



# PHARMACOLOGICAL ACTIVITIES AND PHYTOCHEMICAL CONSTITUENTS OF HELIOTROPIMUM INDICUM LINN

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## **ABSTRACT**

The methanol extract from the leaves of *Heliotropium indicum* was tested for anthelmintic, analgesic, and neuropharmacological activities. Anthelmintic activities were assessed using earthworms and *Trichuris* spp. Various crude extracts from *Heliotropium indicum* (basic, neutral and acidic compounds) at 10 mg/mL, 50 mg/mL, 100 mg/mL and 150 mg/mL were used to estimate the anthelmintic effect on *Trichuris* spp. Phytochemical analysis identified alkaloids, saponins, tannins, and reducing sugar. The plant also showed moderate analgesic activity.

Neuropharmacological tests on Swiss albino mice demonstrated the extract's efficacy.

Overall, the study suggests that *Heliotropium indicum* leaves could be a cost-effective treatment for *Trichuris* spp.

*Heliotropium indicum*, an extensively used medicinal plant in traditional practices, has been reported to possess various pharmacological properties. This study aimed to research the antimicrobial activity of *Heliotropium indicum* extracts against a range of bacterial and fungal strains.

Aqueous and ethanolic extracts of *Heliotropium indicum* leaves were prepared using standard extraction methods. The phytochemical composition of the extracts was analyzed, and antimicrobial assays were conducted against selected bacterial strains (including both Gram-positive and Gram-negative bacteria) and fungal species. The minimum inhibitory concentration (MIC) and minimum bactericidal/fungicidal concentration (MBC/MFC) were determined. The study also included a comparative analysis of the antimicrobial efficacy of *Heliotropium indicum* extracts with standard antimicrobial agents.

- **KEYWORDS:-** *Heliotropium indicum*, phytochemicals, ethno medicine, alkaloids, medicinal weed

## INTRODUCTION

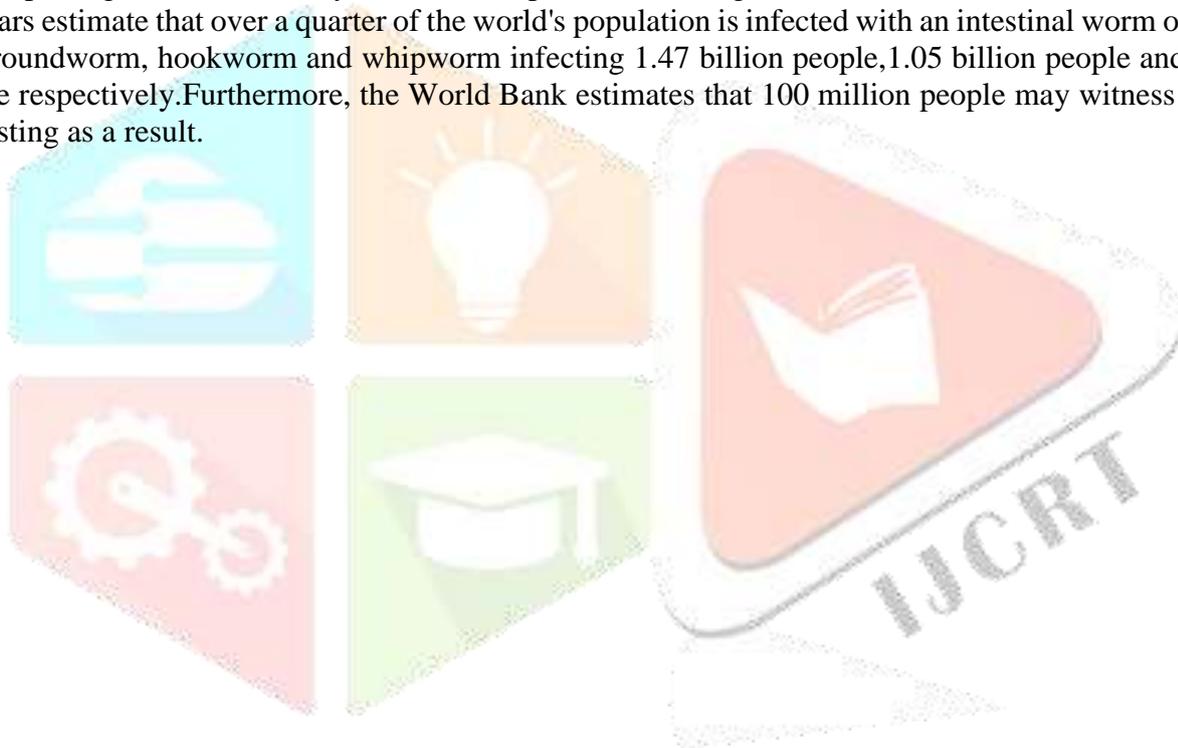
*Heliotropium Indicum* is a common plant in Ghana and other parts of Africa. It's generally known as 'Indian heliotrope', a traditional medicinal plant with numerous uses. The plant possesses antibacterial, antitumor, uterine stimulant effect, antifertility, wound mending, anti-inflammatory, antinociceptive and diuretic activities, anti-tumor and rheumatism. It is also periodically used to treat intestinal worm infestation.

