Phyllanthus niruri: A Review on its Ethno Botanical, Phytochemical and Pharmacological Profile

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ABSTRACT
Phyllanthus niruri Linn. belongs to Euphorbiaceae family and it is a small herb having wide range of medicinal properties, and it is used widely across the world. In Indian ayurvedic system it is used for Jaundice, ulcers, skin diseases, diabetes, chest pain and urinary complications. Its taste is bitter and acts as astringent and show laxative effect. This review covers information about ethano medicinal uses of P. niruri in different countries with various pharmacological profile of the plant. The phytochemical studies were characterized and the presence of various compounds such as lignans, phyllanthin, hypophyllanthin, flavonoids, glycosinoids & tannins was mentioned. The extracts of Phyllanthus niruri have a wide range of pharmacological activities like antimicrobial, antiviral, hepato protective, antioxidant, anticancer, anti-inflammatory, antiprotozoal and diuretic. This review summarizes the information about its botanical, morphological, ethanobotanical, pharmacological and biological activities of the plant. In addition this review provides information about the structure of the phytochemical compounds that promotes better commercial exploitation.

Key words: Phyllanthus niruri, Ethano Botany, Phytochemistry, Hepatoprotective, Antiviral, Kidney stones, HIV replication inhibition.

INTRODUCTION
Chanka piedra (Phyllanthus niruri Linnaeus., Euphorbiaceae), is sparsely spread throughout the tropical and subtropical countries of the world. This is an annual herb and widely spread in coastal areas of India. It is used in the Indian ayurvedic systems from the ancient times (more than 2000 years). It is having very short life. P.niruri is a field weed and its genus Phyllanthus comprises of 600-700 species with minor distinguishing features among them. In Indian ayurvedic system Phyllanthus niruri plant extract is used as a medicine and is recommended for Bronchitis, Anaemia, Leprosy, Asthma, Urinary disorders etc. In Chakra Samhita book P niruri is used in effective treatment of asthma, stimulating liver, improving digestion, increase appetite and produce laxative effects. Maharshi Charaka has categorized it as Kasahara: alleviates cough. Swasahara: relieves asthma, mootoragahara: cures urinary disorders, Kaphapittahara: relieves the kaphapitta dosha, Kaamalahara: cures jaundice, and Bhava prakasa Nighantu: cures cough and blood disorders. It is bitter in taste but sweet in the post digestive effect (vipaka) and it is also used as astringent.

Sidha medicinal uses
1. For jaundice: The whole plant juice with 10-20ml of dose is recommended three times daily.
2. The fresh roots (10gms) powder is mixed with fresh milk. This is recommended to take in the early mornings for effective cure for jaundice.
3. The leaves were crushed with salt and applied for skin diseases.
4. The plant decoction was very effective for diabetes and chest pain.
5. The decoction of leaves or roots is used for ulcers.
6. The dried powder of the plant mixed with gruel water is applied over ulcers and wounds.
7. The juice of whole plant can be taken as a dose of 45-50 ml in the early morning for leucorrea, gonorrhea, menorrhea and other urinary complains.

The extract of this plant can cure Hepatitis very effectively and it can be a remedy for HIV-AIDS. P.niruri is having various properties like anti-inflammatory[76], anti-fungal, anti-viral, anti-bacterial[21], anti-oxidant[13,30], hepatoprotective[58], hypoglycemic[77-78], hypotensive, analgesic[7,53], inhibitory effect on renal stone formation[20] etc., P.niruri is used as an ingredient of almost 175 ayurvedic formulations, the fruits of this plant is commonly used in the treatment of hemorrhages, diarrheas, dysentery, jaundice, cough and anaemia. It is also used in the preparation of various health care and personal products like chavanprash, hair oil dye, face cream, tooth powder[58].

In Unani medicine the roots of this plant are used for the remedy of liver diseases and seeds were used in the treatment of ulcers, wounds and scabies & ring worms.

The aqueous infusions of the whole plant is employed as a stomachic, appetite, anti-spasmodic, laxative, diuretic[80], carminative, against constipation, fever including malaria, hepatitis B[90], dysentery, gonorrhea, syphilis, tuberculosis, cough, diarrhea, vaginitis[44,47].

