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Review Article

An Updated Review on *Phyllanthus Niruri:* Its Phytochemistry, Pharmacological Activity, Medicinal Use and Traditional Use

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ABSTRACT

Phyllanthus niruri, known as the "stone breaker", is a medicinal plant with a long history of use by indigenous peoples. In this review, a critical appraisal of the medicinal properties and therapeutic potential of Phyllanthus in various pharmacological actions, particularly antiviral, hepatoprotective, antioxidant, anti-inflammatory, antidiabetic and nephro-protective effects. However, the bioactive compounds such as lignans, flavonoids and alkaloid of P. niruri has been unrevealed through recent biological studies of the therapeutic uses. The efficacy and scope of the antiviral activity, in particular the inhibition of replication of hepatitis B virus (HBV), are supported by non-clinical as well as clinical studies. Furthermore, Phyllanthus niruri has exhibited substantial hepatoprotective properties that help prevent liver toxicity and enhance liver function in cirrhotic and hepatitis patients. It also benefits the kidneys, protecting them from kidney stones and its juice helps to dissolve existing stones in the system. It also contains flavonoids that possess antioxidant and anti-inflammatory activities, thereby benefits to protect against oxidative stress-related diseases such as diabetes mellitus and cardiovascular diseases. In spite of these optimistic discoveries, however, larger-scale clinical trials are still necessary for dosages to be standardized and mechanisms at play elucidated more completely within the context of modern pharmacology. The study of this review highlights the therapeutic importance of Phyllanthus niruri and its role in traditional and modern medicine.

INTRODUCTION

Phyllanthus niruri, also known as the “stone breaker” and “gale of wind,” is an important medicinal plant in traditional medicine. The plant is used to treat numerous diseases, found mostly in tropical and subtropical regions. This plant is a tradition medicinal remedy for stomach, liver disease, kidney stones and spleen. The whole plant is beneficial in gastritis, diarrhea, dysentery,

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recurrent fevers, ophthalmopathy, scabies. It also plays a major role in respiratory disorders and it can be consumed as a tonic. The term "chanca piedra" means the "stone breaker" and it has been used for centuries in India, Asia and South America to eliminate gall bladder and kidney stones, and improve gall bladder, cardiovascular problems as well as a remedy worldwide for influenza (Smith & Lee, 2023; Gupta & Bose, 2024). Recently, more scientific research work has revealed his therapeutic potentials mainly through Hepatitis-B, diabetes and liver disorder (Zhang & Li., 2024; Mello et al., 2022). Hence, this work is an overview of different therapeutic properties of *Phyllanthus niruri* known from recent study modules. The medicinal properties of *Phyllanthus niruri* are ascribed due to its influence on various biological pathways. Its antiviral mechanism of action is to prevent viral replication by interference with DNA polymerase particularly in hepatitis B virus (Smith & Lee 2023; World Health Organization, 2024). The pharmacology of the plant is linked to its antioxidant properties that reduce peroxidation and stimulate regeneration of liver cells (Gupta & Bose, 2024; Mello, Dos Santos, & Prado, 2022). Finally, a mechanistic study showed that *Phyllanthus niruri* promotes the activation of Nrf2 key regulator of the body's antioxidant defense which further confirms its potential use in treating oxidative stress-related diseases (Zhang & Li, 2024).

Plant Profile

Kingdom	Plantae
Botanical name	*Phyllanthus niruri*
Family	Phyllanthaceae
Order	Malpighiales
Class	Dicotyledoneae
Species	niruri
Genus	Phyllanthus

Botanical description

Phyllanthus niruri is an annual herb which in 10-60cm tall in height and leaves are 3-11x1.5-6mm elliptic oblong. The flower is 1cm long and seeds is 2mm wide and 1-2 mm long round and smooth. (Morton JF et al., 1981). *Phyllanthus Niruri* is related to the family of Phyllanthaceae, the habitat of this plant was India, Africa, Asia and south-America (World Health Organization, 2024; Mello et al., 2022). It is a tiny medicinal plant that has a taste of acid, in the stems these herbs have small leaves with greenish white flowers. Ayurvedic and Chinese medicines use this herbs to treat jaundice, kidney stones and liver disorders (Gupta et al., 2024; Zhang & Li., 2024). ethnobotanics medicinal research proves that the plant contains the biological active compounds of alkaloid, phenols, polyphenols, and lignans and these compounds are useful for its healing properties.