The anthelmintic properties of medicinal plants, including *Heliotropium Indicum*, are estimated on earthworm species due to their similarity to intestinal roundworm spongers in humans and easy availability. In helminthiasis, a body part gets infested with worms like pinworms, roundworms, or tapeworms. These worms usually inhabit the gastrointestinal tract but can also burrow into the liver and other organs.

Parasitic worms are categorized into tapeworms (cestodes), roundworms (nematodes), and flukes (trematodes). Helminthic diseases can lead to severe morbidity, including conditions like lymphatic filariasis (causing elephantiasis), onchocerciasis (river blindness), and schistosomiasis.

Most helminth-related conditions are chronic, and existing anthelmintic medicines often cause side effects such as abdominal pain, loss of appetite, nausea, vomiting, headache, and diarrhea. According to the World Health Organization's Technical Report Series 749 on the Prevention and Control of Intestinal Parasitic Infections (2007), a significant health issue in West Africa is worm infections among growers. Communities especially in children. The study showed that, the period under review from 2001 to 2011 saw total number of 47147 cases reporting to the Laboratory for intestinal parasitic investigation (Walana et al., 2011).

Scholars estimate that over a quarter of the world's population is infected with an intestinal worm of some kind, with roundworm, hookworm and whipworm infecting 1.47 billion people, 1.05 billion people and 1.30 billion people respectively. Furthermore, the World Bank estimates that 100 million people may witness suppressing or wasting as a result.





(a)



(b)



(c)



(d)



(e)

**fig :-**Heliotropium indicum plant parts (a)Whole plant (b)Leaves (c)Flowers (d)Seeds (e)Roots

### TAXONOMY

- Domain: Eukaryota
- Kingdom: Plantae
- Phylum: Spermatophyta
- Subphylum: Angiospermae
- Class: Dicotyledonae
- Order: Boraginale
- Family: Boraginaceae (Forget-Me-Not Or Borage Family)

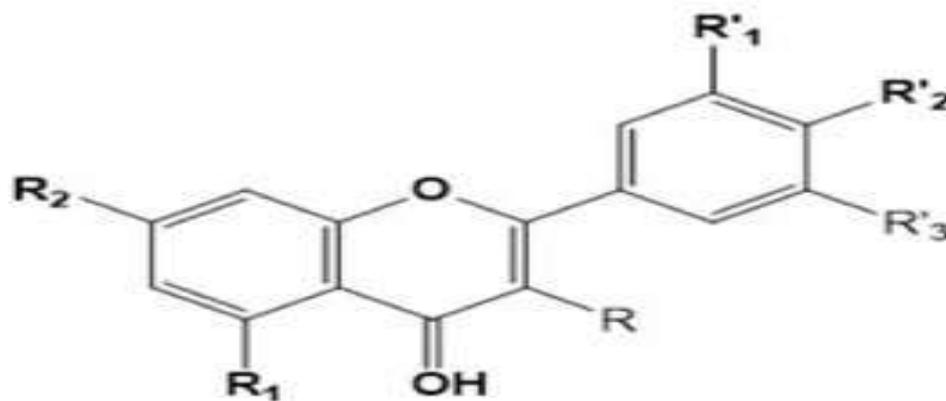
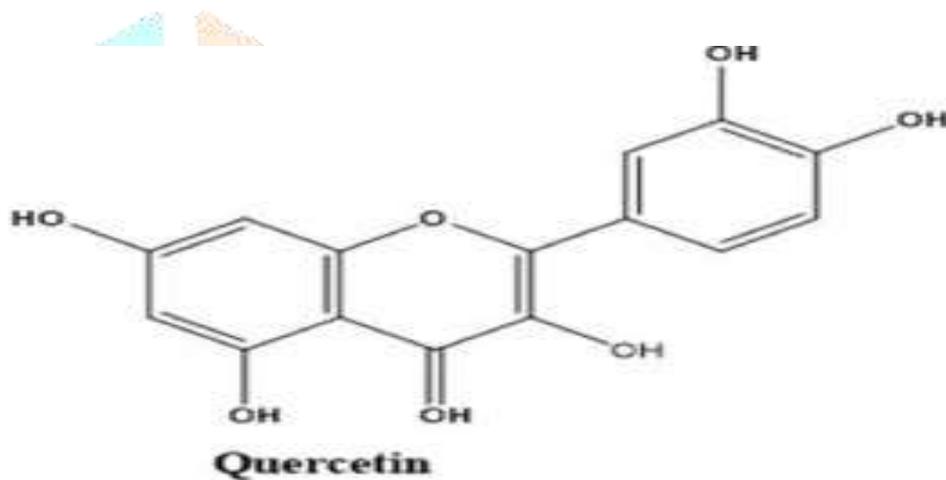
- Common name: Indian Heliotrope, Indian Turnsole
- Vernacular name: Sirari, Hattasura, Hatta Juri, Hatisura(Hindi)
- Genus: Heliotropium

### Flavonoids

Flavonoids Within this rubric, flavonoids (Fig) are the substantially common class of bioactive secondary metabolites.

