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Review Article

An Overview of *Phyllanthus Niruri*

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ABSTRACT

Phyllanthus niruri Linn. (Commonly known as Chanca piedra or Bhumi Amla) is an annual herb that has been historically utilized in traditional medical systems, particularly Ayurveda, for over 2,000 years. It is widely distributed across tropical and subtropical regions. The plant's therapeutic efficacy is attributed to its rich and diverse phytochemical profile, which includes major classes such as lignans (e.g. phyllanthin), flavonoids, and alkaloids. Contemporary research substantiates its traditional applications and confirms a broad spectrum of pharmacological activities. Key properties include pronounced hepatoprotective and antioxidant effects, anti-lithic activity against kidney stones that has earned it the common name "stone crusher" and notable antiviral properties against Hepatitis B virus and human immunodeficiency virus (HIV). Additional documented activities include anti-diabetic, anti-ulcer, diuretic, antiplasmodial (antimalarial), and anti-amnesic effects mediated through acetylcholinesterase (AChE) inhibition.

INTRODUCTION

Phyllanthus niruri Linn. (Euphorbiaceae), commonly known as Chanka piedra or Bhumi Amla, is a small, erect annual herb widely recognized for its extensive medicinal properties [1]. It is sparsely distributed throughout the tropical and subtropical regions of the world, with an indigenous occurrence in the Amazon rainforest, India, and China [2]. The genus Phyllanthus is considerable in size, comprising more than 600 species of shrubs, trees, and annual herbs [2,3].

Historically, P. niruri has been a cornerstone of traditional medical systems, particularly in Indian Ayurveda, where its use dates back more than 2,000 years. Traditional applications utilize its therapeutic potential for a wide array of disorders, including jaundice, ulcers, skin diseases, urinary tract disorders, diabetes, bronchitis, and asthma [4]. It has traditionally been reported to stimulate

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hepatic function, enhance digestion, and act as an astringent and laxative [1].

The plant's documented efficacy is attributed to its rich and diverse phytochemical profile. Active constituents identified from various parts of P. niruri include major classes such as lignans (e.g., phyllanthin and hypophyllanthin), flavonoids, alkaloids, terpenoids, polyphenols, tannins, coumarins, and saponins [1,2].

Modern scientific investigations have validated many of its traditional uses and have demonstrated a broad spectrum of pharmacological activities [1]. Key therapeutic properties that have attracted substantial research interest include its potent hepatoprotective and antioxidant activities [5]. The herb is also widely known as a "stone crusher" because of its anti-lithic action against kidney stones. Extracts of P. niruri have additionally exhibited important antiviral properties against viruses such as Hepatitis B virus and Human Immunodeficiency Virus (HIV). Other reported biological activities include antimicrobial, anticancer, anti-inflammatory, antiplasmodial, and diuretic effects [1].

COMMON NAMES

Table 1. Common Name Of Phyllanthus Niruri [6]

Sr. No.	Country	Names
1	India	Bhoomi Amalaki , Bhui Amla, Bhuianvalah, Bhumyamalaki, Jar Amla , Kizha Nelli.
2	Bangladesh	Bhui Amla
3	East Indies	Bhuimy-amli, Daun Marisan, Pombinha.
4	Pakistan	Bhuin-Amla, Niruri.
5	West Indies	Cane Peas Senna, Carry-me Seed, Chamber Bitters, En Bas, Gale-Wind Grass, Mimosa,
6	Fiji	Carry-me Seed, Jar Amla.
7	Peru	Chancapiedra,
8	Virgin Island	Creole Senna,
9	Haiti	Derriere-Dos, Deye Do.
10	Sudan	Elrageig,
11	Papua-New Guinea	Eruption Plant, Sasi, Se.
12	Bimini	Gale-O-Wind.
13	French Guiana	Gale-Wind Grass.
14	Paraguay	Para-Parai Mi.
15	Thailand	Ya-Tai-Bai.
15	Philippines	Yerba De San Pablo.

FIGURES

Figure.1: Plant of Phyllanthus Niruri [7]

HISTORICAL CHARACTERS

Table 2. Scientific Classification [7]

Domain	Eukaryota
Kingdom	Plantae
Family	Phyllanthaceae
Order	Malpighiales / Euphorbiaceae [1]
Clade	Angiosperms, Eudicots, Rosids.
Genus	Phyllanthus
Species	P.Niruri
LatinName	Phyllanthus Niruri Linn
English Name	Gulf Leaf Flower.

