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Veliparuthi (*Pergularia daemia* (Forsk.) Chiov.) – As a phytomedicine: A review

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ABSTRACT: The plant *Pergularia daemia* has been traditionally used as anthelmintic, laxative, antipyretic expectorant and also used to treat infantile diarrhea and malarial intermittent fevers. It is widely distributed in the tropical and sub tropical regions of the world. Various phytochemical including terpenoid, flavonoids, sterols and cardenolids have been isolated and identified from the various parts of the plant (leaves, stems, shoots, roots, seeds and fruits). *P. daemia* widely used by various tribal communities in Western Ghats of India for the treatment of variety of ailments, while predominantly the roots of the plant have been used to treat liver disease and jaundice. The present review article aims towards medicinal properties, chemical constituents and other important aspects of *P. daemia*.
Keywords: Ethnobotanical uses, *Pergularia daemia*, pharmacological activities,phytochemistry

INTRODUCTION

Plant and plant products are being used as a source of medicine since long. According to World Health Organization (WHO) more than 80% of the world's population, mostly in poor and less developed countries depend on traditional plant based medicines for their primary healthcare needs [1]. The efficacy and safety of herbal medicine have turned the major pharmaceutical population towards medicinal plant's research. Owing to the global trend towards improved 'quality of life', there is considerable evidence of an increase in demand from medicinal plant [2]. Use of plants for treating various ailments of both man and animal is as old practice as man himself. India is richly endowed with a wide variety of plant shaving medicinal value. These plants are widely used by all sections of the society whether directly as folk remedies or indirectly as pharmaceutical preparation of modern medicine [3]. In recent times, focus on plant research has increased all over the world and a large body of evidence has collected to show immense potential of medicinal plants used in various traditional systems (Ayurveda, Siddha and Unani) [4] and also major source of biodynamic compounds of therapeutic values [5]. Exploration of the chemical constituents of the plants and pharmacological screening may provide us the basis for developing the lead for development of novel agents. Herbs have provided us some of the very important life saving drugs used in the armamentarium of modern medicine. Among the estimated 400,000 plant species, only 6% have been studied for biological activity, and about 15% have been investigated phytochemically [6]. This shows a need for investigation of various chemical constituents, its activity and phytopharmacological evaluation of herbal drugs.

The plant *Pergularia daemia* (Asclepiadaceae) [7] known as "Veliparuthi" in Tamil, "Uttaravaruni" in Sanskrit and "Utranajutuka" in Hindi. Traditionally the plant *P.daemia* is used as anthelmintic, laxative, antipyretic and expectorant, also used to treat infantile diarrhoea and malarial intermittent fevers [8-10]. Latex of this plant used for toothache [11]. Stem bark remedy for cold [12] and fever [13]. Aerial parts of this plant reported the various pharmacological activities like hepatoprotective [14], antifertility [15], anti-diabetic [16], analgesic, antipyretic and anti-inflammatory [17]. Phytochemically the plant has been investigated for cardenolides, alkaloid and saponins [17]. The plant was found to contain various triterpenes and steroidal compounds [18].

PLANT REVIEW

General information [19]

A slender, hispid, fetid- smelling perennial climber. Leaves opposite, membranous, 3-9 cm long and about as wide, broadly ovate, orbicular or deeply cordate, acute or short-acuminate at apex, pubescent beneath, petioles 2-9 cm long. Flowers greenish-yellow or dull white tinged with purple, borne in axillary, long-peduncled, drooping clusters. Fruits (follicles) lanceolate, long-pointed, about 5 cm long, covered with soft spines and seeds are pubescent, broadly ovate. Flowering may occur each year between August and January in central India, with fruits maturing from October to February. In central Indian deciduous forests, the stems typically die down in February and reappear with the onset of the rainy season.

Habitat [19]

A widely distributed in the tropical and sub tropical area. In India it is very commonly found in hedges through cut most of cenfry to an altitude about 1000m in Himalayas and 900m in Southern India.

