

Helicteres isora L.: A Traditional Medicinal Plant

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ABSTRACT

Helicteres isora L. (Indian Screw plant) is a well-known medicinal plant widely distributed in forests of India. Traditionally, it is being used in the Indian medicine system to cure many common and severe ailments, including diarrhea, dysentery, abdominal pains, diabetes, ulcers, intestinal parasites and hemorrhages. The entire plant contains a variety of bioactive compounds such as polyphenols, alkaloids, tannins and antioxidants that exhibit many healing effects. It shows pharmacological actions, including anticancer, hypolipidemic, antibacterial, hepatoprotective, antioxidant, antidiabetic, brain oxidant potency, anti-inflammatory, and antidiarrheal actions. Literature survey reveals that workers throughout the world have carried out extensive work on the pharmacognostic, phytochemical, antioxidant, hepatoprotective, antimicrobial and many other properties of the plant. In the present article, an effort is made to review the plant with all its possible dimensions.

Keywords: *Helicteres isora*, Review, Traditional, Medicine, Ailments.

Highlights

- *Helicteres isora* L. is an important medicinal plant being used for the treatment of various ailments from very ancient times.
- *Helicteres isora* L. shows important phytochemical, pharmacognostic and antimicrobial activities.
- It contains very diverse group of secondary metabolites, proteins, flavones, glycosides, phenolic compounds and terpenoids.
- *Helicteres isora* L. is being used for the treatments of various ailments like, cancer, diarrhea etc. and shows, hypoglycemic, anticiceptive, cytotoxic, antipyretic and antioxidant properties.
- The plant contains crucial chemical constituents for the formulation of new drugs and therefor needs to be conserved as it is being destroyed due to

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INTRODUCTION

India is a treasure home for important medicinal plants. Medicinal plants contain different vital chemicals, including flavonoids, phenolic acids, tannins, alkaloids, glycosides and other secondary metabolites. They have great potential to cure various common and severe ailments like cancer and AIDS (Sabah *et al.*, 2021). Many drugs isolated from plants possess antimicrobial and antioxidant properties. The natural therapeutic chemicals and secondary metabolites are most prominently derived from plants as they play an imperative role in the survival of plants and their protection from harsh environments (Ganesan *et al.*, 2022).

Plant-based drugs are being used to cure many diseases. It has been practiced since very ancient times. Many such claims have been put forward by Ayurveda, an Indian traditional system (Pohocha and Grampurohit, 2001).

Helicteres isora is commonly known as *Marodphali* (Hindi), *Avartani* (Sanskrit), *Antmora* (Bengali), *Balampari* (Tamil), *Pedamuri* (Kannada), *Ishwarmuri* (Malayalam), *Murmuriya* (Oriya) and *Murudsheng* (Marathi). It belongs to the family Sterculiaceae and is found distributed in dry forests throughout India (Kumar and Singh, 2014). The plant bears flowers from mid-August to late October and contains matured fruits from January end to the initial days of April. It is observed that over 31 to 41% of fruits bear undeveloped and least viable seeds. Such natural as well as some anthropogenic factors are highly responsible for their decreased survival and distribution rate (Muthukumar *et al.*, 2017). The flowers are red, bisexual and zygomorphic and

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suitable for ornithophilous (by birds and butterflies) pollination (Manikandan and Kunhikannan, 2016).

H. isora shows various medicinal properties, including anticancer, antimicrobial, antioxidant, antidiabetic, antispasmodic, anti-hyperglycemic and other activities. It contains many phytoconstituents like alkaloids, glycosides, phytosterols, fats and fixed oils (Kumar and Singh, 2014; Tiwari *et al.*, 2012; Kadus *et al.*, 2023).

