Ethanobotany, Phytochemistry and Pharmacological Activities of Helicanthes elastica: A Review

Priti Khanduri[1], Yogita Dobhal[2], Sanjay Singh[3], Mamta F. Singh[4]*, Ajay Kumar[5]

[1,3]Siddhartha Institute of Pharmacy, Dehradun

[2]Sardar Bhagwan Singh University Dehradun

[4]*College of Pharmacy, COER University, Roorkee

[5]Institute of Nano Science and Technology, Mohali, Punjab

Corresponding Author Mail: mamta_fr2002@yahoo.co.in

ABSTRACT

Helicanthes elastica (Desv.) Danser (H. elastica), commonly known as Indian mango mistletoe is a hemiparasitic species from the Loranthaceae family that mainly infests mango trees. It is commonly found in Southern India. It is recognized for its diverse medicinal properties, including antimicrobial, immunomodulatory, hepatoprotective, antioxidant, antidiabetic, diuretic, and natriuretic effects.

Additionally, it demonstrates cytotoxic activity (anti-tumor), anti-asthmatic and anti-anaphylactic properties, as well as anti-arthritic, anti-ulcer, anti-inflammatory, anti-urolithiatic, and nephroprotective effects. The wide ranges of therapeutic actions are primarily attributed to the presence of alkaloids, carbohydrates, steroids, tannins, saponins, phenols, flavonoids, and triterpenoids. Despite its significant medicinal value, it remains relatively unknown within the scientific community regarding its therapeutic benefits. Therefore, the present review aims to summarise the scientific literature on the ethnobotany, phytochemistry, ethanomedicinal and pharmacological activities of H. elastica.

Keywords: *H. elastica, immunomodulatory, anti-asthmatic, anti-anaphylactic, phytochemistry, Loranthaceae*

How to Cite: Priti Khanduri, Yogita Dobhal, Sanjay Singh, Mamta F. Singh*, Ajay Kumar, (2025) Ethanobotany, Phytochemistry and Pharmacological Activities of Helicanthes elastica: A Review, *Journal of Carcinogenesis*, *Vol.24, No.3s*, 377-387.

1. INTRODUCTION

Parasitic plants exploit their hosts to bypass competition for vital resources such as light, water, and nutrients, thereby boosting their adaptability in challenging environments. As a result, parasitism is widely regarded as an evolutionary strategy shaped by natural selection and environmental stressors [1] . To date, around 4,750 parasitic species have been identified among angiosperms, with evidence suggesting that the shift from photosynthetic autotrophy to parasitism has independently evolved at least 12 to 13 times across their evolutionary history. [2] Parasitic plants are broadly classified into two categories based on their photosynthetic ability: hemiparasites and holoparasites. Hemiparasites maintain partial photosynthetic function while drawing essential resources—mainly water and minerals—from their hosts. In contrast, holoparasites have entirely lost their photosynthetic capacity, often exhibiting highly reduced or absent leaves, and are thus wholly dependent on their hosts for both energy and nutrients. [3]

This classification has historically been based on whether or not their tissues contain chlorophyll, which indicates their capacity for self-sufficiency. [4]

Mistletoes, a family of parasitic plants known for their wide distribution, are members of the *Loranthaceae* family, which has alarming rates of misidentification at both the generic and specific levels. Their distribution is mostly pantropical, encompassing temperate regions in the southern hemisphere. The fact that the family is a monophyletic group that includes both aerial and terrestrial root parasites makes it especially fascinating. Furthermore, mistletoe is considered a keystone resource and has a significant impact on species richness despite being a minor component of vegetation in forest and woodland ecosystems. The 74 genera and more than 1000 species of the genus *Loranthaceae* are mostly found in tropical regions. Nine genera and 35 species make up the *Loranthaceae* family in India, with the most widely distributed genera and species being *Dendrophthoe, Helicanthes, Macrosolen, Tolypanthes, Helixanthera, Taxillus, and Scurulla* in South

India.[5][6]

Certain *Loranthaceae* species have been utilised as medicinal materials to treat rheumatism, hypertension, bacterial infections, and cancer. The *Loranthaceae* family contains a variety of chemicals, some of which have been shown to have hypotensive and antimicrobial qualities.

When it comes to application and administration, different tribes in the Western Ghats use the entire plant—roots, branches, leaves, flowers, fruits, etc.—in different forms, such as paste, dried powder, decoction, etc.[7].

Mistletoes are classified as hemiparasites because, despite their ability to photosynthesize, the majority of their carbohydrates come from their host.[8] Because the host species affects the chemical composition of some mistletoes, it has been discovered that the mistletoes' medicinal qualities depend on the species on which they grow[9]. Mistletoes are thought to have medicinal properties. They belong to the genus Loranthus and Viscum. Despite the therapeutic significance of this group of plants, no comprehensive phytochemical studies have been published. One common mistletoe in India, *H. elastica* (Desr.) Danser. (Syn. *Loranthus elasticus* Desr.), belongs to the *Loranthaceae* family and has not been thoroughly studied.[10]

2. METHOD

The literature for this review was found using keywords like mistletoe, *H. elastica, Loranthaceae*, chemical constituents, ethnobotany, ethnomedicine, morphology, and phytochemistry in journal databases such as Google Scholar, Medicine, PubMed, Science Direct, and Scopus.

Taxonomical classification and Botanical description

One of the 74 genera in the *Loranthaceae* family, in southern India, helicanthes, additionally referred to as Indian mango mistletoe, is an invasive shrub that usually thrives on mango trees. The mango mistletoe, or *H. elastica* (Desv.) Danser, is one of the captivating mistletoe species that invade practically every mango tree. There are 46 other plant species that have been identified as *H. elastica's* hosts. According to a survey report by K.N. Sunil Kumar, out of the twenty-seven hosts that were identified in the area in the districts of Kasaragod, Kerala, and Udupi and Dakshina Kannada in Karnataka, fifteen host species were looked into as potential new hosts for *H. elastica*. There have been reports of coiling, knotting, coupling, creeping, and the mother plant becoming infected by the haustorial roots.[11].

