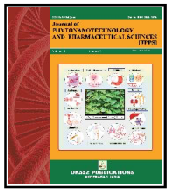
Journal of Phytonanotechnology and Pharmaceutical Sciences 5(2): 16-21, 2025

Online ISSN:2583-0376

http://jpps.ukaazpublications.com

DOI: http://dx.doi.org/10.54085/jpps.2025.5.2.3

Journal of Phytonanotechnology and Pharmaceutical Sciences



Review Article : Open Access

Pergularia daemia (Forssk.) Chiov.: A comprehensive review of its botanical traits, phytochemical profile, and pharmacological significance

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Article Info

Article history
Received 10 April 2025
Revised 13 May 2025
Accepted 14 May 2025
Published Online 30 June 2025

Keywords
Pergularia daemia (Forssk.) Chiov.
Phytochemicals
Flavonoids
Pharmacological activities
Traditional medicine

Abstract

Medicinal plants have long been integral to traditional healthcare systems worldwide, serving as reservoirs of diverse bioactive compounds for drug discovery. *Pergularia daemia* (Forssk.) Chiov., a perennial twining herbaceous plant, is widely distributed across tropical and subtropical regions of the Indian subcontinent. Traditionally, this plant has been extensively utilized in Siddha, Ayurveda, and folk medicine for treating a broad spectrum of ailments, including gastrointestinal disorders, inflammatory conditions, gynecological problems, and infectious diseases. The therapeutic versatility of *P. daemia* is primarily attributed to its complex phytochemical composition comprising flavonoids, phenolic acids, cardiac glycosides, triterpenoids, saponins, and alkaloids. Phytochemical investigations have identified key constituents such as β-sitosterol, lupeol, oleanolic acid, calactin, calotropin, corotoxigenin, and a variety of flavonoids like quercetin, formononetin, and taxifolin. These bioactive metabolites have demonstrated significant pharmacological activities in both *in vitro* and *in vivo* experimental models, including potent antioxidant, anti-inflammatory, antiarthritic, antimicrobial, anticancer, and anti-fertility effects. The antioxidant potential, largely attributed to polyphenolic compounds and flavonoids, underpins the plant's efficacy in combating oxidative stress-related pathologies such as diabetes, cardiovascular diseases, neurodegenerative disorders, and cancer. This review consolidates current knowledge on the botanical characteristics, phytochemistry, and pharmacological relevance of *P. daemia*, highlighting its potential as a promising candidate for natural drug development and integrative medicine.

1. Introduction

Pergularia daemia (Forssk.) Chiov., belonging to the family Asclepiadaceae (Apocynaceae as per recent classifications), is a perennial, twining herbaceous plant widely distributed in tropical and subtropical regions of the Indian subcontinent. It is particularly abundant in disturbed habitats such as roadsides, open woodlands, and fallow lands. The plant is morphologically recognized by its hispid (hairy) stems and leaves, pubescent branches, dull green to yellowish-white flowers arranged in axillary cymes, and distinctive, paired, spiny follicles (fruit) which dehisce upon maturation.The widespread ethnomedicinal use of *P. daemia* across India is reflected in its multiple vernacular names: "Veliparuthi" in Tamil, "Trellis-vine," in English, "Utaran" in Hindi, "Juttuve" in Kannada, "Veliparatti" in Malayalam, and "Jittupaku" in Telugu, among others. In Tamil, the prefix "Veli" translates to "protector" or "guardian," symbolizing the plant's revered status in traditional Siddha medicine. In fact, *P. daemia* is one of only two plants, along with *Plumbago zeylanica* (Kodiveli), considered to possess strong protective or shielding medicinal properties (Nithyatharani and Kavitha, 2018).