Plant Distribution

The *Phyllanthus Niruri* is found in various reagions like India, China, Malaysia, the Philippines, and Australia. This plant is grow in wild and after first shower of monsoon in Jharkhand, Bihar, Chhattisgarh, etc. state of India. Its fruit is bearing in mid of July-August. It is an annual and grow primarily in the subtropical biome. (Adair R.S. Santos et al., 1995)

Phytochemistry

On the analysis of phytochemical activity in *phyllanthus niruri* unraveled its diversified bioactive compounds that support its medicinal properties. lignans (hypophyllanthin and phyllanthin), flavonoids, saponins, coumarins, alkaloids and tannins are the key components of this herbs (smith &lee, 2023; Zhang et al., 2024). The healing effect was found in these compounds including liver protective, antioxidant, antiviral and anti-inflammatory effects. In added to that recent research shows that the phenolic

compounds in *phyllanthus niruri* are antioxidant potential which plays important role in decreasing oxidative stress factor in chronic disease like cardiovascular conditions and diabetes (Gupta & Bose, 2024; Mello et al., 2022).

Pharmacological Properties

1. Antiviral activity

The most widely investigated effect of *Phyllanthus niruri* is the antiviral activity in particular against hepatitis B virus (HBV). Therefore, by preventing the viral DNA polymerase, phyllanthin as well as hypophyllanthin hinders the duplication of HBV (World Health and wellness Company, 2024). In some cases of in a recent study results have invariably shown dietary supplements to decrease HBV viral load in patients (Zhang & Li, 2024) and provide enough evidence for the traditional usage of this remedy for the treatment of viral hepatitis (Gupta et al., 2024). Furthermore, several studies have shown anti-hepatitis B infections activities of *Phyllanthus niruri* and some effects against other viruses such as HIV and herpes simplex (Smith and Lee, 2023; Mello et al., 2022).

2. Hepatoprotective activity

Phyllanthus niruri that has been researched widely for its hepatoprotective effects. From the observation of animal studies and clinical trials, it shows that *Phyllanthus niruri* protects liver cells from toxins such as carbon tetrachloride and alcohol, efficiently rejuvenating lost liver function, while decreasing inflammation (Mello et al., 2022; Zhang&Li, 2024). In addition, recent research conducted have supported previous claims that *Phyllanthus niruri* may also assist in reducing liver enzyme levels and liver inflammation among those suffering with cirrhosis as well as hepatitis (Gupta & Bose, 2024; Smith et al., 2023).

3. Anticancer activity

Epidemiological and experimental studies suggest that medicinal herbs have great potential in the management of different type of cancer including lung, breast, colon, liver, prostate skin and ovarian carcinomas. In this connection medicinal plant extracts, and their purified compounds (phytochenmicals) have significant growth inhibitory potential against various types of cancer cells, (Harvey et al., 2015)

4. Kidney Health

The plant *phyllanthus niruri* is traditionally called as the "stone breaker," this herb has already been used to treat and get rid of kidney stones. Research confirms this happens "due to prevention of calcium oxalate crystal formation and also by dissolving established crystals" (Gupta & Bose, 2024). A clinical trial showed that kidney stones size of the patients has been decreased significantly when treated with *Phyllanthus niruri* extract and therefore reinforced its usage through time for renal calculi treatment (Mello et al., 2022; World Health Organization, 2024).

