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## An effective role of chirayata (*Swertia chirayita*) as anti-malarial medicinal plant

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### Abstract

*Swertia chirayita*, a medicinal plant native to the Himalayan region and parts of Asia, has garnered attention for its potential as an anti-malarial drug. Malaria, a life-threatening disease caused by Plasmodium parasites transmitted through the bite of infected mosquitoes, remains a global health concern, particularly in tropical and subtropical regions. Traditional medicine systems, such as Ayurveda, have long recognized the therapeutic properties of *Swertia chirayita*. In recent years, scientific research has shed light on its anti-malarial activity, opening up new avenues for malaria prevention and treatment. This discussion explores the botanical characteristics, pharmacological properties, and clinical evidence supporting the use of *Swertia chirayita* as an anti-malarial drug. Conventional plants are useful in both preventing and curing human illnesses. *Swertia chirata* is used medicinally according to the Indian Pharmaceutical Codex, American and British Pharmacopoeias, and other traditional medical systems (Ayurveda, Unani, and Siddha). In traditional medicine, *Swertia chirata* is often used as a bitter tonic to treat Malarial fever, appetite loss, digestive issues, diabetes, skin conditions, and other ailments.

**Keywords:** *Swertia chirata*, swerchirin, anti-malarial, pharmacology etc.

### Introduction

In the vast world of medicinal plants, *Swertia chirayita* stands out as a potent healer with a rich history of therapeutic use. This herbaceous plant, native to the Himalayan region and other parts of Asia, has been treasured for centuries in traditional medicine systems such as Ayurveda. Among its many applications, one of the most notable is its role in combating malaria, a disease that continues to afflict millions worldwide. In this article, we delve into the botanical, pharmacological, and clinical aspects of *Swertia chirayita*, exploring its efficacy as an anti-malarial agent.

Traditional medicinal herbs have been used for millennia to cure and prevent a wide range of illnesses, and their use is widespread. Because they are safe, effective, readily available, and have few adverse effects, medicinal herbs are widely used in both industrialized and developing nations<sup>[1, 2]</sup>. *Swertia Chirayata* is one of several herbal plants that have been utilized as hepatoprotective in traditional medicine. This historic plant was brought to Europe in 1839. Because of an annual or biennial plant found in Nepal's woods, it is also occasionally referred to as Nepali neem.

This annual plant, also known as shrub, grows to a height of 1.5 meters from Bhutan to Kashmir and is usually found in the sub-temperate Himalayan area between 1200 and 1500 meters<sup>[3, 4, 5, 6]</sup>. In 1814, Roxburgh described *Swertia*, a genus in the Gentianaceae family, as *Gentiana chyrayta*<sup>[7]</sup>. Approximately 135 species of annual and perennial herbs are included in this large category. *Swertia* species are frequently found as components in many herbal medicines. There are 40 known species of *Swertia chirata* in India<sup>[8]</sup>. Major therapeutic characteristics of *Swertia chirata* have been described, including antitussive, antispasmodic, antioxidant, anti-diabetic, antipyretic, hepatoprotective, antibacterial, and anti-inflammatory properties<sup>[9, 10, 11, 12, 13]</sup>.

Additionally, many pharmaceutical compounds with anticancer, antitumor, and anti-AIDS properties were extracted from natural plants<sup>[14]</sup>. 80% of people on the planet, including in

developed and developing nations, rely on medicinal plants for their basic and primary healthcare requirements, according to the WHO [15]. According to WHO estimates, there are over 170 million people worldwide who have isolated hepatitis C infection, and 3-4 million more are added to the list each year. Furthermore, each year more than five million people have acute hepatitis B virus and over two billion people already have hepatitis B infection [16]. Despite its bitter flavour, *Swertia chirata* is incredibly useful in traditional medicine. It works as an antimicrobial to combat both gram-positive and gram-negative bacteria. All parts of the plant are employed as an astringent, liver tonic, heart tonic, cough, scant urine, melancholy, dropsy, sciatica, and skin ailments in Unani literature. In gastrointestinal diseases such as dyspepsia and anorexia, the plant is also used as a bitter tonic. It has been known to have laxative and digestive properties, and it can prevent malaria, especially in cases of fever. Intestinal worms, body burning, bronchial asthma, and bowel regulation are among the other conditions for which the herb is beneficial [17, 18].

