Review Article

Review on Phytochemicals and Pharmacological Profile of Helicteres isora Linn.

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ABSTRACT
Most indigenous medicinal plants to cure specific ailments from ancient time traditionally. Helicteres isora Linn. (Sterculiaceae) also called as Marodphali, Marorphali, Avartani, and Enhanietc due to screw like shape of fruit commonly known as Indian screw tree possess therapeutic, phytochemical and pharmacological valued medicinal plant in South-East Asia. The present review is an attempt to provide brief scientific rationale of plants used in treatment of various diseases. The presence of flavones, triterpenoids, phytosterols, saponin, sugars flabotanins and cucurbitacin. The roots and barks possess antioxidant, antimicrobial and antispasmodic properties useful in hypoglycemic, expectorants, demulcent, and snake bite. The fruits used in treatment of griping bowels and diarrheal infection in new born baby. Acetone fruit extracts of H. isora has strong antioxidant and cytotoxic activity than other solvent extracts. The review revealed that the fruits are antioxidants and antimicrobial activities but so far no information on antispasmodic activity hence attempt was made to find out phytochemical contents for the same activity.

KEYWORDS
Helicteres isora, antioxidant, antispasmodic, antidiabetic, anticancer activity.
1. INTRODUCTION

In India various part of several medicinal plants are useful for treating different type of diseases. Helecteres isora is important medicinal plant of various Indian system of medicine like Traditional Siddha and Modern system of medicine. Helecteres isora is shrub or plant belongs to family Sterculiaceae commonly called as Indian screw tree. Helecteres means twisted, helical or spiral and isora is the name of boys meaning God of the seashore in Japan.[1] The plant has large genus consist of 45 species distributed in small tree or large shrub found in Asia including Indian Subcontinent, South China, Malay Peninsula, Java[2] and Saudi Arabia. Also, found in Australia. It is a tropical Asian shrub or medium-sized tree. The shrub/plant is found all throughout India from Punjab to Bengal; Jammu to South India and Pakistan, Nepal, Myanmar, Thailand, and Sri Lanka. However, it gregariously grows in dry deciduous forests of central and western India up to 1500m on the hill slopes.[3][4][5]

Name of plant in different Language

Sanskrit – Avartani, avartphala, Murva,
- Hindi – Marorphali Marodphali, Enthani, Gomathi bhendu, jonkphal
- English - Indian screw tree, East Indian screw tree, deer's horn
- Marathi - Kewad, muradsheng
- Bengali – Antamora[6]
- Gujarati – Maradashingh, Maradashinghi
- Kannada – Yedmuri, Pedamuri
- Telugu – Vadampiri

1.1. Species isora

The plant is small tree or shrub 5-15 feet in height [7], young branches and stem covered with stellate trichomes. Leaves are simple, alternate, and ovate; margin is serrate with 6-9 mm long petiole. Flowers are solitary or in sparse cluster with orange-red petals turn pale blue when old. Petals are closely hooked together [8].

The fruits are twisted like screw hence the name Indian screw tree, 5 cm long compound pods greenish brown ripen in March and cylindrical with 5 spirally twisted carpels and stellate lignified hairs along with mucilaginous cavity. The mesocarp and endocarp consist of fibre. [9]

The follicle of fruit contains 15-20 seeds dark brown to black colour placed in row. When fruits ripen turns brown and twisted like corkscrew become untwine and seed scatter. [6]
Figure 2. Flowering Twig.

Figure 3. Dried Seed

Figure 4. Immature Pod
2. Phytochemistry

Table 1. Major bioactive compounds isolated from H. isora

<table>
<thead>
<tr>
<th>Plant Parts</th>
<th>Bioactive compounds</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fruits</td>
<td>Helisterculins A and B, Helisorin Gallic acid, Caffeic acid, vanillin, p-Coumaric acid</td>
<td>[10]</td>
</tr>
<tr>
<td></td>
<td>Carbohydrate, protein, fibre, mineral such as Calcium. Iron, Phosphorous</td>
<td>[11]</td>
</tr>
<tr>
<td></td>
<td>Volatile oil, tannin, flavonoids, gums and mucilage</td>
<td>[2]</td>
</tr>
<tr>
<td></td>
<td>Rosmarinic acid, 49- O-b -D-glucopyranosylrosmarinic acid, 4,49-O-di-b -D-glucopyranosylrosmarinic acid, 2R-O-(49-O-b -D-glucopyranosylcaffeoyl)-3-(4-hydroxyphenyl), lactic acid named as 49-O-b –D-glucopyranosylisorinic acid</td>
<td>[12]</td>
</tr>
</tbody>
</table>