Majorly scientists focused on hepatoprotective activity of P.niruri, the hepatoprotective effects of crude methanol and aqueous extracts against CCl4 induced liver damage in rats have been investigated[24]. The hexane fractions of extract reported to be hepatoprotective against CCl4 and Gal N induced cytotoxicity in primary cultured rat hepatocytes[60] radical scavenging activity along with the hepatoprotective activity was found in aqueous extract of this plant[12].

The Phyllanthus niruri fresh root is believed to be an excellent remedy for jaundice, dropsy and genitor urinary infections. P.niruri promote stone elimination in patients with kidney stones, as well as normalization of Ca levels in hypercalciuric patients[43] so it is best familiar remedy for gall stones & kidney stones in the continent[79]. The extract shows an inhibitory effect on CaOx growth & aggregation in invitro model of crystallization[16]. The fruits are used in treatment of tubercular ulcers, wounds, sores, scabies & ring worms[31].

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It is having high potential anticancer and antioxidant agents \cite{30} to cure viral hepatitis \cite{19} and increased vinblastin cytotoxicity towards multi drug resistant cancer cells \cite{60}. It also inhibits the endogenous DNA polymerase of Hepatitis B virus in both \textit{invitro} and \textit{invivo} models \cite{83}.

The active component of \textit{P.niruri} is niruriside, which has antiviral activity that extends to Human Immuno Deficiency Virus by inhibiting the reverse transcriptase enzyme \cite{48}. \textit{P.niruri} also shows anti plasmodial activity of the ethanolic and dichloromethane extracts as well as the toxicity of the lyophilized aqueous extract previously reported \cite{73,74}.

\textit{Phyllanthus niruri} has several bioactive molecules such as lignans, phyllanthin, hypophyllanthin, flavonoids, glycosides, tannins, alkaloids, ellagitannins, triterpenes, phenyl propanoids, steroids, ricinolic acid, niruriside & phyltetralin \cite{14,54,31,64}. The alkaloids have the anti spasmodic activity leading to smooth muscle relaxation. It even contains acidic Arabinogalctan \cite{32} and Diterpene \cite{25}.

A protein isolated from the aqueous extract of \textit{P.niruri} posses protective activity against number of drugs & toxins induced organ pathophysiology. The protein weigh nearly 35Kda, posses anti oxidant activity and also radical scavenging activity and it even enhances intra cellular anti oxidant property \cite{63}. The seeds of this plant contain Ricinoleic acid, and Linolenic acid \cite{54\%}, Fisetin-4-0-glucoside and a new Flavon glycoside has been isolated from the aerial parts of this plant.

\textit{P. niruri} has enormous pharmacological activities such as antiviral activities against hepatitis B, antimicrobial, hepatoprotective, anticancerous and hypocalcemic agent. Methanolic extract of \textit{P. niruri} exhibited immunomodulatory activity and anti HIV activity. Phyllanthin and hypophyllanthin shows antitumor activities. In this review we tried to assess the potential activities of \textit{P.niruri}, its relation with the traditional and bioscientific research to establish several biochemical and pharmacological studies. This review contains several issues of ethanopharmacology, phytochemistry and pharmacology of \textit{Phyllanthus niruri}.

\section*{Ethnobotany}
\textit{Phyllanthus niruri} has extensive medicinal properties and has long history in the health care system of tropical countries. The plant is known in traditional health care systems. \textit{P.niruri} is commonly known as “Chanca pedra” or “stone breaker”. However there is a lot of confusion about this species identification. \textit{Phyllanthus niruri} is used as a folk medicine for treating kidney stones, gallbladder stones, liver related diseases such as liver cancer & jaundice, apart from these it is also administered for diuretic, hypoglycemic and hypertension cases and it also shows anti inflammatory, anti tumor, antinociceptive and anti oxidant properties \cite{9}.

\section*{Worldwide Ethnobotanical uses:}

\subsection*{Amazonia}
Apertif, anodyne, colic, carminative, digestive, diabetes, dropsy, diuretic, dyspepsia, dysentery, flu, fever, gonorrhea, gallstones, itch, kidney stones, jaundice, malaria, laxative, proctitis, stomachache, vaginitis, tumor, vermifuge.

\subsection*{Bahamas/ Caribbean}
Antiviral, apertif, antispasmodic, antihepatotoxic, appetite stimulant, bactericidal, constipation, cold, diuretic, fever, typhoid, flu, laxative, hypoglycemic, stomachache.

