

Pharmacological Properties of the Magical Plant *Phyllanthus niruri* Linn: a review

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Abstract: This review is particularly based on the medicinal properties of the magical plant called *Phyllanthus niruri* Linn. The wide verities of the pharmacological properties in the history of conservative treatments are lies within the plant itself because of the presence of the important phytochemicals i.e. alkaloids, flavonoids, terpenoids, saponins and polyphenols. Extract of the various parts of this plant have been scientifically proven to have enormous therapeutic activities such as hepato-protective, anti-stress, anti-fungal, anti-bacterial and anti-inflammatory. Preliminary studies such as in vitro, in vivo suggest and provide enough evidence for its uses in many diseases. In this article, the recent devolvement and therapeutic activities on this particular plant has been introduced.

Keywords: *Phyllanthus niruri*, *Benefits of Phyllanthus niruri*, *Herbal Treatment*

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Introduction

The term "traditional" or "indigenous medicine" is traditional practices of indigenous people of the local area using herbal remedies¹. There are a lot of Indian herbal remedies are linked to various pharmacological functions since they are a diverse collection of photochemical.

Medicinal plants are rich sources for new drug discovery as evidenced by some recent drugs that are from plant-derived compounds/derivatives². In the Ayurvedic method of medicine, it is employed in diseases of stomach, genitourinary systems as well as kidney, liver, and the spleen. It is

widely used in Indian ayurvedic systems since the early times (more than 2000 years) it has an extremely short lives³. The 600-700 numbers of species are identified of *P.niruri* family *Euphorbiaceae* which has distinguished health benefits collectively⁴. The *P.niruri* generally found in the coastal

regions of the India and tropical regions of the worlds including the south East Asia. The *P.niruri* is as small erect herb generally grows up to 35-45cm height annually. The leaves of the plants are sessile and alternate in position and grows up to 7-12cm⁵.



Fig.1- *Phyllanthus niruri* Linn⁶

Botanical Classification of *P.niruri*^{7,8}

Kingdom	Plantae
Division	Magnoliophyta
Class	Magnoliopsida
Order	Euphorbiales

Family	Euphorbiaceae
Genus	Phyllanthus
Species	Niruri

*Vernacular Classification*⁹

Language	Names
Assamese	Holpholi; Poram-lokhi
Bengali	Noar
Hindi	Chalmeri, Harfarauri, Bhuiakonla
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, Bhumyamlaki, Sukshmadala, Vitunika, Bhoodatri

Phytochemical Profile

The extensively *Phyllanthus niruri* possess many pharmacological activities including anti-cancer, antioxidant, anti-inflammatory

and analgesic¹⁰. These properties are belongs to the specific phytochemical. The phytochemical have its place in the different categories of the classes such as alkaloid,

flavonoids, steroids, saponins etc¹¹. many of the clinical and pre-clinical studies have been done to find out the role of the specific phytochemicals in the disease. Particularly,

Some of the phytochemicals are mentioned in the table^{12, 13,14}:

these phytochemicals are intrudes in the signaling path ways to protect or kill the cells in any which way.

Phytochemicals	Compound
Alkaloid	4-methoxy-nor-securinine
	Nirurine
	Ent-norsecurinine
Benzeoids	Gallic Acid
Coumarins	Ellagic acid
Flavanoids	Ethyl brevifolin Carboxylate
	Methyl brevifolin carboxylate
	Quercetin
	Rutin
	Astragalin
	Quercitrin
	Isoquercitrin
	Kaempferol-4'-rhamnopyranoside
	Eridictyol-7-rhamnopyranoside

	Fisetin-4-O-glucoside
Lignan	Phyllanthin
	Hypophyllanthin
	Niranthin
	Nirtetralin
	Phyltetralin
	Hinokinin
	Lintetralin
Tannin	Geraniin
	Repandusinic acid
	Corilagin
Triterpene	Limonene
	p-Cymene
	Lupeol acetate
	Lupeol
	Phyllanthanol

Pharmacological activities

Anti-microbial activity

Antimicrobial and anti-fungal activity of the plant was assessed by the Ibrahim, D., et al., (2013) by using methanolic extract of the *Phyllanthus niruri* against the bacteria such

as gram negative and gram positive. The bacteria was grown on the agar medium and exposed with the methanolic extract of the *Phyllanthus niruri* Linn. The results showed the maximum concentration of the extract has the bactericidal effects against gram positive and gram negative bacteria. The morphology of the bacterial cell wall was complete disrupt and ruptured due to the exposure of the test item¹⁵.