It is a parasite with dichotomously branched shrubs with three to five nerved leaves that have obtuse tips and an ovate to elliptic shape. Sessile flowers are grouped together at the nodes. produced with a tiny bract in short fascicles on the axilla. After anthesis, the corolla lobes twist and interlock, and the calyx is cupular. Five stamens with narrowly oblong anthers are frequently produced by flowers. The stigma is obovoid and the style is linear. It is a globose berry in fruit form. The woody branches have swelling at the nodes. One of the most delicate types of mistletoe, it spreads quickly across its host. It produces many epicortical roots or haustoriferous runners from its base to all sides when infested. The parasite quickly spreads throughout the host and branches widely, assisting the mistletoe in growing even on the smooth, vertical trunks of trees. The net-like haustorial growth, dichotomous branching, and enlarged nodes identify the dead parasite.[12]

H. elastica is a generalist parasite that can thrive on both gymnosperms and angiosperms, among other plant species. Out of all the *Loranthaceae* members discovered in Kerala, this parasitic species exhibited the greatest diversity in terms of host tree counts. This *Loranthacean* member infected a wide range of plants, and each host plant may have some control over the parasite's growth pattern. There have already been reports of nearly 73 trees from various families serving as hosts for this plant. According to Scot (1871), trees that yield limbid or milky juice and whose bark has acrid, bitter, or astringent characteristics are less susceptible to *Loranthacean* members.[6]

Traditional Ethnobotanical Uses of *H. elastica*

According to ethnobotany, mistletoes are hemiparasitic plants that attach their roots to the upper branches of different host trees. They are mainly found in the *Loranthaceae* family, with the exception of genera like Nuytsia, Atkinsonia, and Gaiadendron.[13] Because they are parasitic, they weaken the host, which can result in stunted growth, decreased vitality, poor fruit and seed production, thinning foliage, top dieback, deformed woody tissues, increased vulnerability to insect infestations, and even early mortality.[14]

Since mistletoe has proven to be a highly successful treatment for cancer in humans, its use has shown promise in improving the prognosis of cancer patients. [15]

H. elastica is a less well-known species that thrives on a variety of host species, including mango trees. Research has shown that *H. elastica's* genomic DNA varies according on the host. Its leaves are also said to have therapeutic qualities, such as anti-abortifacient actions, vesical calculi, and advantages for kidney diseases.[16]

According to studies, *H. elastica's* aqueous extract greatly increases urine production while encouraging the excretion of potassium, sodium, and chloride. Its methanolic extract also demonstrates strong diuretic effects.[17]

H. elastica extracts cultivated on Citrus maximum and Mangifera indica have shown cytotoxic effects in vitro, as well as the capacity to decrease fluid retention in mice and malignant tumours.[18]

The plant is known to have potent antioxidant and antibacterial qualities and to be a rich source of vital minerals. Additionally, its aqueous and ethanolic extracts have demonstrated hepatoprotective and immunomodulatory properties without demonstrating acute toxicity up to 2000 mg/kg. [19]

Phytochemical Properties and Chemical Makeup

The host-parasite relationship in flora is shaped by the three different evolutionary responses that insects show to their host plants. The first entails becoming resistant to the chemical defences of the host. Insects then use these protective substances as cues to feed. Lastly, certain species have supplementary uses for host defence compounds. The bioactive substances generated by parasitic plants offer an intriguing path for phytopharmacological research because of this complex interplay. [20]

Ajit Kumar and Lizy Mathew's initial phytochemical analysis of *H. elastica* growing on Nerium and Hevea identified glycosides, phenols, saponins, and tannins as the primary constituents. A positive Keller-Kiliani test confirmed the presence of cardiac glycosides. Results for alkaloids, sterols, triterpenoids, proteins, and carbohydrates were inconsistent, indicating variability in their presence and concentration depending on the host plant.[21]

Since *H. elastica's* chemical makeup and therapeutic potential are closely related, it has been the subject of multiple phytochemical investigations with a range of conclusions. *H. elastica* has been used traditionally to cure a variety of illnesses and has been acknowledged in numerous literary sources for its ethnomedicinal uses. Early studies of its phytochemistry revealed that whole-plant extracts contained glycosides. Its rich and complex biochemical profile was further highlighted by subsequent screens that found the presence of steroids, terpenes, reducing sugars, phenolics, cardiac glycosides, flavonoids, and alkaloids.[22]

Flavonoids: Flavonoids, also known as bioflavonoids, are powerful secondary metabolites found in plants and fungi, renowned for their diverse phenolic structures and bioactive properties [23]. Quantitative research highlights that plants are rich sources of polyphenolics, particularly flavonoids and proanthocyanidins. In a detailed analysis of *H. elastica*, high-performance thin-layer chromatography (HPTLC) and liquid chromatography-tandem mass spectrometry (LC-MS/MS) confirmed the presence of two key flavonoids—epicatechin (Figure 1) and quercetin (Figure 2) —within its ethyl acetate extract. These findings underscore the plant's potential as a reservoir of bioactive compounds with significant therapeutic value. [22]

Primary metabolites: Scientific validation of *H. elastica's* nutraceutical potential has shown that it contains important nutrients including iron and zinc, as well as lipids, proteins, carbs, and important vitamins like riboflavin, thiamine, nicotinamide, pyridoxine, and ascorbic acid.[24]