Flavonoids are the substantially occurring phenols formed of a phenylpropane unit and three acetate units (Evans, 2009). Flavonols and Flavones and their glycosides are the most common ingredients are found as flavonoids in the rubric Heliotropium. Different scientists in many exploration surveys have characterized and identified various flavonoids (Fig)viz. 5,4 '- dihydroxy-7-methoxyflavanone,

4 '- acetyl- 5 hydroxy -7- methoxyflavanone, 4 methoxy- 3-[(2) -7 '- methyl- 3 '- hydroxymethyl- 2 ', 6 '- octadienyl] phenol, 5,3 '- dihydroxy- 7,4 '- dimethoxyflavanone, 7- O- methyleriodictiol, 3- O- methylgalangin, filifolinol, filifolinyl senecionate, naringenin, filifolinoic acid, filifolinone, 3- oxo-2-arylbenzofuran, dihydroquercetin, quercetin,etc.( Modak et al., 2009a, 2009b,; Modak et al., 2007, 2010; Goyal and Sharma, 2014 and Mughal, 2009).[9]



Flavones	R	R1	R2	R'1	R'2	R'3
Quercetin	OH	OH	OH	H	OH	OH
Galangin	OH	OH	OH	H	H	H
3-O-Methylisorhamnetin	OCH3	OH	OH	OCH3	OH	H
3-O-Methylgalangin	OCH3	OH	OH	H	H	H
3,7-O-Dimethylgalangin	OCH3	OH	OCH3	H	H	H

fig- Some of flavonoids insulated from the rubric Heliotropium [9]

## MORPHOLOGY

**Habitat:-** It's an endemic hirsute medicinal weed in disturbed areas, garden or lawns, roadsides, anthropogenic habitats and waste places. It's found in approximately 1000 altitude.

**Growth:-** An annual coarse foetid herbaceous plant with standing, branched growth form upto 60 cm long. Slightly woody base.

**Foliage:-** Leaves are 4-10 cm long and 2-5 cm wide, opposite or sub-opposite, alternate or sub-alternate, ovate to obovate, and acute, with a wavy or undulate, serrulate or cordate leaf margin, nerves on either side or veins conspicuous beneath the leaves. The leaf surface is covered in short hairs which may be quite stiff. The splint blade extends down the length of the petiole. Distinctly petiolate, petioles 5 cm long with a sub-truncate base or ovate.

**Flowers:-** Flowers(4-5 mm wide) are regular, sessile, axillary, slightly purple or white or whitish violet(lilac) with a small yellow center and having a narrow tube with lobes formed a plate shape. The thin cyme inflorescence is analogous as a string or twisted of beads with a prominent curl at the apex. The flowers are green and approximately 5 mm in periphery.

Flowers develop apically within the cymose there at the base of the inflorescence. Flowers arranged at one side of cyme inflorescences. Sepals number is five, 3 mm long, diffused with hairs in outside, deep green, linear to lanceolate and uneven or unstable. Calyx lobes ciliate, 3 mm long; Stamens are five and borne in a corolla tube, terminal, corolla-tube 4- 6 mm long; petals rounded. The ovary is 4-lobed.

**Stem and Roots :-**

Wide distributed, branched or unbranched, hirsute with hairs in the stem and the root system is long tap root, and it's largely branched [3, 4, 5, 6, 7]

**Genetios:-** Chromosome number of *Heliotropium indicum* Linn. is  $2n = 22, 24$ .

### Traditional and Folk Values:

Ethnopharmacology is the study of medicinal plant use in specific artistic groups or the study of differences in response to medicines in different cultures. About 90% of native people depend on the natural products of plant origin to treat several conditions. Further than 80% of the ecosystem's people depend on the folk drug system. Because of insurrections in traditional theory, awareness of traditional health care programs is constantly demoralized around the world. In Bangladesh, the juice or decoction of leaves and roots of *H. indicum* is traditionally used in chicken pox, allergy, blood purification, swelling of the knees, joint pain, and austere itchy legs and also be used as an antidote to poisoning. The *Heliotropium* species plants in the history of folk drugs provide cures for gout, inflammation, skin disorders, menstrual dysfunction, rheumatism, and noxious mouthfuls. In India *Heliotropium indicum* to cure skin infections, toxic animal mouthfuls, stomach cases and nervous diseases. *H. europacum*, is a species rich in essential oil, that has been used in the Iranian traditional drug as antipyretic, cholagogue, emmenagogue, cardiogenic, and anthelmintic, besides the treatment of headache and gout, also it has been used externally for mending injuries, and treatment of knobs. The plant is used externally in the vaginal cavity to induce abortion in pregnant women. Women take a decoction of the flowers for the treatment of menorrhagia. Leaf excerpt is used externally to prevent rheumatoid arthritis in southern parts of India. Utilizing leaves sap in hot water with coconut oil painting to protect dandruff. and fresh leaf paste is applied externally to heal injuries.[10]

**table :-**

Traditional/Folk uses of different plants of Heliotropium genus in ethno-pharmacological studies.

