

PHYLLANTHUS AMARUS: AN AMPLE THERAPEUTIC POTENTIAL HERBKiran Divya¹, Rohilla Ankur^{2*}, Rohilla Seema², Khan M.U.³¹PDM School of Pharmacy, Safidon, Haryana, India²Department of Pharmaceutical Sciences, Shri Gopi Chand Group of Institutions, Baghpat, UP, India³Sri Sai College of Pharmacy, Badhani, Pathankot, Punjab, India

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ABSTRACT

Herbal drugs have been one of the primarily used drugs since olden times for the treatment of a range of diseases. In addition, the medicinal plants have played a vital role in world health as the herbal plants still make an important contribution to health care. *Phyllanthus amarus*, a world-renowned botanical, has been used since ages because of its rich medicinal values and ethnomedical importance. *Phyllanthus amarus* is a small, erect, annual herb which is a rich source of phytochemicals that are attributed to biologically active lignans, glycosides, flavonoids, alkaloids, ellagitannins and phenylpropanoids that are present in the leaf, stem and root of the plant. It is a little wonder that the plant is used for so many purposes in herbal medicine systems and in clinical research over the years. Numerous studies have reported that *Phyllanthus amarus* have anti-inflammatory, antidiabetic, antimicrobial, antihyperlipidemic, antioxidant and anticancer activities. Moreover, studies have demonstrated hepatoprotective, antifertility, antidiarrhoeal, antiallodynic, antioedematogenic, antispasmodic, chemoprotective, antihypercalciuric, antiviral, antispasmodic, antinociceptive and diuretic properties associated with *Phyllanthus amarus*. The present review article summarizes the potent pharmacological properties exhibited by the plant.

KEY WORDS: Herbal, *Phyllanthus amarus*, Properties***Address for Correspondence**Ankur Rohilla, M.Pharm, Senior Lecturer, Department of Pharmaceutical Sciences, Shri Gopi Chand Group of Institutions, Baghpat 250609, UP, India E-mail: ankurrohilla1984@rediffmail.com**INTRODUCTION**

Nature can be considered as the ultimate chemist. About 80% of the world's inhabitants still depend on natural products that have inspired chemists and physicians for years because of their rich structural diversity and complexity. Considerable advances have been obtained for the understanding of natural-product biosynthesis in the recent decades¹. *Phyllanthus amarus* is a small, erect, annual herb that grows 30–40 cm in height which is indigenous to the rainforests of the Amazon and other tropical areas throughout the world, including the Bahamas, southern India, and China. *Phyllanthus amarus* has been used since ages by the folk because of its rich medicinal values which has ethnomedical importance. *Phyllanthus amarus* has a long history in herbal medicine systems in every tropical country where it grows. It is little wonder that plant is used for so many purposes in herbal medicine systems and in clinical research over the years. The plant has demonstrated anti-inflammatory, antihepatotoxic, antilithic, analgesic, hypotensive, antispasmodic, antiviral, antibacterial,

diuretic, antimutagenic and hypoglycemic properties² (fig 1). It is a rich source of phytochemicals including many which have been found only in the *Phyllanthus* genus. A number of active constituents of the plant are related to biologically active lignans, glycosides, flavonoids, alkaloids, ellagitannins and phenylpropanoids found in the leaf, stem, and root of the plant alongwith common lipids, sterols and flavonols³. The present review article discusses about the various pharmacological properties possessed by the plant. Moreover, the mechanisms involved in affording various properties have been delineated.

Anti-inflammatory Activity

The anti-inflammatory property of the extracts and purified lignans obtained from *Phyllanthus amarus* was confirmed by the fact that given orally, the hexane extract (HE), the lignan-rich fraction (LRF) and the lignans phyltetralin, nirtetralin, niranthin inhibited carrageenan (Cg)-induced paw oedema and neutrophil influx. The HE and LRF also inhibited the increase of IL1-beta tissue levels induced by Cg that further

confirmed the anti-inflammatory potential of *Phyllanthus amarus*. Moreover, the anti-inflammatory potential of the plant was confirmed by the fact that bradykinin (BK)-, platelet activating factor (PAF) and endothelin-1 (ET-1)-induced paw oedema were significantly inhibited by the HE or LRF. The results of the above study show that HE, LRF and the lignans niranthin, phylltetralin and nirtetralin demonstrated marked anti-inflammatory properties of the plant. Additionally, it has been suggested that these lignans seem to be the main active principles that are responsible for the anti-inflammatory properties reported in support for the HE of *Phyllanthus amarus*⁴.

