



ISSN (E): 2320-3862  
ISSN (P): 2394-0530  
<https://www.plantsjournal.com>  
JMPS 2024; 12(2): 52-55  
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Received: 29-01-2024  
Accepted: 05-03-2024

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## A study on different pharmacological activity of bhumyاملaki (*Phyllanthus amarus Schum and Phyllanthus niruri L.*): An important medicinal plant of India

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### Abstract

*Phyllanthus amarus* Schum, a member of the Euphorbiaceae family, is a significant herbal medicine. It goes by the name Bhumyamalaki. Plant components such as roots, leaves, fruits, milky liquid, and dried plant powder are utilized. This plant's milky extract is applied topically to treat a variety of skin ailments, such as wounds and ulcers. It is used medicinally for treating diabetes, diarrhea, jaundice, and menstruation. *Phyllanthus* is particularly important in the fight against Hepatitis B and supports liver health in general. In addition, the plant has therapeutic value for ailments including gonorrhea, dyspepsia, fever, flu, tumours, jaundice, vaginitis, dyspepsia, diarrhea, and colic. Phenolic chemicals, saponins, flavonoids, terpenoids, alkaloids, tannins, cardioglycosides, steroids, reducing sugars, and anthraquinones are the main ingredients of Bhumyamalaki. Important components like minerals, vitamins, glucose, energy, protein, crude fiber, and mild fat are found in the plant's green parts. We have covered the medicinal value, nutritional significance, biochemical components, applications in various ailments, and use as a home remedy.

**Keywords:** *Bhumyاملaki*, pharamcognosy, *phyllanthus amarus schum* and *phyllanthus amarus etc.*

### Introduction

Bhumyamalaki was first mentioned in Brihatrayees for treating respiratory system illnesses. Later, it was proven to be useful in hepatobiliary ailments. Known for its Rasayana qualities, this plant is an essential component of formulas like Jivantyadi Churna, Amritaprasa Ghrita, and Chyavanaprasa. Its importance in conventional medicine is highlighted by its adaptability to the ailments listed. Mostly found in tropical and subtropical regions of India, the plant is widely scattered across the nation. It thrives as a weed in areas that have been farmed and may also be found by roadsides and next to bodies of water. The anti-inflammatory, antioxidant, antiviral, antibacterial, nephroprotective, diuretic, hepatoprotective, anti-carcinogenic, and anti-fibromyalgic properties of several plant components have been demonstrated by studies<sup>[1]</sup>. As to the World Health Organization, the initial phase in verifying the authenticity and purity of a medicinal plant is to describe it both macroscopically and microscopically. This should be done prior to conducting any tests. In order to aid in the plant's authenticity, the current study attempts to evaluate the phytochemical and pharmacognostic characteristics of the plant. This plant is regarded by Maharshi Charaka as Kasahara because it eases coughing, while mootrargahara treats urinary diseases, swasahara helps asthma. Bhavaprakasa Nighantu: treats blood problems and cough; Kaphapittahara: Relieves kaphapittadosha; and Kaamalaahara: Treats jaundice<sup>[2]</sup> It has a bitter flavor, but becomes sweet after digestion (vipaka), and it may also be used as an astringent.

### Classical References

तामलकी हिमा तित्ता कषाय मधुरा लघुः | रोचनी पाण्डुपित्तास्रकफकुष्ठविषापहा ||  
जयेच्छवासतृषादाहहिध्माका [कै. नि]  
भूधात्री मधुरा तित्ता वीर्यतः शिशिरा स्मृता । पित्तं हन्ति कफास्रघ्नी वृष्टिदाहविनाशिनी || [ध.नि.]  
भूधात्री वातकृत्तिका कषाय मधुरा हिमा | पिपासाकासपित्तास्रकफकण्डूक्षतापहा || [भा.प्र.]  
भूधात्री तु कषायाम्ला पित्तमेहविनाशनी | शिशिरा मूत्ररोगार्तिशमनी दाहनाशनी || [रा.नि]

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**Taxonomical classification of the plant is as follows**

Kingdom: Plantae.  
 Phylum: Tracheophyta.  
 Class: Equisetopsida.  
 Order: Malpighiales.  
 Family: Phyllanthaceae.  
 Genus: Phyllanthus.  
 Species: amarus and niruri.

**Vernacular Names**

Assamese: Holpholi.  
 Poram: Lokhi.  
 Bengali: Noar.  
 Hindi: Chalmeri, Harfarauri, Bhuiaonla.  
 Kannada: Kirunelli, Nela Nelli.  
 Konkani: Bhuin-avalae.  
 Telugu: Ratsavusirike, Nela Usiri.  
 Tamil: Arunelli, Keela Nelli.  
 Malayalam: Arinelli, Kizhanelli, Nellipuli.  
 Marathi: Rayavali, Bhuiavli.  
 Oriya: Narakoli.  
 Sanskrit: Amala, Bhumymlaki, Sukshmadala, Vitunika, Bhoodatri.