Morphology

H. isora (Fig. 1a-c) is a small deciduous tree that grows up to 3.0 m in height. New shoots contain stellate hairs. Leaves are 7.5 to 13.5 by 5 to 8 cm, oblong and obovate clothed with stellate hairs on both surfaces, apex short and acuminate, base subcordate-subacute, irregularly serrulate. Flowers are 2.5 to 4.0 cm in length, bright red, bilabiate and arise in axillary clusters of 2 to 6 together (Fig. 1b). Calyx brown-tomentose, petals glandular, red and fading to grey. Fruits are in the form of follicles, which are

greenish-brown in color, cylindrical and beaked (Fig. 1c). They are with 5 spirally twisted carpels and are about 5 cm long. The seeds are tubercled, numerous, angular, and wrinkled (Kumar and Singh, 2014; Singh and Karthikeyan, 2000, Tiwari *et al.*, 2012).

The wood of the plant is very hard and durable and is used for making carriages, longbows of violins, boats, cars, tool handles and as a source of firewood (Tiwari *et al.*, 2012).

Ethnomedicinal properties

Literature survey reveals that, the different plant parts are being used for many purposes. The bark of the plant is used for making bags, paper and ropes (Manikandan and Kunhikannan, 2016). It is reported that the fruits are used for dealing with snakebite, diarrhea and constipation, vermifuge and diseases related to malnutrition (Kumar and Singh, 2014). Fruits with mustard oil are used on the bodies of infants in order to relieve pain and treat diarrhea. The powder obtained from fruits, along with other herbs, is given to women to manage post-delivery health problems (Dayal *et al.*, 2015; Pandey *et al.*, 2021). Nearly all parts of the plant are used in the preparation of various ethnomedicinal formulations. The bark of the plant is used to cure diarrhea and diabetes, fruits are recommended for gastrointestinal problems, seeds are used to cure dysentery, roots are used to cure cut and wounds and fresh paste of leaves is used to cure various skin infections like eczema and scabies (Gawai *et al.*, 2022, Dayal *et al.*, 2015).

The fried pods of the plants are and recommended for children to kill intestinal worms. Bark is used to cure dysentery and diarrhea (Kumar and Singh, 2014). It is also recommended in the treatment of constipation in new born babies and snakebite.

The fruits and seeds are used for stomachache, diarrhea and dysentery, ear problems and ulcers (Malarvizhi *et al.*, 2018). The bark and root decoctions are used in the treatment of scabies, empyema, etc. Seed powder is suggested to use in otorrhoea (Jamal *et al.*, 2021).

According to Billal *et al.*, (2023), *H. isora* extract is well tolerated in both short-term and long-term therapies. However, caution should be taken as prolonged administration in high doses for up to 28 days may have adverse effects on the kidneys and liver.

Chemical Composition

Nearly all parts are used in medicine probably because they contain important chemical constituents.

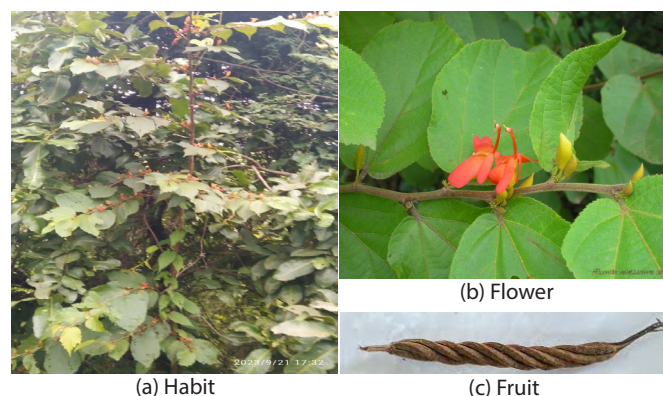


Fig. 1 (a-c): Morphology of *H. isora* L. Ethnobotanical properties

Fruits are used in the various medical formulations used to cure different ailments. It contains D-glucopyranosyl rosmarinic acid and D-lucopyranosyl caffeoyl, lactic acid (Kumar and Singh, 2014, Satake *et al.*, 1999). Fruits are a good source of terpenoids and phenolics. Fruits also show the presence of Helisterculins A and B, Neolignans, and Heliisorin (Tiwari *et al.*, 2012).

Leaves are isolated with flavones methyl ether, 7,4 di--omethyle isoscutellarein, etc. (Kumar and Singh, 2014). Leaves also contains tetratriacontany 1- tetratriacontanoate, tetratriacontanoic acid, Tetratriacontanol and sitosterol etc. (Sabale *et al.*, 2012).