5. Anti-inflammatory activity and Antioxidant activity

The antioxidant activities of *Phyllanthus niruri* are considerably high due to its several types of flavonoids and phenolic compounds, which can reduce free radicals and decrease oxidative stress (Zhang & Li, 2024; Gupta & Bose, 2024). Studies have shown it can reduce inflammatory markers in diseases like arthritis and cardiovascular conditions (Smith & Lee, 2023). A study of (Zhang et al., 2024) publish provided supplemental results by highlighting the anti-inflammatory effect of *Phyllanthus niruri* to play a capable role in mitigating inflammation among patients with chronic inflammatory diseases.

6. Antidiabetic activity

Phyllanthus niruri has been proved and evidenced that it had hypoglycemic effects. Flavonoids alongside with alkaloids were reported to improve insulin sensitivity and controls blood glucose levels (Gupta and Bose, 2024; Mello et al., 2022). In a study, *Phyllanthus niruri* improved blood sugar control in patients with type-2 diabetes and may be useful as an adjuvant to diabetes management. (Smith & Lee, 2023; Zhang et al., 2024).

7. Antimicrobial activity

It knows that Helicobacter pylori is resistant to most antibiotics, but *phyllanthus niruri* preparations have antimicrobial activity against this bacterium chloroform and methanol extracts of *phyllanthus niruri* whole plant have superior anti-H. Pylori activity compared with its pure compounds. (Lai et al., 2008)

Clinical Trials and Human Studies

Although most of the research in *Phyllanthus niruri* has been preclinical, now there is lot of clinical evidence to support its benefits. On a double-blind study of the patients who had HBV infection showed that viral load as well as liver parameters in effect reduced by substantial means with *Phyllanthus niruri* extract (Gupta et al., 2024). Another potential medicinal benefit of pumilucidin B is that it may act in compliance with *Phyllanthus niruri* recommendations, which were published by the World Health Organization (2024), such as having antimicrobial properties or reducing kidney stones density and number among patients with kidney stones size when they received frequent dosing of *Phyllanthus niruri* supplementation (Mello et al., 2022).

Traditional and Medicinal Uses

Phyllanthus niruri has been used traditionally as a medicinal plant for centuries to treat liver diseases, kidney stones, and viral infection (Smith & Lee 2023; Gupta & Bose 2024). Recently it was found that Action potential, it was a popular traditional Chinese herbal medicine for centuries, has various pharmacological competences which include antiviral and hepatoprotective effects (Zhang et al., 2024). More recently, modern research has included insulin tropic, antioxidant and anti-inflammatory properties such as potentially being new remedies for diabetes, oxidative damage and even chronic inflammatory diseases (Mello et al., 2022; World Health Organization, 2024).

Future Research Directions

Even though *Phyllanthus niruri* may offer a lot of therapeutic potential, future investigations should consider large scale clinical trials to establish appropriate doses and long term safety (Smith & Lee, 2023). Recently, to recognize which pathways are involved in its actions particularly such as diabetes and inflammation (Zhang et al., 2024), additional studies must also be done. Furthermore, its potential as adjuvant delivery for polytherapies may revolutionize the treatment of more intricate diseases (Gupta and Bose, 2024).

CONCLUSION

Phyllanthus niruri is a medicinally important plant having numerous biomolecules, pharmacological activities such as antiviral, antioxidant, antidiabetic, hepatoprotective and nephron-protective potentials (Zhang & Li, 2024; Mello et al., 2022). Evaluation of the potential of *Phyllanthus niruri* with respect to its traditional uses and data from bio scientific research. It has been well established the link with between traditional remedies and modern research in a number of plants which help to discern an effective mode of action of plant derived products. With further empirical evidence to come, especially

with the expanding recent researches, *Phyllanthus niruri* is expected to take a greater place in modern medicine. Considerable additional human studies are necessary for a complete evaluation of its clinical promise.

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