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PHARMACOGNOSTIC, PHYTOCHEMICAL AND PHARMACOLOGICAL STUDY OF *Phyllanthus fraternus*: A REVIEW

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ABSTRACT

Phyllanthus fraternus a distinctive member of the family Euphorbiaceae is a little annual herb found all through the tropical and subtropical area. Phyllanthus genus has widely been used in the conventional system of medicine. It has a wide variety of activities like antioxidant, anticancer, antibacterial, hepatoprotective, diuretic, antiplasmodial, cardiovascular, and antifibromyalgic activity. This study summarizes the basic information about the plant morphology, different isolated compounds, and pharmacological action of every part of the plant. This review aims at the congregation of study of various researchers on this plant to date. This information will help and give sufficient baseline information for further research and commercial exploitation.

KEYWORDS: *Phyllanthus fraternus*, Pharmacognosy, Phytochemicals, Pharmacological activity.

INTRODUCTION

Plant-derived content is used as a source of drugs in various medicines disciplinary. Due to the diverse nature of the content, it is a major part of drug discovery. Globally attention is increased to use phytoconstituents to prevent or to treat various diseases. More than 80% of

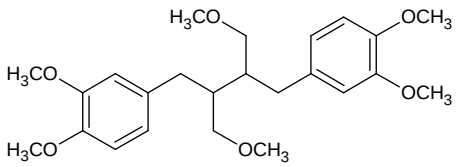
the world's population uses herbal or plant products as the primary source of medicine.[1] It is an herbaceous plant belonging to the family *Euphorbiaceae*.[2] It is an annual herb known as Bhuiamla. The flowering and fruiting time is April to August and *Phyllanthus fraternus* found in the tropical and subtropical regions of the world. It is a native of India and West Pakistan. It is generally weed and found in grassland from Assam to Punjab and Kerala.[3]

Pharmacognostic study of plant

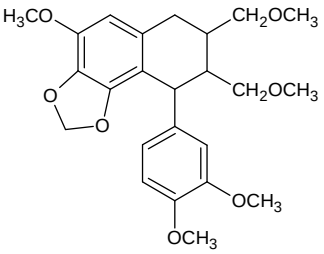
The leaf of *Phyllanthus fraternus* is simply abundant to some extent alternate, opposite, thin, and approximately sessile. The upper surface of leaves is green and glabrous and the lower surface is pale green and somewhat glaucous. It occurs in two rows with a whitish rachis elliptic-oblong shaped, margin entire, apex rounded, obtuse base rounded, 6–13 by 3–6 mm, unicostate reticulate venations. The lateral nerves are typically four to five pairs, petioles very short, stipules simple, minute, free-lateral, awl-shaped, lanceolate-subulate, and very acute. The taste of the leaf is bitter with an indistinct odor. The stem of the plant is herbaceous, somewhat smooth, aerial, erect, green, branching profuse toward the upper region, 30–60 cm in height, and up to 4 mm in diameter. Stem naked below with 5–11 pairs leaves bearing branches, pale green, angular, slender, and spreading. The internodes are small, 1–1.5 cm long. The root is taproot and straight, small, 2.5–11.0 cm long, gradually tapering, with several whitish fibrous secondary and tertiary roots, external surface light brown, fracture short.[4-6]

Fig. 1: Leaf and whole plant of *Phyllanthus fraternus*.

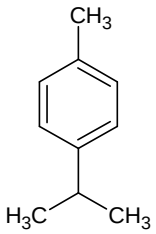
Chemical investigation of the plant shows that it contains several lignans and alkaloids. The plant contains the following active constituents.[7-13]