Stem Bark is a rich source of phytosterols, hydroxyl carboxylic acid, saponins, phlobotanins, sugar and lignins. (Kumar and Singh, 2014). Stem bark also contains β -sitosterol (Tiwari *et al.*, 2012)

Seeds are the better source of fixed oils and fats, phytosterols, carbohydrates, phenolic compounds, amino acids and tannins (Kumar and Singh, 2014).

The roots of the plant contain cucurbitacin B, isocucurbitacin as well as some cytotoxic components (Kumar and Singh, 2014; Tiwari *et al.*, 2012, Gawai *et al.*, 2022). Phytochemical screening reveals that the root contains carbohydrates, saponins, steroids, tannins, proteins, anthraquinone glycosides, phenolic compounds, terpenoids and alkaloids (Kadus *et al.*, 2023, Sharma and Chaudhary, 2016). β -sitosterol, betulic acid, oleanolic acid and, daucosterol and novel triterpenoid are also observed in roots (Sabale *et al.*, 2012).

Plant is a rich source of proteins, antioxidants, carbohydrates, gallic acid, calcium, phosphorus, vanillin, caffeic acid, coumaric acid, cucurbitin, rosmarinic acid, helisorin acid, etc (Jamal *et al.*, 2021; Islam *et al.*, 2015). Meena *et al.*, (2016) experimentally confirmed the presence of ellagic acid in the stem bark. A list of phytochemicals with their biological activities is given in Table 1.

Pharmacological Activity

A literature survey reveals that *H. isora* shows antioxidant and anticancer activities. It is also reported to have antibacterial, antiplasmid activities, and anti-diarrheal activity. The cytotoxic property is supposed to be present due to alkaloids and flavonoid contents. (Kumar and Singh, 2014). Cucurbitacin B and isocucurbitacin B are also observed to be responsible to cytotoxic activity (Shah and Khan, 2014). It induces cell death in HepG2 cells by constraining cell division in cancer cells by declining the level of the anti-apoptotic gene, *Bcl-2* and by increasing the level of the pro-apoptotic gene, *Bax* (Thach *et al.*, 2023). Tiwari *et al.*, 2012 reported that different plant parts are being used in various Ayurvedic formulations prepared by various commercial medicine companies, including *Chrak*, *Dhanvantari*, *Sandu*, *Aushadhi*, etc. These formulations are prepared for the treatment of cardiac disorders, diarrhea, anal and rectal disorders, eczema, psoriasis and different pediatric preparations.

The plant is reported to be useful for diabetes and shows antifungal, antispasmodic, hypoglycaemic, antinociceptive, antipyretic, antioxidant and antipyretic activities. The plant also shows anti-diarrheal, anti-inflammatory, hypolipidemic, antiplasmid and hepatoprotective activities (Kadus *et al.*, 2023; Suthar *et al.*, 2009; Gawai *et al.*, 2022; Pandey *et al.*, 2021, Chakrabarti *et al.*, 2002). The plant parts are also used as a