Antidiabetic Activity

The methanolic extract of *Phyllanthus amarus* was found to inhibit lipid peroxidation, and scavenge hydroxyl and superoxide radicals in vitro and thus showed antidiabetic activity. Moreover, the extract was found to reduce the blood sugar in alloxan-induced diabetic rats. In addition, the continuous administration of the extract for 15 days has been shown to produce significant reduction in blood sugar levels that further confirmed the antidiabetic potential of the plant⁵.

Antimicrobial Activity

The antimicrobial potentiality of the methanolic extract of *Phyllanthus amarus* was studied against some drug resistant pathogenic bacterial strains by disc diffusion and agar dilution method. The extract showed significant concentration dependent antibacterial activity particularly against gram-negative microbes in dysenteric and diarrheal infections alongwith fever. The antibacterial action was reported mainly due to the isolated phyllanthin⁶. The antimicrobial effect of the plant extracts was further supported by the fact that the organic solvent and aqueous solvents of *Phyllanthus amarus* inhibited the growth and development of *S. faecalis*⁷.

Anti Oxidant Activity

Phyllanthus amarus has been reported to be a potent antioxidant which was proved by the fact that elevation of the antioxidant enzymes in the intestine and decrease in the lipid peroxidation levels were observed after its administration. Histopathological evaluations of the intestine revealed decreased damage to intestinal cells that further demonstrated that *Phyllanthus amarus* protected the intestine by oxidative damage. *Phyllanthus amarus* treatment also increased the activity of various antioxidant enzymes, such as superoxide dismutase (SOD), catalase (CAT), glutathione-S-transferase (GST), glutathione peroxidase (GPX) and glutathione reductase (GR) both in blood and tissue further evidencing the antioxidant potential of the plant⁸.

Anti Cancer Activity

The treatment with the aqueous extract of *Phyllanthus amarus* exhibited potent anticarcinogenic activity against 20-methylcholanthrene (20-MC) induced sarcoma development. The extract was found to inhibit DNA topoisomerase II of *Saccharomyces cerevisiae* mutant cell cultures and inhibited cell cycle regulatory enzyme cdc25 tyrosine phosphatase (IC: 50-25 microg/ml). The antitumour and anticancer activity of *Phyllanthus amarus* may be related with the inhibition of metabolic activation of carcinogen as well as the inhibition of cell cycle regulators and DNA repair. These results indicate significant anti-mutagenicity of the extract in vitro as well as in vivo⁹.

Hepatoprotective Activity

Phyllanthus amarus possessed a potent hepatoprotective effect against aflatoxin B(1) - induced hepatic damage by a mechanism involving reduction in the intracellular level of reactive oxygen species by enhancing the level of both enzymatic and non-enzymatic antioxidants. In conclusion, data obtained suggest that the protein fraction show hepatoprotective effect against nimesulide-induced oxidative stress probably via promotion of antioxidant defence mechanisms¹⁰.

Anti Fertility Activity

The antifertility effects of an alcoholic extract of *Phyllanthus amarus* was confirmed by the fact that change in 3-beta and 17-beta hydroxy steroid dehydrogenase (HSDs) levels, probably affecting hormonal conversions in the female mice were observed by its treatment. The antifertility property exhibited by the plant was further confirmed by the fact that cohabited females with normal male mice were unable to become pregnant as their cyclicity was affected. Such factors are attributed to a significant change in the hormonal status governing the female reproductive function. Hence, the extract apparently shows a definite contraceptive effect in female mice¹¹.

Anti Diarrhoeal Activity

The anti-diarrhoeal and gastro-intestinal protective potentials of aqueous extract of leaves of *Phyllanthus amarus* were investigated in mice. Graded doses of the aqueous extract (100-800 mg/kg) administered orally produced a dose-related inhibition of gut meal travel distance in normal mice. *Phyllanthus amarus* extract (400 mg/kg) delayed the onset of diarrhoea, reduced frequency of defecation and reduced gut meal travel distance. In addition, the activities of some intestinal mucosal enzymes (maltase, sucrase, lactase and alkaline phosphatase) in mice pretreated with extract was also found to be increased that further confirmed the antidiarrhoeal potential of the plant¹².

Anti-Allodynic and Anti-Oedematogenic Activity

The anti-allodynic and anti-oedematogenic effects of the HE, LRF and purified lignans were investigated from a plant used in the traditional medicine, *Phyllanthus amarus*, in the inflammatory and neuropathic models of nociception. The HE inhibited the allodynia and the oedema induced by the intraplantar injection of complete Freund's adjuvant (CFA). Moreover, the treatment with HE inhibited the increase of myeloperoxidase activity, either following intraplantar injection of CFA or after sciatic nerve injury that accounts for antoallodynic and antioedematogenic potential of the plant¹³.

