



WWJMRD 2023; 9(01): 47-50  
www.wwjmr.com  
International Journal  
Peer Reviewed Journal  
Refereed Journal  
Indexed Journal  
Impact Factor SJIF 2017:  
5.182 2018: 5.51, (ISI) 2020-  
2021: 1.361  
E-ISSN: 2454-6615

**Rameeza khathoon M.A**  
Department of Pharmacognosy  
& Phytochemistry, College of  
pharmaceutical sciences,  
Government Medical College  
Kannur, Kerala, India.

**Meera Bhaskaran**  
Department of Pharmacognosy  
& Phytochemistry, College of  
pharmaceutical sciences,  
Government Medical College  
Kannur, Kerala, India.

**Anagha Vijayan K.M**  
Department of Pharmacognosy  
& Phytochemistry, College of  
pharmaceutical sciences,  
Government Medical College  
Kannur, Kerala, India.

**Fathimathul Nisa M.K**  
Department of Pharmacognosy  
& Phytochemistry, College of  
pharmaceutical sciences,  
Government Medical College  
Kannur, Kerala, India.

**Aswathi D.**  
Department of Pharmacognosy  
& Phytochemistry, College of  
pharmaceutical sciences,  
Government Medical College  
Kannur, Kerala, India.

**Correspondence:**

**Rameeza khathoon M.A**  
Department of Pharmacognosy  
& Phytochemistry, College of  
pharmaceutical sciences,  
Government Medical College  
Kannur, Kerala, India.

## A Review Article on *Pilea Microphylla*

**Rameeza khathoon M.A, Meera Bhaskaran, Anagha Vijayan K.M,  
Fathimathul Nisa M.K, Aswathi D.**

### Abstract

*Pilea microphylla* commonly known as artillery weed, rockweed or gunpowder plant is an important medicinal plant belonging to family Urticaceae. *Pilea* is used in Indian folk medicine to cure allergies, wounds, diuretics, treating burn & scald, childbirth problems, infertility & bacterial infection.

Study evaluated the antidiabetic potential of a flavonoid rich fraction in C57BL/KsJ-db/db mice. Antioxidant activities were tested by using DPPH free radical scavenging, & methanolic extract showed highest antioxidant potential. Polyphenolic fraction of *Pilea* showed antigenotoxicity or cytoprotective activity against  $\gamma$ -radiation in V79 cells, correlating the antioxidant activity of polyphenols with their radioprotective effects. *Pilea microphylla* improves sperm parameters and DNA fragmentation in varicocele rats. Toxicity assay carried out by using brine shrimps. The antimicrobial activity of *Pilea microphylla* extract was tested in vitro by using disc diffusion method and minimum inhibitory concentration (MIC). The antidepressant effect of *P. microphylla* was examined due to its rich flavonoid contents using two behavioural models, the Forced Swimming Test (FST) and Tail Suspension Test (TST) in mice. In vivo studies of anti-inflammatory and anti-diabetic activities of the methanolic extract of *pilea* was evaluated on paw edema in mice induced by carrageenan & OGTT (Oral glucose tolerance test) respectively.

**Keywords:** *Pilea microphylla*, Urticaceae, artillery plant.

### Introduction

Plants are a good source of biologically active natural products. In the investigation of bioactive natural compounds, it is essential to have access to simple biological tests to locate required activities. The preservative effect of many plant species and herbs suggests the presence of antioxidative and antimicrobial constituents in their tissues <sup>(1)</sup>.

*Pilea* is the largest genus of the Urticaceae and one of the largest genera in the Urticales. It includes over 600 species, that are mostly distributed throughout the tropics, subtropics, and warm temperate regions. Most species are succulent herbs, epiphytes or small shrubs growing in heavy shade. <sup>(2)</sup>