Table 1: Chemical constituents of *H. isora* and their biological activities

| S. No. | Chemical constituent | Biological activity |
|--------|--|--|
| 1 | Rosmarinic acid | Shows effect on human colon cancer cells (RCM-1) |
| 2 | D-glucopyranosyl rosmarinic acid | Cytotoxic and Proliferative activity |
| 3 | Cucurbitacin | Cytotoxic activity |
| 4 | Isocucurbitacin | Cytotoxic activity |
| 5 | Alkaloids | Cytotoxic activity |
| 6 | Flavonoids | Cytotoxic activity |
| 7 | β -sitosterol | Hepatoprotective activity, anticancer activity |
| 8 | Phenolic and triterpenoid compounds | Toxic effects on the cancerous cells |
| 9 | Tannins, saponins, alkaloids, flavonoids, amino acids, carbohydrates, steroids proteins and anthraquinones | Treatment of various ailments like burns, leucorrhea, inflammation, gonorrhoea, diabetes, abdominal pain |
| 10 | Flavonoids and Alkaloids | Antibacterial action |
| 11 | Flavonoids | Antioxidant activity |
| 12 | Sterols, triterpenoids, glycosides | Antinociceptive activity treats breast cancer |
| 13 | 7,4 di-o-methyl Isoscutellarein | Potent influenza virus sialidase inhibition |
| 14 | Tetratriacontane | Inhibit RNA replication and anticancer property |
| 15 | Oleanolic acid | Antibacterial, antileishmanial and antitumor activity |
| 16 | Daucosterol | Nourish brain cells and increase intelligence |
| 17 | Vanillin | Anticancer, antidiabetic, antioxidant, antibacterial and antidepressant properties. |
| 18 | Caffeic acid | Antioxidant, anti-inflammatory and anticarcinogenic activity |
| 19 | Coumaric acid | Antimicrobial, antioxidant and anti-inflammatory activity |

demulcent and an astringent, which shows effects on diarrhea, cancer and diabetes (Malarvizhi *et al.*, 2018). It is reported that *H. isora* mixture is effectively used to control glucose levels in the blood in type-2 diabetic patients practicing regular Yoga and exercise (Subramaniam *et al.*, 2014). However, it is observed that consumption of it affects fat accumulation, adipocyte differentiation and adiponectin transcription, which is not suitable for the prevention of diabetes (Siripurkpong and Fungkrajai, 2020).

A study reveals that, the fruits of the plant are used in the cases of colic pain and diarrhea underlines its antispasmodic potential (Pohocha and Grampurohit, 2001). Ethanol extract of aerial parts of *H. isora* may be due to the presence of phenolics or β -sitosterol, is observed to show hepatoprotective activity. It has been studied in mice which is affected by paracetamol-induced liver injury and toxicity. (Giang *et al.*, 2021). The hepatoprotective effect of plants in CCl₄-intoxicated rats exhibited a total setback and retrieval of all antioxidant and biochemical markers studied succeeding the drug administration (Dhevi *et al.*, 2008). Roots and bark extracts also play an important role in the recovery of damaged parts and play a hepatoprotective role (Dayal *et al.*, 2015).

Hot water extract of *H. isora* triggers glucose uptake capacity in L-6 cell line of skeletal muscles of the mouse (Gupta *et al.*, 2010). Above ground parts of the plant contain phenolic and triterpenoid compounds, which show toxic effects on the cancerous cells (Nguyen *et al.*, 2019).

Pharmacognostic Activity

A pharmacognostic evaluation of the fruits of *H. isora* has been carried out by Andalil *et al.*, 2018. Accordingly, they evaluated microscopic and macroscopic studies of the twisting pods of the plant and authenticated its medicinal importance for the treatment of intestinal disorders. The roots contain a variety of phytochemicals, including tannins, saponins, alkaloids, flavonoids, amino acids, carbohydrates, steroids, proteins, etc., proving that it can be used for the treatment of various ailments like burns, leucorrhea, inflammation, gonorrhoea, diabetes, etc., (Sharma and Chaudhary, 2016, Mankar *et al.*, 2021).

The leaf microscopic studies reveal that the stomata are anomocytic and present on both the lower and upper surfaces and are bounded by 4 to 5 subsidiary cells resembling epidermal cells. Trichomes are present on both upper and lower surfaces and 6 to more armed stellate hairs. Phytochemical constituents such as glycosides, anthraquinones, alkaloids, saponins and tannins are responsible for curing abdominal pain, dysentery, and diarrhea and for the detection of adulteration (Kanthale and Biradar, 2017)

Antimicrobial and antioxidant activity

According to Verghese *et al.*, 2012 methanolic extracts of fruits of *H. isora* contain phenolic compounds, flavonoids and alkaloids, which are responsible for their antibacterial action against *Pseudomonas aeruginosa*, *Escherichia coli*, *Staphylococcus aureus* and *Salmonella abony*. Not only fruit but leaf extract also contains

a combination of a variety of phytochemicals like flavonoids. Their presence in the plant leads it to play an important role in antioxidant, antimicrobial and wound healing potential (Mahajan and Itankar, 2020). It is observed that almost all parts of the plant contain phytochemicals like flavonoids, phenols, steroids, glycosides and alkaloids, which show antioxidant properties (Jain *et al.*, 2014).