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Historically, *P. daemia* has played a significant role in indigenous healing systems, including Siddha, Ayurveda, and folk medicine. Its aerial parts are valued for their broad spectrum of therapeutic properties, including anthelmintic, antiseptic, and antivenom actions. These parts are commonly used for the treatment of gastrointestinal disturbances such as gastric ulcers and infantile diarrhea, as well as gynecological disorders including uterine dysfunction, amenorrhea, and dysmenorrhea. The leaves have been traditionally administered for managing chronic ailments such as leprosy, arthritis, anemia, asthma, and bronchitis, while the plant latex is topically applied for the treatment of skin ailments such as boils and sores (Yoganarasimhan, 2000). Pharmacognostic evidence further supports the use of its stem in febrile conditions, including malarial fever and cold (Dokosi, 1998). The roots, on the other hand, have emetic, abortifacient, and anti-asthmatic properties, and have been utilized in folk medicine to manage constipation and gonorrhea. In ethnoveterinary practices and rural health care, fresh leaf extracts mixed with lime or ginger have been found effective in relieving inflammatory symptoms associated with rheumatic swelling (Karthishwaran and Mirunalini, 2010). These diverse therapeutic applications are indicative of the plant's complex phytochemical composition and multi-targeted biological potential. Given its extensive traditional usage and increasing scientific interest in its bioactive constituents and pharmacological potential, *P. daemia* is emerging as a plant of significant therapeutic relevance. Therefore, the objective of this review is to provide a comprehensive overview

of the botanical traits, phytochemical composition, and pharmacological properties of *P. daemia*, highlighting its ethnomedicinal relevance and scope for future research and drug development.

1.1 Botanical description of *P. daemia*

P. daemia is a fast-growing, perennial, twining or scrambling herbaceous plant. It is well recognized in traditional medicine for its therapeutic potential and is often encountered in disturbed habitats such as roadsides, hedges, scrublands, and the fringes of woodlands. *P. daemia* is widely distributed throughout tropical and subtropical regions, including India, Pakistan, Afghanistan, Arabia, Malaya, several parts of Southeast Asia, and tropical Africa. In India, it is commonly found growing wild in hedgerows and fences and thrives from sea level up to an altitude of approximately 1000 meters in the Himalayan region and up to 900 m in Southern India (World Flora Online, 2025; India Biodiversity Portal, 2025). This species is a climbing or prostrate herb that can grow up to 4 m or more in length. The stems are slender, cylindrical, and densely covered with soft, hispid (hairy) trichomes. Upon mechanical injury, the stem exudes a white, sticky, latex-like sap, a diagnostic trait common to members of the Asclepiadoideae subfamily. The semi-woody nature of the stem allows it to twine around supports, enabling vertical growth in open or partially shaded areas (Nithyatharani and Kavitha, 2018).

1.1.1 Leaves

The leaves are opposite, simple, and broadly ovate to suborbicular in shape, typically measuring 5-10 cm in length and 3.8-9 cm in width. The leaf base is deeply cordate (heart-shaped), and the apex is acute to acuminate. Margins are ciliate (hairy), particularly in juvenile leaves. The upper (adaxial) surface is nearly glabrous, while the lower (abaxial) surface is pubescent, often velvety to the touch. Petioles are slender, pubescent, and range from 2 to 6.3 cm in length (Ananth *et al*., 2021; Chandak and Dighe, 2019).

1.1.2 Inflorescence and flowers

The inflorescence is axillary and consists of pseudo-umbellate cymes borne on elongated peduncles (4-12 cm). Flowers are small (approximately 1.5 cm in diameter), pendulous, and open primarily in the evening hours, suggesting a possible adaptation for nocturnal or crepuscular pollinators. The corolla is campanulate (bell-shaped), creamy-white to greenish in color, and occasionally tinged with purple. The corolla lobes are ovate, acute, and pubescent with villous (hairy) margins and long fringes, contributing to the ornamental and taxonomic distinctiveness of the flower. A prominent corona is present within the corolla, a characteristic structure aiding in the plant's unique pollination mechanism (Ananth *et al.,* 2021; Nithyatharani and Kavitha, 2018; Chandak and Dighe, 2019).

1.1.3 Fruits and seeds

The fruit is typically a pair of erect, narrowly ovoid to fusiform follicles, each measuring 5-8 cm in length. The surface of the fruit is covered with recurved or hooked bristles. On maturation, the follicles dehisce longitudinally to release numerous flat, ovate seeds. Each seed bears a tuft of long, silky, white hairs (coma) that facilitates wind dispersal (Chandak and Dighe, 2019).