*Pilea microphylla*, commonly known as artillery weed, rockweed or gunpowder plant, is native to Mexico and tropical South America. It is mainly utilized in gardens and landscapes as foliage or groundcover ornamental plant, but also for many ethnobotanical uses. At present, it is considered as a problematic weed affecting tropical and subtropical environments worldwide (Pacific Island Ecosystems at Risk 2010). In Europe, *P. microphylla* is known as casual alien in Belgium, introduced as weed via plant nurseries; naturalized in the Balkan Peninsula, Archipelago of Madeira, or doubtfully naturalized in the Canary Islands. During our field surveys, *P. microphylla* has been ascertained occurring in the Favorita Park of Palermo (Sicily, Southern Italy), that is placed on the southwestern foothills of Mt. Pellegrino. Climate can be referred to thermo mediterranean type, with an average annual temperature of 18°C and rainfall of 642 mm. *P. microphylla* was found on shady surrounding wall. The vector of introduction is uncertain. Probably, *P. microphylla*, escaped from nearby gardens, where, probably, originally was introduced as weed in several pots of ornamental exotic plants. At present the spread of this species entirely depends vegetative reproduction <sup>(2)</sup>.

This generic circumscription of the Urticaceae, however, was established prior to the era of molecular phylogenetics. With the advent of the molecular tools, classification within tribe Urticaceae has received much attention, with both taxonomic and phylogenetic studies spurring realignments. Although our understanding of evolutionary relationships of the tribe Urticaceae has improved in recent years, some important nodes remain unresolved<sup>(3)</sup>.

### Botany

*Pilea microphylla* is a small, soft, smooth herb, 10 centimeters or less in height. Stems are slender, angular, green with a tint of purple, and angular. Leaves occur in two rows, petioled, somewhat elliptical in shape, 2 to 5 millimeters in length. Flowers are very small and crowded in small inflorescences (cymes) which are greenish or tinged with red and less than 1 millimeter in length.

A multitude of minute, lime green leaves on short, arching stems gives artillery plant a fine-textured, fern like appearance (Fig. 1). Growing only 8 to 12 inches tall and quickly forming spreading clumps up to two feet wide, artillery plant makes an attractive tropical ground cover. The common name is derived from the forcefully ejected pollen from the rather inconspicuous flowers on this brittle and succulent plant. Although a member of the stinging nettle family (Urticaceae), members of this genus do not have stinging hairs.



Fig. 1

### General Information

Scientific name: *Pilea microphylla*

Common name(s): artillery plant

Family: Urticaceae

Plant type: herbaceous; ground cover

Planting month: year round

Origin: Mexico and tropical South America

### Description

Height: 0.5 to 1.5 feet

Spread: 1 to 2 feet

Plant habit: spreading

Plant density: dense

Growth rate: moderate

Texture: fine

### Foliage

Leaf arrangement: opposite/subopposite

Leaf type: simple

Leaf margin: entire

Leaf shape: obovate

Leaf venation: none, or difficult to see

Leaf type and persistence: evergreen

Leaf blade length: less than 2 inches

Leaf color: green

Fall characteristic: not showy

### Flower

Flower color: green

Flower characteristic: year-round flowering

### Fruit

Fruit shape: unknown

Fruit length: less than 0.5 inch

Fruit cover: dry or hard

Fruit color: brown

Fruit characteristic: inconspicuous and not showy

### Trunk and Branches

Branches: branched

Stem/twig color: green

Stem/twig thickness: medium

### Culture

Light requirement: plant grows in the shade.

Drought tolerance: moderate

Soil salt tolerances: poor

Plant spacing: 24 to 36 inches

### Other

Invasive potential: potentially invasive

Pest resistance: no serious pests are normally seen on the plant<sup>(4)</sup>.

### Distribution

- In and about towns, on damp walls, etc.

- Native of tropical America.

- Now found in most tropical countries.

### Constituents

- Study yielded flavonoids quercetin (reported DPP-IV inhibitor), rutin, chlorogenic acid (reported lipid lowering property) along with others (luteolin-7-O-glucoside, apigenin-7-O-glucoside, isorhoifolin)<sup>(8)</sup>.

- Study of whole plant yielded six phenolic compounds: (1) quercetin-3-O-rutinoside (2) 3-O-caffeoylquinic acid (3) luteolin-7-O-glucoside (4) apigenin-7-O-rutinoside (5) apigenin-7-O-@b-d-glucopyranoside and (6) quercetin<sup>(10)</sup>.

### Properties

Studies have suggested antioxidant, antidiabetic, radioprotective, antimicrobial, cytoprotective, antigenotoxic, antidepressant properties.