**Synonyms**

Tamalaki, jata, vira, uccata.

**Ayurvedic Properties**

Rasa: Tikta, Madhura, Kashaya.  
 Guna: Laghu, Ruksha.  
 Virya: Sita.  
 Vipaka: Madhura.  
 Karma: Kapha-pitta Shamaka.

**Chemical Composition**

Lignans, flavonoids, triterpenes, sterols, alkaloids, and essential oils are found in this plant.

**Habit and Habitat**

The leaves are 3.0-11.0x1.5-6.0 mm in height, with an elliptical oblong shape. The oval, oblong leaves range in height from 10 to 60 cm<sup>[3]</sup>. The leaves are 3.0-11.0 x 1.5-6.0 mm, and the stem is upright and treaded. The younger sections are rough. Axillary flowers have bisexual blooms in the following axils after the initial 2-3 axils of unisexual, 1-3 male flowers. The male flowers have a pedicel that is 1 mm long, a calyx that is 5 oblongs, elliptic, with an acute apex and hyaline, and an unbranched midrib. The disc segments are 5 rounded and contain 3 stamens, 3 filaments that are connate, and 5 rounded and stamens, 3 filaments connate (Bagchi *et al.*, 1992)<sup>[4, 5, 6]</sup>.

**Aim & Objectives**

A study to evaluate the different pharmacological effects of *Bhumyamalaki*

**Methods and Materials**

Bhumyamalaki materials, authentic websites (PubMed, medicinal plants, etc.), Authentic Magazines, Literature, Manuscripts, Sanskrit dictionary, Shabdakosha, etc., have been compiled from various publications and journals, Ayurvedic and modern texts.

**Bhumyamalaki**

Phyllanthus amarus Schum and Thonn's new vegetable

materials. Phyllanthus Web., Phyllanthus maderaspatensis, Phyllanthus simplex, Linn Urinaria, and Phyllanthus simplex<sup>[7]</sup>. The two samples' shadows were dried. In order to investigate the epidermal structural tests for the dried leaves, the leaf epidermis must first be prepared. The dried leaves were coated evenly with a household adhesive on both the top and bottom epidermis. It is then allowed to dry at ambient temperature.

After that, the dried translucent "Quick fix" film is gently peeled off the leaf's surface and put, impression side up, on a dry, clean glass slide. To flatten the film, slide the cover slip over it and give it a little tap. After that, a compound microscope is utilized to examine it. To make line drawings, a mirror-style camera lucida was utilized.

In resolutions, the World Health Assembly has emphasized the significance of utilizing current monitoring techniques and implementing suitable standards to guarantee the safety of medical plant products<sup>[8]</sup>. In general, classical pharmacognostical studies are acceptable for quality control of herbal medications.

To provide criteria for individual medications and compound formulations to verify the authenticity of raw medications derived from plants, minerals, and animals, Macroscopic, microscopic, physio-chemical constants, fluorescence examination of the components under investigation, and the development of standards for individual medications and compound formulations are all included in the pharmacognostical standardization of herbal medicines. Before conducting any trials, the WHO (1998) states that the macroscopic and microscopic investigation of a medicinal plant is the first step toward determining its categorization and purity. One of the potential herbal medications used in Indian medicine for a variety of liver illnesses is "Bhumyamalaki", a plant medicinal made by Phyllanthus niruri Lin, a member of the Euphorbiaceae family<sup>[9]</sup>.

*P. niruri* is not found in India; it is limited to the West Indies. Among the Phyllanthus species referred to as "Bhumyamalaki" are *P. amarus* Schum and Thonn, *P. fraternus* Web, *P. maderaspatensis* Linn., *P. simplex* Retz, and *P. urinaria* Linn. It has also been used to treat various ailments, wounds, and ulcers on the skin. The main focus of Phyllanthus is its capacity to inhibit viruses, particularly the hepatitis B virus. Studies show that Phyllanthus can lessen the quantity of hepatitis B virus in the circulation and prevent the virus's development and replication. While its ability to eradicate viruses has not been verified, it has demonstrated efficacy in mitigating symptoms and combating the hepatitis B virus. Additionally, Phyllanthus can support the general. An examination of the literature indicates that very few scientists have examined *P. fraternus*'s structural characteristics. Saha and Krishna Murthy researched *P. fraternus* Web's structural features (1959). Yelene *et al.* subsequently conducted the leaf structural research. Khatoon *et al.* examined three varieties of Phyllanthus<sup>[10]</sup>. A published study comparing the microscopic diagnostic features of every known Phyllanthus species with hepatoprotective qualities has not yet been released. Histological investigations of plant drugs are crucial for correct identification as well as for the research of adulterants.

