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A Narrative literature review on Phytopharmacology of a Caricature Plant: *Graptophyllum pictum* (L.) Griff. (Syn: *Justicia picta* Linn.)

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ABSTRACT

Graptophyllum pictum is a plant used in medicine from the time of Ayurveda, the ancient system of Indian medicine. This review article is presented to give an insight on all the updated information on its pharmacological activities. Studies indicated that *G. pictum* possesses diverse medicinal properties such as anti-inflammatory, nephroprotective, antidiabetic, oxytocic, and anti-implantation properties. This review comprehends the numerous medicinal uses and present literature for pharmacological review of *G. pictum* belongs to family Acanthaceae.

Keywords: Phytopharmacology, Plant, Traditional medicine

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Introduction

Ayurveda, a popular traditional medicine system of India, utilizes natural products to treat the root cause of the diseases either by restoring the balance or creating a healthy lifestyle to prevent the recurrence of imbalance.[1,2] In Ayurveda, the fundamental concept of health is to understanding the disease (this means deprived of and ease means "comfort").[3,4] From ancient times, plants have been used as a source of medicine that forms the backbone of human healthcare.[5] Plants have the ability to synthesize a wide variety of chemical compounds that are used to perform important biological functions.[6,7] In traditional system of medicine, 75% of the Indian population depend on this indigenous system for relief as the herbal drugs are easily available with low cost, comparatively less toxic, and the shortage of practitioners of modern medicine in rural areas[8-10] he dark-leaved variety is known with trade name "black adulsa" in India. Genus name comes from the Greek words graptos meaning painted or marked with letters or to write and phyllon meaning a leaf from the variegated markings on the leaves. *Graptophyllum pictum* (L.) Griff. Family Acanthaceae is one of the plants that can be used as traditional medicine. In Indonesia, the plant is known as purple leaves.[11,12] Also known as "caricature plant" or joseph's coat because of the biocolors of its leaf. The plant is ornamental and grows profusely during the raining season in the tropic region of the world *G. pictum* is pharmacologically used in for various health problems such as constipation, rheumatism, scabies, urinary infection, hemorrhoid, maturing boil process, swelling, smoothing skins wounds, hepatomegaly, ear diseases, and laxative. In addition, the leaves are popular as a folk remedy for the treatment of several conditions such as anti-fungal, anti-inflammatory, and anti-plague. *G. pictum* contains alkaloids and pectin formic acid. Therefore, we aimed to compile, an update and comprehensive knowledge on *G. pictum*.[13,14]

Vernacular Names

It has many common names, depending on the geographical region or the language, for example: English: Caricature plant, Joseph's coat, Café conleche, Konkani: Kala adulsa, Pandharaadulsa, Chinese: Man huahua, and Malay: Daunungu.[15,16]

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Taxonomical Classification[17]

- Kingdom: Plantae
- Subkingdom: Tracheophyta
- Division: Spermatophyta
- Class: Magnoliophyta
- Sub Class: Magnoliopsida
- Order: Lamiales
- Family: Acanthaceae
- Genus: *Graptophyllum*
- Species: *Pictum*.

Botanical Descriptions

The caricature plant is a tropical evergreen shrub that will grow to 6–9′ tall. The leaves are oval to elliptic (up to 6″ long) deep green varyingly blotched with cream along the mid veins. The flowers are 3–4″ long, red to purple-red color, and tubular with protruding stamens. They bloom in summer.[18]

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Distribution

The plant is widely found in India, Papua New Guinea, Nicaragua, Panama, Costa Rica, Mexico, United States, Ghana, Bolivia, Ecuador, and gown as an ornamental plant in gardens.[19-21]

Traditional Uses

This plant is used in treatment of reduce fertility constipation, rheumatism, hemorrhoid, urinary infections, scabies, hepatomegaly, ear disease, anti-fungal, anti-inflammatory, anti-plaque, laxative, anti-viral, and anti-bacterial activity.[22]

Phytoconstituents

G. pictum has been found to contain alkaloids, glycosides, pectin, formic acid, steroids, saponins, tannins, anthraquinones, flavonoids, and alcohol.[23,24]

Pharmacological Review

Anti-inflammatory Effect of *G. pictum*

The anti-inflammatory activity on carrageenin-induced edema in rats and acetic acid-induced vascular permeability was investigated using ethanol extract obtained from the leaves of *G. pictum*. The extract was partitioned between ether and water, and then the water-soluble fraction was extracted with 1-butanol. The 1-butanol-soluble fraction was extracted with chloroform-acetone, hot methanol and water, successively. The ethanol extract showed an anti-inflammatory activity as well as an analgesic activity and the same activities were investigated in the water-soluble fraction, 1-butanol-soluble fraction, methanol-soluble fraction, and hot methanol fraction. It also investigated that hot methanol contained flavonoids which are responsible for the anti-inflammatory effect of the ethanol extract of *G. pictum*.[25]

