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## Therapeutic Potential of *Pergularia daemia* (Forsk.): The Ayurvedic Wonder

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**Abstract:** *Pergularia daemia* Forsk. (Asclepiadaceae) is a perennial twinning herb grows widely along the roadsides of India and also in the tropical and subtropical regions. The whole plant posses high medicinal value and traditionally used in treating various ailments for human beings. Some of the folklore people used this plant to treat jaundice, anthelmintic, laxative, anti-pyretic, expectorant and also used in infantile diarrhoea. Phytochemically the plant has been investigated for cardenolides, alkaloids, triterpenes and saponins. The plant has been demonstrated to possess multiple pharmacological activities such as antiinflammatory, hepatoprotective, anticancer, antidiabetic, antioxidant, antibacterial, antifungal, analgesic, antiinfertility and central nervous system depressant activity. This review highlights on the existing information particularly on the phytochemistry and various pharmacological properties of *Pergularia daemia* which may provide incentive for proper evaluation of the plant as a medicinal agent.

**Key words:** *Pergularia daemia*, phytochemical studies, medicinal plant, anticancer, antioxidant

### INTRODUCTION

Since, ancient times nature has been an important source of medicinal agents and a large number of natural products have been identified and developed from natural sources based on their use in traditional medicine. Numerous medicinal plants are of global interest today because of their therapeutic and economic significance. According to the World Health Organization, approximately 80% of the world's population currently uses herbal medicines directly as teas, decocts or extracts with easily accessible liquids such as water, milk, or alcohol (Farnsworth, 1990). The use of alternative medicinal therapy has increased the interest of pharmacologist and herbalist over the past decades. Historically, plants have provided a source of inspiration for novel drug components, as plant derived medicine have made large contribution to human health and well being. In general, biological studies are very much essential to substantiate therapeutic properties of medicinal plants. The potential of medicinal plants as a source of new drugs is still largely unexplored.

Research in medicinal plants has gained a renewed focus recently. The prime reason is that other system of medicine although effective come with a number of side effects that often lead to serious complications. Plant based system of medicine being natural does not pose this serious problems. *Pergularia daemia* also called as *Pergularia extensa* or *Daemia extensa*, belongs to a milky

weed family Asclepiadaceae. Generally, the family Asclepiadaceae includes more than 2000 species classified under 280 genera are distributed worldwide in the tropical and subtropical regions (Pankaj, 2003). It is grown widely along the roadsides of India and also in the tropical and subtropical regions of Asia and Africa. The plant is often found covering other shrubs and trees and it has been brought into cultivation as an ornamental in tropical countries and was used to overgrow on penthouses. The purpose of the present study is to gather together the available published information on the constituents of the plant and its pharmacological and toxicological properties.

### TAXONOMIC DESCRIPTION

The plant is classified as shown in Table 1.

Table 1: Taxonomical classification of *Pergularia daemia*

Kingdom	Plantae
Subkingdom	Tracheobionta
Super division	Spermatophyta
Division	Magnoliophyta
Class	Magnoliopsida
Subclass	Asteridae
Order	Gentianales
Family	Asclepiadaceae
Tribe	Asclepiadeae
Subtribe	Asclepiadinae
Genus	<i>Pergularia</i>
Species	<i>Daemia</i>

#### Vernacular names

Tamil	: Uttamami, Seendhal kodi, Veliparuthi
English	: Hariknot plant
Sanskrit	: Uttamarani, Kurutakah, Visamika, Kakajangha
Hindi	: Ugaran, Sagovani, Aakasan, Gadaria Kibel, Jutak
Bengali	: Chagalbati, Ajashringi
Gujarath	: Chamardudhi
Marathi	: Utarn
Oriya	: Utrali, Uturdi
Malayalam	: Veliparatti
Telugu	: Dustapuchettu, Jittupaku, gurtichettu
Kannada	: Halokoratige, Juttuve, Talavaranaballi, Bileehatthi balli
Punjab	: Karial, silai, trotu
Synonymy	: <i>Pergularia extensa</i> (Jacq.) N.E.Br., <i>Pergularia daemia</i> (Forssk.) Chiov., <i>Daemia extensa</i> (Jacq.) R.Br., <i>Daemia scandens</i> , <i>Pergularia barbata</i> (Klotzsch) N.E.Br. ex., <i>Daemia barbata</i> Klotzsch, <i>Daemia cordifolia</i> , <i>Daemia garipensis</i> , <i>Asclepias daemia</i> Forssk., <i>Cynanchum extensum</i> Jacquin, <i>Daemia extensa</i> (Rech, 1916; Iran, 1970)