Sabah *et al.*, (2021) and Mahire and Patel (2020) also reported similar antimicrobial and antioxidant properties of the plant mainly due to the occurrence of flavonoids and alkaloids. Ganesan *et al.*, 2022 evaluated the antibacterial and antioxidant activities of oil prepared from various medicinal plants, including *H. isora* and found that oil can exhibit significant antibacterial and antioxidant activities. The oil prepared is used in massage and is believed to be effective on weight loss, menstrual pain, body ache, etc. Along with antioxidant and antimicrobial activities, the fruits also show antidiabetic properties (Suthar *et al.*, 2009, Gawai *et al.*, 2022, Murudkar *et al.*, 2020). Aqueous and alcoholic extracts from bark and fruits are reported to be useful in, toxicity to tumor cells, free radical scavenging and protection to normal cells which displays the antioxidant activity of the plant (Dayal *et al.*, 2015, Mankar *et al.*, 2021).

Bark extracts is observed to show a beneficial effect on the glycoprotein moiety along with the antidiabetic effects (Kumar and Murugesan, 2007). Fruits contain active constituents to counter the hyperlipidemic conditions in streptozotocin-induced diabetic rats (Raja *et al.*, 2010). An antinociceptive activity is also reported to be present in the roots of *H. isora*.

CONCLUSION

Almost all parts of the *H. isora* are treasure houses of various important chemical components. It is being used as a medication for different common and severe ailments, including diabetes and cancer. In the name of development and due to ever-fluctuating environmental conditions, the plant is facing many difficulties. So, it is an urgent need to protect and conserve the plant.

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AUTHORS CONTRIBUTION

Dr. Bhagwat W. Chavre is the only author involved in the complete writing, formatting and editing of the article. He is involved in the overall idea, conception and design of the article and for giving crucial inputs and supervision from time to time.

CONFLICT OF INTERESTS

The authors have no conflict of interest.

REFERENCES

Andalil R, Mattummal R, Gopi D.K., Sundaramoorthy B., Bobbili E., Narayana S.K.K. (2018), Pharmacognostic Evaluation of Key Ingredient of *Valampuritailam: Helicteres isora* L. fruit, Journal of Ayurveda Medical