\subsection*{Brazil}
Analgesic, Abortifacient, aperient, anti-bacterial, anti-inflammatory, anti-
cancerous, antiviral, arthritis, ache (joint), antilithic, albuminuria, antispasmodic, bladder stones, calculi, cystitis, catarrh (liver and kidney), diabetes, digestion stimulant, diaphoretic, diuretic, fever, gout, gastrointestinal problems, hepatoprotective, hepatitis, hydropsy, hypoglycemic, hypertension, jaundice, kidney stones, malaria, obesity, muscle relaxant, purgative, prostatitis, renal problems, stomachic, tonic, uric acid excess, uterine relaxant, urinary problems.

\subsection*{Haiti}
Colic, carminative, diuretic, digestive, indigestion, fever, spasmyolitic, malaria, stomachache.

\subsection*{India}
Asthma, anemia, astringent, conjunctivitis, bronchitis, cough, dropsy, diarrhea, diabetes, dysentery, diuretic, eye disorders, galactagogue, gonorrhea, genitourinary disorders, jaundice, hepatitis, menorrhagia, leucorrhrea, ringworm, oligogalactia, stomachic, scabies, tuberculosis, thirst, urogenital tract infections, tumor (abdomen).

\subsection*{Malaya}
Caterpillar sting, diarrhea, dermatitis, diuretic, itch, piscicide, miscarriage, renosis, purgative, vertigo, syphils.

\subsection*{Peru}

\subsection*{United States}
Bronchitis, analgesic, deobstrucent, chologogue, fever, diabetes, gallstones, gallbladder problems, hepatitis, gout, hypertension, kidney stones, kidney problems, uric acid excess, liver disease, urinary tract infections.

In India, Chhattisgarh state has medicinal tradition of this weed. Mainly it is used for the snake bite. Chanca pedra was popularly grown throughout India it is more common in southern and central regions.

\section*{Botanical Description and Vernacular Names}
\textit{Phyllanthus niruri} is an erect annual herb, growing 40 - 70cm height having ascending herbaceous branching; it is quite glabrous and branching at the base. The genus \textit{Phyllanthus} means “leaf and flower” because the flower and fruit can be associated with the leaf. It is a plumose leaf that carries flower and fruit.

\subsection*{Leaves}
Numerous, small, green, sub sessile, closely arranged, elliptic along shaped, obtuse, having short petiole and stipules present, they are arranged alternately on each side of the stem.

\subsection*{Flowers}
The flowers are yellowish, small, numerous, axillary. These are unisexual, monoecious flowers, male flowers having 1-3 sessile stamens and female flowers were solitary in nature.

\subsection*{Fruits}
Fruit is a capsule, very small, depressed globose and more over capsule is smooth, 2-3mm in diameter.

\subsection*{Stem}
It is having horizontal branches and height of 30-60cm, 1-2.5mm width.

\subsection*{Root}
It is somewhat branched and large.
Botanical classification: Phyllanthus niruri L.

Kingdom – Plantae
Division – Magnoliophyta
Class – Magnoliopsida
Order – Euphorbiales
Family – Euphorbiaceae
Genus – Phyllanthus
Species – Niruri

Vernacular names around the world

Phytochemistry

Phyllanthus niruri plant shows significant activities on various diseases in many ways and it was essentially evaluated and analyzed.

(Adapted from Calisto et al. 1998)

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In P. niruri phytochemical studies were conducted since mid of 1960s.

**Different classes of organic compounds with various medical interests have been reported.** Majorly we can find lignans, tannins, polyphenols, alkaloids, flavonoids, terpenoids and steroid. The following chemical constituents have been isolated from *P. niruri*. Pharmacological Activity

**Alkaloids**

<table>
<thead>
<tr>
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<th>Compound</th>
<th>Source and Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>01.</td>
<td>Stem, Aerial plant, Roots(87)</td>
<td></td>
</tr>
<tr>
<td>02.</td>
<td>Whole plant(87)</td>
<td></td>
</tr>
<tr>
<td>03.</td>
<td>Roots (87)</td>
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**Diaryl butane lignans**