**Habitat:** The plant is distributed in the tropical and sub tropical areas, growing wildy along the road sides of Tamil nadu state in India. It is very commonly found in hedges through cut most of cenfry to an altitude about 1000 m in Himalayas and 900 m in Southern India. Widely distributed in tropical Africa, extending to Arabia and further east.

#### BOTANICAL DESCRIPTION

*Pergularia daemia* is a perennial twining herb, foul-smelling when bruised; Stems bears milky juice and covered with longer stiff erect hairs 1mm; Leaves are thin, broadly ovate and heart-shaped 2-12 cm long, covered with soft hairs; Greenish yellow or dull white, sweet-scented flowers born in axillary, double white corona at the base of a stamina column, long-peduncled, umbellate or corymbose clusters tinged with purple; Fruits paired with follicles 5.8 cm long and 1 cm in diameter, reflexed, beak long, covered with soft spinous outgrowth and release many seeds with long white hairs when they split open. Seeds are densely velvety on both sides. The entire plant constitutes the drug and is used as a medicine.

#### PHYTOCHEMISTRY

Generally, medicinal values of the plants are dictated by their phytochemical and other chemical constituents. A number of phytochemical studies have demonstrated the presence of several classes of chemical compounds. It is not our intention in this review to cover all the many compounds reported for *P. daemia*, but to summarize the major components that have been implicated in the pharmacological activities of the crude drug. Most commonly found phytochemicals from the leaves of *P. daemia* are flavonoids alkaloids, terpenoids, tannins, steroids and carbohydrates (Karthishwaran *et al.*, 2010). Although, a large number of compounds have been isolated from various parts of *P. daemis*, a few of them have been studied for biological activity and the structure of some of these bioactive compounds has been presented in Table 2. Phytochemical studies have shown the presence of cardenolides, alkaloids, triterpenes (lupeol), saponins, steroidal compounds (Aanjaneyulu *et al.*, 1998). The seeds of *P. daemia* contain uzarigenin, coroglaucigenin, calactin, calotropin, other cardenolides and a bitter resin, Pergularin and have a cardiotoxic action (Patel and Rowson, 1964; Rowson, 1965). It has been suggested that the plant seed action on the uterus is similar to that of pituitrin and is not inhibited by progesterone (Dutta and Gosh, 1947; Paris and Moyse, 1971).

#### ETHNOMEDICINAL USES

*Pergularia daemia* has a vast application in different folk medicine even in the ayurveda and are believed to increase defense against various diseases (Table 3). The whole plant is used as an anthelmintic, antiseptic, antivenin, emmenagogue, emetic expectorant and expectorant. Extract of this plant is taken orally for gastric ulcers, uterine and menstrual complaints. The leaves are useful in leprosy and haemorrhoids. The fresh, pulped leaves are applied as a poultice to relieve carbuncles. Leaf juice is used as an amenorrhea, catarrhal infections and dysmenorrheal, infantile diarrhea and also used to reduce body pain. In addition dried leaves are used as an antirheumatic, asthma, amenorrhea, dysmenorrheal, bronchitis, whooping cough, heals cuts and wounds and finally to facilitate parturition. The stem bark of this plant was a good remedy for cold, it is also used to treat malaria and the twig is used as an antipyretic and appetizer. Latex of the plant is used for boils and sores. Dried roots are used as an abortifacient, emetic, bronchitis and used for

