

A Comprehensive Review on Ethno-phytopharmacological Profile of Medicinal Plant *Pedaliium murex*

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ABSTRACT

In the modern era, drug discovery and development from phytocompounds have hugely increased as medicinal plants are known for their inherent therapeutic nature against various ailments. Also, the practice of the phytotherapeutic approach has increased significantly as they are more effective with minimal side effects. The medicinal plant *Pedaliium murex* is an herbaceous plant that belongs to the family Pedaliaceae and has numerous medicinal properties. The current review briefs and focuses on the phytochemical and pharmacological characteristics of *Pedaliium murex* and reviews previous research reports. The only means of dealing with the adverse effects of synthetic medications is to rely on phytomedicines. Through toxicity testing, adverse effects associated with the use of phytomedicines can be detected, which enables the prevention of possible hazardous side effects. *Pedaliium murex* has the potential to be used for the development of novel drugs. The plant is chiefly known for its efficacy in treating various complications, namely urinary disorders such as Ardorurinae, Dysuria, and Spermatorrhoea; diabetes; and cancer, and as an aphrodisiac, antioxidant, and nootropic. This review gives an eagle's view on a pharmacological activity from several parts of the herbs with both therapeutic and environmental advantages.

Keywords: *Pedaliium murex*, Toxicity, Anti-cancer, Antioxidant, Anti-urolithiatic.

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INTRODUCTION

Medicinal plants have been used traditionally for curing innumerable illnesses from time immemorial. In daily lives, medicinal plants are utilized to treat various illnesses. The capacity of plants to produce a wide range of therapeutic and bioactive chemicals is a natural medicine. Traditional treatments worldwide have used herbal medicines to treat various illnesses, and India is the world's top producer of medicinal herbs. The medicinal plant *Pedaliium murex* is an herbaceous plant that belongs to the family Pedaliaceae. The plant has received more attention in recent times due to its therapeutic medicinal benefits.^[1]

Many medications are made from the entire plant to treat conditions including respiratory infections, diabetes, cancer, urolithiasis, ulcers, and hyperlipidemia, etc. Since the beginning of time, Indians have used this plant to treat a variety of infections. *Pedaliium murex* is still commonly used to treat several illnesses in some areas. Clinical applications of *Pedaliium murex* have demonstrated that the plant parts serve as a repository for various

phytoactive compounds, ensuring pharmacological potential. Therefore, researcher chiefly focus on the phytoactive constituents for their medical applications in depth.^[2] The characteristics of *Pedaliium murex* are examined in this review to establish a scientific basis for further study of the plant. It also emphasizes the significance of the phytopharmacological approach in treating various ailments with bioactive phytocompounds.^[3]

Traditional remedies

Human beings are strongly connected to medicinal plants since the ages of civilization to preserve their vibrancy and health. Since ancient times, various forms of traditional, complementary, and alternative medicine have employed a wide diversity of aromatic and medicinal plants as therapeutic substance.^[4]

The plant has long been said to be a great remedy for a variety of illnesses, including leucorrhoea in women, digestive tonics, ulcers, fevers, wounds, and general debility, as well as reproductive issues like gonorrhoea, nocturnal discharges, and impotence in males. Predominantly, an infusion made from the leaves and stems of the shrub can cure gonorrhoea. Multiple flavonoids have been discovered in leaves and flowers. Its fruit broth has antispasmodic, diuretic, demulcent, and aphrodisiac properties, while its root broth has anti-biliary properties.^[1]



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Botanical description

Vernacular Names

Pedaliium murex is known by various regional names, such as the “Gokhru or gokhar” in Hindi, “gaja-daunstraka, gokshura, or titta-gokshura in Sanskrit, doddaneggilu in Kannada, motha-malvi-gokharu in Malayalam, Ananerinnil in Tamil, Gokhara in Marathi, Gokhura in Gujarati, Yanai nerunjil in Oriya, Khasake kabir in Arabic, Sulegi in Burmese, Ati neranchi in Singapore, and Khasake Kalan in Persian.^[3]