Phenolic acids: Phenolic acids, a vital class of plant-derived polyphenols, are characterized by their distinct phenolic structure with a single carboxylic acid group. They are important phytochemicals that are widely present in plant-based diets, with the largest quantities occurring in vegetable leaves, fruit skins, and seeds. Phenolic acids are usually found in bound forms such amides, esters, or glycosides; free forms are very uncommon. Their importance in plant defence, antioxidant activity, and possible human health benefits are highlighted by their presence in nature [25]. The plant *H. elastica's* extensive phytochemical profile was highlighted by the identification of many bioactive chemicals by enhanced isolation utilising column chromatography over silica gel. These include the powerful phenolic and antioxidant qualities of gallic acid (Figure 9), and ethyl gallate (Figure 10). Further supporting the existence of bioactive phenolics in the extract is ethyl gallate, which is categorised as a phenolic ester (a derivative of phenolic acid). This finding highlights the plant's potential as a useful source of chemicals with medicinal significance [26]

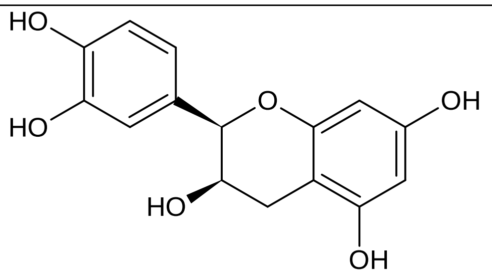
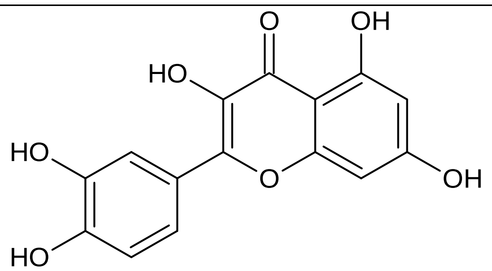
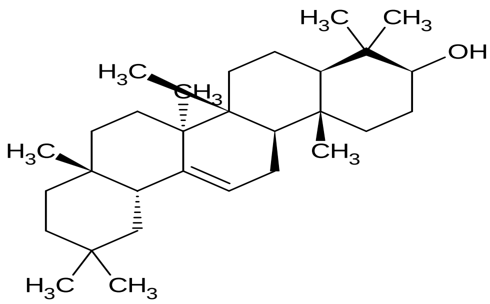
Terpenoid: Terpenoids are compounds with carbon skeleton based on 6 isoprene units ($C_{30}H_{48}$). They are categorized into two major groups, the tetracyclic compounds which are steroidal in nature with C27 and pentacyclic compounds with C30 skeleton. Neophytadene (Figure 7), a pentacyclic terpenoids, is present in the whole plant of *H. elastica* [27]. The phytochemical profile of the plant was further enhanced by the discovery of important triterpenoids, such as β-amyrin (Figure 3) (a pentacyclic triterpene alcohol), friedelin (Figure 5), and epifriedelinol (Figure 4), which were obtained through advanced isolation employing column chromatography over silica gel. Given their well-known therapeutic potential, these secondary metabolites may play an integral role in the plant's therapeutic uses. Furthermore, lupeol (Figure 6), a bioactive terpenoid (isoprenoid), was initially discovered in the cuticular wax of *H. elastica* leaves in a groundbreaking work by Kedar Kalyani A., establishing it as the most prevalent triterpenoid in this particular plant structure. This finding demonstrates the plant's potential as a wealth of chemicals with medicinal value.[26]

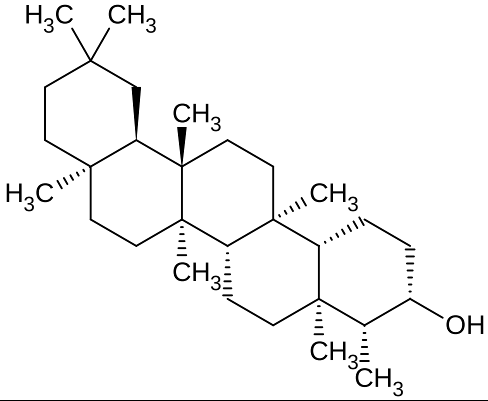
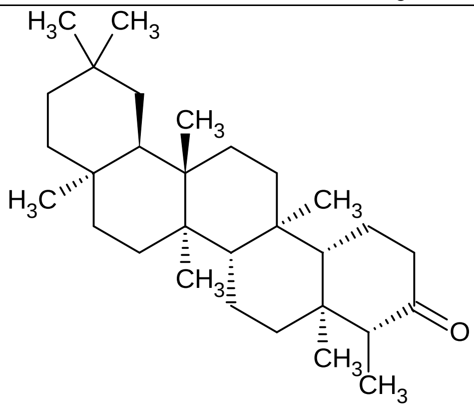
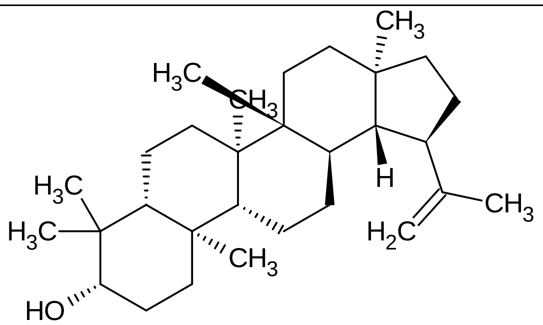
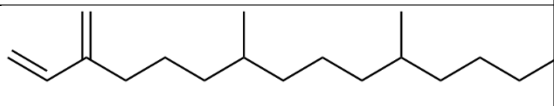
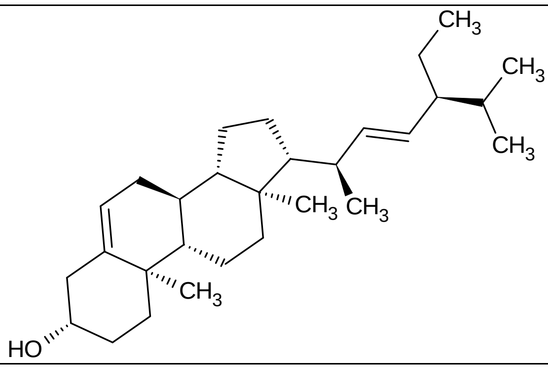
Phytosterols: Phytosterols are bioactive compounds that are naturally present in plant cell membranes with chemical structure similar to the mammalian cell- derived cholesterol. They are highly present in lipid-rich plant foods such as nuts, seed, legumes and olive oil [28]. Among various phytosterols, β-sitosterol (Figure 11) is the major compound, found plentiful in plants. β-sitosterol, is the powerful phytosterol glycoside and steroidal saponin derivative. β-sitosterol-3-β-D-glucopyranoside (Figure 12), are also found in this parasitic plant.