Table 2: Some medicinal uses of *Pergularia daemia* as mentioned in ayurveda

Parts used	Medicinal uses	Reference
Leaves	Catarrhal infection and infantile diarrhea	Dalziel (1937), Oliver (1960), Watt and Breyer-Brandwijk (1962)
	Stomachache and tetanus	Irvine (1952)
	Leprosy and haemorrhoids	Thatoi <i>et al.</i> (2008)
	Nasobronchial disease	Chitravadivu <i>et al.</i> (2009)
	Stomach pain	Sandhya <i>et al.</i> (2006)
	Antihelmetic, expectorant	Ndukwu and Ben-Nwadiibia (2005)
	Headache	Omobuwajo <i>et al.</i> (2008)
	Cough and chest pain	Iganacimuthu <i>et al.</i> (2008)
	Alopecia	Kshirsagar and Singh (2001)
	Snake bite	Burkill (1985)
Whole plant	Malaria, fever	Bruce (1998)
	Catarrhal infection, infantile diarrhea, rheumatism, Uterine and menstrual disorders and facilitating parturition, gastric ulcers, expectorant, emetic, anthelmintic, leucoderma dysentery	Thatoi <i>et al.</i> (2008) Singh <i>et al.</i> (2002)
		Burkill (1985)
Root decoction	Veneral diseases, arthritis, muscular pain, asthma and rheumatism	Royen <i>et al.</i> (2001)
Latex	Veneral diseases, arthritis, muscular pains, asthma, rheumatism and snake- bites and Fish poison	Van Damme <i>et al.</i> (1922)
	Toothache	Hebbar <i>et al.</i> (2004)
Milky sap (from leaves)	Sore eyes	Irvine (1952)
	Rheumatism, oedema and kidney pains	Burkill (1985)
Root	Gonorrhoea	Haerdi (1964)
	Ulcer, Respiratory problem	Chitravadivu <i>et al.</i> (2009)
Stem bark	Cold	Dokosi (1998)
	Fever and diarrhea in infants	Ndukwu and Ben-Nwadiibia (2005)
Fruits	Digestive and thermogenic	Thatoi <i>et al.</i> (2008)

Table 3: Structures and activities of some active compounds from *Pergularia daemia*

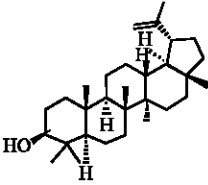
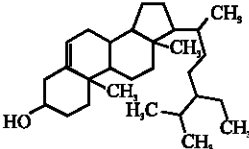
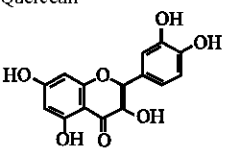
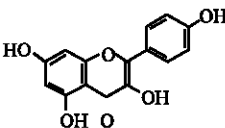
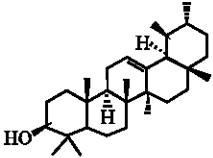
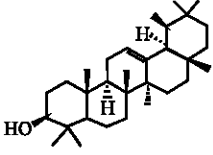
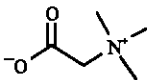
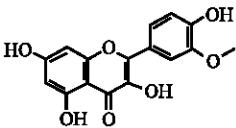
Lupeol	Responsible for antihepatotoxicity, antitumor, anti-inflammatory (Shirwaikar <i>et al.</i> , 2004; antiarthritic (Agarwal and Rangari, 2003) nutraceutical/chemopreventive agent (Surh, 2003) and antimicrobial (Shai <i>et al.</i> , 2008), antiedemic, antihyperglycemic, antioxalate, cytotoxic and hypotensive, antiedemic and antiperoxidant activities (Sunitha, <i>et al.</i> , 2001)
	
$\beta$ -sitosterol	Responsible for antidiabetic, antioxidant (Li <i>et al.</i> , 2007), atherosclerosis, prostate enlargement, artemicide, candidicide, spermicide, ulcerogenic, antihypercholesterolemia androgenic, antiadenomic, anticancer (Imanaka <i>et al.</i> , 2008), antiedemic, antimutagenic, antiophidic, antifeedant, Antigonado-trophic, antihyperlipoproteinaemic and antiprostatic
	