Effect on Acrylic Resin Complete Denture Plaque Growth

The ethanolic extract (5%, 10%, 20%, and 40%) of *G. pictum* effect toward the growth of denture plaque on acrylic resin complete denture was investigated. Forty samples of acrylic resin complete denture were used, which divided into four groups. At first, each denture was cleansing from saliva with running water. After the first treatment, all the samples (Group I to IV) denture was soaking in *G. pictum* extract with various concentration 5%, 10%, 20%, and 40%, each for 15 min. Following this, the dentures were worn by the patients again for 4 h, and then removed and washed with water. Then, the disclosing agent was rubbed on the dentures and subsequently washed with water. The study result showed that *G. pictum* extract could inhibit the plaque growth on acrylic resin complete denture. Moreover, it seems also that the highest plaque growth inhibition on acrylic resin complete denture is caused by the 40% concentration. The results of the experiment revealed the highest plaque growth inhibition in those soaked in 40% extract solution and the lowest inhibition was found in those soaked in 5% concentration solution.[26]

Oxytocic and Anti-implantation Activities

In this study, *in vivo* anti-implantation and *in vivo* anti implantation activities were evaluated using aqueous and ethanolic extract of leaves of *G. pictum*. The oxytocic effect was carried out on the isolated strip of gravid rat uterus in mild pregnancy and was compared with the activity of standard drug oxytocin. The *G. pictum* ethanolic extract showed oxytoxic activity while *G. pictum* aqueous extract was found to reduce the normal contraction of the uterine strip. Be potent and suppressed the normal contraction of uterine strip while the ethanolic extract exhibited agonistic effect which was rapid in onset. The anti-implantation activity was done using 8 week old virgin female Sprague-Dawley albino rats (eight rats/group) in three groups. Group I was administered 400 mg/kg of GPEE by oral route and the same dose of GPAE was similarly administered to another group while the vehicle of administration (distilled water) was similarly administered to the third group as control. All administrations started on day 1 of pregnancy and were given daily for 7 days. The rats were sacrificed on day 10 of pregnancy. The presence of fetus, implantation sites, and number of corporal lutea in the autopsied rats was recorded and used to calculate the percentage anti-implantation effect. The experimental results of GPEE, GPAE, and distilled water showed the percentage of anti-implantation value of 93.8 ± 9.1, 16.8 ± 8.5, and 3.9 ± 5.4, respectively.[27]

Nephrotoxicity Activity

The nephrotoxicity of the alcoholic extract of whole plant of *G. pictum* in albino male Wistar rats was investigated by determined the serum creatinine and urea level as well as renal antioxidant status in rats after cisplatin administration at dose level of 12 mg/kg body weight. Ethanolic extract at dose level of 150 and 300 mg/kg was administered orally after cisplatin injection for 15 days. The ethanolic extract significantly reduce the elevated serum creatinine and urea levels and renal antioxidant defense systems such as superoxide dismutase, catalase, glutathione peroxidase, and reduced glutathione was restored to normal by treatment with the extract. The result indicated that ethanolic extract of *G. pictum* showed the preventive effect against the cisplatin induced nephrotoxicity.[28]

Blood Glucose Lowering Effect of Aqueous Extract and its Acute Toxicity in Mice

The anti-diabetic property of the aqueous extract of *G. pictum* leaf was evaluated on alloxan-induced diabetic Wistar rats. After

diabetic induction, the rats were divided into fie groups. Groups 1 to 3 were administered 100, 150, and 200 mg/kg body weight extract orally by gastric probe for 4 weeks; Group 4 was administered 10 mg/kg body weight metformin, while Group 5 served as control which received distilled water. During the drug administration period, using the Roche Accu-chek Active Glucometer the fasting blood glucose level (FBGL) of the rats was checked before commencement of treatment and weekly. The anti-diabetic study showed a significant reduction ($P < 0.05$) in the mean FBGL in all the three groups of animals treated with aqueous extract of *G. pictum* leaf when compared to the control; and it exhibited effective anti-diabetic potency when compared with metformin.

Alkaline Phosphatase (ALP) Activity against MC3T3E1 Cells as a Marker of Osteoblast Differentiation Cells

The simulative activity on ALP of MC3T3-E1 osteoblast cells was evaluated using the hexane, ethyl acetate, *n*-butanol, and water fractions of leaves of *G. pictum*. At concentration 50 μg/ml, the ALP simulative activity of ethanolic extract of *G. pictum* was 128% whereas *n*-butanol and water fractions assessed 112% and 122% activity against MC3T3E1 osteoblast cell.