No.	Heliotropium species	Traditional uses of different Heliotropium Species	Part of the plant used	References
1	<i>H. indicum</i> L.	Insect stings and skin rashes	Leaves	(Muthul et al., 2006)
		Diuretic	Whole plant	(Dattagupta et al., 1977)
		Gonorrhoea	Whole plant	(Wiar, 2006)
		Rheumatism	Leaves	(Nagaraju and Rao, 1990)
		Cleaning of ulcers, eye embrocation,	Whole plant	(Schmelzer et al., 2008)
		Whooping cough in infant	Leaves, roots	(Anderson and Coe, 1996)
2	<i>H. aegyptiacum</i> L.	Dandruff	Leaves	(Giday et al., 2003)
		scorpion stings and snake bites	Roots	(Thulin, 1993)
3	<i>H. supinum</i> L.	Tumors	Whole plant	(Schmelzer et al., 2008)
4	<i>H. europaeum</i> L.	Cattle wounds, Acneantipyretic, cholagogue, emmenagogue, cardiotoxic, anthelmintic, headache, gout, externally for healing wounds, and treatment of knobs	Whole plant	(Qureshi and Bhatti, 2008)(Zargari A. 1992)
5	<i>H. ramosissimum</i> Lehm.	Burns	Leaves	(Schmelzer et al., 2008)
6	<i>H. strigosum</i> Willd.	Laxative, diuretic, gum boils, and sore eyes	Leaves	(Roeder and Wiedenfeld, 2009)
		Breast abscesses	Whole plant	(Neuwinger, 2000)
7	<i>H. amplexicaule</i> L.	Fever and cough	Whole plant	(Schmelzer et al., 2008)
8	<i>H. eichwaldi</i> Steud.	Ear pain	Leaves	(Shafi et al., 2001)
9	<i>H. steudneri</i> Verdc.	Squeezed over bruises	Whole plant	(Dattagupta et al., 1977)
		Cuts or injuries to stop bleeding and to avert infection	Leaves	(Roeder and Wiedenfeld, 2009)
10	<i>H. dasycarpum</i> Ledeb.	Eye infections	Leaves	(Tareen et al., 2010)

[Reference 10]

### **Phytochemical constituents:**

The *H. indicum* plant contains many important phytochemicals, including alkaloids (e.g., acetyl indicine, cynoglossine, echinidine, heleurine, heliotrine, helindicine, europine N-oxide, heleurine N-oxide, heliotridine N-oxide, heliotrine N-oxide, indicine, indicinine, indicine N-oxide, lasiocarpine, lycopsamine, trachelanthamidine, retronecine, and supinine) The aerial parts contain echinidine, heleurine, lasiocarpine-N-oxide, supinine, heliotrine, indicine 23, 24, 28, indicine-N-oxide. Pyrrolizidine alkaloids are a common constituent of a diverse genus of Boraginaceae family. They exhibit high toxicity on liver and lungs. Other alkaloids, including

heleurine, supinine, echinitine, heliotrine, lasiocarpine N-oxide, acetyl indicine, indicinine, and retronecine, have been isolated from the aerial parts of *H. indicum*.

### **Pharmacological Activities:**

In ancient time *Heliotropium indicum* have been used for thousands of years in the treatment of fever, cough, eye infection, stomach pain, laxatives, diuretics, gonorrhoea, rheumatism, ulcer, skin rashes, snake bites, etc. and it showed different bioactivities in animal models and reported to possess anti-oxidant, wound healing, anti-tussive, anti-bacterial, anti-fertility, anti-tumor, antihyperglycemic, anti-tuberculosis, anti-inflammatory, histogastro protective, anti-ulcer, anti-cataract, analgesic, antihelminthic and antipyretic properties.  
[12]

#### **Antibacterial activity :-**

*Heliotropium indicum* was showed significant anti-microbial properties in a dose-dependent way against different such as *Staphylococcus aureus*, *Bacillus subtilis*, *Bacillus pumilus*, *Pseudomonas aeruginosa*, *Micrococcus glutamicus*, *Serratia marcescens*, *Escherichia coli* and *Proteus vulgaris* alcoholic excerpts. Antibacterial activities of the methanolic isolate of the entire plant of *H. 7 strigosum* exhibited different inhibition zones which are produced by crude excerpt, chloroform bit, ethylacetate bit, n-hexane bit, aqueous bit, and standard doxycycline. *H. indicum* roots has been tested against certain fungi similar as *A. Niger*, *R. oryzae*, and *A. Wentii*. At a concentration of 100 • g/ml, the excerpt exhibited considerable activities with the inhibition area noted against *A. niger*, *R. oryzae*, and *A. Wentii*, compared to standard fluconazole, is 8.00, 8.00, 9.00 mm.