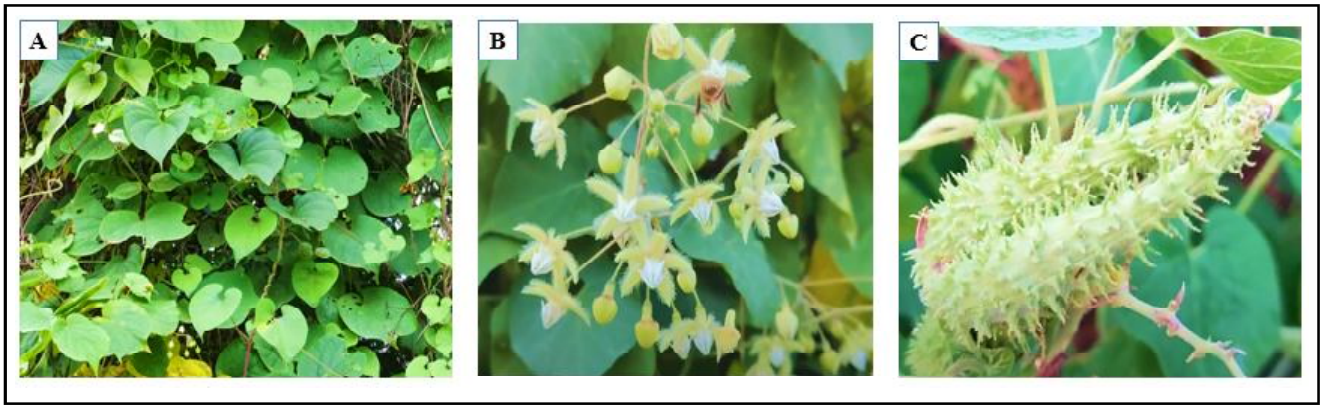

Figure 1: Various parts of *P. daemia:* A. Leaves, B. Flowers, and C. Fruit follicle.

Table 1: Phytochemical constituents of *P. daemia* and their distribution across plant parts

Plant part	Identified phytochemicals	Quantitative data/remarks	References
Leaves and roots	β-sitosterol, lupeol, oleanolic acid, calactin, calotropin, corotoxigenin, daucosterol, sucrose, α-amyrin, β-amyrin, β-amyrin acetate	Key sterols and triterpenoids	Rakhit et al., 1954; Raman and Barua, 1958
Whole plant	Betaine, hentriacontane, pentacosanoic acid, polypeptides, glucoside of Daemia extensa (syn. *P. daemia*)	Diverse bioactives including long-chain alkanes	Bhaskar and Balakrishnan, 2009
Seeds	Calactin, calotropin, calotropigenin, corotoxigenin, dihydrocalotropigenin, protouscharin, uscharidin, uscharin	Cardiotonic glycosides	Bhaskar and Balakrishnan, 2009
Stems	Coroglaucigenin, corotoxigenin, uscharidin, uzarigenin	Cardenolide-rich	Mittal *et al.,* 1962

Aerial parts	Flavonoids (qualitative), hyperoside (flavonol), saponins	Found in fresh shoots, flowers and dried stems	Sinha and Dogra, 1985; Subramanian and Nair, 1985
Methanolic leaf extract	Formononetin, quercetin, chrysoeriol, taxifolin, naringenin	Five pharmacologically important flavonoids with anti-arthritic potential	Ananth *et al.,* 2016
General (Polyphenols)	Phenols, flavonoids, phenolic glycosides, saponins, cyanogenic glycosides	General chemical classes responsible for biological activities	Shahidi, 2000
Flavonoid concentration	Flavonoid content ranged from 72.549 ± 0.449 to 400.196 ± 0.339 mg/g (leaf and stem extracts highest)	At 10 mg/ml: n-hexane = 338.725 mg/g, ethyl acetate = 388.627 mg/g, methanol = 400.196 mg/g (as quercetin equivalents)	Dosumu *et al.,* 2019
Antioxidant-relevant flavonoids	Flavones, isoflavones, anthocyanins, coumarins, lignans, catechins, isocatechins, Quercetin, kaempferol, myricetin, morin	Key contributors to antioxidant and anti-inflammatory properties	Aqil *et al.,* 2006; Lin and Weng, 2006