Vernacular Names [19]

P.daemia(Forsk) Chiv or *P.extensa* N.E.Br or *Daemia extensa* R.Br [20]

Bengali : Chagulbanti, Changulbati
Guajarati : Amaradudheli, Chamardudheli, Nagaladudhi, Nagaladhdheli
Hindi : Utranajutuka, Utran, Dudhi, Dudhibel, Jutuk, Sagovani

Kannada : Haalu koratige, Hala koratige, Juttuve balli, Kurudigana balli,Alavaarana balli, Talayarana balli
Malayalam : Veliparatti, Veliparuti
Marathi : Utaranavel, Uturhi
Oriya : Juktiruhi, Uttruri, Uturdi
Sanskrit : Uttaravaruni, Kurutakah,Yugaphala, Yugmaphala
Tami : Beliparti, Nandamani, Uthamani, Veliparuthi
Telegu : Dushtupatige, Gurtichettu, Guruti, Jittupaku

Taxonomy classification [21]

Kingdom : Plantae
Subkingdom : Tracheobionta
Super division: Spermatophyta
Division : Magnoliophyta
Class : Magnoliopsida
Subclass : Asteridae
Order : Gentianales
Family : Asclepiadaceae
Genus : Pergularia
Species : *P. daemia* (Forsk) Chiv

Ethnomedical Information

Aerial parts of the plant used for snake bite [22]. Entire plant used as an anthelmintic [23], emmenagogue [24] emetic [25, 26], antiseptic [27], emetic expectorant[27], expectorant[25,26,28] and antivenin[29] and used to facilitate parturition[30], while used in Ayurvedic medicine for delayed childbirth[31], amenorrhea[23], asthma, snakebite, rheumatic swellings[26] and used to treat post-partum hemorrhage[31]. Latex of this plant used for boils and sores [32]. Dried leaf used as an emetic [33], antirheumatic [34] and used for bronchitis [33], amenorrhea, dysmenorrheal [35, 36], asthma [25], healing cuts and wounds [37], while used to treat whooping cough [38] and to facilitate parturition [36]. Fresh leaf used as fish poison [39], while leaf juice used for amenorrhea, dysmenorrheal, catarrhal infections, infantile diarrhea [25] and used reduce the body pain [40,41]. Dried root used as an abortifacient [42], emetic, bronchitis [33] and used for cough, asthma and constipation [39], while fresh root used as an abortifacient[43, 44] and used to treat gonorrhea[45]. Shoots used to treat whooping cough [46]. Stem bark has been used to treat malaria [47] and twig used as an antipyretic and appetizer [48].

CLAIMS AND REPORTS

Pharmacological/Biological activity

Suresh Kumar and Mishra, 2008a; ethanol extract and its ethanol fraction from aerial parts of *P. daemia* exhibited significant hepatoprotective effect against CCl_4 induced hepatotoxicity in rats. Glutamic oxaloacetic transaminase, glutamic pyruvic transaminase, alkaline phosphatase, total bilirubin, total cholesterol, total protein and albumin in serum indicated hepatoprotective effect of the ethanol extract and its ethanol fraction. Histopathological examination of liver sections confirmed that, pre-treatment with ethanol extract and its ethanol fraction prevented hepatic damage induced by CCl_4. The results were comparable with the standard hepatoprotective drug silymarin. The extract and its fraction showed no signs of toxicity up to a dose level of 2000 mg/kg. It is suggested that, the presence of flavonoids in ethanol extract and its ethanol fraction may be responsible for hepatoprotective properties. High Performance Thin Layer Chromatography profile of flavonoids of bio-active extracts was developed using quercetin-3-glucoside as a marker. Results indicate hepatoprotective properties of ethanol extract of *P. daemia* [49].

Suresh Kumar and Mishra, 2008b; studied on the hepatoprotective effect of acetone and ethanol sub fractions of ethanolic fraction obtained from total ethanol extract was carried out using carbon tetrachloride-induced toxicity in primary cultured rat hepatocytes. In vitro activity was assessed by determining the change in hepatocyte viability and other biochemical parameters such as glutamic oxaloacetic transaminase, glutamic pyruvic transaminase and total protein. Acetone and ethanol sub fractions showed significant ($P<0.05$) protective effect by restoring altered parameters in the selected in vitro model. The flavonoids present in acetone and ethanol sub fractions of total alcohol extract from *P. daemia* may be responsible for significant hepatoprotective properties. The results justify the claims of *P. daemia* in folk medicine as a hepatoprotective agent [50].

Flyman and Afolayan, 2007; studied the implication of the mineral ratios of *P. daemia* in human diets. The Ca/Fe, Ca/K, Ca/Mg, and Ca/Zn ratios were 1.7, 0.3, 1.6, and 9.7, respectively. The Fe/Zn ratio was 5.6, while P/Ca ratio was 0.3 [51].