1. Methyl 4-methyl-2-(2’-nitrosophenyl)-5-oxo-5,7-dihydrofuro[3,4-b]pyridine-3-carboxylate  
2. 3-(D-Galacto-penta-O-acetylpentitol-1’-yl)-4nitropyrrole  
3. 3-(D-Manno-penta-O-acetylpentitol-1’-yl)-4nitropyrrole  
4. Phenylcyclopentadienyl  
5. Diphenyl r-2methoxycarbonyl-2,t-5-diphenylpyrrolidine-c-3,t-4-dicarboxylate  
6. Docosanoic acid, 1,2,3-propanetriyl ester,  
7. 2-Propenoic acid, 2-ethylhexyl ester,  
8. Dimethylene-berberine.  
9. Isoscutellarein 4’-methyl ether 8-O-β-D-glucuronide 6″-n-butyl ester  
10. Isoscutellarein 4’-methyl ether 8-O-β-D-glucuronide 2″  
11. 4″-disulfate and isoscutellarein 8-O-β-D-glucuronide 2″,4″-disulfate.  

Leaves Gallic acid, Caffeic acid, vanillin, p-Coumaric acid  

7,4′di-O-methyl isoscutellarein (5,8-dihydroxy-7,4′flavones) along with kaempferol-3-o-galactoside (trifolin) and herbacetin-8-o-glucuronide (hibifolin)  

[10]  
[11]  
[2]  
[12]  
[13]  
[14]  
[15]
<table>
<thead>
<tr>
<th>Part</th>
<th>Compounds</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stem, bark</td>
<td>Tetratricanyl 1-tetratricontanoate, tetratricontanoic acid, tetratricontanol, sitosterol</td>
<td>[16]</td>
</tr>
<tr>
<td></td>
<td>Pigments, phytosterol, hydroxyl carboxylic acid, orange-yellow colouring matter (carotenoids), saponin, phlabotaninis, sugar, lignin</td>
<td>[17]</td>
</tr>
<tr>
<td>Seed</td>
<td>Diosgenin</td>
<td>[18]</td>
</tr>
<tr>
<td></td>
<td>Phytosterols, fixed oil, fats, phenolic compound, tannin, amino acid, carbohydrate</td>
<td>[19]</td>
</tr>
<tr>
<td>Root</td>
<td>Cucurbitacin b, isocucurbitacin b</td>
<td>[20]</td>
</tr>
<tr>
<td></td>
<td>β-sitosterol, betulic acid, oleanolic acid, daucosterol, isorin, 3β27diacetoxy lup20(29)en-28-oic methyl ester</td>
<td>[21]</td>
</tr>
<tr>
<td></td>
<td>Catechol, Gallic acid</td>
<td>[22]</td>
</tr>
</tbody>
</table>

**Structure 1.** Methyl 4-methyl-2-(2'-nitrosophenyl)-5-oxo-5, 7-dihydrofuro[3,4-b]pyridine-3-carboxylate

**Structure 2.** 3-(D-Galacto-penta-O-acetylpentitol-1'-yl)-4-nitropyrrrole
Structure 3. 3-(D-Manno-penta-O-acetylpentitol-1'-yl)-4-nitpyrrole)

Structure 4. Phenylcyclopentadienyl

Structure 5. Diphenyl r-2methoxycarbonyl-2,t-5 diphenylpyrrolidine 4- dicarboxylate
Structure 6. Docosanoic acids, 1, 2, 3-propanetriyl ester

Structure 7. 2-Propenoic acid, 2-ethylhexyl ester

Structure 8. Dimethylene-berberine

Structure 9. isoscullarein 4′-methyl ether 8-O-β-D-glucuronide 6″-n-butyl ester
Structure 10. isoscutellarein 4′-methyl ether 8-O-β-D-glucuronide 2″

Structure 11. 4″-disulfate and isoscutellarein 8-O-β-D-glucuronide 2″,4″-disulfate.