2. Phytochemical profile of *P. daemia*

P. daemia is a rich source of diverse phytoconstituents that contribute to its broad pharmacological potential. Various plant parts, including leaves, roots, stems, seeds, and aerial portions, contain an array of bioactive compounds such as flavonoids, triterpenoids, cardenolides, phenolics, and sterols. Notably, flavonoids like quercetin, formononetin, and taxifolin have been identified in significant quantities and are largely responsible for the plant's antioxidant and anti-inflammatory activities. Table 1 below summarises the major phytochemical compounds identified from different parts of *P. daemia*, along with relevant quantitative data.

3. Pharmacological activities of *P. daemia*

P. daemia has been extensively studied for its diverse pharmacological properties, attributed largely to its rich phytochemical composition. Various extracts of different plant parts have demonstrated significant bioactivities, including antioxidant, anti-inflammatory, analgesic, antiarthritic, anticancer, and many more. These activities have been validated through *in vitro* and *in vivo* experimental models, highlighting the plant's therapeutic potential. Table 2 summarizes the key pharmacological activities, experimental models employed, main findings, probable bioactive constituents, and corresponding references.

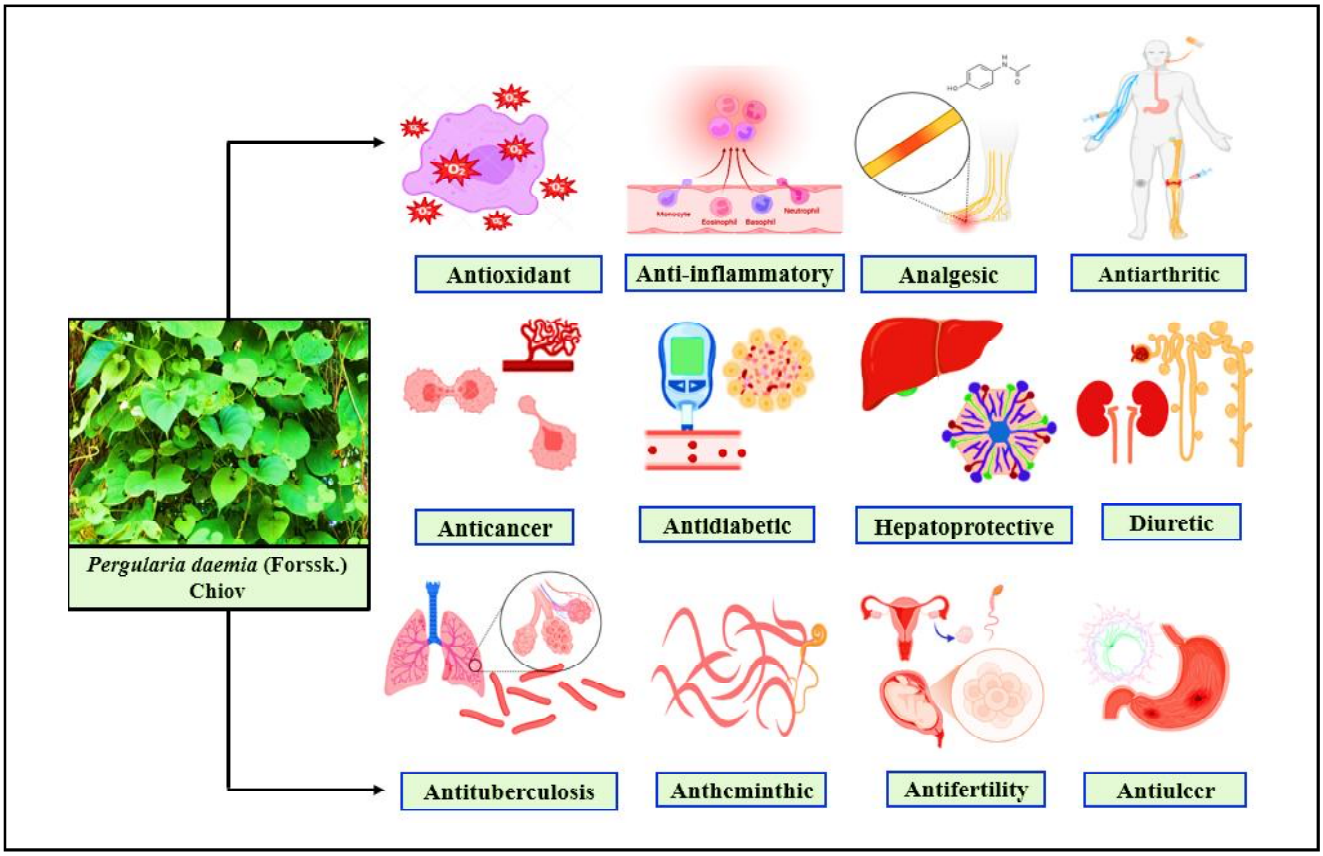

Figure 2: Biological activities of *P. daemia*.

Table 2: Pharmacological activities of *P. daemia*

Pharmacological activity	Experimental models/assays	Key findings	Probable active constituents	References
Antioxidant	ABTS, DPPH, nitric oxide scavenging, ferric reducing assay	Methanolic extract showed strong ABTS (IC_{50} : 19.72 µg/ml), DPPH (IC_{50} : 33.36 µg/ml), NO scavenging (IC_{50} : 32.37 µg/ml), comparable to gallic acid. EC_{50} values indicated strong activity for ethanolic extract (DPPH: 0.149 mg/ml). Recent studies: IC_{50} for DPPH: 6.27 µg/ml (ethanol), 17.78 µg/ml (ethyl acetate), 22.49 µg/ml (n-hexane).	Phenolics, flavonoids, triterpenes, tannins, alkaloids, phytosterols, saponins	Dosumu *et al.,* 2019; Karthishwaran *et al.,* 2012
Anti-inflammatory	Carrageenan-induced paw edema, HRBC membrane stabilization	Ethanolic extract (200 mg/kg) showed 44. 18% and 19.87% reduction in granuloma; HRBC method showed 54.55% (leaf) and 45.55% (root) membrane stabilization; comparable to diclofenac sodium	Flavonoids, glycosides	Usman *et al.,* 2012; Venkataraman *et al.,* 2010; Hina and Rose, 2018