MORPHOLOGICAL DESCRIPTION [8]

Phyllanthus niruri is an herbaceous plant that grows to approximately 12-20 cm in height. It contains lateral horizontal branches that are very thin and measure 3-7 cm long, bearing from 7 to 28 leaves. The leaves are small (4-12 mm), green, and oval-shaped. The flowers may be male or female; all flowers of one type are usually found on the same plant. The fruits measure 2-2.5 mm in

diameter. The seeds are small, about 1 mm, round, and smooth.

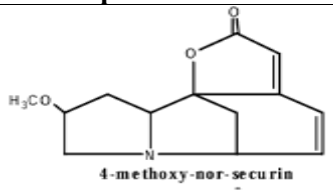
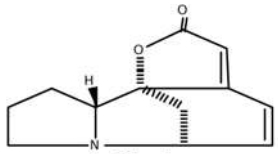
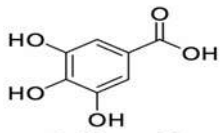
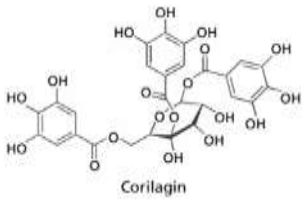
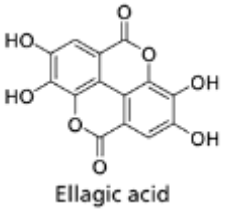
CHEMICAL CONSTITUENTS

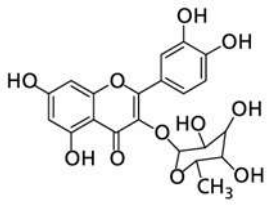
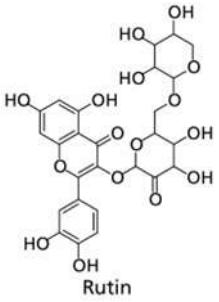
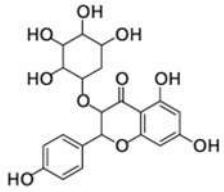
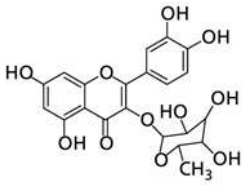
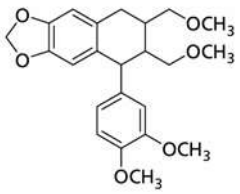
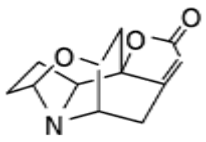
Table 3. Chemical Constituents of Phyllanthus Niruri

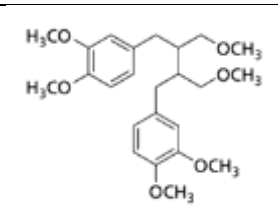
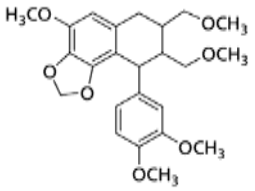
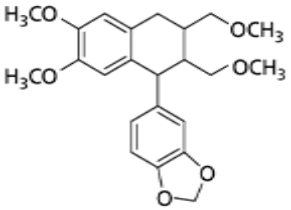
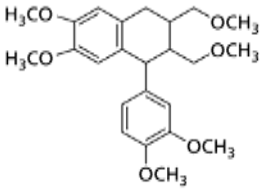
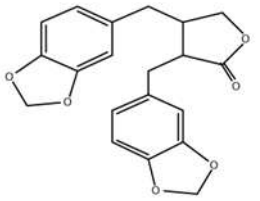
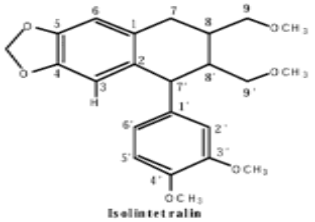
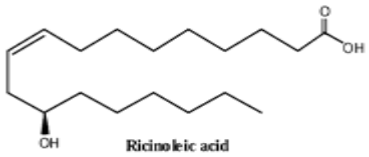
Sr. No.	Class	Compound
1	Alkaloid	4-Methoxy-nor-securinine [9]
2	Benzenoid	Gallic acid [10], Corilagin [1]
3	Coumarin	Ellagic acid [11]
4	Flavonoid	Quercetin, rutin, astragalin ,quercitrin, isoquercitrin nirurin [12,13]
5	Lignin	Phyllanthin, hypophyllanthin, niranthin, nirtetralin hinokinin , isolintetralin [13,14]
6	Lipid	Ricinoleic acid [14]
7	Phytallate	Phyllester [1]
8	Sterol	Estradiol, ß-sitosterol [1]
9	Tannin	Geranin [11]
10	Triterpene	Lupeol acetate, lupeol, Phyllanthenol, phyllanthenone , phyllantheol [1]