- Sciences; 3 (4):446-450. <http://dx.doi.org/10.5530/jams.2018.3.27>
- Bilal H., M.A. Khan, S.W.A. Shah, M. Ghias, H. Hussain, H. Ali, M. U. Rehman, M. Zahoor, R. Ullah and A. Alotaibi (2023), Pre-Clinical Safety Profile and Behavioural Effects of *Helicteres isora* Linn in an Animal Model, Journal of Biological Regulators, 37 (11): 6231-6245. <http://dx.doi.org/10.23812/j.biol.regul.homeost.agents.20233711.594>
- Chakrabarti R., R.K. Vikramadithyan, R. Mullangi, V.M. Sharma, H. Jagadheshan, Y.N. Rao, P. Sairam and R. Rajagopalan (2002), Antidiabetic and hypolipidemic activity of *Helicteres isora* in animal models, Journal of Ethnopharmacology, 81: 343-349. [https://doi.org/10.1016/S0378-8741\(02\)00120-4](https://doi.org/10.1016/S0378-8741(02)00120-4)
- Dayal R., A. Singh, R.P. Ojha and K.P. Mishra (2015), Possible therapeutic potential of *Helicteres isora* (L.) and its mechanism of action in diseases, Journal of Medicinal Plants studies, 3 (2): 95-100. <https://doi.org/10.22271/plants>
- Dhevi R. K. Gayathri, M.M. Shabi, U Subashini, G.P. Dubey, G. V Rajamanickam and M. Chitra (2008), A Preliminary Biochemical Screening of *Helicteres isora* L. Stem Bark in Carbon Tetrachloride Induced Toxicity in Rats, Bulgarian Journal of Veterinary Medicine, 11(4): 235-242. <https://doi.org/10.15547/issn13133543>
- Ganesan J., S.N. Weng and S. Arullappan (2022), Evaluation of Antioxidant and Antibacterial Activities of Bubble Belly Massage Oil and their Crude Ingredients, Journal of Experimental Biology and Agricultural Sciences, 10 (3): 607-618. [https://doi.org/10.18006/2022.10\(3\).607.618](https://doi.org/10.18006/2022.10(3).607.618)
- Gawai P., S.Waghmare and H. Kambale (2022), Studies of *Helicteres isora*'s Antioxidant and Antidiabetic Activity Review, international Journal of Trends in Scientific Research and Development, 6 (3): 595-600. www.ijtsrd.com/papers/ijtsrd49564.pdf
- Giang T.T.L, L.P. Q. Nhu, T.B. Trinh, L.N.T. Linh, V.Q. Dao, N.T.T. Oanh and B.D. Thach (2021), Hepatoprotective Activity of *Helicteres isora* Ethanol Extract Against Paracetamol-Induced Liver Injury in Mice, Bioscience Biotechnology Research Communications, 14 (4):1468-1472. <http://dx.doi.org/10.21786/bbrc/14.4.15>
- Gupta R.N., A. Pareek, M. Suthar, G. S. Rathore, P.K. Basniwal, Deepti Jain (2010), Study of glucose uptake activity of *Helicteres isora* Linn. Fruits in L-6 cell lines., International Journal of Diab. Dev Ctries, 29 (4): 170-173. <https://doi.org/10.4103%2F0973-3930.57349>
- Islam M.S., M. Mia, M.A. Islam Apu, J. Halder, M.F. Rahman, M. Islam and N. Jahan (2015), A comprehensive review on region based traditional Ayurvedic practitioner's plants secondary metabolites and their phytochemical activities in Bangladesh, Journal of Pharmacognosy and Phytochemistry, 3(6): 202-216. <http://dx.doi.org/10.13140/RG.2.2.34564.37761>
- Jain A., R.Ranade, P. Pritam, N. Joshi, S.L. Vavillala, A. Jain (2014), A comparative study of antioxidant activity, total phenolic and flavonoid contents in different parts of *Helicteres isora* L., American Journal of Life Sciences, 2 (5): 292-302. <https://doi.org/10.11648/j.ajls.20140205.17>
- Jamal A., A. Siddiqui, A. Waseem, M. Fazil (2021), Ethno-medicinal, phytochemical and pharmacological investigation on *Ra'i ibl* (*Helicteres isora* linn.) -a persuasive unani medicinal plant, Panacea Journal of Pharmacy and Pharmaceutical Sciences, 10 (4): 1-16.
- Kadus P.A., A. A. Giramkar and S.A. Nirmal (2023), A review on: Avartani (*Helicteres isora*), International Journal of Agriculture and Nutrition, 5 (1): 55-58. <http://dx.doi.org/10.33545/26646064.2023.v5.i1a.100>
- Kanthale P.R. and S. Biradar (2017), Pharmacognostic study of *Helicteres isora* L., Pharmaceutical and Biological Evaluations, 4 (1):47-51. <http://dx.doi.org/10.26510/2394-0859.pbe.2017.07>
- Kumar G. and Murugesan A.G. (2007), Influence of *Helicteres isora* Bark Extracts on Plasma and Tissue Glycoprotein Components in Streptozotocin Diabetic Rats, Journal of Clinical and Diagnostic Research, 1 (4): 330-338. <https://doi.org/10.7860/JCDR/2007.105>
- Kumar N. and A.K. Singh (2014), Plant profile, phytochemistry and pharmacology of Avartani (*Helicteres isora* Linn.): A review, Asian Pacific Journal of Tropical Biomedicine, 4 (1): S22 to S26. <https://doi.org/10.12980/APJTB.4.2014C872>
- Mahajan R and P. Itankar (2020), Antioxidant, Antimicrobial and wound healing potential of *Helicteres isora* Linn. Leaf Extracts, Digital Chinese Medicine, 3 (3): 188-198. <https://doi.org/10.1016/j.dcm.2020.09.005>