Quercetin	Responsible for anti-inflammatory (Laura <i>et al.</i> , 2008), antihistamine, antioxidant, anticancer activities and to prevent prostatitis, heart disease, cataracts, allergies and respiratory diseases such as bronchitis, asthma and hives
	
Kaempferol	Responsible for antidepressant (Hadizadeh <i>et al.</i> , 2003), anti-cancer (Nguyen <i>et al.</i> , 2003) and inhibit fertility, epilepsy, anti-inflammatory, anti-oxidants, spasm, anti-ulcer, lidan diuretics and cough
	

Table 3: Continued

<p><math>\alpha</math>-Amyrin</p> 	<p>Responsible for anti-inflammatory activity, antioxidant, anti protease, antinoceptive effect (Otuki <i>et al.</i>, 2005), antiedemic, antitumor, aytotoxic, hepatoprotective, insectifuge and antiedemic activities</p>
<p>Beta-Amyrin</p> 	<p>Responsible for anti elastase activity, antifungal, antidepressant (Subarnas <i>et al.</i>, 1993), antiedemic, antiinflammatory, hepatoprotective, mosquitocide and antiedemic activities</p>
<p>Betaine</p> 	<p>Treat high levels of homocysteine, heart disease and liver Disease, rheumatid arthritis, thyroid problems, tic colours, vitiglio, gall stones, indigestion (Stuart, 2004)</p>
<p>Isorhamnetin</p> 	<p>Responsible for anti-adipogenic (Jongsung <i>et al.</i>, 2009), antitumor (Teng <i>et al.</i>, 2006), antigenotoxic and antioxidant activities (Bouhlef <i>et al.</i>, 2009)</p>

cough, asthma and constipation, while the fresh roots used as an abortifacient and used to treat gonorrhea. In ayurvedic system of medicine this plant is used for delayed child birth, amenorrhea, asthma, snake bite, rheumatic swellings and also to treat post-partum hemorrhage. The decoction of the plant (10-20 mL) is also applied on white spots (leucoderma). Leaf decoction is an uterine tonic and is taken orally up to 20 mL day<sup>-1</sup>. The stem and root bark extract is taken against fever and diarrhea in infants. The leaves are specially used as a condiment for soup and porridge yam. Fruits are digestive and thermogenic. Plant extract is useful in uterine and menstrual disorders and in facilitating parturition.

### EPIDEMIOLOGICAL STUDIES

Locally the plant has been used occasionally for flavoring food and young leaf shoots are eaten like spinach. In Ghana the hairy stems' fire resistant properties are harnessed as they are used as binding in situations that might be exposed to fire. Apparently in Arabia hides have been smeared with the sap and then buried in the ground to remove the hair. The leaves have had a veterinary application in Ghana as a remedy for young

turkeys suffering from diarrhoea - and leaf juice has been used in India to treat eye problems in cattle. Medicinally, *P. daemia* has been used locally for treating worms and period and other female disorders - and the sap (or a leaf poultice) has been applied to boils. Ghanaian medicine has recommended that roasted stems be chewed to ease bronchitis and coughs (Nigerians have used the leaves and bark) and some Ghanaian women have taken a leaf soup after childbirth. Local Nigerian medicine also turns to the leaves and stem bark for a treatment to ease rheumatic pain. In Botswana and South Africa, the leaves are eaten as wild spinach. The latex or a decoction of the roots is used in many countries as a medicine to treat several illnesses such as, venereal diseases, arthritis, muscular pains, asthma, rheumatism, snake-bites, etc. the latex may also be used as a fish poison.

Mainly in South Africa the young leaves and shoots are taken as soup and in Spanish the soup in particular is given to newly delivered womens (Irvine, 1952). In Ghana and in Tanganyika, the sap expressed from the leaves is used to cure sore eyes. In Nigeria, the plant is used in combination with others for fever. The latex or a poultice of the leaves is applied to maturate abscesses, a usage known in India. In Ivory Coast, the latex is applied to maturate abscesses.