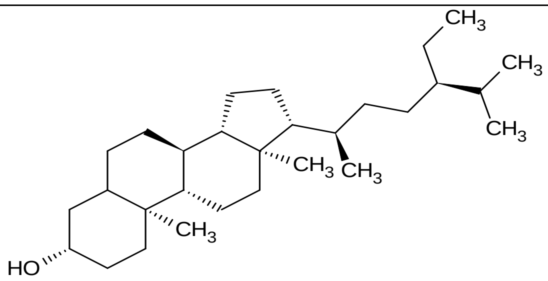
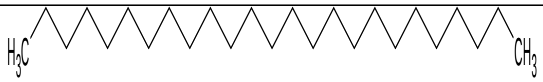
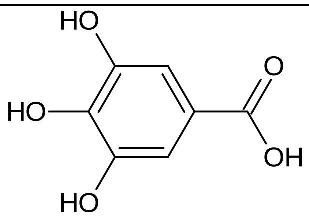
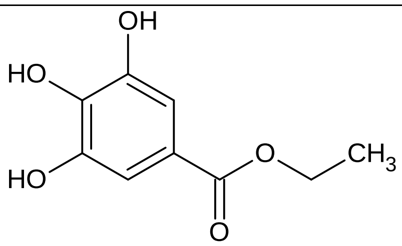
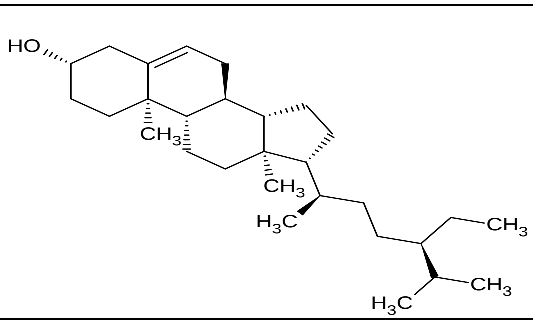
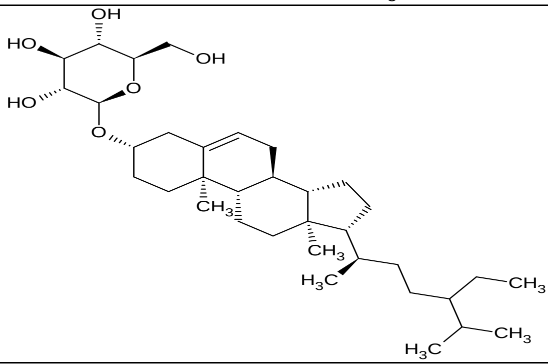
Fatty acids: Phytochemical research verified the presence of Hexadecanoic acid, 1-octadecene, octadecanoic acid ethyl ester was found in GC-MS analysis. [29]

H. elastica has a strong reducing power and efficiently scavenges free radicals, such as hydroxyl, hydrogen peroxide, superoxide anion, and nitric oxide reactive oxygen species (ROS) and reactive nitrogen species (RNS), at concentrations of 5–100 µg/mL. Its strong antioxidant action is thought to be mostly due to its high phenol content.[30]

Table 1. Figure of compound extracted from *H. elastica*

S no.	Class of compound	Compound	Structure	References
1.	Flavonoids	Epicatechin		[22]
2.	Flavonoids	Quercetin		[22]
3.	Triterpenoid	β-Amyrin		[29]

4.	Triterpenoid	Epifriedelinol		[29]
5.	Triterpenoid	Friedelin		[29]
6.	Triterpenoid	Lupeol		[26]
7.	Triterpenoid	Neophytadiene		[29]
8.	Triterpenoid	Stigmasterol		[29]

9.	Triterpenoid	β-stigmastan-3-ol		[29]
10.	Triterpenoid	Pentacosane		[26]
11.	Phenol	Gallic acid		[26] [29]
12.	Phenol	Ethyl gallate		[26] [29]
13.	Phytosterol	β-Sitosterol		[29]
14.	Phytosterol	β-sitosterol-3-β-D-glucopyranoside		[29]

Pharmacological and biotechnological applications

With its vast range of ethnomedical uses and notable therapeutic potential, *H. elastica* has gained widespread recognition. It has historically been utilised to treat kidney diseases, vesical calculi, and ascites tumor reduction. [18][10] It is also used to treat diabetes mellitus and has been shown to have abortifacient qualities. Its significance in traditional medicine is further supported by its hepatoprotective (liver-protective) characteristics, which also point to its potential for additional pharmacological research and therapeutic uses. [31] [32]

Anti-Asthmatic and Anti-Anaphylactic Activity

According to the current state of global health, respiratory illnesses like asthma, tuberculosis, and others are the leading cause of death and disability worldwide. Globally, asthma is a chronic inflammatory disease of the airways that causes significant morbidity and mortality. The preferred course of treatment for asthma is still corticosteroid therapy, though these medications are not always 100% successful.[33]

It has been reported that plants containing flavonoids have anti-asthmatic, antiallergic, and mast cell stabilizing properties. Compared to their host plant, hemiparasitic plants have higher concentrations of polyphenolic compounds. It has been reported that the hemiparasitic plant *H. elastica* has antihistaminic and mast cell stabilizing properties. Quercetin, certain cytotoxic proteins, and common flavonoids were found to be present in the hemiparasite *H. elastica*.