- Mahire S. P and S. N. Patel (2020), Extraction of Phytochemicals and study of its antimicrobial and antioxidant activity of *Helicteres isora* L., *Clinical Phytoscience*, 6 (40): 2-6. <https://clinphytoscience.springeropen.com/articles/10.1186/s40816-020-00156-1>
- Malarvizhi M., B.Kunthavi and A.S. P. Kandhimathi (2018), Review article on *Helicteres isora* Linn., with an activity of Demulcent and Astringent, *International Journal of Current Research in Chemistry and Pharmaceutical Sciences*, 5 (3): 1-4. <http://dx.doi.org/10.22192/ijcrps.2018.05.03.001>
- Manikandan P. and C. Kunhikannan (2016), Avian flower visitors of *Helicteres isora* L. a deciduous forest species in Thathengalam forest of Kerala in Western Ghats, *International Journal of Advanced Research in Biological Sciences*, 3 (10): 171-176. <http://dx.doi.org/10.22192/ijarbs.2016.03.10.023>
- Mankar S.S., Younus M., A.Pimpale and Devyani Awari (2021), Pharmacognostic and Pharmacological Study of *Helicteres isora* Linn.- A Review, *Journal of Pharmaceutical Research International*, 33 (49 A):208-214. <https://doi.org/10.9734/jpri%2F2021%2Fv33i49a33322>
- Meena R. R. Joshi, R. Meena and V. Patani (2016), Isolation, Identification and quantitative analysis of Ellagic acid: a tannin compound from *Helicteres isora*, *Indian Journal of Pharmaceutical and Biological Research*, 4 (3): 1-4. <https://doi.org/10.30750/IJPBR.4.3.1>
- Murudkar P., S. Kolhe and S. Tembhurne (2020), Protective Effect of Hydroalcoholic Extract of Dried Fruits of *Helicteres isora* in Dextran Sulfate Sodium Induced Ulcerative Colitis in Experimental Wistar Rats, *International Journal of Pharmaceutical Sciences and Drug Research*, 12 (4): 325-330. <https://doi.org/10.25004/IJPSDR.2020.120404>
- Muthukumar M., T.S. Kumar and M.V. Rao (2017), Phenology and seed germination of the Indian Screw Tree *Helicteres isora* L. (Malvales: Malvaceae), *Journal of Threatened Taxa*, 9 (12): 11040- 11044. <https://doi.org/10.11609/jott.3058.9.12.11040-11044>
- Nguyen T.T., N. Kretschmer, E.P. Wenzig, O. Kunert and R. Bauer (2019), Triterpenoidal and Phenolic Compounds Isolated from the Aerial Parts of *Helicteres hirsuta* and their Cytotoxicity on Several Cancer Cell Lines, *Natural Product Communications*, 14 (1): 7-10. <https://doi.org/10.1177/1934578X1901400103>
- Pandey S., D.Patel, P.Mishra and R.Tiwari (2021), Morphological, phytochemical and pharmacological study of *Helicteres isora* (Marorphali), *International Journal of Research in Pharmacy and Pharmaceutical Sciences*, 6 (3): 13-17. <https://doi.org/10.5772/intechopen.82497>
- Pohocha N. and N. D. Grampurohit (2001), Antispasmodic Activity of the Fruits of *Helicteres isora* Linn., *Phytotherapy Research*, 15: 49-52. [https://doi.org/10.1002/1099-1573\(200102\)15:1%3C49::aid-ptr729%3E3.0.co;2-e](https://doi.org/10.1002/1099-1573(200102)15:1%3C49::aid-ptr729%3E3.0.co;2-e)
- Raja A.B., C. Elanchezhiyan and S. Sethupathy (2010), Antihyperlipidemic activity of *Helicteres isora* fruit extract on streptozotocin induced diabetic male wistar rats, *European Review for Medical and Pharmacological Sciences*, 14: 191-196. <https://www.europeanreview.org/wp/wp-content/uploads/723.pdf>