## PHARMACOLOGICAL ACTIVITY

Pharmacological studies have confirmed that *Pergularia daemia* exhibit a broad range of biological effects. However, the crude extract of the plant have been used as a traditional medicine for the treatment of various diseases. Some of which are very interesting for possible future development.

### Anti-inflammatory, analgesic and antipyretic activity:

Crude ethanol extract of *Pergularia daemia* leaves was successively fractionated with petroleum ether, solvent ether, ethyl acetate, butanol and butanone. The ethanolic extract and various fractions were investigated for anti-inflammatory activity in rats at a dose of 100 mg kg<sup>-1</sup> via intraperitoneally. Ethanol extract and its butanol fraction exhibited significant anti-inflammatory activity when compared with respective controls and were comparable with that of standard drug aspirin (Hukkeri *et al.*, 2001). Another study was also demonstrated on the anti-inflammatory activity of *Pergularia daemia* by using various solvent extracts. In the result they found that alcohol extract of *P. daemia* showed significant reduction in swelling of paw at a dose of 300 mg kg<sup>-1</sup> b.wt. which was equivalent to diclofenac sodium as a standard in a dose of 15 mg kg<sup>-1</sup> b.wt. The anti-inflammatory activity of *Pergularia daemia* extract could be attributed due to the presence of steroids (Sutar *et al.*, 2009). Analgesic effect of aqueous and ethanol extract of *Pergularia daemia* was demonstrated in the experimental models using Eddy's hot plate and Heat conduction method using thermal stimuli. Both extracts showed the analgesic activity when compared with control and analyzed statistically by Tukey Kramer Multiple Comparison Test (Lokesh, 2009). Antipyretic activity was also reported from the aerial parts of *Pergularia daemia* extract (Jain *et al.*, 1998).

**Antifertility activity:** The ethanol extract of *Pergularia daemia* and its steroidal fraction are reported to have antifertility activity. In this study the alkaloidal fractions of ethanol extract was observed for its antifertility activity. Oral administration of the alkaloidal fraction at a dose of 200 mg kg b. wt. showed a significant activity in preimplantation stage of female mice. The activity of the alkaloidal fraction, when compared with the steroidal fraction, was found to be more pronounced since the former inhibited not only the fertility of the female mice but also took short period to return the oestrous cycle to normal, with in 4 to 6 days of drug treatment while steroidal fraction treated mice returned to normal within 6 to 8 days (Golam Saclik *et al.*, 2001).

**Central nervous system depressant activity:** The roots of *P. daemia* were evaluated for central nervous system depressant activity. This study was investigated on swiss albino mice using chlorpromazine and pentobarbitone sodium induced sleeping time. Alcohol and aqueous root extract of *P. daemia* showed significant central nervous system depressant activity and was compared with that of control and drug treated groups. Their results concluded that both alcohol and aqueous extract showed central nervous system depressant activity and this activity is mainly due to the presence of glycosides present in *P. daemia* roots (Lokesh, 2009).

**Hepatoprotective activity:** *Pergularia daemia* is traditionally used as a folk medicine for treating jaundice. A preliminary investigation on the aerial parts of *Pergularia daemia* showed significant hepatoprotective activity at a fixed dose level of 200 mg kg<sup>-1</sup> (Suresh kumar and Mishra, 2006). Furthermore, Suresh Kumar and Mishra (2006) extended their study to identify the active compounds of *P. daemia* which are responsible for hepatoprotection. They investigated on both aqueous and ethanolic extract which showed the presence of triterpenoids and flavonoids in ethanolic extract. Their result suggests that presence of flavonoids in *P. daemia* could be responsible for hepatoprotection (Sureshkumar and Mishra, 2007). In addition, an *in vitro* evaluation hepatoprotective activity of *Pergularia daemia* was also investigated. In this study, acetone and ethanolic fraction obtained from total ethanolic extract was carried out using CCL<sub>4</sub> induced toxicity in primary cultured rat hepatocytes. The result of this study also justify that flavonoids are responsible for hepatoprotective activity. Thus, it is evident from these studies that flavonoids like quercetin, kaempferol and isorhammetic glycosides could be liable for various liver disorders (Sureshkumar and Mishra, 2008).