*Heliotropium indicum*, generally known as Indian heliotrope or Indian turnsole, is a plant that has been traditionally used in various folk drug systems. It's important to note that while there may be traditional uses and anecdotal reports of medicinal properties, scientific exploration on the antibacterial activities of *Heliotropium indicum* is limited.

Some information based on the available literature up to that point:

**1. Limited studies:-** There are a limited number of studies investigating the antibacterial properties of *Heliotropium indicum*. Some studies have explored its implicit antimicrobial activities, including against bacteria.

**2. Traditional Use:-** In traditional drug systems, *Heliotropium indicum* has been used for its purported anti-inflammatory, analgesic, and antimicrobial properties. Still, traditional use doesn't always correlate with scientifically established efficacy.

**3. Caution:-** It's important to approach the use of traditional remedies with caution, as the safety and efficacy of similar treatments may not be well-established through rigorous scientific studies. Also, the concentration and bioavailability of active compounds can vary depending on factors like plant growth conditions and medication preparation methods.

**4. Further Research:-** Further exploration is needed to evaluate the antibacterial activities of *Heliotropium indicum* more exhaustively. This includes investigating specific active compounds, understanding their mechanisms of action, and conducting well-designed clinical trials.

Before considering the use of *Heliotropium indicum* or any plant-based remedy for antibacterial purposes, it's judicious to consult with healthcare professionals. They can provide guidance based on the most current scientific knowledge and help ensure safe and effective use. [3]

**table:-**Antibacterial activities of the methanol excerpt of *H. indicum*.

Organism	Mean diameter of zone of inhibition (mm)						
	Plant extract (mg/ml)						Control drug(mg/ml)
	6.25	12.5	25	50	100	200	10
<b>Staphylococcus aureus</b>	----	----	----	7	8	14	14
<b>Pseudomonas aeruginosa</b>	----	----	----	---	6	11	7
<b>Proteus mirabilis</b>	----	----	----	---	8	12	22.5
<b>Escherichia coli</b>	---	----	----	---	---	12	22.5
<b>Klebsiella spp</b>	----	----	----	6	9	14	27

Circumference of cork borer = 6 mm

### Analgesic Activity :-

In analgesic activities the ethanolic and aqueous excerpts of the upstanding parts of *H.indicum*(30-300 mg/kg) in a mouse model of formalin- induced pain was compared with the standard medicines, diclofenac sodium(1-10 mg/kg), and morphine(1-10 mg/ kg). In ethanolic and water excerpts. A 14-day orally administered of 1-2g/kg of the ethanolic excerpt in Sprague Dawley animals produced pathological effects on the different organs such as the heart, kidney, liver,and lungs.For contrast the effect of analgesic,diclofenac sodium and morphine were used as a reference NSAID and opioid respectively. At the dosage of 30-300 mg/kg, both the first and alternate phases of formalin-brought nociception were inhibited by ethanol and aqueous excerpts in a dose-dependent.

There's limited scientific evidence on the analgesic(pain-relieving) activities of *Heliotropium indicum*,also known as Indian heliotrope.Still, traditional drug systems in various cultures have used this plant for its purported analgesic and anti-inflammatory properties.

*Heliotropium indicum* contains various phytochemicals,including alkaloids, flavonoids, tannins, saponins,and glycosides,which are often associated with implicit medicinal properties.Some studies have researched the plant's anti-inflammatory effects, but exploration specifically focusing on its analgesic activities is limited.[11]

It's essential to note the following:

**1.Traditional Use:-** In traditional drug, *Heliotropium indicum* has been used to alleviate pain and inflammation. Still, traditional uses are based on empirical knowledge and may not always align with scientifically proven effects.

**2.Scientific Research:-**While there's some exploration suggesting anti-inflammatory properties of *Heliotropium indicum*, rigorous scientific studies specifically examining its analgesic activities, especially in humans, are lacking.

**3.Caution:-**The safety and efficacy of traditional remedies, including *Heliotropium indicum*, may not be well-established through scientific studies. Additionally, the concentration of active compounds can vary, and there may be implicit side effects or interactions.

It's pivotal to consult with healthcare professionals. They can provide guidance based on the most current scientific knowledge, assess implicit hazards, and help you make informed decisions regarding its use.

As exploration in the field of herbal drug is ongoing, there may be new findings and developments beyond my last update in January 2022.Thus, checking more recent scientific literature or consulting with healthcare professionals for the latest information is recommended.

### Antihelminthic activity:-

In anthelmintic effects of methanolic and aqueous leaf excerpts of *H. indicum* (25,50, and 100 mg/mL) were tested against the Indian adult earthworm, *Pheretima posthuma*.