### Parts Utilized

Entire plant, stems, leaves.

### Uses

Folkloric

- Entire plant infusion is used as a diuretic.

- Used for diarrhoea and asthma.

- Crushed leaves applied to sores and bruises.

- In the Antilles, sweetened decoction of roots used as diuretic.

- In Jamaica, entire plant used for women in labour; used for infertility and inflammation.
- In Brazil, used as a diuretic.
- In Guatemala, used for urinary problems.
- In Jamaican and Chinese medicine, used for diabetes.
- In western Panama, stem decoction drunk for diarrhea.
- In Trinidad and Tobago, leaves used for inflammation and as womb cleanser<sup>(4)</sup>.

### Use and Management

Growing in full sun but preferring light shade, artillery plant needs well-drained yet moist soils and should only be watered when the soil dries. Plant on 18- to 24-inch centers to establish a quick cover. Plants may be pinched occasionally to encourage bushiness, but this is seldom necessary. Light applications of fertilizer are recommended.

Artillery plant can become a weed since seeds germinate in the landscape. It is best used as a ground cover planted in a mass in a bed beneath existing trees. Do not mix with other ground covers or low shrubs since it will spread into these areas.

The cultivar 'Variegata' has leaves blotched white and pink. Propagation is by cuttings, which root easily.

### PESTS AND DISEASES

Artillery plant is occasionally bothered by chewing insects. Plants are subject to root rot in poorly drained soils.

#### Availability

- Wildcrafted.
- Occasionally cultivated as a dish garden plant or cover plant.
- Plant available in the cybermarket.

### Clinical Efficacy of Pilea Microphylla:

#### Antidiabetic Activity of Flavonoid Rich Fraction of Pilea

Study evaluated the antidiabetic potential of a flavonoid rich fraction in C57BL/KsJ-db/db mice. Study yielded flavonoids quercetin (reported DPP-IV inhibitor), rutin, chlorogenic acid (reported lipid lowering property) along with others (luteolin-7-O-glucoside, apigenin-7-O-glucoside, isorhoifolin). An overall antidiabetic effect could be the result of a combination of several constituents acting in concert restoring homeostasis in energy consumption and utilization<sup>(5)</sup>.

#### Cytoprotective or Antigenotoxicity Study of Pilea Microphylla

Study compared the cytoprotective and antigenotoxic activity of the polyphenolic fraction with its active polyphenolic constituents against  $\gamma$ -radiation in V79 cells. Results showed radioprotection probably from a synergistic effect of the phytochemicals present in the herbal extract rather than any single component<sup>(6)</sup>

#### Improvement in Sperm Parameters and Dna Fragmentation Using Pilea

Study investigated the effects of Pilea microphylla in a rat model of varicocele. Results showed Pilea microphylla improves sperm parameters and DNA fragmentation in varicocele rats. Pilea can reduce the damage to sperm DNA but not chromatin condensation.<sup>(7)</sup>

### Antioxidant, Antimicrobial Activity and Toxicity Test of Pilea Microphylla.

A total of 9 plant extracts were tested, using two different kinds of extracting methods to evaluate the antioxidant and antimicrobial activities from Pilea microphylla (Urticaceae family) and including toxicity test. Antioxidant activity were tested by using DPPH free radical scavenging, also total phenolic contents and total flavonoid contents were determined. Toxicity assay carried out by using brine shrimps. Methanol extract of method I (ME I) showed the highest antioxidant activity at  $69.51 \pm 1.03$ . Chloroform extract of method I (CE I) showed the highest total phenolic contents at  $72.10 \pm 0.71$  and chloroform extract of method II (CE II) showed the highest total flavonoid contents at  $60.14 \pm 0.33$ . The antimicrobial activity of Pilea microphylla extract was tested in vitro by using disc diffusion method and minimum inhibitory concentration (MIC). The Pilea microphylla extract showed antibacterial activity against some Gram negative and positive bacteria. The extracts did not exhibit antifungal and anti-yeast activity. The hexane extract of method I (HE I) was not toxic against brine shrimp (LC50 value was  $3880 \mu\text{g/ml}$ ). Therefore, the extracts could be suitable as antimicrobial and antioxidative agents in food industry.<sup>(8)</sup>