**Antioxidant activity:** Bhaskar and Balakrishnan (2009) carried out an in vitro screening of antioxidant activity on *P. daemia* root extract. In their preliminary phytochemical test, both aqueous and ethanolic extract indicated the presence of alkaloid, glycoside, steroid, flavonoid, saponin, terpinoid, tannin and phenolic compound. The result obtained from their study shows that *P. daemia* exhibited antioxidant activity which may be attributed to the presence of polyphenolic and other phytochemical constituents. This may be used in preventing oxidant stress related degenerated diseases.

**Anticancer activity:** Anticancer activity of *Pergularia daemia* was screened against sixty human cancer cell lines and was organized into sub panels representing

laukaemia, melanoma and cancer of the lung, colon, kidney, ovary and central nervous system. In their result, it was found that  $\alpha$ -amyrin exhibited anticancer activity in low potency (Khorombi *et al.* 2006). Triterpenoids play a vital role as anti-cancer agents and structural modification of this class of compounds can result in the establishment of an innovative drug for the treatment of cancer.

**Antidiabetic activity:** Ethanol and aqueous extract of *Pergularia daemia* plant was investigated against alloxan induced hyperglycemia. 200 mg kg<sup>-1</sup> of the extract significantly reduced blood glucose levels to normal which proved hypoglycemic activity (Wahi *et al.*, 2002). The hypoglycemic activity of *P. daemia* extract is possibly be due to the presence of  $\beta$ -sitosterol and quercetin.

**Antibacterial activity:** The promising antibacterial activity was observed in ethyl acetate and ethanol extracts of *Pergularia daemia* which showed significant antibacterial activity against *S. aureus*, *P. aeruginosa*, *A. hydrophila*, *E. coli* and *S. typhi*. (Senthilkumar *et al.*, 2005). Similarly, Karuppusamy *et al.* (2001) have reported that the ethanol extract of *P. daemia* exhibited antibacterial activity. In addition, recent report also showed the antibacterial activity of *Pergularia daemia* leaf extract was tested by using various solvents such as hexane, chloroform and ethyl acetate against *B. subtilis*, *S. aureus*, *E. coli* and *P. vulgaris*. Their experiment was determined by disc diffusion method and their results showed that ethyl acetate extract of *Pergularia daemia* was found to be effective. They have also isolated a new bioactive compound, 6-(4, 7-dihydroxy-heptyl) quinine, a novel agent which is proved to be responsible for antibacterial activity (Ignacimuthu *et al.*, 2009).

**Antifungal activity:** Qureshi *et al.* (1997), reported that sensitivity of the Keratinophilic fungi in *Pergularia daemia* extract by dry weight method. A recent study was investigated on *Pergularia daemia* against antifungal activity. In their study, the sensitivity of the keratinophilic fungi and inhibition of mycelial growth were evaluated by dry-weight method. The antifungal activity of *Pergularia daemia* plant salts was shown against only one fungal pathogen *Aspergillus flavus* and doesn't showed any inhibitory activity against the other test pathogens such *Cryptococcus neoformans*, *Candida albicans* (Suresh *et al.*, 2010).

## CONCLUSIONS

As seen throughout this review, we have focused on botanical description, ethnomedicinal uses,

Phytochemistry and pharmacological properties of *Pergularia daemia*. Various phytochemicals such as flavonoid, alkaloid, terpenoid, tannin and steroid have been reported to be present in this plant. The plant also exhibits several pharmacological properties such as antiinflammation, analgesic, antipyretic, antioxidant, anticancer, antidiabetic, hepatoprotective, antibacterial, antifungal and central nervous system depressant activity. It is believed that detailed information presented in this review would help the researchers to get aware of this plant and extensive research should be undertaken on *P. daemia* for establishing new therapeutic drugs for mankind.

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