<table>
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<th>Compound</th>
<th>Source and Reference</th>
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<tbody>
<tr>
<td>04.</td>
<td>Leaf and aerial parts (52)</td>
<td></td>
</tr>
<tr>
<td>05.</td>
<td>Leaf (02)</td>
<td></td>
</tr>
<tr>
<td>06.</td>
<td>Leaves (63)</td>
<td></td>
</tr>
<tr>
<td>07.</td>
<td>Leaves (63)</td>
<td></td>
</tr>
<tr>
<td>08.</td>
<td>Aerial parts(64)</td>
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<tr>
<td>S.No</td>
<td>Compound</td>
<td>Source and Reference</td>
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</tr>
<tr>
<td>9.</td>
<td>2,3-deoxo-lin tetra lin</td>
<td>Leaves (65)</td>
</tr>
<tr>
<td>10.</td>
<td>2,3-deoxo-lin tetra lin diastere</td>
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</tr>
<tr>
<td>11.</td>
<td>Lin tetra lin</td>
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<tr>
<td>12.</td>
<td>Deoxo-lin tetra lin</td>
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**Aryl tetra lin lignans**

<table>
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<tbody>
<tr>
<td>13.</td>
<td>Neo lin tetra lin</td>
<td>Leaves and aerial parts (53)</td>
</tr>
<tr>
<td>14.</td>
<td>Neo lin tetra lin</td>
<td>Plant and leaves (02)</td>
</tr>
<tr>
<td>15.</td>
<td>Neo lin tetra lin</td>
<td>Plant and leaves 0.14% (02)</td>
</tr>
<tr>
<td>16.</td>
<td>Lin tetra lin</td>
<td>Leaves (85)</td>
</tr>
<tr>
<td>17.</td>
<td>Neo lin tetra lin</td>
<td>Plant (23)</td>
</tr>
<tr>
<td>18.</td>
<td>Neo lin tetra lin</td>
<td>Plant (86)</td>
</tr>
<tr>
<td>19.</td>
<td>Seco-4-hydroxy lin tetra lin</td>
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<tr>
<td>20.</td>
<td>Dibenzy l butyro lactone</td>
<td>Leaves (63)</td>
</tr>
<tr>
<td>21.</td>
<td>Hin okin a</td>
<td>Plant (Huang et al., 1989a)</td>
</tr>
<tr>
<td>22.</td>
<td>Phyllirurin</td>
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<table>
<thead>
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<th>Compound</th>
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<tbody>
<tr>
<td>23.</td>
<td>Gallic acid</td>
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</tr>
<tr>
<td>24.</td>
<td>Ellagic acid</td>
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</tr>
<tr>
<td>25.</td>
<td>Brevifolin carboxylic acid</td>
<td>Leaves(66)</td>
</tr>
<tr>
<td>26.</td>
<td>Ethyl brevifolin carboxylic acid</td>
<td>Leaves(66)</td>
</tr>
<tr>
<td>27.</td>
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<tr>
<td>28.</td>
<td>Geraniin</td>
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<tr>
<td>29.</td>
<td>Corilagin</td>
<td>Plant(66)</td>
</tr>
<tr>
<td>30.</td>
<td>Phyllanthusin D</td>
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<tr>
<td>31.</td>
<td>Amarin</td>
<td>Plant (17)</td>
</tr>
<tr>
<td>32.</td>
<td>Amarinic acid</td>
<td>Plant (18)</td>
</tr>
<tr>
<td>33.</td>
<td>Elaeocarpusin</td>
<td>Plant (18)</td>
</tr>
<tr>
<td>34.</td>
<td>Geranilinic acid</td>
<td>Plant (18)</td>
</tr>
<tr>
<td>S.No</td>
<td>Compound</td>
<td>Source and Reference</td>
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<tr>
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<tr>
<td>35.</td>
<td>Repandusinic acid</td>
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<tr>
<td>36.</td>
<td>Amarulone</td>
<td>Plant (18)</td>
</tr>
<tr>
<td>37.</td>
<td>Furosin</td>
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<tr>
<td>38.</td>
<td>1,6 - digalloyl glucopyranoside</td>
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<tr>
<td>39.</td>
<td>Catechin</td>
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<tr>
<td>40.</td>
<td>Epicatechin</td>
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<tr>
<td>41.</td>
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<tr>
<td>42.</td>
<td>Epigallo catechin</td>
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<tr>
<td>43.</td>
<td>Epicatechin 3-O-gallate</td>
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<tr>
<td>44.</td>
<td>Epigallocatechin 3-O-gallate</td>
<td>Root (26)</td>
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<tr>
<td>45.</td>
<td>Quercitrin</td>
<td>Leaf (42)</td>
</tr>
<tr>
<td>46.</td>
<td>Rutin</td>
<td>Plant, Leaf (42)</td>
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</table>
Pharmacological Activity