Cytotoxic Activities of (*G. pictum*) Ethanolic Extract and its Fractions on Human Colon Cancer Cell WIDR

The cytotoxic activity was determined by ethanolic extract of *G. pictum* and to elucidate the compounds contained in most active extracts on human colon cancer WiDr cells. *G. pictum* was extracted using 70% ethanol and fractionated using n-hexane, chloroform, and ethyl acetate, respectively. The yield of extract obtained was 18.9%. The yield of hexane, chloroform, ethyl acetate, and ethanol water fractions was 1.07%, 2.93% 10.26%, and 84.82, respectively. Cytotoxic activity was assessed using MTT assay based on IC_{50} values. The IC_{50} value of extract, hexane, chloroform, ethyl acetate, and ethanol water fractions was determined 1527,58; 143,97; 507,19; 3538,67; and 318660 μg/ml. The hexane fraction showed the highest cytotoxic activities due to the presence of terpenoids and phenolics.[29]

Blood Glucose Lowering Effect of Aqueus Extract of *G. pictum* (L.) Griff on Alloxan-induced Wistar Rat

The blood glucose lowering effect of *G. pictum* (L.) Griff leaves extract was reported in alloxan-induced Wistar rats. In this study, 25 male Wistar rats were divided into five groups. On day 0, the negative control and each group animals injected with 125 mg/kg dose of alloxan. On the 4th day after the rats had diabetes, normal group (K-1) was given only standard feed, negative control (K-2) was given only alloxan intraperitoneally on day 0, first treatment group (K-3) was given 50 mg/kg dose of *G. pictum* (L.) Griff, second treatment group (K-4) was given 100 mg/kg dose of the leaf extract, and the third treatment group (K-5) was given the leaf 200 mg/kg dose of the leaf extract. On the 10th day, fasting blood glucose was taken from the rats. Post-test only group design was used to be the experimental design. There were significant differences in the treatment groups (K-3, K-4, and K-5) compared to the negative control group (K-2) after treatment. The mean of blood glucose levels decreased with the increased doses of *G. pictum* (L.) Griff leaf extract treatment. The treatment groups (K-3, K-4, and K-5) were not significant compared to the normal group (K-1).[30]

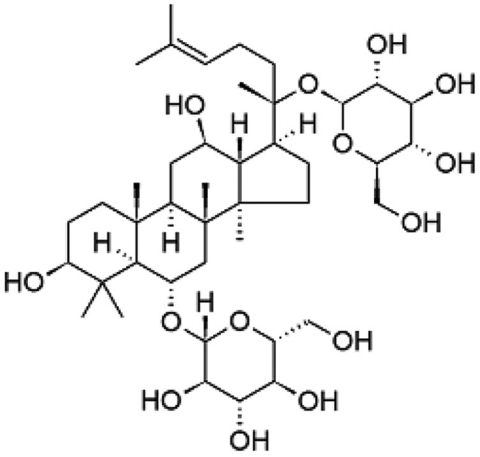

Figure 1: Saponin

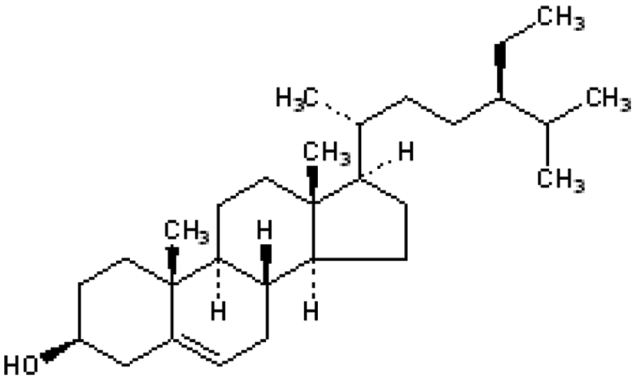

Figure 2: β-sitosterol

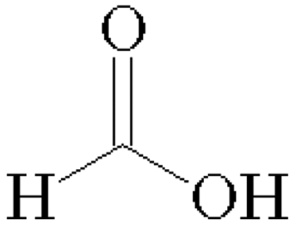

Figure 3: Formic acid

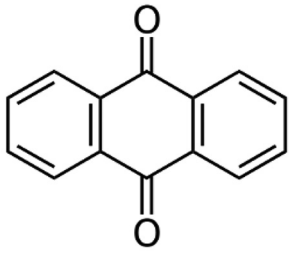

Figure 4: Anthraquinone

G. pictum (L) Griff leaf extracts have potential to protect pancreas of alloxan-induced hyperglycemic mice.

The pancreatic cells protecting activity of alloxan-induced hyperglycemic was evaluated by using leaf extract of *G. pictum* (L) Griff in mice. The leaves of *G. pictum* (L) Griff were macerating with ethanol and then partitioning the extract with diethyl ether, ethyl acetate, and butanol. Resultant extracts were used to treat hyperglycemic mice over 14 days. The results assessed that the leaf extracts have the ability to protect the pancreas from alloxan-induced damage and ethyl acetate extract has the highest protective activity.[31] Figure 1-4 provides structures of compounds.

Conclusion

The medicinal plants play a fundamental role in the treatment and prevention of various diseases in humans as they are the rich source of bioactive phytochemicals that have potential beneficial properties. Scientific research into *G. pictum* commonly known as caricature plant demonstrates various physiological benefits such as anti-inflammatory, denture plaque, oxytocic and anti-implantation activities, nephrotoxicity activity, anti-diabetic activity, ALP activity, cytotoxic activities, and also potential to protect pancreas of alloxan-induced hyperglycemia. This review may be beneficial for investigation of this medicinal plant for the development of new drug for sustaining human health and betterment of human kind.

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