Chemoprotective Activity

The chemoprotective activity effect of 75% methanolic extract of the *Phyllanthus amarus* plant was studied against cyclophosphamide (CTX) induced toxicity in mice. Administration of CTX produced significant myelosuppression as seen from the decreased WBC count and bone marrow cellularity. Administration of *Phyllanthus amarus* extract at doses 250 and 750 mg/kg body weight significantly reduced the myelosuppression and improved the WBC count, bone marrow cellularity as well as the number of maturing monocytes that accounted for its chemoprotective activity. In addition, extract from the plant of *Phyllanthus amarus* was found to decrease the activity of phase I enzyme that showed potent chemoprotective potential of the plant¹⁴.

Diuretic Activity

The diuretic, hypotensive and hypoglycemic effects of *Phyllanthus amarus* on human subjects were assessed. Appropriate parameters have been studied in the blood as well as urine samples of the patients. In addition, the physiological profile and dietary pattern before and after the treatment period were assessed. Interestingly, a significant increase in urine volume, urine and serum Na levels was observed after treatment with *Phyllanthus amarus* extract. A significant reduction in systolic blood pressure in non-diabetic hypertensive subjects was noted that further confirmed its diuretic property¹⁵.

CONCLUSION

Phyllanthus amarus has been used since ages by the folk because of its rich medicinal values. The broad spectrum of its medicinal use accounts for the chemical investigation of the herb. Hence, the chemical standardization of the raw material and the formulations containing *Phyllanthus amarus* is under vast discovery and thus more work is required to establish *Phyllanthus*

amarus as a useful herb for treatment of various complications. Coupled with improvements in approaches for natural-product isolation, characterization and synthesis, this could be opening the door to a new era in the investigation of natural products in academia and industry.

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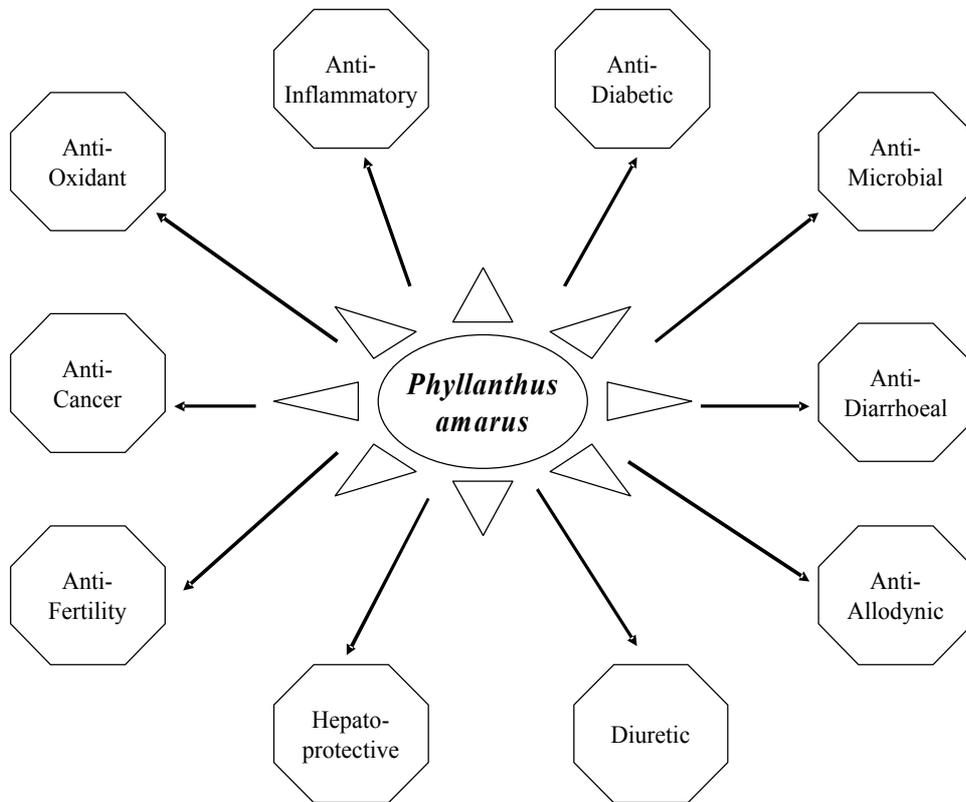


Fig. 1. Diagram showing potential properties of *Phyllanthus amarus*.