The another study was carried out by the Rajeshwar, Y., et al., (2008), In this study the anti-microbial effect of the plant *Phyllanthus niruri* were seen in the gram positive and gram negative bacteria (*Bacillus cereus*, *Escherichia Coli* and *Vibrae Cholera*). The maximum dose was selected as 750 mg/ml/disc. The result showed that anti-microbial activity of the plant is limited to the bacillus cereus and *E.coli*. The results revealed that the methanolic extract of the *Phyllanthus niruri* was not significant for the *Staphylococcus aureus* and *Vibrae cholera* in terms of reducing the growth of the bacteria¹⁶.

Similar experiment was performed by the Shanmugam, B., et al., (2014), the study was done on the gram negative and gram positive bacteria. *Phyllanthus niruri* was extracted in three different solvents

(methanol, ethanol and water) with different ratio. The test samples were exposed to the bacteria at different concentrations and zone of inhibition was observed. The result showed that the maximum zone of the inhibition was observed in the methanolic and ethanolic extract at the concentration of 30% w/v. The study also revealed that the bactericidal activity showed up because of the presence of the saponins, tannins and flavonoids¹⁷.

Antioxidant activity

Zain, S. N. D. M., & Omar, W. A. W. (2018) explored the antioxidant activities so the *Phyllanthus niruri*. The anti-oxidants activity was evaluated by using the methanolic extract of the *Phyllanthus niruri* and two other species of the same plant. The anti-oxidant activities was identified by exploring the levels of the total phenolic content and total flavonoids content and was measured using 2,2-diphenyl-1-picrylhydrazyl (DPPH) and 2,20- azinobis (3-ethylbenzothiazoline-6-sulphonic acid) (ABTS) assays. The result showed that *Phyllanthus urinaria* has the maximum TFC and TPC followed by *Phyllanthus niruri*. The results are also revealed that the methanolic extract has the lowest EC50 value as compare to the other species used¹⁸.

Rajamanickam, G., & Manju, S. L. (2020) also revealed that *Phyllanthus niruri* possess the antioxidant activities. This study was done to find out the antioxidant potential of the *Phyllanthus niruri* by the different methods i.e. HPLC, in vitro antioxidant activity and by measuring the total phenolic content. The results revealed that the extract of the *Phyllanthus niruri* in the ethyl acetate as a solvent does have the potential to exhibit the maximum level of the high flavonoid and polyphenolic compounds level. The results are also revealed that high flavonoid and polyphenolic compounds level leads to the antioxidant activity¹⁹.

Sukweenadhi, J., et al., (2020) examined that the activity of the *Phyllanthus niruri* along with the other six different plants. The DPPH, ABTS and FRAP methods were used to identify the antioxidant levels. The result showed up as *Phyllanthus niruri* does have the highest antioxidant activities as compare the other examined plants²⁰.

Anticancer activity

Maheswari, P., et al., (2021) examined the anticancer potential of the *Phyllanthus niruri*. The anticancer activity of the plant *Phyllanthus niruri* was assessed by using the parameters MTT (Cytotoxicity assay and Cell viability assay). KB oral cancer cells

were used as the secondary cell line grows up to the 70% confluency and exposed with the nanoparticles of the TiO₂ nanoparticles merged with the *Phyllanthus niruri*. The results showed that *Phyllanthus niruri* nanoparticles showed great properties of killing the cancer cells as compare to other modified nanoparticles. Results also revealed that the modified nanoparticles are safe for the other normal cell lines such as L929²¹.

Similar study was performed by the Kalimuthu, A. K., et al., (2022). The endophytic fungus isolated from the plant *Phyllanthus niruri* and evaluated for its anti-cancer activity against the hepatoma cell lines (HepG2). The anti-cancer potential was showed up as the binding affinity of the phytochemical found in the plant (2-methyl-7-phenylindole). The activity of the isolated fungus extract established the concentration dependent cytotoxicity at the maximum concentration 62.23µg/mL against the hepatic cancer cell lines. The cell lines apoptosis was estimated by the flowcytometry and established the connection of the nuclei disruption in the cells. The extract of the endophytic fungus was also exposed with the normal cell lines, the effect was not observed²².

Similarly Yuniati, Y., et al., (2019) has extracted of the endophytic fungi from *Phyllanthus niruri* and exposed against the T47D cells lines for its efficacy and toxicity. The ethyl acetate extract of the fungi was exposed at the different concentrations against the cancer cell lines. The result evaluated by the MTT test and cell viability of the cell lines for 48h. A cell cycle disruption was found out by using the flowcytometry. Result revealed that the IC50 8, 3 and 124 µg/mL which could be interfering the cell cycle at the S-phase. The results also revealed that the extract of the isolated fungi does not interfere in the normal cell cycle²³.