Ecology, Environmental requirements, and Growth condition

Pedaliium murex typically grows as a weed along the borders and on open grasslands close to the coast at an altitude of 500 M above sea level. It can be found on sandy and limestone soil and is a sign of saline soil. Growing generously in rich, fertile soil and agricultural areas, it is a weed found at 25 to 30°C. Germination in Western Uttar Pradesh begins in June or July and blossoms between September and December. The plant is primarily found in Southern India, particularly along the shores of the Deccan Peninsula and Coromandel regions, as well as in salty sandy areas along river belts in Tamil Nadu, Andhra Pradesh, Haryana, Delhi, Rajasthan, Punjab, Gujarat, Madhya Pradesh, Uttar Pradesh, and other states. *Pedaliium murex* leaves are simple, glabrous, alternating, and succulent in nature, and the bases have black glands. The fruits are pale yellowish to brown in color, measuring 1.5 to 2.0 cm in length and 0.8 to 1.5 cm in diameter.

They are indehiscent hard drupes with a pyramidal glabrous surface and an ovoid, globular shape with four ridges. At the base, they have four spreading spines that are 2.0 to 4.0 mm long, which are connected by a short, curved pedicle and have a terminal apex. Fruit has five to twelve compartments, each of which contains a solitary seed.^[5]

Phytochemistry

The existence of all main classes of plant secondary metabolites has been confirmed by phytochemical characterization of several *Pedaliium murex* sections. Researchers and specialists in the phytopharmacological sector are interested in these plant metabolites as they elicit varied positive outcomes on human health.^[4] Numerous phytoconstituents, including triterpenoids, fatty acids, steroids, flavonoids, tannins, saponins, vitamins, proteins, sugars, vanillin, and ursolic acid, were found in the plant during extensive phytochemical analysis.^[3]

According to Rastogi *et al.* (1982)^[6] and Bedigian *et al.* (1985),^[7] the plant's fruit contains mucilaginous alkaloid, fat, resin, gum, caffeic acid, coumaric acid, hepatatricacontonic acid, ferulic acid, protocatechic acid, vanillinic acid, and β -sitosterol. Saturable proteins, flavonoids, sapogenin, and diosgenin are also present.^[8-10] The phytoactive compounds from various parts of

Pedaliium murex, including leaves, seeds, flowers, roots, stems, and fruits, and their respective pharmacological properties (Figure 1) are presented in Table 1.

Toxicity of *Pedaliium murex*

The acute toxicity study of the leafy stem and fruit extract of *Pedaliium murex* stated that single oral administration at 5000 mg/kg b.w. in rats showed no significant changes in body weight, relative organ weight, or behavioral changes between the control and treatment groups after a period of 14 days. No mortality or morbidity was observed. Histopathological findings also revealed normal liver and kidney histology in the control and treatment groups.^[18]

Similar outcomes were reported in a previous study where the aerial part of the plant extract was shown to be non-toxic up to a dose of 2000 mg/kg b.w. in acute toxicity studies.^[19]

Efficacy studies

Antioxidant and Nootropic effect

Pretreatment of ethanolic leaf extract of *Pedaliium murex* in rats at doses of 200 and 400 mg/kg significantly reduced the elevated nitric oxide levels and improved the protein levels in rat brains when compared to LPS (1 mg/kg)-treated rats, indicating its antioxidant potential. Similarly, the nootropic effect of *Pedaliium murex* treated groups showed improved cognitive performances in behavioral tests for learning and memory when compared to rats exposed only to endotoxin LPS.^[20] In a different study, a different EEPM dosage stops the elevated nitric oxide and restores the protein levels in the rat brain's hippocampal region.