Table 3. Ethano-medicinal claims and their scientifically proved activities

<table>
<thead>
<tr>
<th>Plant parts</th>
<th>Disease</th>
<th>Ethanobotany</th>
<th>Scientific basis</th>
<th>Experimental evidences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bark</td>
<td>Diarrhea</td>
<td>Bark boiled with water taken orally thrice per day</td>
<td>Antimicrobial activity/ Antispasmodic action</td>
<td>[10][ 29][28][34]</td>
</tr>
<tr>
<td></td>
<td>Diabetes</td>
<td>1 fresh fruits each taken orally</td>
<td>Antioxidant activity/ Anti hyperglycemic and hypolipidemic effects Decreased level of glucose, glycosylated hemoglobin and plasma glycoproteins; Increase</td>
<td>[23][24][25] [26][ 29][ 30] [31][ 32][ 33]</td>
</tr>
<tr>
<td>Disease</td>
<td>Treatment</td>
<td>Benefits</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-------------------------------</td>
<td>---------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gastrointestinal problems</td>
<td>Approx. 5 g fruit powder with salt is to be taken thrice daily with water</td>
<td>Antioxidant activity/ Antimicrobial effects</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| Fruits                        | 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 born baby to remove body pain. | Antioxidants activity / Antispasmodic action                              |
| Sores of ear                  | Fruits are made into liniment for sores of ear                             | Antioxidant activity/ Antimicrobial activity                              |
| 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                                 |
| Dysentery                     | 5 g seed powder boil with water; taken twice a day                         | Antimicrobial activity                                                   |
| Seeds                         | Diabetes                                                                  | Anti-hyperglycemic activity                                               |

Seeds and fruits...
Cut and wounds is applied externally

Diarrhea

Root decoction

Antioxidant activity/
Antimicrobial activity

[10][25][26]

Antioxidant activity/
Antimicrobial activity

[10][25][26]

Roots

Frank root paste with turmeric paste is applied externally

Diarhea

Root decoction

Antioxidant activity/
Antimicrobial activity

[10][25][26]

Antioxidant activity/
Antimicrobial activity

[10][25][26]

Scabies

Paste is applied externally twice per day till cure on infection area of scabies

Leaves

Fresh leaf paste applied thrice a day

Antioxidant activity/
Antimicrobial properties

[10][25][32][33]

Antioxidant activity/
Antimicrobial properties

[10][25][32][33]

Snakebite

Fresh leaf paste applied on affected area

Free-radical scavenging activity might be playing an important role in inflammation

[10][25][32][33]

Skin infections

Fresh leaf paste applied thrice a day

Antioxidant activity/
Antimicrobial properties

[10][25][32][33]

Venkatesh et al. (2010) investigated restoration of pancreatic islets, kidney glomeruli, and liver to its normal size after treatment with root extract of H. isora.

Saponins obtained from H. isora shows antidiabetic effects with activation of PI3K/Akt pathway, leading to phosphorylation and inactivation of GSK-3α/β with subsequent stimulation of glycogen synthesis as well as increase of Glut4-dependent glucose transport across the cell membrane.

4. Pharmacological effects of Extracts of Helicteres isora Linn

4.1 Antidiabetic Activity

Ranjan Chakrabartiet al evaluate Helicteres isora L for antidiabetic antihyperglycemic and Hypolipidemic Activity, plant extract at various doses shows significant reduction in plasma glucose, triglycerides and insulin level in mice.

Aqueous bark extract of Helicteres isora L evaluated by M. Rajasekara Pandian et al in normal, glucose loaded and streptozotocin induced diabetic rats shows hypoglycemic effects.

Hypolipidaemic effect of extracts of Helicteres isora L streptozotocin (STZ) induced diabetic rats shows significant reduction in serum and tissue cholesterol, phospholipids, free fatty acids and triglycerides investigated by G. Kumar, and A. G. Murgesan.

Venkatesh et al. (2010) investigated restoration of pancreatic islets, kidney glomeruli, and liver to its normal size after treatment with root extract of H. isora.