*Swertia chirayita*, known as "Chiraiyata" or "Kiratatika" in Ayurveda, holds a significant place in traditional Indian medicine. Revered for its therapeutic properties, this herbaceous plant has been utilized for centuries to address various ailments. In Ayurveda, *Swertia chirayita* is valued for its bitter taste (Tikta rasa) and cooling nature (sheetala virya), making it a versatile remedy in balancing the doshas and promoting overall health. This discussion explores the Ayurvedic perspective on *Swertia chirayita*, its botanical characteristics, medicinal uses, and therapeutic applications

#### Vernacular Names [20, 21, 22, 23]

- **English:** Chirata (Indian Gentian).
- **Hindi:** Charayatah.
- **Urdu:** Chiarayata.
- **Sanskrit:** Anaryatikta, Bhunimba, Chiratika, Ardhatika, varantaka.
- **Panjabi:** Charaita.
- **Bengali:** Chireta.
- **Marathi:** Chiraiyata.
- **Tamil:** Nilavembu, Shirattakuchi.
- **Telugu:** Nilavembu.
- **Kannada:** Nilavebu.
- **Malayalam:** Nilaveppa.
- **Gujarati:** Chirayata.

#### Taxonomical Classification

- **Kingdom:** Plantae.
- **Phylum:** Tracheophyta.
- **Class:** Magnoliopsida.
- **Order:** Gentianales.
- **Family:** Gentianaceae.
- **Genus:** *Swertia*.
- **Species:** *Chirata*.
- **Binomial name:** *Swertia chirata*.

#### Geographical Distribution

It is native to the hilly regions of northern India, the Khasi hills of Meghalaya at 1,200-1500 meters, and the Temperate Himalayas at 1,200-3,000 meters in elevation from Kashmir to Bhutan. It appears as whole plants or as shattered plant material. The smooth stem has up to one meter of easily separated bark that is yellowish or purplish brown on the

outside. It has a cylindrical base and a quadrangular shape with climbing branches. The stem's wood is porous and yellow, and it encloses the intermodal areas. This plant has a large, readily separated pith that is yellowish and has a conical, simple root with a few thin rootlets. The fruit is an ovoid, yellowish brown, unilocular, many-seeded capsule with an indistinct Odor and a very bitter taste. The leaves are opposite sessile, entire ovate lanceolate, 5-nerved with rounded base, acuminate apex, and entire margin panicles. The calyx and corolla are each 4-lobed, and the stamens are four perigynous. The ovary is unilocular with two parietal placentae. The style is slender with recurved stigmas.

#### Botanical profile

*Swertia chirayita*, commonly known as "Chiraiyata" or "Indian Gentian," belongs to the Gentianaceae family. It is a perennial herbaceous plant characterized by its slender stem, lanceolate leaves, and bright yellow flowers. Typically found in temperate and alpine regions, *Swertia chirayita* thrives in well-drained soil and prefers cool, moist environments. It has a long history of traditional use in various cultures, where it is revered for its diverse medicinal properties.

#### Macroscopic Description

The Chirayata plant has medicinal use in all its components. The fresh sample of the plant has a unique brilliant golden color throughout. The stem's surface is smooth, hair-free, and devoid of protrusion. Its length and diameter range from 6 mm to 1 m, and its color ranges from yellowish-brown to purple. The stem has a broad, continuous, easily detached yellow pith that is somewhat quadrilateral in shape at the top and cylindrical at the bottom. The plant's leaves are opposite, broad at the base, smooth on the surface, thin oval shaped, tapering to a point at either end, acuminate, and often have five to seven readily identifiable lateral veins. The round, 2-3 mm diameter, tetramerous blooms have two glandular depressions close to the base of each corolla lobe. The fruit is an irregularly shaped capsule containing numerous small reticulated seeds of around 0.25 mm in length and 0.16 mm to 0.45 mm in width. The ovary is oval-shaped, pointed, and has two carpels, each with a single loculus [24].

#### Microscopic Description

There are a lot of chloroplasts in the parenchyma, the interior tissue of leaves, and there is not much mesophyll tissue differentiation in it. The epidermis consists of a single layer that is externally coated in a thick cuticle that is more developed on the top surface than the lower. The top epidermis cells have straight walls and are bigger than the lower epidermis cells, which have a sinus shape, as may be seen with the unaided eye. The cruciferous form of stomata is limited to the bottom surface. Transecting the stem reveals a single-layered epidermis that is externally coated in a thick cuticle that is present in the stem at an early age. As the epidermis ages, it still retains its integrity but the cells become flattened and tangentially elongated. The four ribs are also composed of parenchymatous cortical cells and an epidermis, with a distinct endodermis that displays anticlinal or periclinal walls. Large amounts of very tiny needle-shaped crystals are also present; certain cortical cells contain resin combined with tiny oil droplets forming a dark brown aggregate. If roots are cut, 2-4 layers of cork are visible; the secondary cortex is made up of 4-12 layers of thick-walled parenchymatous cells.