Analgesic	Eddy's hot plate, tail flick test	Aqueous/alcoholic extracts showed significant analgesic effects at 1000 mg/kg (p<0.001); chloroform/petroleum ether extract effective at 100 mg/kg	Flavonoids, glycosides	Venkataraman *et al.,* 2010; Nikajoo, 2009
Antiarthritic	FCA-induced arthritis, membrane stabilization assay	Methanolic extract improved hematological markers ('Hb, RBC; "WBC, RF, ESR, CRP); petroleum ether leaf extract reduced hind paw edema; ethanolic extract (leaf/root) showed 54.55% and 45.55% HRBC membrane stabilization	Flavonoids (formononetin, quercetin, chrysoeriol, taxifolin, naringenin), sterols	Hina and Rose, 2018; Sutar and Pal, 2014
Anticancer	*In vivo* DMBA -induced hamster buccal pouch model; *in vitro* cytotoxicity on PA-1 and OAW-42	Ethyl acetate extract (300 mg/kg) showed strong antioxidant effect; IC_{50} on PA-1: 30 µg/ml, OAW-42: 120 µg/ml; α-amyrin identified as active compound	Triterpenoids, polyphenols, α-amyrin	Martin *et al.,* 2011
Antiproliferative	MTT assay on HeLa (KB) cells	Methanolic extract showed cytotoxicity at 160 µg/ml; IC_{50} approx. 90%; induced ROS generation, apoptosis, LPO and DNA fragmentation	Phenolic acids, flavonoids	Mirunalini *et al.,* 2014
Antidiabetic	STZ-induced and alloxan-induced diabetic rats	Ethanol and aqueous extracts reduced BGL significantly: ethanol extract 132.61 mg/dl; ethanol callus extract 123.26 mg/dl; comparable to glibenclamide	Flavonoids, alkaloids, phytosterols, glycosides, saponins	Kumar and Ramesh, 2014; Sarkodie *et al.,* 2016
Hepatoprotective	CCl_4 and paracetamol-induced hepatotoxicity in rats	Ethanolic extract reduced SGOT, SGPT, ALKP, bilirubin and increased protein levels at 200 mg/kg; protective effect attributed to neutralizing ROS and LPO	Flavonoids (quercetin-3-glucoside), terpenoids, glycosides, saponins	Sureshkumar and Mishra, 2006; Bhaskar and Balakrishnan, 2010; Sureshkumar and Mishra, 2007
Diuretic activity	Lipschitz test in rats using various extracts (alcoholic, ethyl acetate, n-butanol, petroleum ether); Furosemide as standard	Alcoholic extract at 400 mg/kg showed highest diuretic index (0.93). Significant increase in urinary output and Naz , Kz excretion (p<0.001) by all extracts except petroleum ether. Alcoholic extract's diuretic action (2.04 units) was comparable to furosemide (2.19 units)	Alkaloids, flavonoids, steroids	Bhavin and Ruchi, 2011
Antituberculosis activity	*In vivo* study on Antitubercular drugs(ATDs)-induced liver injury in animal model	Hydroalcoholic extract significantly reversed elevated AST, ALT, ALP, bilirubin, cholesterol, and triglycerides. Restored GSH, GPx, GR, CAT, SOD, G6PD levels and reduced lipid peroxidation	Antioxidant phytoconstituents (flavonoids, phenolics)	Mishra *et al.,* 2018