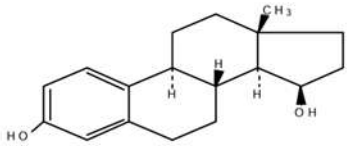
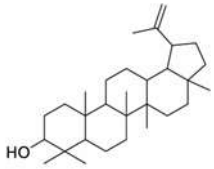
STRUCTURES

Table 4. Structures Of Phytochemicals

Sr. No.	Class	Name Of Structure	Compound / Structure
1.	Alkaloid	4-Methoxy-Nor-Securin [1]	 4-methoxy-nor-securin
		Nirurin [1]	 Nirurin
2.	Benzenoid	Gallic Acid [5]	 Gallic acid moiety
		Corilagin [5]	 Corilagin
3.	Coumarin	Ellagic Acid [5]	 Ellagic acid

4.	Flavonoid	Quercetin [5]	 Quercitrin
		Rutin [5]	 Rutin
		Astragalin [5]	 Astragalin
		Quercitrin [5]	 Quercitrin
		Isoquercitrin [5]	 Isolintetralin
		Nirurine [5]	 Nirurine

5.	Lignin	Phyllanthin [5]	 Phyllanthin
		Hypophyllanthin [5]	 Hypophyllanthin
		Niranthin [5]	 Niranthin
		Nirtetralin [5]	 Nirtetralin
		Hinokinin [1]	 Hinokinin
		Isolintetralin [1]	 Isolintetralin
6.	Lipid	Ricinoleic Acid [1]	 Ricinoleic acid

7.	Sterol	Estradiol [5]	 Estradiol
8.	Tannin	Geranin [5]	 Geraniin
9.	Triterpene	Lupeol [1]	 Lupeol

PHARMACOLOGICAL ACTIVITY

Anti-Malarial Activity

Malaria is one of the most significant public health problems in tropical and subtropical countries. Several medicinal plants exhibit antagonistic properties against malaria. Phyllanthus niruri have demonstrated antiplasmodial activity when albino mice were administered ethanol extracts [16]. The ethanolic extract of one -month -old in vitro grown callus of P. niruri showed higher antiplasmodial activity than the extract prepared from fresh apical stem tissue [17].

Action On Kidney Stones [4]

Phyllanthus niruri Linn. is commonly referred to as “stone crusher” because of its effects on the urinary tract, where it interferes with stone formation at multiple stages. Calcium oxalate (CaOx) crystals constitute the main component of human urinary stones and can adhere to the lining of the urinary tract, potentially causing cellular damage. The toxicity of CaOx is attenuated by the triterpenes of P. niruri Linn., which also inhibit markers of crystal deposition in the urinary system. The aqueous extract of P. niruri Linn. has the capacity to modify the shape and texture of calculi to a smoother and probably more fragile form, which may facilitate the elimination or dissolution of the calculi.

Anti-Ulcer and Gastroprotective Activity [13]

The anti-ulcer activity of P. niruri was evaluated in stress-induced ulcer models, specifically indomethacin- and ethanol-induced ulcer models. The extract significantly decreased the development of ulcers, and this anti-ulcer effect was associated with cytoprotection, probably due to the enhancement of prostaglandin synthesis. Similarly, the gastroprotective activity of the leaf extract of P. niruri was evaluated against ethanol-induced gastric mucosal injury in rats. At a concentration of 1000 mg/kg, a decrease in ulcer area, inhibition of ulcer formation, and reduction of oedema and leukocyte infiltration of the submucosa were observed. The prevention of gastric ulcer was attributed to the presence of tannin phytoconstituents of P. niruri, which exert an astringent effect.

Immune Modulatory Actions [18]

An arabinogalactan obtained from Phyllanthus niruri tea preparations was found to possess immunological properties and was tested using peritoneal mouse macrophages. The glycoside exhibited the same activity when subjected to acidic and neutral gastric conditions using human gastric fluids and an aqueous hydrochloric acid solution.

Anti-Diabetic Activity [19]

An alcoholic extract of Phyllanthus niruri was observed to significantly reduce blood glucose levels in both normoglycemic rats and rats with alloxan-induced diabetes. In normoglycemic rats, administration of Phyllanthus niruri at a dose of 200 mg/kg body weight resulted in a 34.5% reduction in blood glucose levels, whereas administration at a dose of 1000 mg/kg body weight produced a 47.4% reduction at 1 hour postadministration. By the sixth hour, however, the values had returned to levels that were almost baseline. These findings indicate the potential antidiabetic properties of Phyllanthus niruri.