Using various animal models, the anti-asthmatic and anti-anaphylactic activity of *H. elastica* was investigated by cold maceration method with methanol serving as the solvent. Results showed that *H. elastica* may be useful in treating bronchitis and asthma due to its potential anti-histaminic broncheo-dilating properties. *H. elastica* methanolic extract may have antihistaminic spasmolytic activity, suppress IgE antibody production, stabilize mast cells, and inhibit antigen-induced hypersensitivity reaction in addition to its anti-asthmatic and anti-anaphylactic properties. Its potential polyphenolic compound content may also contribute to its anti-anaphylactic and anti-asthmatic properties.[34]

Antiulcer activities

Due to stress and changes in lifestyle, gastrointestinal disorders like gastric ulcers and hyperacidity are more prevalent these days. The mechanism is still not well understood, though. While there are numerous medications (such as antacids and antihistamines) that can be used to treat gastric ulcers, the majority of them cause a number of side effects, including hematopoietic abnormalities, impotence, arrhythmias, and gynecomastia.[35]

For this reason, alternative therapies—especially those derived from natural sources—are desperately needed to treat gastric ulcers. In this case, herbal extracts are the origin of novel medications since they are generally safer to use and less expensive. *H. elastica* was shown to be able to reverse the histopathological alterations in the stomach and lower the ulcer index in a study conducted by Jacob Jincy et al. It has been reported that *H. elastica* contains four major compounds: gallic acid, ellagic acid, quercetin, and friedelin. Friedelin demonstrated its antiulcer properties by inhibiting TNF-a, promoting apoptosis, and opening K+ ATP channels through a significant PGE2 production process facilitated by COX-1, a pathway that also reduced pro-inflammatory cytokines and vascular permeability.

Quercetin is another compound that has demonstrated gastroprotective activity by decreasing mast cell activity, lipid peroxidation, and antioxidant enzyme activity. Additionally, the antioxidant properties of gallic acid and ellagic acid demonstrated antiulcer effects. [36]

Hepatoprotective activity

One of the most important areas of herbology research is to look for herbal remedies to cure illnesses related to the liver. One of the most common serious health issues is hepatotoxicity, that is brought on by medications and chemical compounds**.** Hepatotoxicity is the most common type of iatrogenic illness. [37]
Corticosteroids and immunosuppressive drugs only provide symptomatic relief; they do not alter the advancement of the illness. Conversely, herbal medications are very effective in treating a variety of liver conditions, and the majority of them hasten the liver's natural healing processes.[38]

The hemiparasites of the *Loranthaceae* family, mistletoes, have important medicinal uses. Although references to these plants can be found in texts on Ayurveda and other traditional medicines, many of these kinds of plants have not been the subject of scientific study. The hepatoprotective potential of an extract made of 95% ethanol of the entire *H. elastica* plant blooming on trees of mangoes was assessed. The extracts were tested at doses of 200 and 400 mg/kg body weight for their ability to prevent hepatic damage caused by paracetamol. It was discovered that the changes brought about by paracetamol in the biochemistry and pathologic parameters significantly reversed by the extract of the whole *H. elastica* plant in ethanol. Surprisingly, though, the reversal was independent of dosage.

Noteworthy reversion of the histological alterations in the liver caused by paracetamol as well as retraction of the SGPT, SGOT occurred at lower dose levels. Although the pre-treatment with silymarin reversed the elevation of ALPase, the ethanolic extract had no effect on it at lower dose levels, and at higher dose levels, additional elevation was seen. Although, there is no documented observation for this, it doesn't seem to indicate that the liver's efficiency is compromised. The moderate reversal of liver histopathology at elevated dose levels was consistent with the changes in biochemical parameters. In actuality, the increase in total bilirubin caused by paracetamol was not significantly reversed at the higher dose level.

Even the shift in SGOT and SGPT rise that was seen was milder than the reversal that was seen at lower doses. This suggests that the ethanol extract has only modest hepatoprotective activity at higher dose levels.[32]

Immunomodulatory activity

H. elastica showcased significant immune modulatory action towards the emergence of antibodies induced by SRBCs. The production of antibodies was markedly enhanced at both dose levels by the repetitive delivery of both alcohol-based and water-based *H. elastica* extract. On the 21st day following sensitization, slight to somewhat increase in immunological paw edema was observed at higher doses of *H. elastica* extract. Histopathological analysis of the spleen tissues showed a significant increase in the mass of the white pulp, as well as enhanced cellularity and creation of unique germinal cells in the lymph nodes. Without significantly altering cell-mediated immunity, *H. elastica* exhibits possible function of immunomodulation, particularly in humoral defense.[39]

Diuretic activity of *H. elastica*

Potassium-sparing effects increased in tandem with a dose-dependent increase in diuresis caused by *H. elastica*. According to a phytochemical analysis of the methanol, *H. elastica*'s is primarily made up of carbon-based secondary chemicals (CBSCs) like polyphenolic compounds and triterpenoids; *H. elastica* has a higher concentration of polyphenolics and a lower concentration of triterpenoids, such as lupeol. Given the established impact of triterpenoids and numerous polyphenolics on the physiology of the kidney, it is reasonable to assume that these components of mistletoe are accountable for their diuretic action.[40]

Anti-inflammatory and Antiarthritics effects

People all over the world are prone to arthritis and various inflammations of the rheumatic or non-rheumatic joints. Medications made from plants and other herbal remedies are frequently used to treat these malfunctions.[41]

The endemic hemiparasite *H. elastica* was discovered to be less utilized for these kinds of illnesses, and it's possible that this plant, which was collected from various hosts, expressed itself differently in response to these conditions. To evaluate this differential expression, the methanolic extract of *H. elastica* from six different hosts was put through the HRBC membrane stabilization test for anti-inflammatory responses and the protein denaturation method for anti-arthritic assay. *H. elastica* showed anti-inflammatory and anti-arthritic characteristics when it was growing on different hosts. *Hevea brasiliensis, Nerium oleander*, and *Anacardium occidentale* hemiparasitic plants exhibited strong anti-inflammatory responses, while *Nerium oleander* plants demonstrated strong anti-arthritic efficacy.

