tissue was more vulnerable to oxidative stress and showed increased lipid peroxidation<sup>[17]</sup>. The above observation shows that the aqueous extract of bark of *H. isora* plant possesses antioxidant activity, which could exert a beneficial action against pathologic alterations caused by the presence of free radicals in streptozocin diabetes<sup>[17]</sup>.

#### 4.6. Anticancer activity

Varghese *et al.* reported that the drug has a potent action against human breast cancer<sup>[18]</sup>. 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.

#### 4.7. Antinociceptive activity

Venkatesh *et al.* reported that the aq. ethanol, petroleum ether and chloroform extract showed significant antinociceptive activity. Phytochemical analysis of the active extracts indicated that their major constituents are sterol, triterpenoids (petroleum ether extract), and their glycosides (chloroform and aqueous ethanol extracts) may be responsible for observed pharmacological activity<sup>[19]</sup>.

#### 4.8. Hepatoprotective activity

Chitra *et al.* reported that ethanolic root extracts of

*H. isora* demonstrated hepatoprotective activity against carbon tetrachloride induced liver damage in rats<sup>[20]</sup>. 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 CCl<sub>4</sub> treated animals showed significant increase in the levels of serum markers and decrease in total protein level reflecting the liver injury caused by CCl<sub>4</sub><sup>[20]</sup>.

#### 4.9. 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<sup>[21]</sup>.

#### 4.10. Wormicidal activity

The pods are fried and given to children to kill intestinal worms<sup>[22]</sup>.

## 5. Conclusion

Numerous studies have been conducted on different parts of Avartani (*H. isora*). A detailed and systematic study is required for identification, cataloguing and documentation of plants, which may provide a meaningful way for promoting traditional knowledge of the medicinal herbal plant.

## Conflict of interest statement

We declare that we have no conflict of interest.

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## Comments

### Background

This is a review article pertaining to well known medicinal plant – *H. isora*, used in Indian indigenous medicine for

the treatment of abdominal colic, cough and other common disorders. It is a need of present era to search remedies of common disorders by natural products.

### Research frontiers

The present article makes acquainted with medicinal properties and useful therapeutic indications of the medicinal plant *H. isora* viz. – its use in snake bite, diarrhea, constipation, malnutrition etc. It is better to encourage the use of this naturally occurring plant and its parts in place of synthetic drugs.

### Related reports

Several studies have been carried out regarding its use in various disorders, and they are quoted by the authors in reference at the end of the article which support its rational use in those disorders.

### Innovations and breakthroughs

*H. isora* commonly known as Avartani is used since many centuries in India for treating various disorders such as cough, abdominal colic, malnutrition etc. Authors have highlighted its therapeutic uses in today's context.

### Applications

The review described the use of *H. isora* and its different parts to be used in various disorders which is again proved by many scientific studies quoted by the authors.

### Peer review

This is a good review done on *H. isora* which supports its wide range of therapeutic applications. This is further supported by planned research works carried out by different research workers of its antioxidant, hypolipidaemic, cardio protective, anti peroxidative, antibacterial, anti cancer, anti nociceptive, hepatoprotective etc.

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