Suresh Kumar and Mishra, 2007; studied on the hepatoprotective effect of acetone and ethanolic sub fractions of ethanolic fraction obtained from total alcoholic extract was carried out using carbon tetrachloride- induced liver damage in wistar albino rats. Acetone sub fraction showed significant ($P<0.05$) protective effect by lowering serum levels of various biochemical parameters in the selected model. These biochemical observations were supplemented by histopathological examination of liver sections. Silymarin was used as positive control. The presence of flavonoid compounds in the ethanolic sub fraction of alcohol extract of *P. daemia* may be responsible for significant hepatoprotective properties. The results justify use of *P. daemia* as a hepatoprotective agent [52].

Suresh Kumar and Mishra, 2006; reported hepatoprotective effect of crude ethanolic and aqueous extracts from the aerial parts of *P. daemia*. The aqueous and ethanolic extracts obtained from aerial parts of *P. daemia* were evaluated for hepatoprotective activity in rats by inducing liver damage by carbon tetrachloride. The ethanolic extract at an oral dose of 200 mg/kg exhibited a significant ($P<0.05$) protective effect by lowering serum levels of glutamic oxaloacetic transaminase, glutamic pyruvic transaminase, alkaline phosphatase, total bilirubin and total cholesterol and increasing the levels of total protein and albumin levels as compared to silymarin used as a positive control. These biochemical observations were supplemented by histopathological examination of liver sections. The activity may be a result of the presence of flavonoid compounds. Furthermore, the acute toxicity of the extracts showed no signs of toxicity up to a dose level of 2000 mg/kg. Thus it could be concluded that ethanolic extract of *P. daemia* possesses significant hepatoprotective properties [14].

Hebbar et al., 2004; reported the ethnomedicine of Dharwad district of Karnataka in southern India. It was revealed that *P. daemia* was used to treat tooth ache [11].

Kohler et al., 2002; reported lipophilic fraction obtained from stem bark was showed antimalarial activity against *Plasmodium falciparum* and the IC_{50} was found to be > 50 µg/ml [47].

Wahi et al., 2002; studied the ethanol and aqueous extract of entire plant 200 mg/kg showed antihyperglycemic (antidiabetic) activity on rat (both the sex) by alloxan induced hyperglycemia method [16].

Golam Sadik et al., 2001a; reported ethanolic extract of *P. daemia* and its steroidal fraction 200 mg/kg body weight showed significant anti fertility activity in preimplantation stage of female mice [15].

Golam Sadik et al., 2001b; studied the oral administration of the alkaloidal fraction of ethanol extract at a dose of 200 mg/kg body weight showed significant anti fertility activity in preimplantation stage of female mice [53].

Srinivasan et al., 2001; reported the 0.3 ml of aqueous extract of whole plant was inactive against various bacteria and fugal such as *Chromobacterium violaceum, Escherichia coli, Enterococcus faecalis, Klebsiella pneumonia, Pseudomonas aeruginosa, Proteus mirabilis, Staphylococcus aureus, Salmonella paratyphi, Salmonella typi, Bacillus subtilis, Aspergillus niger, Aspergillus flavus, Aspergillus fumigates* and *Candida albicans* by agar plate(well) method [54].

Perumal Samy and Ignacimuthu, 2000; studied the antibacterial activity of various extracts of leaf by disc diffusion method and found methanol extract active *against B. subtilis , S. aureus* and *E. coli* at 10 mg/ml concentraction [55].

Qureshi et al., 1997; studied the sensitivity of the keratinophilic fungi in *P. daemia* extract by dry-weight method [56].

Valsaraj et al.,1997; studied the antibacterial activity of ethanol (80%) extract of leaf and stem and exhibited activity against various bacteria strain such as *Pseudomonas aeruginosa*, *Bacillus subtilis, Escherichia coli* and *Staphylococcus aureus* at a concentration of 25 mg/ml, while ethanol (95%) extract of plant inactive against Mycobacterium tuberculosis by agar plate method [57].

Elango et al., 1985; studied the antibacterial activity of ethanol (80%) extract of whole plant and it was exhibited activity at a concentration of 80 µg/ml against *Proteus mirabilis, Escherichia coli, Staphylococcus aureus* and *Pseudomonas aeruginosa*, agar disc diffusion method .1to3 mg of the extract showed cardiovascular effects on heart of frog, while the high dose of extract was blocked heart. The extract 10 mg/kg showed uterine stimulant effect on female guinea pig, while 1 to 2.5 mg of the extract exhibited smooth muscle stimulant activity on guinea pig ileum [25].

Runnebaum et al., 1984; reported the ethanol extract of leaf not showed anti-implantation and abortifacient effect on female pregnant rat at a dose level of 200 mg/kg [58].

Prakash et al., 1978; reported aqueous ethanolic extract of leaf not showed embryotoxic effect on pregnant rat (related to fertility regulation), at a dose of 100 mg/kg [59].