Antifungal activity

Ajibade, V. A., et al., (2018) examined the potential of the plant *Phyllanthus niruri*. The anti-fungal activity of the *Phyllanthus niruri* was evaluated by using saponins (phytochemical) extracted from the *Phyllanthus niruri*. The extract of the plant was assessed by using the Flame-Photometric method. The results showed that the nine elements (Zn Mn, Ca, Mg, Na, K, Fe and P) are presents in the extract of *Phyllanthus niruri* which could inhibit the growth of the fungi. The inhibitory action of the extract was due to by the saponins

majorly and nine elements. The study further revealed that the *Phyllanthus niruri* could also inhibit the growth and kill the fungi²⁴.

Shilpa, V. P., et al., (2018) has done the study on anti-fungal effects of the *Phyllanthus niruri*. The study was done against the fungus *Candida albicans* (NCIM - 3100), *Aspergillus niger*. The extract of the plant *Phyllanthus niruri* exposed to the fungi and evaluated the growth and inhibition of the fungus. The aqueous and methonoil extract of the plant was prepared and exposed. The result reveled that *Phyllanthus niruri* does not kill the fungus but it could inhibit the activity of the fungus by the Immunomodulatory activities²⁵.

Yahaya, A. M., et al., (2021) showed the antifungal and antimicrobial potential of the plant *Phyllanthus niruri*. In their study, the aqueous and ethanolic extract was prepared of the whole plant of *Phyllanthus niruri*. The anti-fungal activities were evaluated by the agar gel infusion method. Different microbial agents were used in the study to expose with the extract of the plant at the different concentrations. The results were compared with the standard drug. The minimum inhibitory concentration and zone of inhibition was obtained from the study.

The result showed the *Phyllanthus niruri* at the maximum concentration (64 µg/mL) showed the maximum inhibition zone in the all microorganism²⁶.

Anti-inflammatory and analgesic activity

The anti-inflammatory studied was done by Sutrisna, E., & Wahyuni, S. (2019). *Phyllanthus niruri* is considered as the pain relief herbal plant in Indonesia. This study was done to evaluate the analgesic and anti-inflammatory activities of the *Phyllanthus niruri*. The plant was extracted in the polar solvent (ethanolic) and administered in the Wistar rats at dose of 250, 500 and 1000mg/kg. All the animals were divided in to the five group's three doses of test item, one standard and one reference group. The inflammation was induced by the carrageenan. The dose was administered once in an everyday and the rats were subjected to evaluate for the pain and inflammation by putting them on the hot plate for 30 sec and record the paw flicking frequency. The evaluation parameter includes the paw thickness by vernier caliper. The result showed that the latency of the paw licking, inflammation and flicking was reduced²⁷.

Similarly Ferrante, C., et al., (2020) was confirmed the anti-inflammatory and

analgesic activity of the *Phyllanthus niruri*. The water and ethanolic extract of the *Phyllanthus niruri* were analyzed for its effects on the inflammation. The severe condition which occurs during the prostatitis is infection from the bacteria and fungus. This study was aimed to design a extract which could potentially inhibit the inflammatory cytokines and reduce the pain during this stage. The results showed up that *Phyllanthus niruri* could inhibit inflammation and reduce the growth of bacteria and fungus during the Prostatitis²⁸.

Sumitha, A., et al. (2022) studied that the *Phyllanthus niruri* could possibly the one of the most important herb for anti-inflammatory and analgesic activity. The methanolic extract of the *Phyllanthus* seeds were administered in experimental animals at 50, 100 and 200 mg/kg. The animals were divided in to three groups test item, standard and reference group. The extract of the seeds were analyzed by the two parameters tail clip and hot plate method. The results showed the increase frequency of the paw keeping frequency. The significant reduction in the pain and inflammation was observed during the study. The hispathology results are also revealed that the inflammatory cells in the tissue significantly reduced²⁹.

Conclusion

The literature review suggested that the *Phyllanthus niruri* could be the plant for necessity. As it has enormous uses in different diseases, some of have been known since the ancient time and some of have been researched. Although, it has been proven that *Phyllanthus niruri* has the effects on diseases and possibly those effects are changed or enhanced country to country. Traditionally, this plant has been using as anti-cancer, anti-oxidant, anti-inflammatory and analgesic. Phytochemical studies reported that *Phyllanthus niruri* has the important phytochemicals which are useful to eradicate and treat the disease such as alkaloids, flavonoids, saponins, tannins, Vitamin C and steroid. Some of the effects of the phytochemicals are noted and explained in this article. There have not been any kinds of the toxicity reported from this plant or any part of this plant. However, extensive research has been done on the *Phyllanthus niruri* but still a lot of scope of the research is there such as antifungal, anticancer and antispasmodic.

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