**Pharmacological action****Antioxidant action**

Ferric Reducing Antioxidant Strength (FRAP) tests, 2,2-diphenyl-1-picrylhydrazyl (DPPH) free radical scavenging activity, and the Folin-Ciocalteu method were used to

quantify the Total Phenolic Content (TPC) and antioxidant activity of both fresh and dried *Phyllanthus amarus*. The TPC and antioxidant activity of *P. amarus* methanolic extracts were significantly reduced by various drying techniques, with microwave drying producing the most decrease<sup>[11]</sup>.

#### Anti-hepatotoxic action

Administration of ethanol lowers the content of phospholipids, cholesterol, and triglycerides in the liver, brain, kidney, and heart (Tripathi *et al.*, 1992). Whole plant powder administered to cattle at dosages of 35 and 70 mg kg<sup>-1</sup>. (Sane and others, 1995)<sup>[12]</sup>.

#### Antiviral action

Following Elisa antigen screening, *P. amarus* alcoholic, hexane, chloroform, butanol, and water extracts were analyzed *in vitro* on HbsAg, HBeAg, and HBV-DNA in blood samples positive for HBV antigen. The butanol extract was the most efficient against HBV antigen (Mehrotra *et al.*, 1991). a single injection of an aqueous extract on human hepatocellular carcinoma-derived cells at a dosage of 1 mg mL<sup>-1</sup>. For a duration of 48 hours, the secretion of HBsAg was stopped (Jayaram and Thyagarajan, 1996; Yeh *et al.*, 1993). *Phyllanthus amarus* might be employed as an antiviral drug since it affected the Hepatitis B virus's polymerase activity, mRNA transcription, and replication<sup>[13]</sup>. *Phyllanthus amarus* was found to be effective as an antiviral drug due to its disruption of the Hepatitis B virus's polymerase activity, mRNA transcription, and replication.

#### Anti-Bacterial Action

Using the Bauer disc diffusion technique, the antibacterial efficacy of extracts from the root and leaf was evaluated against ESBL-producing *Escherichia coli* obtained from stool samples collected from HIV-positive individuals. All HIV seropositive patient strains were sensitive to the extracts at different dosages (5, 10, 20, 40, and 80 mg mL<sup>-1</sup>). This demonstrates the antibacterial potential of the extract (Akinjogunla *et al.*, 2010)<sup>[14]</sup>.

#### Hepatoprotective Action

Total cholesterol, AST, ALT, urea, uric acid, total protein, prostatic, alkaline, and acid phosphatases were significantly reduced (p<0.05 student's t-test) following a methanol extract of *Phyllanthus amarus* leaves (50-800 mg kg<sup>-1</sup>). Uric acid had the most lowering impact and total cholesterol the least at 400 mg kg<sup>-1</sup> *P. amarus* extract. The duration and dose of these effects were also crucial. This demonstrates *P. amarus* leaf hepatoprotective, nephroprotective, and cardioprotective qualities (Obianime and Uche, 2008)<sup>[15]</sup>.

#### Hypoglycaemic Action

It was discovered that an alcoholic *P. niruri* extract considerably lowered the blood sugar levels of both normal and inalloxan-induced diabetic mice. According to tests on liver and kidney function as well as hematological indicators, plant extract did not result in any harm. The findings suggest that *P. amarus* Schum may have anti-diabetic properties<sup>[16]</sup>.

#### Anti-inflammatory activity, analgesic activity and anti-nociceptive properties

In mice using glutamate and capsaicin models, the isolated tannin Corilagin ( $\beta$ -1-O-galloyl-3,6-(R)-hexahydroxydiphenoyl-D-glucose) from *P. niruri* has antihyperalgesic efficacy at a dosage of 3 mg/kg, which may be

because of an interaction with the glutamatergic system. When given intraperitoneally to rats to treat acetic acid-induced writhing and formalin-induced pedal edema, the methanolic extract of *P. niruri* demonstrated antinociceptive properties and greatly improved nociception. A 1984 study on *P. niruri* conducted in Brazil at the Federal University of Santa Catarina found an alkaloid (phyllanthoside) in the leaves and stem that had potent antispasmodic properties. They found that because of its smooth muscle-relaxing properties, *P. niruri*'s ability to effectively evacuate stones was likely due to its spasmolytic activity<sup>[17, 18]</sup>.