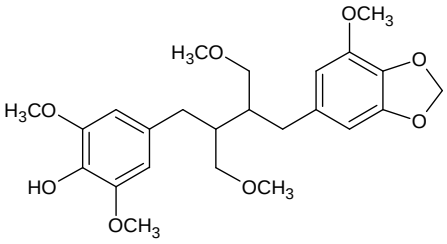
Phyllanthin



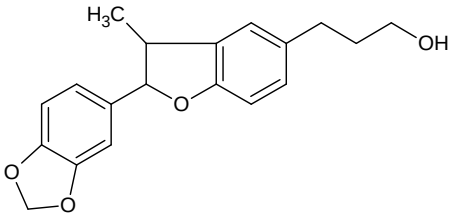
Hypophyllanthin



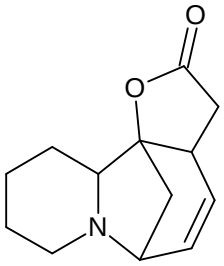
Cymene



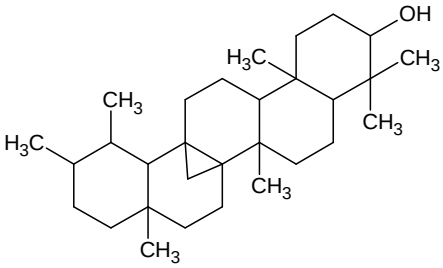
Nirphyllin



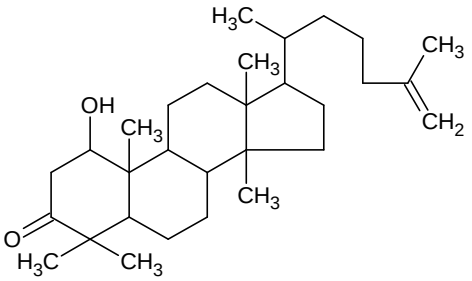
Phyllnirurin



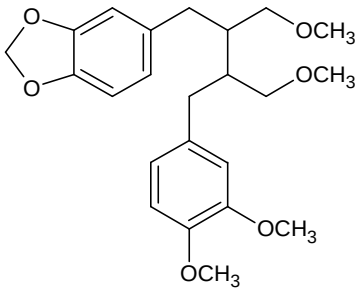
Phyllochrysine



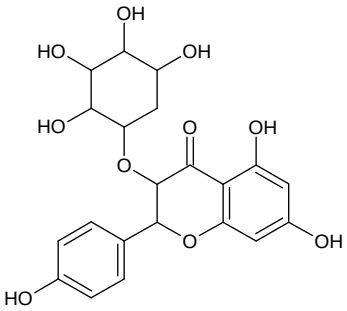
Phyllanthol



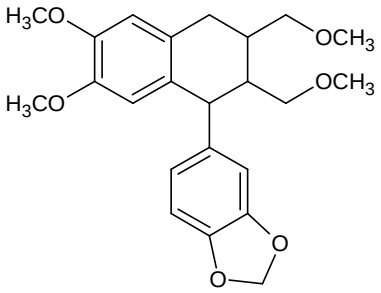
Phyllanthenol



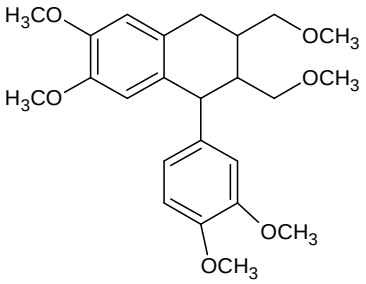
Lintetralin



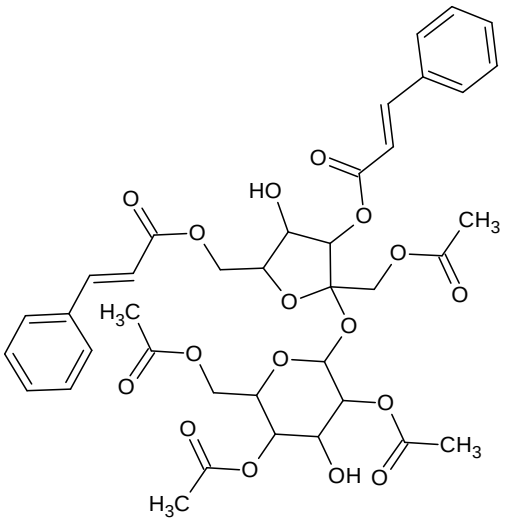
Astragalin



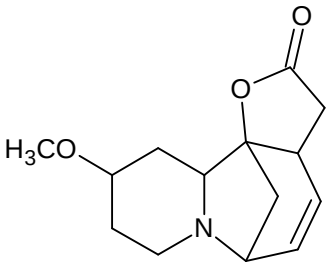
Niranthin



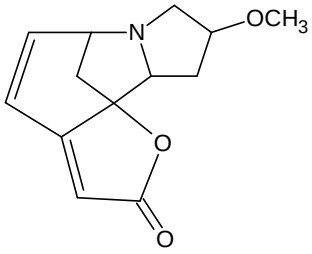
Nirtetralin



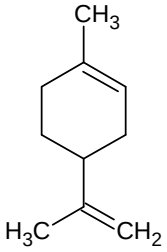
Niruriside



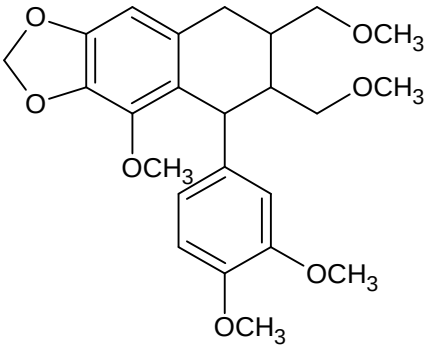
4-Methoxy-Securinine



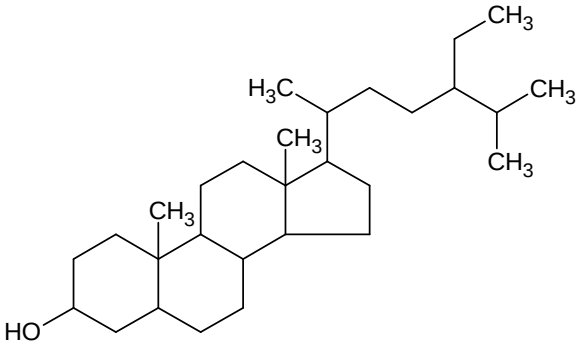
4-Methoxy-Norsecurinine



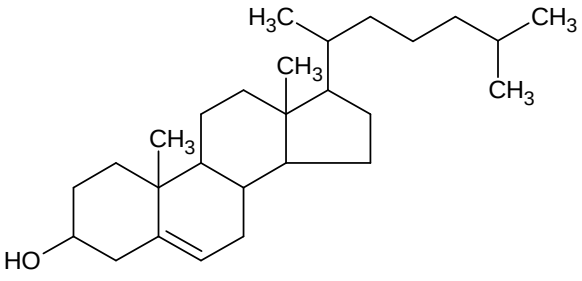
Limonene



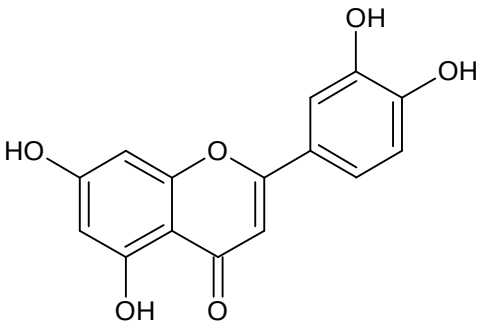