Hiv Replication [20]

The aqueous extract of Phyllanthus niruri has been reported to possess inhibitory effects on the human immunodeficiency virus (HIV). Accordingly, an investigation was conducted to evaluate the anti-HIV effects of the alkaloidal extract of Phyllanthus niruri in human cell lines. The inhibitory effect on HIV replication was assessed by monitoring the inhibition of virus-induced cytopathogenicity in MT-4 cells. The alkaloidal extract of Phyllanthus niruri demonstrated a pronounced and sensitive inhibitory response to the cytopathic effects induced by both strains of HIV on human MT-4 cells at the tested concentrations.

Diuretic Activity [21]

The diuretic, hypotensive, and hypoglycemic effects of Phyllanthus niruri in human subjects were evaluated. Relevant parameters were measured in blood and urine samples of the patients. In addition, the physiological profile and dietary pattern before and after the treatment period were assessed. A significant increase in urine volume and in urine and serum sodium levels was observed following treatment with Phyllanthus niruri extract. A significant reduction in systolic blood pressure in non-diabetic hypertensive subjects was also noted, which further supports its diuretic properties.

Lipid Lowering Activity

Phyllanthus niruri has the capacity to reduce serum lipid levels. Oral administration of the extract at 250 mg/kg body weight in hyperlipemic rats resulted in reduced lipid levels [22]. The methanol extract of P. niruri was tested against chlorpyrifos (CPF)- evoked erythrocyte fragility and lipoperoxidative changes in Wistar rats and was observed to attenuate lipid peroxidative alterations and provide protection from CPF-induced erythrocyte fragility [23].

Antiplatelet And Vasorelaxant Activity

Methyl brevifolin carboxylate isolated from P. niruri exerted a vasorelaxant effect on rat aortic rings via inhibition of noradrenaline-induced vasoconstriction, which was mediated by a decrease in calcium ion influx through receptor-operated Ca2+ channels [24]. The same compound also functioned as an inhibitor of platelet aggregation [25].

Cardioprotective Activity [26]

Only one major animal study has been conducted to investigate the attenuating effect of Phyllanthus

niruri extracts in the prevention of doxorubicin-associated cardiotoxicity. Pretreatment of rats with P. niruri extract significantly protected rat myocardium from doxorubicin-induced toxicity by normalizing cardiac biomarkers, restoring intracellular levels of enzymatic and non-enzymatic antioxidants, and decreasing cardiac tissue lipid peroxidation

Anti-Amnesic Property [27]

Isocorilagin from Phyllanthus niruri has been reported to be two to three times more potent than galantamine, the clinically used acetylcholinesterase (AChE) inhibitor. Kinetic analyses indicate that isocorilagin functions as a noncompetitive inhibitor of AChE. In silico molecular docking studies further reveal that isocorilagin effectively blocks substrate entry by forming hydrogen bonds with residues located at the entrance of the AChE active site.

Spasmolytic Activity [27]

Alkaloid extracts of P. niruri have demonstrated smooth muscle relaxation in the urinary and biliary tracts. Extracts of P. niruri leaves, stems, and roots have exhibited antispasmodic properties in vivo on several types of smooth muscle, including guinea pig ileum, rat uterus, and canine vascular smooth muscle. Ether extracts were found to be the most effective as antispasmodic agents.

Hepatoprotective [28]

Phyllanthus niruri has demonstrated significant anti-hepatitis B virus surface antigen activity in both in vivo and in vitro studies. Hepatitis B infection frequently results in a chronic carrier state due to the inability of the host immune system to eliminate the virus from hepatocytes. Detectable levels of various viral antigens, such as HBsAg (the viral surface antigen), and antibodies to the viral core antigen (anti-HBc), are indicative of active or past infection. The hepatoprotective effect of an Ayurvedic polyherbal preparation, HPN-12, containing Glycyrrhiza glabra, Picrorhiza kurroa, Berberis aristata, Piper longum, Phyllanthus niruri, Solanum dulcamara, Zingiber officinale, Curculigo orchioides, Elettaria cardamomum, Tinospora cordifolia, Desmodium trifolium, and Saccharum officinarum, has also been documented.

CONCLUSION

Phyllanthus niruri is a significant medicinal herb with a long history of traditional use, particularly for liver disorders and urinary tract conditions, that has now been scientifically validated. Its therapeutic efficacy is associated with a rich profile of phytochemicals, including lignans and flavonoids. Key experimentally confirmed activities include potent hepatoprotective and antioxidant effects , anti-lithic action that has earned it the name “stone crusher” and notable antiviral properties against hepatitis B virus and human immunodeficiency virus (HIV). In addition, it exhibits anti-diabetic, lipid-lowering, cardioprotective, and anti-amnesic activities. Collectively, contemporary research supports P. niruri as a versatile, multi-target agent with substantial potential for further therapeutic development.

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