Only a small number of them exhibit tangentially elongated, sinuous walls with radial wall development. The companion cells, thin-walled sieve tube strands, and phloem parenchyma comprised the secondary phloem, whereas the tracheid cells, vessels, and xylem fibers comprised the secondary xylem.<sup>25</sup>

### Substitute

1. *Swertia purpurascens* Wall.
2. *S. chinensis* Franchet.
3. *S. paniculata* Wall.
4. *S. lawii* Burkill.
5. *S. decussata* Nimmo.
6. *S. affinis* C. B. Clarke.
7. *S. perennis* Linn.
8. *Exacum bicolor* Roxb.
9. *Erythraea roxburghii* G. Don.
10. *Exacum tetragonum* Roxb.
11. *Enicostemma littorale* Blume.
12. All are belonging to Gentianaceae family.

**Part used:** The whole plant.

### DOSAGE

- 5-7gm.
- 2-3gm.

### Phytochemical composition

The therapeutic potential of *Swertia chirayita* stems from its rich phytochemical profile. Key bioactive compounds found in this plant include *Swertia* marin, amarogentin, mangiferin, and chiratanin. These phytoconstituents exhibit a wide range of pharmacological activities, including anti-inflammatory,

hepatoprotective, antioxidant, and antimicrobial effects. However, it is the plant's anti-malarial properties that have garnered significant attention from researchers and healthcare practitioners alike. And some other important constituents such as Xanthonenes, Xanthone glycoside and a flavonoid mangiferin also found. Other constituents are calcium, magnesium, iron, potassium and sodium<sup>[26]</sup>.

### Pharmacological Studies

- Antibacterial Activity.
- Antifungal Activity.
- Antiviral Activity.
- Antioxidant Activity.
- Anti-inflammatory Activity.
- Hypoglycaemic Activity.
- Anti-diabetic Activity.
- Anti-malarial Activity.
- Hepatoprotective Activity.
- Anti-leishmanial Activity.
- Anti-carcinogenic Activity.
- Anthelmintic Activity.
- Anti-pyretic Activity.
- Anti-diarrhoeal Activity.
- Anti-HIV.
- CNS depressant Activity.
- Mutagenicity Activity.
- Anti-leprosy Activity.
- Anti-cholinergic Activity.
- Anti-hepatitis B Virus Activity.
- Dyslipidemia.
- Gastroprotective Activity.
- Wound Healing Activity.

**Table 1:** chemical constituents and biological activity

Chemical Constituent	Biological activity
Mangiferin <sup>[27]</sup>	Anti-viral, Immunomodulatory, Anti-inflammatory, Antioxidant, Anti-diabetic, Antitumor, Anti-HIV, Chemo preventive, Hypoglycemic, Ant atherosclerotic, Anti-parkinson.
<i>Swertia</i> marin <sup>[28]</sup>	CNS depressant, Anticholinergic, Antibacterial, Anticancer, Anti-hepatitis, Anti-atherosclerotic, Cardio-protective, Anti-diabetic, Anti-arthritis.
Amaroswerin <sup>[29]</sup>	Gastroprotective.
Amarogentin <sup>[30]</sup>	Antileishmanial, Topoisomerase inhibitor, Anticancer, Anti-diabetic, Gastro protective, Anthelmintic.
Swerchirin <sup>[31]</sup>	Hepatoprotective, Hypoglycemic, Pro-hematopoietic, Chemo preventive, Blood glucose lowering activity.
Ursolic acid <sup>[32]</sup>	Antitumor, Antimicrobial.
Sweroside <sup>[33]</sup>	Hepatoprotective, Antibacterial, Hyper pigmentation, Osteoporosis, Anthelmintic.
Swertanone <sup>[34]</sup>	Anti-inflammatory.
Gentianine <sup>[35]</sup>	Antimalarial, Anti-hepatitis B virus, Antipsychotic.
Bellidifolin <sup>[36]</sup>	Hypoglycemic.
Oleanolic acid <sup>[37]</sup>	Antimicrobial, Antitumor, Anti-inflammatory, Antioxidant activity.
Syringaresinol <sup>[38]</sup>	Hepatoprotective.
Isobellidifolin <sup>[39]</sup>	Hypoglycemic.
1-Hydroxy-3,7,8 Trimethoxyxanthone <sup>[40]</sup>	Antiulcerogenic, Spasmogenic agent.
1-Hydroxy-3,5,8 Trimethoxyxanthone <sup>[41]</sup>	Antimalarial.
1,5,8-trihydroxy-3 Methoxyxanthone <sup>[42]</sup>	Blood sugar lowering.
Alkaloids <sup>[43]</sup>	Antipyretic.
ChiratoI <sup>[44]</sup>	Anti-inflammatory.
Flavonoids <sup>[45]</sup>	Antipyretic.
β-Amyrin <sup>[46]</sup>	Anti-inflammatory, Antimicrobial, Antifungal.
Xanthonenes <sup>[47]</sup>	Anti-inflammatory, CNS depressant.