Human arthritic conditions and inflammatory reactions were shown to be significantly improved by *H. elastica*, and the effectiveness of this treatment varied depending on the host plant in which the hemiparasite was discovered to be growing. One could argue that the host-parasite relationship has an essential function in governing the parasitic plants' metabolic activities, generating secondary metabolites as a consequence and ultimately determining their potential pharmacological effects. [42]

Anti-microbial activity

H. elastica whole plant alcohol extract was tested against *B. subtilis, E. coli, K. pneumoniae, MR Sta. aureus, P. aeruginosa, Str. pyogenes, and V. fischeri* to determine its antibacterial activity. *C. albicans* was used to test the extract mentioned above's antifungal activity. In concentrations between 250 and 500 µg, extract of *H. elastica*'s in alcohol has been proven to be beneficial against *V. fischeri, A. hydrophila, K. pneumoniae, and E. coli*. among the eight tested bacteria. Only at a concentration of 2000 µg did the alcoholic extract exhibit inhibition when tested on *Candida albicans*.[43]

Cytotoxic activity

The ability of plant extracts from the *Loranthaceae* family to kill tumour cells was tested on samples taken from 15 host trees. Gel filtration was used to partially purify biologically active extracts made from *H. elastica* grown on Citrus maxima and Mangifera indica (host trees). The refined substance was discovered to be cytotoxic in vitro and to decrease solid tumors and ascites in mice when administered concurrently or proactively. It was discovered that the material that had been partially purified was a protein with a molecular weight of roughly 80000 Da.[18]

Anti diabetic activity

Diabetes is a metabolic disease characterized by peripheral and hepatic insulin resistance that results from aberrant insulin production and action.[44] The efficacy of a methanolic extract of *H. elastica*, a parasitic plant, was investigated *in vitro* using six different hosts: *Hevea brasiliensis, Anacardium occidentale, Citrus maxima, Saraca asoca, Mangifera indica,* and *Nerium oleander.* The study compared the influence of each host on the parasitic plant. Because it inhibits alpha-amylase and alpha-glucosidase, *H. elastica*, which can be sourced from six distinct hosts, is useful in creating anti-diabetic formulations. This is due to the efficient reduction of postprandial hyperglycemia provided by the repression of alpha-amylase and alpha-glucosidase. Medicinal plants' inhibition of α-amylase can be ascribed to varying factors, including the concentration of fiber and the existence of inhibitors on fibers.

Enzyme activity is decreased when starch and enzyme are encapsulated in fiber, which limits the accessibility of starch to the enzyme. A number of researchers have proposed that different phytoconstituents, including flavonoids, cardiac glycosides, and different phenolic compounds, may be responsible for the inhibition of α-amylase. The presence of alkaloids and saponins may be the cause of the inhibition of α-glucosidase.[31]

3. CONCLUSION

For millennia, *H. elastica* has been utilized for a variety of uses. Notoriety surrounds its diversity of bioactive chemicals and its intricate array of pharmacological effects, many of which remain unexplored. Because of this plant's cytotoxic and immunomodulatory properties, research on it both *in vitro* and *in vivo* is becoming more and more important. The plant or any of its parts may have antihyperlipidemic, antibacterial, hepatoprotective, antidiabetic, and antioxidant properties. The goal of this review was to compile as much data as possible about the pharmacological activity, bioactive chemicals, and botanical features of the *H. elastica* plant. To determine which ingredients are causing the biological effects, more investigation is required. Thus, it was determined from the most recent literature assessment that the herb has a significant therapeutic value. Herb is highly efficient and safe for use in medicine, according to traditional and ethnomedical literature. A powerful and secure medication for a variety of chronic illnesses can be discovered from the plant by employing the reverse pharmacological procedures in natural drug discovery as well as to validate some claims made by the ethnobotanists. This review indicates that *H. elastica* contains several chemical compounds with demonstrated antibacterial, antioxidant, antiulcer, and immunomodulatory effects. Since *Loranthaceae* is a hemiparasite that gets its chemical components from host plants, more research is needed. Further investigation into the anatomical aspects of the investigated extracts is necessary to clarify their pharmacological mode of action. More research on the plant's ethnobotanical claims that need to be confirmed by science, the mechanism of action of the extracts under investigation, their potential to treat diabetes, and their immunomodulatory properties will build upon the current review in order to develop any of these extracts into a widely recognized medicine.

REFERENCES

[1] Sheelarani T, Gopal V, Seethalakshmi S, Chitra K. In vitro anti-inflammatory and anti-arthritic activity of selected medicinal plant. Int J Pharm Sci Rev Res. 2014;28(2):162-3.

[2] N. Kwanda, K. Noikotr, R. Sudmoon, T. Tanee, and A. Chaveerach, “Medicinal parasitic plants on diverse hosts with their usages and barcodes,” *J Nat Med*, vol. 67, no. 3, pp. 438–445, Jul. 2013, doi: 10.1007/s11418-012-0695-2.

[3] J. Těšitel, L. Plavcová, and D. D. Cameron, “Heterotrophic carbon gain by the root hemiparasites, Rhinanthus minor and Euphrasia rostkoviana (Orobanchaceae),” *Planta*, vol. 231, no. 5, pp. 1137–1144, Apr. 2010, doi: 10.1007/s00425-010-1114-0.

[4] J. D. Marshall and J. R. Ehleringer, “Are xylem-tapping mistletoes partially heterotrophie ?,” 1990.