Mebendazole was used as a reference standard using the same concentration as the excerpt. The time to paralysis and death progressively decreased in parallel with the increase in the concentrations of the methanolic excerpt, showing results analogous to those of the standard medicine mebendazole(93). On the contrary, the effects of the aqueous excerpt were much lower and not very effective against *P. posthuma*.

There's limited scientific documentation regarding the anthelmintic (anti-worm) activities of *Heliotropium indicum*, also known as Indian heliotrope. Still, some traditional drug systems have used this plant for its purported anthelmintic properties.

**1.Traditional Use:-** *Heliotropium indicum* has been traditionally used in various cultures for its medicinal properties, including as a remedy for intestinal worms.Traditional uses are often based on empirical knowledge passed down through generations.

**2.Scientific Research:-** While there's limited scientific research specifically focusing on the anthelmintic activities of *Heliotropium indicum*, certain studies have explored its broader antimicrobial and pharmacological properties. Still,further exploration is needed to establish its efficacy against specific helminths.

**3.Caution:-** It's important to approach traditional remedies with caution, as the safety and efficacy of similar treatments may not be well-established through rigorous scientific studies. Additionally, the concentration of active compounds can vary, and there may be implicit side effects or interactions.

**4.Limitedbscientific Studies:-**While there are some studies suggesting the anthelmintic potential of *Heliotropium indicum*, the number of scientific investigations on this specific aspect is limited. Further exploration is needed to understand the mechanisms of action and efficacy against different types of parasites.

It's judicious to consult with healthcare professionals. They can give guidance based on the most current scientific knowledge, assess implicit hazards, and help you make informed decisions regarding its use.

Since my information is grounded on the state of knowledge as of January 2022, there may have been additional exploration or developments in this area. It's recommended to check more recent scientific literature for the latest findings on the anthelmintic activities of *Heliotropium indicum*. [11]

### Anti-tussive:

*Heliotropium indicum* is used for anti-tussive property in a traditional system of medicine. the antitussive activity was observed in ethanolic extract of leaves of the plant.

The anti-tussive properties of the ethanolic extract were investigated in animals in the citric acid saturated chamber.

There is limited scientific evidence on the antitussive (cough-suppressant) activity of *Heliotropium indicum*, commonly known as Indian heliotrope. Antitussive properties are often attributed to plants with certain compounds, but specific research on this aspect of *Heliotropium indicum* is limited.

Here are some general considerations:

- 1. Traditional Use:-** In traditional medicine systems, *Heliotropium indicum* has been used for various purposes, including respiratory conditions. Traditional uses, however, may not always align with scientifically proven effects.
- 2. Limited Scientific Studies:-** While there is some research suggesting anti-inflammatory effects of *Heliotropium indicum*, studies specifically addressing its antitussive activity are limited. Further research is needed to understand the mechanisms of action and efficacy in the context of cough suppression.
- 3. Caution:-** The safety and efficacy of traditional remedies, including *Heliotropium indicum*, may not be well-established through scientific studies. It's important to

exercise caution, especially considering potential variations in the concentration of active compounds.

If you are considering the use of *Heliotropium indicum* for antitussive purposes, it is advisable to consult with healthcare professionals. They can provide guidance based on the most current scientific knowledge, assess potential risks, and help you make informed decisions regarding its use.

As research in the field of herbal medicine is ongoing, there may be new findings and developments beyond my last update in January 2022. Therefore, checking more recent scientific literature or consulting with healthcare professionals for the latest information is recommended.[4]

### **Antifertility activities :**

Antifertility and abortifacient activities of petroleum ether extract of *H. indicum* were significant in rats, which validated the ethnomedicinal use of this plant as an antifertility agent. The n-hexane and benzene fractions of the ethanol extract of the whole plant also showed antifertility activities using antimplantation and abortifacient models in rats.

As of my last knowledge update in January 2022, there's limited scientific documentation on the antifertility activities of *Heliotropium indicum*, naturally known as Indian heliotrope. Antifertility activities generally refers to the capability of a substance to prevent or reduce fertility.

**1.Traditional Use:-** *Heliotropium indicum* has been used traditionally in some cultures for various medicinal purposes, but information specifically related to antifertility effects is limited. Traditional uses are often based on empirical knowledge and may lack rigorous scientific documentation.

**2.Phytochemicals:-** The plant contains various phytochemicals, including alkaloids, flavonoids, tannins, saponins, and glycosides. Some of these compounds have been studied for implicit effects on reproductive physiology, but specific antifertility activities isn't well- established.

**3.Limited Scientific Studies:-** While there may be studies indicating certain effects on reproductive organs or hormones, comprehensive scientific studies specifically concentrating on the antifertility activities of *Heliotropium indicum* are scarce.