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4.2. Hepatoprotective Activity

Researchers have provided a scientific rationale for traditional use of these plants in management in liver diseases. Alcoholic extracts of H. isora studied for hepatoprotective activity against carbon tetrachloride induced liver damage in rats. The blood sample clinically studied parameters serum total bilirubin, total protein, alanine transaminase, aspartate transaminase and
alkaline phosphatase activity. Result shows that total protein level significantly decreases in injured liver of rats.

Dhevi et al (2008) showed that ethanolic extract of H. isora bark in hepatotoxicity induced rats the total reversal and recovery of all parameter studied biochemical and antioxidant markers. [38]

Ethanolic extract of stem bark of Helicteres isora L showed that significant hepatocellular regeneration in carbon tetrachloride induced toxicity in rats were studied by K. Gayatri et al.[39] The blood sample of rats was taken for biochemical studies previously induced liver toxicity and treated with ethanolic extract of root of Helicteres isora L potential reduction in total protein and serum marker. [32]

4.3. Antioxidant activity

The H. isora has potent action against free radical scavenging property due to presence of alkaloids and flavonoids. Kumar et al investigated antioxidant and anticancer activity of H. isora dried fruit extracts in various solvent extracts acetone extract showed strong cytotoxicity against human lung cancer cells by dot plate assay. [40]

Aqueous and alcoholic extracts from fruits and bark of H. isora are reported antioxidant activity such as free radical scavenging, toxicity to tumor cells, inhibiting nitric oxide and hydrogen peroxide radicals, and protection to normal cells when compared to standards Lascorbid acid, quercetin and rutin.[41-43]

Kumar et al reported that brain tissue was more susceptible to oxidative stress and increased lipid peroxidation in streptozocin diabetes. [44]

4.4. Anticancer activity

The fruit of H. isora methanolic extracts (50%) showed antitumor activity in melanoma cells but protected normal human blood lymphocytes.[33] Varghese et al reported that drug has potent action against human breast cancer their further plan is to isolate and evaluate active principles with probable mechanism of action.[45]

4.5. Antinociceptive activity

Phytochemicals analysis of drug shows that sterol, triterpenoids, glycosides responsible for pharmacological action. Sama Venkatesh et al obtained various extracts of root, petroleum ether, chloroform, ethanol, aqueous extracts shown significant antinociceptive activity on acetic acid induced writhing test in mice. [46]

4.6. Cardiotonic activity

H. isora has Cardiotonic activity due to Diosgenin compared with digoxin on isolated frog heart shows rapid onset of action. These studies confirmed that it is better option for digitalis. [47]

4.7. Hypolipidaemic activity

G. Kumar and et al investigated the hypolipidemic effect of aqueous extract of bark of Helicteres isora in streptozotocin induced diabetic rats at various doses. The significant reduction in the level of cholesterol, phospholipids, free fatty acid and triglycerides. [48]

4.8. Anti-diarrheal activity

The fruit has demulcent astringent and antispasmodic effect that are useful in the gripping of bowels and flatulence of infants and children. The bark, root and seeds are use in dysentery and diarrhea. [49]
4.9. Antimicrobial activity
Aqueous and alcoholic extract of fruit of Helicteres isora effective against a number of bacterial strains. The fruit aqueous extract of H. isora showed prominent antibacterial activities against E. coli, Staphylococcus epidermidis, Salmonella typhimurium, Proteus vulgaris, and moderate activity against Enterobacter aerogones, Staphylococcus aureus, and Salmonella typhi. S. Venkatesh et al reported antimicrobial activity of root extract of Helicteres isora. [50, 51]

4.10. Wormicidal activity
Pods are effective for killing the worms in children [52].

5. CONCLUSION
In the present review observed that different plant parts of Helicteres isora L. varied in phytochemical constituents. The above evidences show that each and every part of the medicinal uses having Antibacterial, Antidiabetic, Cardiotonic, anticancer activities. Various bioactivity studies of plant carried out. Only few studies shed no light on mechanism but the phytoconstituents from the extract showing activity still required to isolate, tested for bioactivity and formulated in to suitable herbal formulation alone or in combination with other drugs.

6. REFERENCES