Anti-diabetic effect

An Accu-Chek glucometer was used to assess antidiabetic activity. Healthy albino mice were tested for the antidiabetic action of seed oil at 100 mg/kg and 200 mg/kg, compared to the conventional medication glibenclamide at 5 mg/kg. Antidiabetic action was detected on the 1st, 7th, 14th, 21st, 27th, and 30th days. *Pedaliium murex* seed oil has significant medicinal properties, indicating the presence of very effective plant components. Phytochemical screening and examination of plant contents reveal numerous compounds such as hydrocarbons, fatty acids, aldehydes, fatty acid esters, and thymol. Seed oil has impressive properties. The oil has significant anti-diabetic action.^[21]

Rats with alloxan-induced diabetes were used to test the antidiabetic effect of ethanolic extract of *Pedaliium murex* root. The daily ingestion of 100 and 200 mg/kg b.w. of *Pedaliium murex* ethanolic extract for three weeks resulted in a significant drop in blood sugar levels and an increase in blood insulin, Superoxide Dismutase (SOD), Catalase (CAT), Glutathione Peroxides (GPx), reduced Glutathione (GSH), and Glutathione Transferase (GST).^[22]

Also, the production of free radicals in the tissues of the liver and renal organs was quenched by the *Pedalium murex* root extract.^[2] Compared to glibenclamide, the ethanolic extract of *Pedalium murex* (200 mg/kg of body mass) has demonstrated greater efficacy.^[23]

Anti-cancer activity

Different concentrations of the fruit extract (50, 125, 250, 500, and 1000 µg/mL) were tested in A549 lung cancer cells. The percentage of viable cells had decreased as a result of significant growth inhibition at increasing concentrations of the methanolic fruit extract. As a result, *Pedalium murex* fruit extract in methanol may be useful as an antiproliferative agent.^[24]

Additionally, the methanolic extract from *Pedalium murex* leaves has dose-dependent anticancer efficacy against the A549 cell line. (*Pedalium murex* leaf methanolic extract has been used for 6, 12, 24, and 36 hr.) Leaves for 6, 12, 24, and 36 hr, the development of A549 cells is regulated. At 500 µ/mL, the methanolic extract of *Pedalium murex* leaves exhibits a maximal 68% suppression of A549 lung cancer cells.^[25]

The aqueous fruit juice of *Pedalium murex* L. included biomolecules that act as capping and reducing agents during the synthesis of CuNPs. Several experiments were conducted to determine the fruit extract's *in vitro* antioxidant activity. CuNPs induced dose-dependent cytotoxicity and apoptosis in A549 cells. VD Kannan's findings suggest that biosynthesized CuNPs derived from *Pedalium murex*. Fruit juice has anti-cancer effects and can be utilized for lung cancer treatment, particularly for early-stage intervention.^[26]

Aphrodisiac

It has been proposed that enduring ethanol consumption may cause testicular injury and infertility in men. Gunasekaran Balamurugan *et al.*, studies examine the effectiveness of a petroleum ether extract from *Pedalium murex*, a member of the Pedaliaceae family, in improving aphrodisiac activity and preventing ethanol-induced germ cell damage and sterility in male rats.^[27]

It was discovered that the *Pedalium murex* plant's ethanolic and petroleum ether extracts have aphrodisiac properties and can repair ethanol-induced germ cell damage and sterility.^[28] Finally, it improves testosterone levels, protein, total cholesterol, sperm motility, body weight, and sexual desire.^[29]

Antihyperlipidemic

The antihyperlipidemic potential of an ethanolic extract from *Pedalium murex* fruits in a high-fat diet was examined by Balasubramanian *et al.*^[28] Additionally, the ethanol extract

decreased the animals' body weight that was caused by hypercholesterolemia. *Pedalium murex* induced reductions in the body's cholesterol levels may interfere with enzyme activity through a positive feedback mechanism.

The antihyperlipidemic efficacy of *Pedalium murex* ethanol extract was like that of the common medications' atorvastatin and gemfibrozil. It is tested against several biochemical components, including triglycerols, lipoproteins (high density, low density), and blood serum cholesterol, and the results are seen in the treated animals.^[5,28]

Table 1: Phytoconstituents and Pharmacological activity.