**4.Caution:-** The safety and efficacy of traditional remedies, including *Heliotropium indicum*, may not be well- established through scientific studies. It's crucial to exercise caution and consult with healthcare professionals before using herbal remedies, especially for reproductive purposes. The use of *Heliotropium indicum* for antifertility purposes, it's judicious to consult with healthcare professionals. They can give guidance based on the most current scientific knowledge, assess implicit pitfalls, and help you make informed decisions regarding its use.

Since my information is current as of January 2022, there may be new developments or exploration findings beyond that date. Checking more recent scientific literature or consulting with healthcare professionals for the latest information is recommended.[5]

### **Wound Healing Activity :**

The alcoholic extract of *H. indicum* showed wound-mending activities in animal models. In a rat model, topical application of 10% w/v *H. indicum* showed a complete wound- mending capacity on the 14th day[19]. Two alkaloids, pestalamide B and glycylamide, N-(1- oxooctadecyl) glycyl-lalanyl|glycyl- L- histidyl, isolated from the n- butanol crude extract of *H.indicum*.showed excellent wound-mending activities on H292 human lung cells[96] e n- butanol extract of *H. indicum* also showed a significant wound-mending activities on H292 human lung cells in vitro[96]. Another experiment proved that the methanol and aqueous extracts of *H. indicum* revealed significant wound-mending activities than the other extracts (e.g., petroleum ether and chloroform in rats).

There's limited scientific documentation on the wound mending activities of *Heliotropium indicum*, commonly known as Indian heliotrope. Still, various traditional drug systems have used this plant for its purported medicinal properties, including potential wound mending effects.

Here are some key points:

**1. Traditional Use:-** Heliotropium indicum has been used traditionally in some cultures for various medicinal purposes, including the treatment of injuries. Traditional uses are frequently based on empirical knowledge and may lack rigorous scientific documentation.

**2. Limited Scientific Studies:-** While there's a scarcity of specific scientific studies researching the wound mending activities of Heliotropium indicum, some exploration on affiliated species or compounds found in the plant may suggest potential benefits for skin health.

**3. Anti-Inflammatory Properties:-** Some phytochemicals in Heliotropium indicum are believed to possess anti-inflammatory effects, which could indirectly contribute to the wound mending process by reducing inflammation.

**4. Caution:-** The safety and efficacy of traditional remedies, including Heliotropium indicum, may not be well-established through scientific studies. It's important to exercise caution and consult with healthcare professionals before using herbal remedies for wound mending.

The use of Heliotropium indicum for wound mending purposes, it's judicious to consult with healthcare professionals. They can provide guidance based on the most current scientific knowledge, assess implicit risks, and help you make informed decisions regarding its use.

Since my information is current as of January 2022, there may be new developments or exploration findings beyond that date. Checking more recent scientific literature or consulting with healthcare professionals for the latest information is recommended.[6]

### Antimicrobial Activity:-

As of my last knowledge update in January 2022, there is limited but emerging scientific evidence regarding the antimicrobial activity of Heliotropium indicum, commonly known as Indian heliotrope. Various studies have explored the potential of this plant for its antimicrobial properties, including against bacteria and fungi.

Here are some key points:

**Antibacterial Activity:** Some studies have investigated the antibacterial activity of Heliotropium indicum extracts against different bacterial strains. The results suggest that certain components of the plant may have inhibitory effects on the growth of bacteria.

**Antifungal Activity:** There is also some evidence suggesting antifungal activity of Heliotropium indicum against certain fungal species. This may be particularly relevant in the context of managing fungal infection.

**Mechanisms of Action:** The specific mechanisms through which Heliotropium indicum exerts its antimicrobial effects are not always well-elucidated and may vary based on the type of microorganism.

**Caution:** While there is promising evidence, it's important to exercise caution and not solely rely on traditional remedies without proper scientific validation. The concentration of active compounds can vary, and the safety and efficacy of herbal preparations should be established through rigorous research.

It's advisable to consult with healthcare professionals. They can provide guidance based on the most current scientific knowledge, assess potential risks, and help you make informed decisions regarding its use.

Since my information is current as of January 2022, there may be new developments or research findings beyond that date. Checking more recent scientific literature or consulting with healthcare professionals for the latest information is recommended. [3]

**table :- Pharmacological activities of dfferent parts of H.**

Activity	Excert	Method/Sy stem	Result
Anthelmi ntic activity	Methanolic excerpt of leaves	In-vitro anthelmintic bioassay	The excerpt showed significant anthelmin tic efficacy.
Antifertil ity activity	Petroleum ether excerpt of the wholeplant.E xtract of the n hexane and benzene fraction of whole plant.	In-vivo test on rats  Antiimplantation and abortifacient models in rats.	Exhibite d profound activity. Had substantia l antifertil ity activity
Antitussi ve property	Ethanolic excerpt of leaves	The citric acid saturated chamber in animals.	Extract syrup recorded the lowestnu mber of coughs.
Wound- mending activity	Dried parts of ethanolic excerpts n- Butanol fragments upstanding part (stem and leaves) The petroleum ether, chloroform, methanol and waterless excerpts of leaves.	Excision and restored incision wound model The seratch assay Excision (normal and infected), incision, and dead space crack models in rats.	Showed crack- mending capacity. e-isolated emulsion contains profound wound- mending activity.
Analgesi c activity	Aqueous and ethanol excerpts of the whole plant.	In-vivo: Formalin- induced nociception in mice.	Excerpts have analgesic activity.
Antioxida nt activity	Methanolic excerpt of leaf, stem, and root. Aqueous leaf excerpt	DPPH free radical scavenging assay.	Leaf excerpt yields greater freeradica l

			scavenging exertion than roots.
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table :-