Anonymous, 1976: reported aqueous ethanolic extract of fruit, leaf and stem exhibited cytotoxicity (CA-9KB) by cell culture method and the ED_{50} was 20µg/ml [60].

Ogunlana and Ramstad, 1975; reported the 50% methanol (1:1) extract of flower and leaf inactive against various bacteria including *Pseudomonas aeruginosa*, *Staphylococcus aureus, Staphylococcus albus, Bacillus subtilis* and *Proteus species* by broth culture method [61].

Dhar et al., 1973; studied the toxicity (LD_{50}) of aqueous ethanolic extract of whole plant and it was showed more than 1 gm/kg on mouse. Cytotoxic activity (CA-9KB) of the extract inactive (ED_{50}> mcg/ml) and hypotensive activity of the extract showed active at 50 mg/kg (IV route) dog, while antispasmodic activity of the extract tested on guinea pig ileum and hypothermic activity of the extract showed active at dose level of 500 mg/kg (mouse, IP) [62].

Ghatak and De, 1961; studied the toxicity assessment (LD_{50}) of ethanol extract of whole plant and it was found to be 6, 5, 6 and 4 mg/kg, IV on guinea pig, rabbit, dog and cat respectively [31].

Ghatak and De, 1961; reported ethanol extract of whole plant was showed uterine stimulant effect on normal and pregnant female animals such as rat, rabbit, guinea pig, and cat at a dose of 1-2 mg /kg, IV and also it showed intestine smooth muscle stimulant activity on cat, rabbit and guinea pig at a dose of 0.067 mg/ml, while bronchoconstrictor and respiratory depressant activities active at a dose of 2 mg/kg, IV on cat, rabbit and guinea pig. The ethanol extract of whole plant (0.1 mg/ml) exhibited cardiac depressant activity on rabbit and guinea pig heart (Perfusion method) and it was showed hypertensive activity at dose of 1-2 mg/kg, IV on dog and cat[31].

Rakhit et al., 1959; reported the aqueous extract of whole plant was showed uterine stimulant effect on female guinea pig [63].

Gupta et al., 1950; reported alkaloid fraction of the whole plant was showed uterine stimulant effect on female cat (0.75 mg / animal, IV), while the same fraction was exhibited intestine smooth stimulant activity on cat (3mg/kg, IV) and also hyperglycemic activity on monkey (3mg/kg, IV). Oral dose of 3 mg/ kg on cat was showed gastric secretory stimulation activity [64].

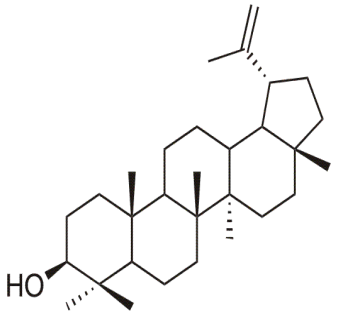
Heal et al., 1950; studied the insecticide activity of aqueous extract of entire plant and it was exhibited strong insecticide activity against *Periplaneta Americana*, *Blatella germanica* and *Oncopeltus fasciatus* at a dose level of 40 ml/kg [65].

Dutta and Ghosh, 1947a; reported aqueous extract of entire plant was showed uterine stimulant effect on female cat [23].

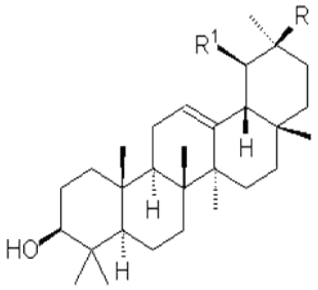
Dutta and Ghosh, 1947b; reported ethanol (95%) extract of entire plant was showed uterine stimulant effect on female rat [36].

Phytochemistry

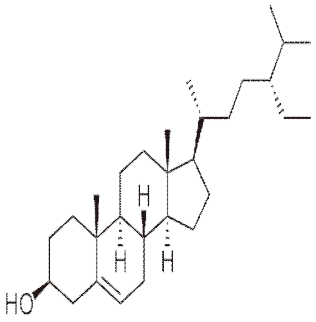
Anjaneyulu et al., 1998; Seshadri and Vydeeswaran,1971; Rakhit et al., 1959; Raman and Barua, 1958; reported to contain β-sitosterol, lupeol, lupeol acetate, α, β-amyrin and its acetate in entire plant and root [18, 28, 63, 66].