- Sabah F.S., H.S. Al- Atbi, E.A. Mukhaiti (2021), Flavonoids and Alkaloids Extracted From marorphali (*Helicteres isora*) And Their Using Role as Antibacterial, Antifungal and Their Effectiveness As Antioxidants, *Natural Volatiles & Essential Oils*, 8 (4): 4681-4691. <https://www.nveo.org/index.php/journal/article/view/1057>
- Sabale P.M., N.D. Grampurohit, S.K Banerjee, D.D. Gaikwad and M.V. Gadhve (2012), Recent Advances on the Phytochemical and Pharmacological profile of Plant *Helicteres isora* Linn., *International Research Journal of Pharmacy*, 3 (4): 14-17. <https://www.irjponline.com/index.php/IRJP/article/view/1376/1170>
- Satake T., K. Kamiya, Y.Saiki, T. Hama, Y. Fujimoto, S. Kitanaka, Y. Kimura, J.Uzawa, H. Endang and M. Umar (1999), Studies on the constituents of Fruits of *Helicteres isora* L., *Chem. Pharm. Bulletin*, 47 (10): 1444-1447. <https://doi.org/10.1248/cpb.47.1444>
- Shah S.M.A and U. Khan (2014), Pharmacological Activity of *Helicteres isora* L. A Review Article, *Journal of Pharmacy and Pharmaceutical Sciences*, 2 (2): 47-49. <https://jpps.juw.edu.pk/index.php/jpps/article/view/90>
- Sharma V. and U. Chaudhary (2016), Pharmacognostic and Phytochemical Screening of *Helicteres isora* Roots, *Asian Journal of Pharmaceutical and Clinical Research*, 9 (2): 96-101. <http://dx.doi.org/10.22159/ajpcr.2016.v9s2.12178>
- Singh N.P. and S. Karthikeyan (2000), *Flora of Maharashtra State: Dicotyledons Vol-1*, Page, 355.
- Siripurkpong P and M. Fungkrajai (2020), Effects of Ethanol Crude Extract of *Helicteres isora* Fruit on Adipogenesis and Fat Accumulation in 3T3-L1 Cells, *Science and Technology Asia*, 25 (4): 115-124. <https://ph02.cti-thaijo.org/index.php/SciTechAsia/article/view/183944>
- Subramaniam V, Giridharan B, Devaraj D, Sachidanandam M, Vijayan S, et al. (2014) Efficacy of Aqueous Extract of *Helicteres isora* on Glucose Level in Type-2 Diabetic Patients Practicing Yoga – A Cohort Study, *Journal of Diabetes and Metabolism* 6 (1): 1-4. <http://dx.doi.org/10.4172/2155-6156.1000473>
- Suthar M., G.S. Rathore and A. Pareek (2009), Antioxidant and Antidiabetic Activity of *Helicteres isora* (L.) Fruits, *Indian Journal of Pharmaceutical Sciences*, 71 (6): 695-699. <https://doi.org/10.4103%2F0250-474X.59557>
- Thach, B.D., Giang, T.T.L., Nhu, L.P.Q., Ben, T.T., Linh, L.N.T., Dao, V.Q., Oanh, N.T.T., Tuan, L.H. and Chung, D.C. (2023). *Helicteres isora* Ethanol Extract Induces Apoptotic Cell Death in HepG2 Cells. *Agricultural Science Digest*. 43(6): 817-823. <http://dx.doi.org/10.18805/ag.DF-548>
- Tiwari V., A. Singh and A. Tiwari (2012), *Helicteres isora* L.-"Mrigashringa"- Current Strategies and Future Aspects, *The Natural Products Journal*, 2: 9-19. <http://dx.doi.org/10.2174/2210315511202010009>
- Vergheese E., K.L. Pappachen and S.S. Narayanan (2012), Isolation and Evaluation of Antimicrobial Properties of Isolated Phytoconstituents of Fruits of *Helicteres isora* Linn., *Research Journal of Pharmaceutical, Biological and Chemical Sciences*, 3 (3): 959-964. https://www.rjpbcs.com/2012_3.3.html