**Traditional Uses of H.Indicum**

Country	Local Name	Traditional Use	Part Used	Mode of Administration
Bangladesh	Hatisur	Antidote to poisoning, Chicken pox	Leaves and steams	Decoction of leaves and steams is administered orally.
Benin	Koklosouden	Dystocia	Leaves	Trituration with water and drops in eyes
India	India helitrope and hatisundha	Wounds and Skin infection and ophthalmia	Wholw plant,Root	Paste of Whole plant is applied topically, Juice of the root is taken orally
Colombia	Rabo dade alcran and Verbena	Internal Parasites	leaves	Decoction of fresh leaves.
Indonesia	Tlale	Herpes and rheumatism	leaves	Decoction of fresh leaves.
Mauritius	Herbepapillon	Renal colic	leaves	Infusion of 4 or 5 green leaves.
Conakry	Not Registered	Fever	Whole plant	Decoration of whole plant ground leaves of H.indicum for local application.

**Materials and methods**

• **Collection of plant material :**

The leaves of H. indicum were collected from Dibrugarh University Campus, Assam, India during the month of April May, 2012. Both mature and young leaves were collected, washed thoroughly with water and then dried under the shade for a week. The dried leaves were then coarsely powdered and stored in airtight containers for further study. Dr. N Odyuo from Botanical Survey of India, Shilong, authenticated the plant (Voucher Specimen: Du/KM/2012/07). It's kept in the Department of Pharmaceutical Sciences, Dibrugarh University, Assam.

• **Extraction of plant material :**

Around 300 grams of powdered H. indicum leaves were extracted using a soxhlet apparatus. First with petroleum ether for 18 hours, then with solvents like chloroform, methanol, and water. The extracted solvents were recovered, and the extracts concentrated using a rotary evaporator at low temperature and pressure.

• **Selection of Indian earthworms for experiment:**

Adult Indian earthworms (P. posthuma) were chosen for their anatomical and physiological

similarity to human intestinal roundworm parasites. These worms, collected from the moist soil of Dibrugarh, Assam, India, were cleansed with normal saline to remove dirt and fecal matter. Worms measuring 3-5 cm in length and 0.2-0.3 cm in width were utilized for the experimental procedure.

- **Authentication and Identification:**

The *Heliotropium indicum* specimens were authenticated and identified. This may involve using botanical keys, consulting with taxonomists, or other methods to ensure the correct plant species.

- **Preparation of Extracts:**

Detail the process of extracting bioactive compounds from *Heliotropium indicum*. This may involve methods such as maceration, percolation, or Soxhlet extraction. Include information about the solvent used (e.g., ethanol, methanol) and extraction duration.

- **Preparation of Extracts:**

Detail the process of extracting bioactive compounds from *Heliotropium indicum*. This may involve methods such as maceration, percolation, or Soxhlet extraction. Include information about the solvent used (e.g., ethanol, methanol) and extraction duration.

### **Medicines and chemicals:-**

Mebendazole purchased from Cipla Pharmaceuticals Ltd. was used as standard drug. Similarly methanolic extract of *H. indicum* (MEHI) and aqueous extract of *H. indicum* (AEHI) were used as test medicine for the activities. The solvents and chemicals of analytical grade were used for the experimental protocol.

### **Experimental procedure:-**

The anthelmintic assay was carried out as per the system of Panda et al. with minor modifications in the process (18).

Indian adult earthworm 3- 5 cm in length and 0.1-0.3 cm in range were used for the in- vitro anthelmintic bioassay of MEHI and AEHI. A total of forty five worms were collected and were divided into nine groups each containing five earthworms in each group. Different concentration (25 mg/ mL, 50 mg/mL and 100 mg/mL) of the test (MEHI and AEHI) and standard solution were prepared in distilled water keeping the volume upto 10 ml.

### **CONCLUSION**

The review suggested that *Heliotropium indicum* Linn. Has significant potential in various aspects such as its plant characteristics, chemical composition, medicinal uses, and nutritional value. It's been a crucial natural remedy for many ailments worldwide, as discussed briefly in the article.

The review covered its diverse traditional uses, biological features, taxonomy, and other essential aspects. However, due to insufficient studies on its safety, thorough research on its medicinal properties is crucial considering its widespread traditional use across the globe. The review also identified areas that need further investigation for future research efforts.

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