Antifertility activity	*In vivo* study in female mice; pre-implantation and abortifacient models	Steroidal fraction (200 mg/kg) inhibited implantation; ethanolic extract (600 mg/kg) showed late abortifacient effect with 100% activity and no mortality within 48 h	Steroids, flavonoids	Sadik *et al.*, 2001
Anthelmintic activity	*In vitro* testing on *Ascaris lumbricoides, Eudrilus eugeniae*, *Taenia solium* using ethanolic and aqueous extracts	Ethanolic extract (100 mg/ml) induced rapid paralysis and death compared to aqueous extract and showed significant (p<0.01) activity close to albendazole	Tannins, alkaloids, flavonoids	Kumar *et al.*,2014
Antiulcer activity	Ethanol-induced ulcer model in rats; 400 mg/kg ethanolic extract	Ethanolic extract showed 63.01% inhibition of ulcers; standard drug 78.73%. Curative effect possibly via reduction of oxidative stress, inflammation, and NF-κB modulation	Flavonoids, tannins, triterpenes	Dhananjayan *et al.*, 2014

4. Conclusion

P. daemia remains comparatively underinvestigated despite its widespread traditional use and demonstrated pharmacological promise. The plant harbors a diverse array of bioactive secondary metabolites, notably flavonoids and cardiac glycosides, which contribute to its multifaceted therapeutic effects, including anti-inflammatory, antiarthritic, antimicrobial, and anticancer activities. Although preliminary pharmacological studies validate these properties, detailed mechanistic insights at the molecular level and well-designed clinical trials are scarce. To fully exploit the medicinal potential of *P. daemia*, future research must prioritize comprehensive phytochemical profiling, elucidation of molecular targets and pathways, rigorous toxicological assessments, and the development of standardized, reproducible formulations. Such integrative efforts will bridge the gap between traditional ethnomedicinal knowledge and contemporary drug discovery, ultimately enabling the development of cost-effective, safe, and efficacious natural therapeutics for managing chronic and inflammatory diseases.

Acknowledgements

The authors would like to acknowledge and thank RBVRR Women's College of Pharmacy, Barkatpura, Hyderabad, Telangana, India, for their continued support and resources throughout this review.

Conflict of interest

The authors declare no conflicts of interest relevant to this article.

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Citation **A. Snigdhasri, Ramya, Shaik Rubina, Farheena Raheen, Balerao Sowmya and Zeenath Banu (2025). *Pergularia daemia* (Forssk.) Chiov.: A comprehensive review of its botanical traits, phytochemical profile, and pharmacological significance. J. Phytonanotech. Pharmaceut. Sci., 5(2):16-21. http://dx.doi.org/10.54085/jpps.2025.5.2.3**