Plant Parts	Phytochemical compounds	Pharmacological Activity
Fruits	Alkaloids (3.5%-5.0%), glycosides, stable oil, resins, aromatic oil, triterpenoids, carbohydrates, saponins, Flavones, Hydrocarbon, Amino acid, Phenol.	Enhance fertility and other female reproductive disorder, treatment of diabetes, increasing the vigor in men, demulcent, antispasmodic, and aphrodisiac. ^[11]
Leaves	splendid alkaloids, resins, flavonoids, saponins, proteins and steroids, Phenolic acid, Dinatin or Hispidulin.	Treatment for bladder troubles, gonorrhea. ^[3]
Root	reducing sugars, xanthoproteins, saponins, Alkaloids, triterpenoids, flavonoids, and phenolic compounds.	Gonorrhea, anti-bilious, aphthae as local application. ^[3]
Stem	phytosterols, saponins, tannins, herman and carbohydrates, Dinatin or Hispidulin.	For treating urinary disorder such as Ardorurinae, Dysuria and Spermatorrhoea. ^[12]
Flower	Quercetin, Dinatin, Aglycones.	Antioxidant, ^[13] Anti-inflammatory, ^[14] Anti-cancer, ^[15] Antimicrobial and Hepatoprotective. ^[16]
Seeds	--	Seeds are given to patients who are suffering from joint pain and lumbago. ^[17]

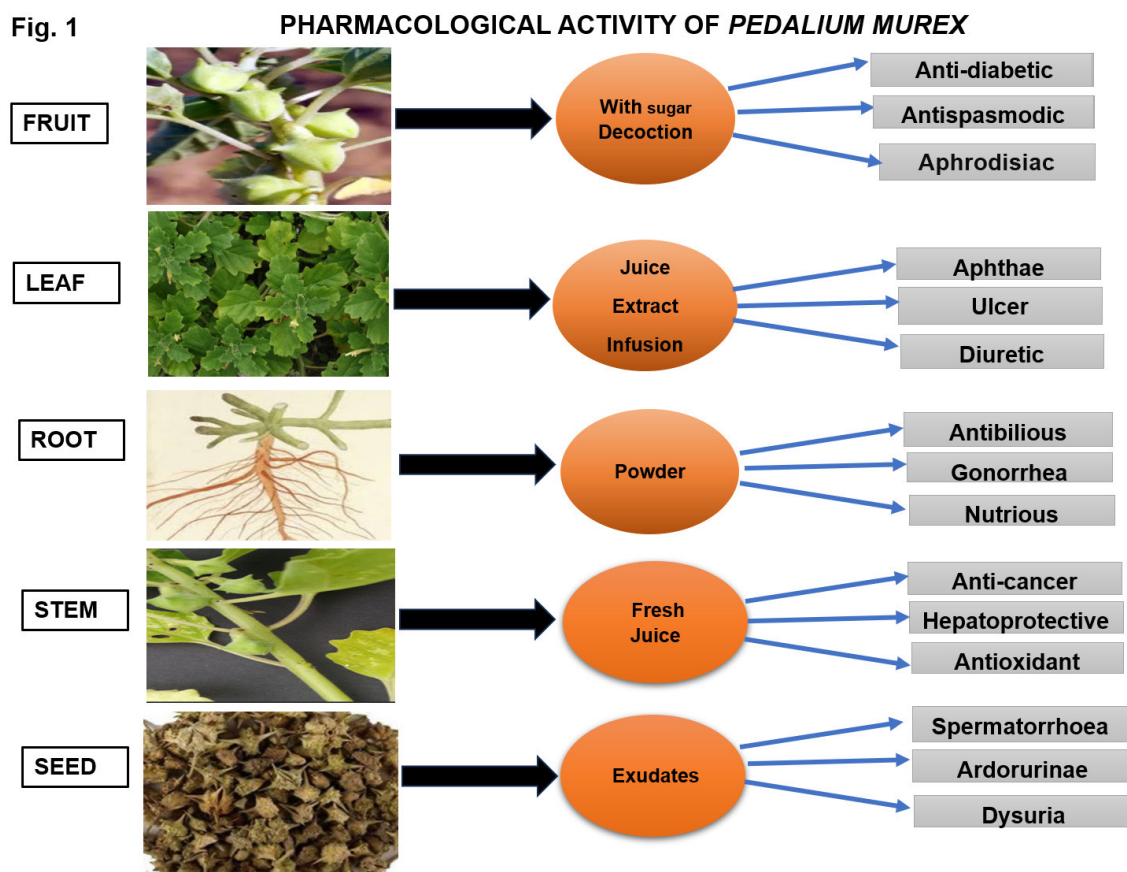


Figure 1: Pharmacological activity of *Pedaliium murex*.