[5] C. A. Wilson and C. L. Calvin, “An origin of aerial branch parasitism in the mistletoe family, Loranthaceae,” *Am J Bot*, vol. 93, no. 5, pp. 787–796, May 2006, doi: 10.3732/ajb.93.5.787.

[6] “Influence of hosts on the production of bioactive compounds in the hemiparasitic plant Helicanthes elasticus,” *Environmental and Experimental Biology*, vol. 19, no. 3, Oct. 2021, doi: 10.22364/eeb.19.16.

[7] A. Kumar, K. K. Jha, D. Kumar, A. Agrawal, and A. Gupta, “THE PHARMA INNOVATION Preliminary Phytochemical Analysis of Leaf and Bark (Mixture) Extract of Ficus Infectoria Plant,” vol. 1, no. 5, 2012, [Online]. Available: www.thepharmajournal.com

[8] G. Glatzel, “Mineral nutrition and water relations of hemiparasitic mistletoes: a question of partitioning. Experiments with Loranthus europaeus on Quercus petraea and Quercus robur,” *Oecologia*, vol. 56, no. 2–3, pp. 193–201, Feb. 1983, doi: 10.1007/BF00379691.

[9] W. Pietrzak and R. Nowak, “Impact of Harvest Conditions and Host Tree Species on Chemical Composition and Antioxidant Activity of Extracts from Viscum album L.,” *Molecules*, vol. 26, no. 12, p. 3741, Jun. 2021, doi: 10.3390/molecules26123741.

[10] B. B. KR Kirtikar, *Indian medicinal plant* . 1935.

[11] K. N. S. Kumar, A. Saraswathy, and S. Amerjothy, “SURVEY REPORT ON HOSTS AND HAUSTORIA OF HELICANTHUS ELASTICA (DESR.) DANSER IN UDUPI AND DAKSHINA KANNADA DISTRICT OF KARNATAKA AND KASARAGOD DISTRICT OF KERALA, INDIA-A CONCISE REVIEW PLUS SOME NEW ADDITIONS.” [Online]. Available: http://www.indianforester.co.in

[12] Sasidharan N, *Flowering plants of Thrissur forest*. 1996.

[13] R. Vidal-Russell and D. L. Nickrent, “Evolutionary relationships in the showy mistletoe family (Loranthaceae),” *Am J Bot*, vol. 95, no. 8, pp. 1015–1029, Aug. 2008, doi: 10.3732/ajb.0800085.

[14] M. C. Thriveni, G. R. Shivamurthy, K. N. Amruthesh, C. R. Vijay, and G. R. Kavitha, “Journal of American Science 2010;6(10),” 2010.

[15] Piao BK, Wang YX, Xie GR, Mansmann U, Matthes H, Beuth J, Lin HS. Impact of complementary mistletoe extract treatment on quality of life in breast, ovarian and non-small cell lung cancer patients a prospective randomized controlled clinical trial. Anticancer research. 2004 Jan 1;24(1):303-10.

[16] K. N. Sunil Kumar, K. R. Maruthi, A. H. Alfarhan, R. Rajakrishnan, and J. Thomas, "Molecular fingerprinting of Helicanthus elastica (Desr.) Danser growing on five different hosts by RAPD," *Saudi J Biol Sci*, vol. 23, no. 3, pp. 335–340, May 2016, doi: 10.1016/j.sjbs.2015.12.002.

[17] S. K. R. P. K. K. U. AL. Aleykutty NA, "Study of the diuretic activity of Helicanthes elastica. Fitoterapia," *Fitoterapia*, vol. 62, no. 5, pp. 439–440, 1991.

[18] K. T. Mary, K. Girija, and K. Ramadasan, "CANCER LETTERS Partial purification of tumour reducing principle from Helicanthis elasticus (Fam. Loranthaceae)."

[19] K. N. Sunil Kumar, B. Ravishankar, B. Yashovarma, R. Rajakrishnan, and J. Thomas, "Development of quality standards of medicinal mistletoe – Helicanthes elastica (Desr.) Danser employing Pharmacopoeial procedures," *Saudi J Biol Sci*, vol. 23, no. 6, pp. 674–686, Nov. 2016, doi: 10.1016/j.sjbs.2016.02.023.

[20] P. O. Osadebe, G. B. Okide, and I. C. Akabogu, "Study on anti-diabetic activities of crude methanolic extracts of Loranthus micranthus (Linn.) sourced from five different host trees," *J Ethnopharmacol*, vol. 95, no. 2–3, pp. 133–138, Dec. 2004, doi: 10.1016/j.jep.2004.06.029.

[21] A. Kumar and L. Mathew, "Comparative account of the preliminary phytochemical aspects of Helicanthes elastica (Desr) Danser growing on two different hosts," *~ 218 ~ Journal of Pharmacognosy and Phytochemistry*, vol. 3, no. 1, pp. 218–221, 2014.

[22] W. P. P. S. U. R. Joshi AA, "Phytochemical analysis, chemical characterization and antioxidant activity of Helicanthus elastica Desr. ," *INDO AMERICAN JOURNAL OF PHARMACEUTICAL SCIENCES.*, pp. 1159–1173, 2018.

[23] A. C. Rana and B. Gulliya, "Chemistry and pharmacology of flavonoids-a review," 2019, *Association of Pharmaceutical Teachers of India*. doi: 10.5530/ijper.53.1.3.

[24] K. N. Sunil Kumar, R. Shakila, and S. Amerjothy, "Physicochemical evaluation, nutraceutical composition and HPLC-UV fingerprint of Helicanthus elastica (Desr.) Danser (Indian Mango Mistletoe)," *International Journal of Green Pharmacy*, vol. 8, no. 3, pp. 175–179, Jul. 2014, doi: 10.4103/0973-8258.140177.