Action of kidney stones & uric acid
Kidney stone is a common problem that accumulates calcium oxalate crystals, and it includes urinary calculi formation, nucleation, growth, and aggregation of crystals. Phyllanthus niruri’s extract interferes in the growth and aggregation of calcium oxalate [CaOx] crystals in the calculi. The extract inhibits CaOx crystal aggregation in the early stages of stone formation in the urine samples of male wister rats. It is advisable to treat stone formation in the early stages [10]. The CaOx metastable limit was decreased by the treatment of P. niruri [5% [v/v]] extract and it can also deprive the CaOx crystals and formation of nucleation. [11]. The extract has the ability to prevent the growth of calculi and also change the shape and texture of the calculi. When treated on the preformed calculi it can form a matrix like material on its surface and it can modify the appearance and texture of the calculus. When treated on the preformed calculi it can form a matrix like material on its surface and it can modify the appearance and texture of the calculus. When treated with the extract a significant increase in wound contraction was found by both oral and topical administration[11].

Anti spasmodic, pain relieving & anti inflammatory
The wound healing nature of Phyllanthus niruri has been evaluated by the healing of wounds by oral and topical administration. P. niruri was proved to have a significant role in wound contraction and epithelialisation. When Dexamethasone (suppress the wound healing) suppressed rats were treated with the extract a significant increase in wound contraction was found by both oral and topical administration[11].

Liver protective, detoxification & antioxidant activity
The carbon tetrachloride and galactosamine induced cytotoxicity in rat hepatocytes can be decreased by the P. niruri hexane extract. Phyllanthin and hypophyllanthin protects against the CCl4 induced cell lesions and GalN induced Hepato toxicity[60].

Phyllanthus niruri can reduce nimesulide induced hepatic damage. By measuring the levels of glutamate oxaloacetate transaminase (GOT), glutamate pyruvate transaminase (GPT) and alkaline phosphatase (ALP) in serum it was concluded that the levels of three enzymes are decreased in the extract treated group. By these observations intra peritoneal treatment was found to be more effective than oral administration and by combining this data we can conclude that P. niruri protects against the CCl4 induced cell lesions and hepatocytes can be decreased by the P. niruri hexane extract. Phyllanthin and hypophyllanthin protects against the CCl4 induced cell lesions and GalN induced Hepato toxicity[60].
The over dose of paracetamol leads to hepatotoxicity same as viral infection. The glutamic pyruvic transaminase (GPT) levels of serum were decreased by the hexane extract [41]. The serum glutamate pyruvate transaminase (SGPT) and glutamate oxaloacetate transaminase (GOT) was decreased in the in vivo studies conducted in rats [56]. The ethanol extract and hexane extract were administered and the serum parameters (serum bilirubin, serum alkaline phosphatase, serum aspartate (AST), serum alanine transferase (ALT), hepatic reduced glutathione (GSH) were analysed and these parameters were controlled after the treatment with hexane extract and .hence, it was stated that P. niruri can control the paracetamol induced hepatotoxicity[27].

Protein isolated from this plant was found to enhance cell viability against tertiary butyl hydroperoxide induced cytotoxicity and cell death; and it protects hepatocytes against thioacetamide induced cytoxicity. The extract prevents the alterations in GSH levels and it also reduces the lipid peroxidation induced by TAA. By the DPPH assay it was found that the isolated protein has radical scavenging activity. This protein protects the liver from the carbon tetra chloride induced hepatotoxicity and this can be measured by the liver enzymes and reduced levels of antioxidant enzymes [38, 37, 36].

Alcohol is a toxin in higher doses and when it is associated with poly unsaturated fatty acids (PUFA) induces oxidative stress & hepatotoxicity. This can be efficiently reduced by P. niruri extract analyzed by the antioxidant potentials of liver enzymes and histopathological studies [38].

**Anti cancerous & cellular protective actions**

P. niruri has high potential to inhibit the growth and intiation of cancerous cells which were introduced into mouse skin cells with 7, 12 dimethyl benz (a) anthracene (100µg/100ml acetone) and croton oil (1%) [40] and there is drastic increase in the catalase, reduced glutathione and protein levels in the skin. In albino mice the chemopreventive action of P. niruri with DMBA induces skin papillomagenesis. [41].