#### Hypolipidemic Activity

Rats were used to test the anti-hyperlipidemic effects of *P. niruri* alcoholic extracts in triton-induced hyperlipidemia. *P. niruri*, at a dosage of 100 mg/kg, decreased the high level of low-density lipoprotein lipids in experimental animals with hyperlipidemia, as demonstrated by rats given cholesterol in an experiment<sup>[19]</sup>.

#### Anti-plasmodial and nematicidal activity

We assessed the antimalarial efficacy of ethanolic, dichloromethane, and lyophilized aqueous extracts of *Cassia occidentalis* root bark, *Moringa chindoides* leaves, and entire plants of *P. niruri* in 4-day suppressive tests against *Plasmodium berghei* ANKA in mice. Mice administered with any of the extracts orally at a single dose of 500 mg/kg body weight or twice weekly for 4 weeks (totaling 4g/kg) did not exhibit any harmful effector mortality. The most potent ethanolic extract, *P. niruri*, exhibited a 73% reduction in parasitaemia. The related ethanolic extract was more active than the lyophilized aqueous extract<sup>[20]</sup>.

#### Anti-hyperuricemic activity

In rats with hyperuricemia brought on by uric acid and potassium oxonate, the methanol extract from the leaves of *Phyllanthus niruri* L. demonstrated oral anti-hyperuricemic action. By using resin chromatography to fractionate the extract, a less polar fraction was isolated that showed the greatest decrease in plasma uric acid. Three lignans were obtained from the fraction after further antihyperuricemic-guided purification: Phyllanthin (1), hypophyllanthin (2), and phylltetralin (3). Of these, phyllanthin (1) significantly reduced the plasma uric acid level of hyperuricemic animals to its normal level in a dose-dependent manner, which is similar to the clinically used treatments of gout and hyperuricemia with allopurinol, benzbromarone, and probenecid. Therefore, more research into the possible antihyperuricemic effects of *P. niruri*'s lignans is warranted<sup>[21]</sup>.

#### Discussion

Furthermore, jaundice, diarrhea, dysentery, sporadic fevers, urino-genital system infections, scabies, ulcers, burns, and the common cold are all treated with this herb. When it comes to the hepatitis B virus, it possesses strong antiviral properties. It contains anti-inflammatory and anti-nociceptive qualities in addition to anti-diabetic and anti-lipidemic ones. Consequently, an attempt has been made to incorporate a comprehensive evaluation of the literature on its pharmacological, conventional, and phytochemical qualities in the current analysis. *Phyllanthus amarus* possesses both anisocytic and paracytic stomata, but *P. fraternus* and *P. maderaspatensis* solely have anisocytic stomata, according to microscopic examination of the *Phyllanthus* species.

*P. maderaspatensis* possesses smooth epidermal cell walls, whereas *P. amarus* and *P. fraternus* have wavy ones. India refers to all of the *Phyllanthus* species mentioned above as "Bhumyamalaki", and they are used to cure various liver ailments. But not all *Phyllanthus* species have the therapeutic ingredients that are used to cure liver ailments [22].

Five different species are combined to form *Phyllanthus niruri* Linn. These species include *P. amarus* Schum and Thonn, *P. fraternus* Web, *P. maderaspatensis* Linn, *P. simplex* Retz, and *P. urinaria* Linn. *P. amarus* Schum and Thonn, *P. fraternus* *P. niruri*, listed in the flora of British India, and "Bhumyamalaki," referenced in the classical literature, have lately been equated with *P. amarus* based on clinical effectiveness. *Phyllanthus niruri* Linn. is a combination of five separate species. However, because of their similar morphologies, all five *Phyllanthus* types are occasionally confused and offered for sale in herbal medicine markets worldwide under the same colloquial name. As a consequence of this study, which was conducted using a highly precise approach, diagnostic features for each of the five *Phyllanthus* species examined have been developed [23].

### Conclusion

Using straightforward methods, the microscopic diagnostic characteristics of the current study will aid in the identification of genuine *Phyllanthus* samples utilized in liver illnesses. This study is the first of its type to compare the microscopic diagnostic features of "Bhumyamalaki." In India, the whole plant is utilized to treat a wide range of illnesses. It is possible to determine the extracts' antioxidant capacity using a variety of *in vitro* tests. Root and leaf extracts were tested for their antibacterial efficacy using extended spectrum lactamase. The suppression of cell cycle regulators and the metabolic control of carcinogens are two ways that *P. amarus*'s antitumor and anticancer action is established.

**Source of Support:** Nil

**Conflict of Interest:** None

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