Anti-Ulcer Activity

Rats treated with a specific dosage of *Pedaliium murex* leaf aqueous extract for 15 to 30 days were shown to have better results against ulcer-induced stomach lesions. While famotidine was used as a reference medication and was found to be less effective than the leaf extract, the effect was quantified by the concentration of total acid, acid volume, total protein, ulcer index, and glutathione.^[30]

Anti-Urolithiatic Activity

According to the expertise of South Indian traditional healers and the examination of *Pedaliium murex*, scientific research on kidney stone removal demonstrated and offered several pieces of evidence in favor of the plant's knowledge. In the year 2017, B. Kaleeswaran *et al.* investigated the anti-urolithiasis properties of ethyl acetate extract of *Pedaliium murex* against MgO-induced struvite crystals. Both *in vitro* and *in vivo* studies revealed the anti-urolithiatic potential of *Pedaliium murex*. via inhibition of the production of struvite crystals, preventing further crystal formation or growth. The *in vivo* histological studies also showed reduced renal damage in the *Pedaliium murex* -treated group. The study reports suggested that *Pedaliium murex* and its phyto-components could be employed as a remedy for kidney stone management.^[31]

Also, significant suppression of calcium oxalate has been demonstrated by Ananta Teepa *et al.* in the year 2010. When *Pedaliium murex* fruit extract had been given to rats intoxicated with ethylene glycol, the levels of liver and kidney symptoms returned to almost normal, limiting the damage to the liver and kidney tissues and preventing the formation of crystals in tissues. The levels of ACP, ALP, AST, and ALT in the hepatic and renal tissues of rats were given ethylene glycol, and that may be the result of the digestive enzymes leaking from the collateral circulation into the general circulation. Oxalate-induced renal and hepatic cellular damage leads to elevated LDH levels in serum, urine, and tissues after ethylene glycol intoxication.^[32]

CONCLUSION

The current review discusses various attributes of *Pedaliium murex*, including its traditional use, wide range of therapeutics, bioactive compounds, and pharmacological activities. Literature has led to the conclusion that it has a higher profile and may be used as a natural remedy for several disorders. It shows numerous pharmacological activities like antioxidant, nootropic effect, anti-diabetic effect, anti-cancer activity, aphrodisiac, antihyperlipidemic, and anti-ulcer activity, etc. Because of its abundance of antioxidants, it can be used to make nutraceuticals that reduce oxidative stress which helps to postpone degenerative diseases. Leaf, fruit, and root extracts demonstrated potential

medicinal properties. This *Pedaliium murex* contains phytochemicals and bioactive substances that are good for human health. However, further research at the molecular level is required to develop a new drug correlating its pharmacological action with phytocompounds based binding at the receptor level. In summary, *Pedaliium murex* is a traditional remedy for several illnesses and a miraculous source of numerous bioactive compounds.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

ABBREVIATIONS

LPS: Lipopolysaccharide; **EEPM:** Ethanolic Extract *Pedaliium murex*; **SOD:** Super oxide dismutase; **CAT:** Catalase; **GPx:** Glutathione peroxidase; **GSH:** Reduced glutathione; **GST:** Glutathione transferase; **b.w:** Body weight; **ALP:** Alkaline phosphatase; **ALT:** Alanine transaminase; **AST:** Aspartate aminotransferase; **ACP:** Acid Phosphatase.

SUMMARY

The current review briefs and focuses on the phytochemical and pharmacological characteristics of *Pedaliium murex*, a herbaceous plant that belongs to the family Pedaliaceae. The current study reviews previous research reports emphasizing numerous phyto-pharmacological properties of *Pedaliium murex* from various plant parts. The review outlines therapeutic and environmental advantages of the plant towards new drug discovery and novel therapy for various ailments..

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