Phyltetralin



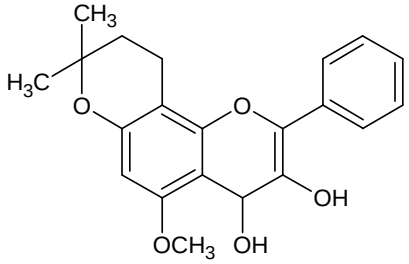
β-Sitosterol



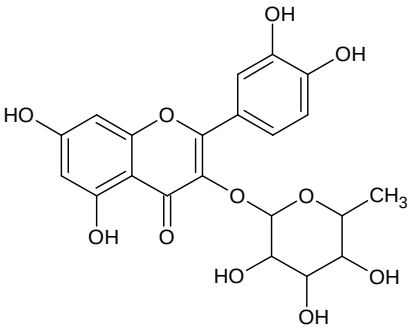
Cholesterol



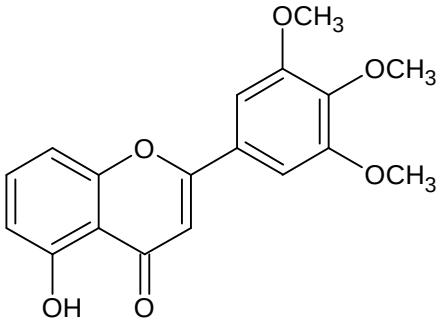
Quercetin



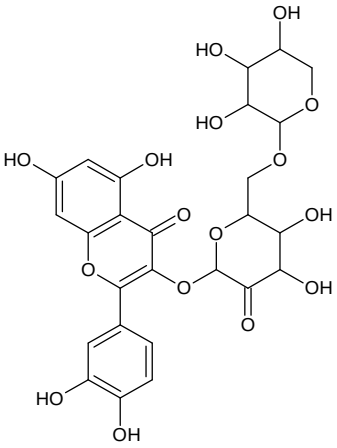
Quercetol



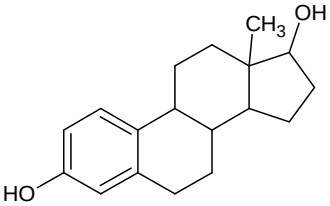
Quercitrin



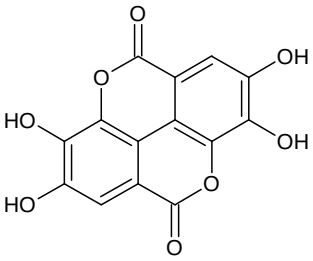
3, 4, 5-Trimethoxy flavon



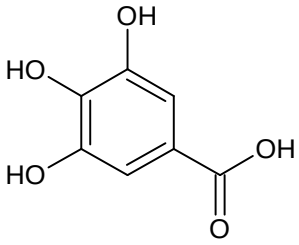
Rutin



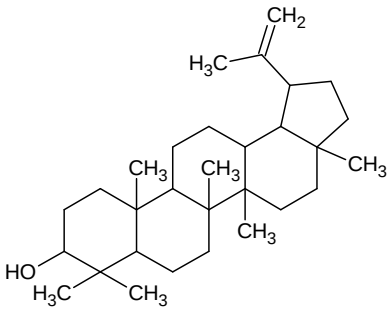
Estradiol



Ellagic acid



Gallic acid



Lupeol

Also, isolated compounds are Phyllanthusiin D, Methyl salicylate, Triacontanal, Triacontanol, lintetralin.

Pharmacological study of *Phyllanthus fraternus*

Antioxidants activity

Ethanolic extract of leaves of *Phyllanthus fraternus* shows antioxidant and anticoagulant activity by *in-vivo* and *in-vitro* model.[14] The aerial part and root of the plant were investigated for free radical scavenging potential. Water and ethanol extract of aerial part and root of plant exhibit excellent antioxidant properties.[15] Aqueous extract of aerial part exhibits hepatoprotective and antioxidant activity against cyclophosphamide.[16] In comparison to the aqueous and ethanolic extract of calli, the ethanolic extract of the stem is more potent in antioxidant activity.[17]

Antimicrobial activity

N-Hexane and ethyl acetate fractions screened for antimicrobial activity against *Staphylococcus aureus, Escherichia coli, Bacillus subtilis, Pseudomonas aeruginosa, Salmonella typhi,* and *Klebsiella pneumoniae*, using the Agar-well diffusion method. It also shows antioxidant activity.[18] Methanolic and ethanolic leaf extract of *P. fraternus* were evaluated for antibacterial and anti-fungal potency. The study indicates that antimicrobial activities may be due to the presence of secondary metabolites. Also, root extract shows antibacterial activity.[19,20]