### Therapeutic Applications

*Swertia chirayita* is utilized in Ayurveda to address a variety of health concerns, including digestive disorders, fever, skin diseases, and inflammatory conditions. It is commonly

prescribed in formulations aimed at detoxification, liver support, and promoting overall vitality. The bitter principles present in *Swertia chirayita* are believed to stimulate appetite, improve digestion, and enhance nutrient absorption.

Moreover, its anti-inflammatory and antimicrobial properties make it valuable in treating infections, including malaria, where it acts as a potent anti-parasitic agent <sup>[48]</sup>.

### Preparation and dosage

*Swertia chirayita* is commonly administered in various forms, including decoctions, powders, and herbal supplements. Traditional Ayurvedic formulations such as "Sudarshan Churna" and "Saptasara Kashaya" often contain *Swertia chirayita* as a key ingredient for its anti-fever and anti-malarial properties. The dosage and preparation method may vary depending on the individual's constitution, the severity of the condition, and the specific therapeutic goals. It is advisable to consult with a qualified Ayurvedic practitioner for personalized recommendations <sup>[49]</sup>.

### Clinical Studies

Numerous preclinical studies have investigated the anti-malarial efficacy of *Swertia chirayita* extracts and isolated compounds. These studies have demonstrated that the plant's bioactive constituents exert inhibitory effects against Plasmodium parasites at various stages of their life cycle. For instance, *Swertia* marin has been shown to disrupt parasite growth by inhibiting crucial enzymes involved in their survival and proliferation. Similarly, amarogentin exhibits potent anti-plasmodial activity by interfering with parasite metabolism and inducing apoptotic cell death <sup>[50]</sup>. Furthermore, clinical trials evaluating the therapeutic efficacy of *Swertia chirayita* in malaria patients have yielded promising results. In a randomized controlled trial conducted in endemic regions, patients treated with *Swertia chirayita*-based formulations showed a significant reduction in parasite load and clinical symptoms compared to standard anti-malarial drugs alone. Moreover, the plant's favorable safety profile and low incidence of adverse effects make it a viable alternative for populations at risk of malaria, particularly in resource-limited settings <sup>[51]</sup>.

### Anti-malarial activity

Malaria, a life-threatening infectious disease caused by Plasmodium parasites transmitted through the bite of infected mosquitoes, remains a major global health concern. Despite advances in prevention and treatment, the emergence of drug-resistant strains underscores the urgent need for new therapeutic interventions. *Swertia chirayita* has emerged as a promising candidate in the fight against malaria, owing to its potent anti-parasitic properties.

### Future perspectives

While the anti-malarial potential of *Swertia chirayita* holds great promise, further research is needed to elucidate its mechanisms of action, optimize dosage regimens, and assess long-term safety and efficacy. Collaborative efforts between scientists, healthcare providers, and traditional healers are essential to harnessing the full therapeutic potential of this medicinal plant. Moreover, initiatives aimed at sustainable cultivation and conservation of *Swertia chirayita* will ensure its availability for future generations and contribute to global efforts to combat malaria and improve public health outcomes.

### Conclusion

*Swertia chirayita* stands as a testament to nature's healing

pro prowess, offering a beacon of hope in the battle against malaria. With its potent anti-malarial activity and favourable safety profile, this medicinal plant holds immense promise as a complementary or alternative therapy for malaria prevention and treatment. By leveraging the wealth of traditional knowledge and modern scientific advancements, we can unlock the full potential of *Swertia chirayita* and pave the way towards a malaria-free world.

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