[25] N. Kumar and N. Goel, "Phenolic acids: Natural versatile molecules with promising therapeutic applications," Dec. 01, 2019, *Elsevier B.V.* doi: 10.1016/j.btre.2019.e00370.

[26] K. Kalyani and J. Rambhau, "Isolation and Characterization of Triterpenoids in Cuticular wax of leaves of Helicanthus elasticus Linn. (Loranthaceae) parasitic on Memecylon umbellatum Burm.f. (Melastomataceae)." [Online]. Available: http://www.ijddr.in

[27] S. D. Roy, P. Sunar, R. K. Dasgupta, D. Roy, D. Shil, and S. Kishaganj, "A Review on Terpenoids Introduction," 2023. [Online]. Available: www.irjps.in

[28] "Phytosterols".

[29] S. Ramachandran, "Phytochemical examination of compounds from Mango mistletoe-Helicanthus elastica (Desr.) Danser Article in Indian Journal of Chemistry Section B ·," 2015. [Online]. Available: https://www.researchgate.net/publication/280304674

[30] K. Sunil Kumar, A. Saraswathy, S. Amerjothy, T. Susan, and B. Ravishankar, "Total phenol content and in vitro antioxidant potential of helicanthus elastica (Desr.) Danser-a less-explored Indian mango mistletoe," *J Tradit Complement Med*, vol. 4, no. 4, pp. 285–288, Oct. 2014, doi: 10.4103/2225-4110.130950.

[31] T. G. Ajithkumar and L. Mathew, "In vitro Anti-Diabetic Potential of Loranthacean Hemi-Parasite Helicantes elasticus (Desv.) Danser Collected from Six Different Hosts," *Def Life Sci J*, vol. 7, no. 1, pp. 27–32, Jan. 2022, doi: 10.14429/dlsj.7.17277.

[32] K. N. Sunil Kumar, R. Rajakrishnan, J. Thomas, and G. Aadinaath Reddy, "Hepatoprotective effect of Helicanthus elastica," *Bangladesh J Pharmacol*, vol. 11, no. 2, pp. 525–530, 2016, doi: 10.3329/BJP.V11I2.26149.

[33] M. R. Edwards, N. W. Bartlett, D. Clarke, M. Birrell, M. Belvisi, and S. L. Johnston, "Targeting the NF-κB pathway in asthma and chronic obstructive pulmonary disease," *Pharmacol Ther*, vol. 121, no. 1, pp. 1–13, Jan. 2009, doi: 10.1016/j.pharmthera.2008.09.003.

[34] C. Chandrakant, J. Amol Arun, and J. A. Arun, "Anti-Asthmatic and Anti-Anaphylactic Activity of Helicanthus Elastica Desr."

[35] Ch. V. Rao, A. R. Verma, M. Vijayakumar, and S. Rastogi, "Gastroprotective effect of standardized extract of Ficus glomerata fruit on experimental gastric ulcers in rats," *J Ethnopharmacol*, vol. 115, no. 2, pp. 323–326, Jan. 2008, doi: 10.1016/j.jep.2007.09.019.

[36] J. Jincy and C. Sunil, "Exploring antiulcer and anti-inflammatory activities of methanolic leaves extract of an Indian mistletoe Helicantes elasticus (Desv.) Danser," *South African Journal of Botany*, vol. 133, pp. 10–16, Sep. 2020, doi: 10.1016/j.sajb.2020.06.014.

[37] F. V. Schiødt, F. A. Rochling, D. L. Casey, and W. M. Lee, "Acetaminophen Toxicity in an Urban County Hospital," *New England Journal of Medicine*, vol. 337, no. 16, pp. 1112–1118, Oct. 1997, doi: 10.1056/NEJM199710163371602.

[38] A. S. Negi, J. K. Kumar, S. Luqman, K. Shanker, M. M. Gupta, and S. P. S. Khanuja, "Recent advances in plant hepatoprotectives: A chemical and biological profile of some important leads," *Med Res Rev*, vol. 28, no. 5, pp. 746–772, Sep. 2008, doi: 10.1002/med.20115.

[39] K. N. Sunil Kumar *et al.*, “Effect of Helicanthes elasticus (Desv.) Danser extracts on immune profile of Wistar albino rats,” *Saudi J Biol Sci*, vol. 27, no. 11, pp. 3003–3008, Nov. 2020, doi: 10.1016/j.sjbs.2020.08.049.

[40] R. Jadhav, N. Jadhav, C. Patil, K. Chaudhari, J. Wagh, and S. Surana, “Diuretic and natriuretic activity of two mistletoe species in rats,” *Pharmacognosy Res*, vol. 2, no. 1, p. 50, 2010, doi: 10.4103/0974-8490.60576.

[41] A. A. Kamble, N. D. Khan, Z. H. Khan, and S. M. Mular, “In vitro anti-arthritic activity of,” 2017. [Online]. Available: www.isca.me

[42] T. G. Ajithkumar *et al.*, “In vitro assessment of anti-inflammatory and anti-arthritic effects of Helicanthes elasticus (Desv.) Danser accessions collected from six different hosts,” *Saudi J Biol Sci*, vol. 27, no. 12, pp. 3301–3306, Dec. 2020, doi: 10.1016/j.sjbs.2020.10.008.

[43] K. Sunil Kumar, A. Saraswathy, S. Amerjothy, and B. Ravishankar, “Antimicrobial potential of helicanthus elastica (Desr.) danser-a less explored indian mistletoe growing on mango trees,” *J Tradit Complement Med*, vol. 4, no. 4, pp. 258–262, Oct. 2014, doi: 10.4103/2225-4110.126183.

[44] M. van de Venter *et al.*, “Antidiabetic screening and scoring of 11 plants traditionally used in South Africa,” *J Ethnopharmacol*, vol. 119, no. 1, pp. 81–86, Sep. 2008, doi: 10.1016/j.jep.2008.05.031.