Antidiabetic activity

Methanolic extract of aerial parts of *P. fraternus* screened for anti-diabetic and renoprotective potential in alloxan-induced diabetes in rats. The study suggests that polyphenols present in *P. fraternus* may be responsible for the anti-diabetic and renoprotective activity in rats.[21] Alcoholic extract of the whole plant shows anti-diabetic activity against alloxan-induced diabetes in rats. Activity is studied in a comparison of tolbutamide.[22] Crude methanolic extract of leaf of *Phyllanthus fraternus* has phytoconstituents with glucose-lowering capacity in streptozotocin-induced diabetic and normal rats and also maybe competes with metformin.[23]

Anticancer activity

Silver nanoparticles prepared from leaf extracts of *Phyllanthus fraternus* show cytotoxicity activity against hepatic and breast cancer cell lines.[24] Antiproliferative activity of cultured

Daudi cells was evaluated using 3-(4, 5-dimethylthiazol-2-yl)-2, 5-diphenyltetrazolium bromide assay in a dose- and time-dependent manner after treatment with the hydroalcoholic extract of *P. fraternus*. Trypan blue viability assay was performed. The extracts inhibited the growth and proliferation of Daudi cells through induced cell death, which was dose-dependent and time-dependent.[25] Aqueous extract of *Phyllanthus fraternus* whole plant exhibits CPA-induced nephrotoxicity in mice by decreasing oxidative stress thus it serves as a promising medicinal herb in complementary chemotherapeutic modalities.[26]

Antispasmodic activity

Aqueous extracts and successively obtained petroleum ether, ethyl acetate, and methanol fractions of the whole *Phyllanthus fraternus* plant show antiplasmodial activity.[27] After chemical investigation of the plant, it shows six different *Securinega* alkaloids (allonorsecurinine, *ent*-norsecurinine, nirurine, bubbialine, epibubbialine, and the lignan phyllanthin) which are isolated and characterized by different analytical methods.[28]

Diuretic activity

Methanolic extract of aerial parts of *Phyllanthus fraternus* screened for diuretic activity in Wister albino rats. The extract shows dose-dependent diuretic activity.[29]

Cardiovascular activity

Aqueous ethanolic extract of dried leaves, stems, and roots of *Phyllanthus fraternus* does not affect normal frog heart but It improves the functioning of hypodynamic heart.[30] Aqueous extract of plant *shows* cardioprotective activity against high-fructose (HF) diet-induced cardiac damage in Wistar rats. After histopathological examination of the heart and aorta, it understands that it reduces fat deposition and necrosis.[31]

Antifibromyalgic activity

Standardized aqueous extract of the whole plant, methanolic extract of leaf, hydromethanolic extract of leaf, and hydroethanolic extract of the whole plant evaluated on mechanical hyperalgesia induced by repeated intramuscular injections of acidic saline. The study suggests that it is used in the treatment of chronic musculoskeletal pain and as an antifibromyalgic agent.[32] Also, the study reveals that the antinociceptive activity of plants in chronic inflammatory hyperalgesia and effective in the management of persistent pain.[33]

Hepatoprotective activity

Alcoholic extract of aerial parts and roots of *Phyllanthus fraternus* were screened for antihepatotoxic activity on carbon tetrachloride-induced liver damage in albino rats. The degree of result tested by SGOT, SGPT, total albumin, and total protein count. The methanolic extract shows the significant recovery of hepatocytes in the histopathological study of the liver showing almost complete normalization of the tissues as neither the fatty accumulation nor the necrosis was observed. The admixture in raw drugs shows hepatoprotective activity.[35]

Miscellaneous activities

Hydro-ethanolic extract of *Phyllanthus fraternus* shows anxiolytic potential.[36] Powder of *Phyllanthus fraternus* shows larvicidal activity in suppressing *Dermestes maculatus Degeer* infestation on smoked African catfish.[37]

CONCLUSION

Phyllanthus fraternus is an important plant that possesses various chemical constituents. The researchers isolated various chemical constituents and studied for pharmacological activity. Pharmacological activities of the plant are mentioned in this review. This review explores the information of plat which will help researchers for further study.

Conflict of interests

The authors declare that there is no conflict of interest regarding the publication of this paper.

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