**Immune modulatory actions**

An arabinogalactan(AG) which was obtained from P. niruri tea preparations was found to have immunological properties and is tested with peritoneal mice macrophages. The glycoside showed the same activity when subjected to acidic and neutral gastric conditions using human gastric fluids and aq.HCL solution [40].

**Anti viral action (Hepatitis B)**

The plants of Phyllanthus genus have been used for natural remedy from thousands of years in Asia. (Thyagarajan et al., 1988). P. niruri has been used to inhibit the hepadna virus and it is extensively used to treat jaundice and hepatitis B virus [38]. The phyllanthus genus plants inhibit duck hepatitis B virus by inhibiting 50 % of DNA polymerase [4].

Hepatitis B is the most prominent disease in emerging era. Phyllanthus niruri extract can prevent Hepatitis B by binding to the endogenous DNA polymerase and even it can bind to the hepatitis B surface antigen in invitro. Wood chuck hepatitis virus (WHV) was tested against the extract in wood chucks (Marmota monax), it efficiently inhibited the wood chuck hepatitis virus (WHV) and elimination of both surface antigen and DNA polymerase activity was found [83].

**HIV replication inhibition**

The prominent human Immuno Virus replication is inhibited by the alkaloidal extract of P. niruri and tested against virus induced MT-4 cells, it suppressed the activity in strains of HIV 1 cells [43].

The REV (regulation of virion expression) is an HIV protein that regulates the transport of viral RNA to the cytoplasm and its basic domain is RRE (responsive element). The niruriside isolated from methanol extract of P.niruri shows inhibitory activity against binding the REV protein to RRE RNA [48].

**Lipid lowering activity**

The Phyllanthus niruri has the capacity to reduce the serum lipid levels. The extract is fed orally (250 mg/kg b.w) in hyper lipemic rats, results followed by reducing lipid levels [29]. Methanol extract of P.niruri was tested against chlorpyrifos (CPF)- evoked erythrocyte fragility and lipoperoxidative changes in wister rats and observed lipid peroxidative changes and protection from the chlorpyrifos induced erythrocyte fragility [67].

**Anti fertility activity**

The anti fertility activity of Phyllanthus niruri was tested on male albino rats; it shows a significant decrease in fructose levels of seminal fluids, sperm count, sperm motility and viability. It shows anti fertility activity by decreasing the testosterone levels of the treated rats. [32].

**Anti-microbial activity**

The extracts of P.niruri and Piper beetle were tested against food borne & spoilage micro organisms. The ethanolic extracts of dried P.niruri inhibited the growth of micro organisms [46].

The antimicrobial activity of fermented P.niruri by using lactobacillus isolated from the surface of the plant was enhanced. The antimicrobial activity was enhanced 80-170% when compared to the crude extract. The potency was increased by 49% when the extract was fermented with lactobacillus [41].

The methanol extract of P. niruri is strong against Bacillus pumillis, Bacillus cerasus, E. coli and Vibrio cholera at conc of 750µg/ml/disc. It is tested against standard drug chloramphenicol at conc 10µg/ml/disc shows potential source of antimicrobial agent [80].

The phyllanthus niruri extract of alkaloids were tested on rabbits infected with E.Coli. The results examined werefound to have increased concentration of WBC, neutrophils and decreased hemoglobin, lymphocytes more over there are no changes in enzyme concentration[43].

**Anti malarial activity**

Malaria is one of the most prominent health problems in the tropical and subtropical countries. The herbal plants show antagonistic properties against malaria. P. niruri and Mimosa pudica showed antiplasmodial activity, when fed orally (250 mg/kg b.w) for one month old invitro grown callus showed higher antiplasmodal activity than extract prepared from fresh apical stem extract [49].

**Anti ulcer activity**

The acidic heteroxylan and another polysaccharide showed anti-ulcer activity. These compounds reduced the gastric lesions induced by 65% and 78% ethanol. P. niruri proved to be efficient against peptic ulcers [69].

**Nematocidal activity**

The two prenylated flavones isolated from the hexane extract of P.niruri. showed Nematocidal activity against two nematodes, Meloiodyne incognita and Rotylenchulus reniformis. The two compounds showed moderate Nematocidal activity against nematodes [48].

**Antinociceptive activity**

The analgesic activity of P.niruri is demonstrated against formalin induced nociception in mice. The hydro alcoholic extract of P.niruri is given orally.
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