Lupeol

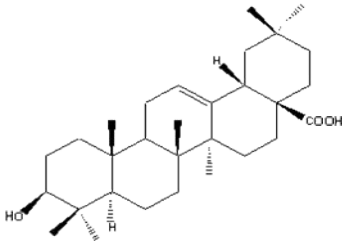


R = H, R^1 = CH_3 = α-amyrin
R = CH_3, R^1 = H = β-amyrin



β-sitosterol

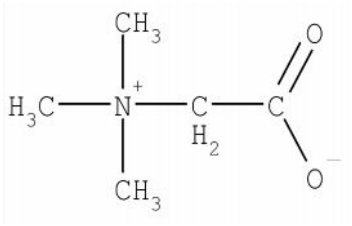
Anjaneyulu et al., 1998; isolated lupeol-3-beta trans crotonate and oleanolic acid acetate from dried whole plant [18].



Oleanolic acid

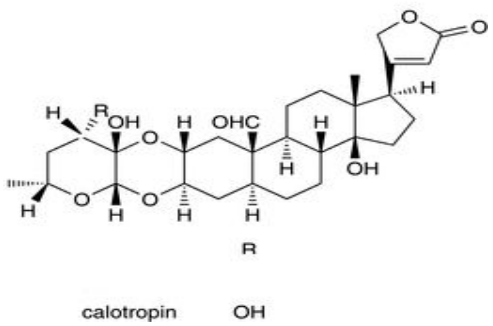
Rakhit et al., 1959; isolated betaine, hentriacontane and pentacosanoicacid from entire plant, while reported to contain magnesium and potassium carbonate, daemia extensa polypeptide, Ca, Mg and K oxalate [63].

Hentriacontane

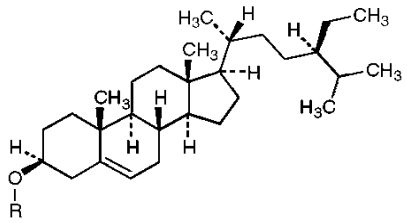


Betaine

Seshadri and Vydeeswaran, 1971; reported to contain calactin, calotropin, corotoxigenin, daucosterol and sucrose in root [28].

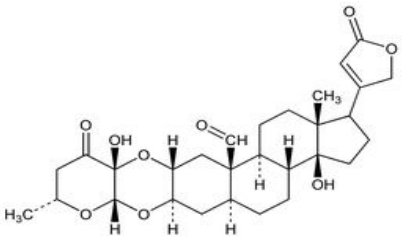


calotropin R OH

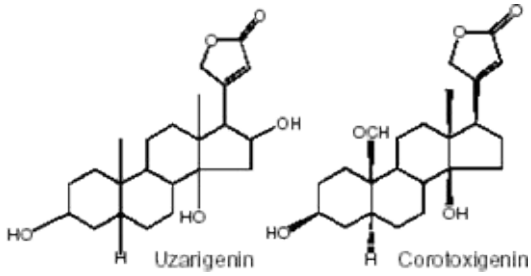


Daucosterol

Mittal et al., 1962; reported to contain various cardenolide such as calotoxin, calotropagenin, dihydro calotropagenin, calotropin and uscharidin in seed, while coroglaucigenin, corotoxigenin, uscharidin and uzarigenin in stem [33].



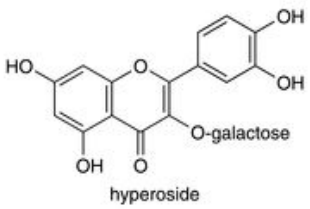
Uscharidin



Uzarigenin Corotoxigenin

Dutta and Ghosh, 1947a, b; reported to contain daemia extensa polypeptide, daemia extensa glucoside, Inorganic salts such as Kcl and KNO_3 in entire plant [23, 36].

Sinha and Dogra, 1985; Sankara Subramanian and Nair 1968; reported to contain hyperoside (flavonol) in dried stem, while flavonoids and saponins in fresh shoots and flowers [67, 68].



hyperoside

CONCLUSION

The plant *P. daemia* (Veliparuthi) has a wide array of pharmacological activities. It is widely used in various traditional system of medicine as a medicine. It has been used since centuries as an analgesic, antipyretic and anti-inflammatory, abortifacient, in treatment of diarrhea and malarial intermittent fever. Recent research carried out indicates its other uses such as hepatoprotective, antifertility and anti-diabetic. The plant *P. daemia* is an important source of various types of compounds with diverse chemical structures as well as pharmacological activities. However, very less work has been done on this plant and there is a wide scope for investigation.

Figure 1. Aerial Parts of *P. daemia*

Figure 2. Roots of *P. daemia*

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