### Antidepressant-Like Effects of Selected Crude Extracts of Pilea Microphylla in Mice Model of Depression

The present study was undertaken to investigate the effect of selected crude extracts namely, Methanol (ME I), Chloroform Extract (CE II) and Ethyl Acetate (EAE II) extracts of Pilea microphylla on depression in mice. In the present study, the antidepressant effect of P. microphylla was examined due to its rich flavonoid contents in the Urticaceae family using two behavioural models, the Forced Swimming Test (FST) and Tail Suspension Test (TST) in mice. Selected crude extracts from Pilea microphylla produced an antidepressant-like effect, since the acute treatment of mice with extracts by intraperitoneal (i.p.) route significantly reduced the immobility time in the FST (50 and 100 mg kg<sup>-1</sup>) and TST (50 and 100 mg kg<sup>-1</sup>), as compared to positive controls (haloperidol and fluoxetine) at 1 and 10 mg kg<sup>-1</sup>, respectively. Reduced immobility and decreasing freezing were observed in FST and TST tests. Therefore, P. microphylla may be served as a potential resource for natural psychotherapeutic agent against depression. The present study clearly demonstrated that Pilea microphylla exerts an antidepressant effect in these two behavioural models. It may be due to present of flavonoids. This is consistent with the hypothesis that enhanced uptake of flavonoids groups might have antidepressant-like effects.<sup>(9)</sup>

### Phenolic Compounds Isolated from Pilea Microphylla Prevent Radiation-Induced Cellular Dna Damage

Six phenolic compounds namely, quercetin-3-O-rutinoside (1), 3-O-caffeoylquinic acid (2), luteolin-7-O-glucoside (3), apigenin-7-O-rutinoside (4), apigenin-7-O-b-D-glucopyranoside (5) and quercetin (6) were isolated from the whole plant of Pilea microphylla using conventional open-silica gel column chromatography and preparative HPLC. Further, these compounds were characterized by 1D, 2D NMR techniques and high-resolution LC-MS. Compounds 1-3 and 6 exhibited significant antioxidant potential in scavenging free radicals such as DPPH, ABTS

and SOD with IC<sub>50</sub> of 3.3–20.4 mmol/L. The same compounds also prevented lipid peroxidation with IC<sub>50</sub> of 10.4–32.2 mmol/L. The compounds also significantly prevented the Fenton reagent-induced calf thymus DNA damage. Pre-treatment with compounds 1–3 and 6 in V79 cells attenuated radiation-induced formation of reactive oxygen species, lipid peroxidation, cytotoxicity and DNA damage, correlating the antioxidant activity of polyphenols with their radioprotective effects. Compounds 1, 3 and 6 significantly inhibited lipid peroxidation, presumably due to 30, 40 -catechol ortho-dihydroxy moiety in the B-ring, which has a strong affinity for phospholipid membranes. Oxidation of flavonoids, with catechol structure on B-ring, yields a fairly stable ortho-semiquinone radical by facilitating electron delocalization, which is involved in antioxidant mechanism. Hence, the flavonoid structure, number and location of hydroxyl groups together determine the antioxidant and radioprotection mechanism <sup>(10)</sup>

### **In Vivo Studies of Anti-Inflammatory and Anti-Diabetic Activities of The Methanolic Extract of Pilea Microphylla on Experimental Mice**

The anti-inflammatory effect of the extracts was evaluated on paw edema in mice induced by carrageenan and the anti-diabetic activity was determined by oral glucose tolerance test (OGTT). In the present study the anti-inflammatory effect was observed of methanol extract in doses of 250 mg/kg and 500 mg/kg and the results were 74.18% and 72.17% inhibition of paw edema respectively compared to the standard drug Diclofenac-Na 80.42% inhibition of paw edema. The anti-diabetic effect was observed of methanol extract in doses of 250 mg/kg and 500 mg/kg and the results were 56.44% and 62.26% inhibition of paw edema respectively compared to the standard drug Metformin hydrochloride 78.05% inhibition of paw edema. These findings suggest the use of Pilea microphylla as therapeutic agents to treat diabetes and inflammation as an alternative option of synthetic drugs particularly among poor people of developing countries <sup>(11)</sup>.

### **References**

1. Chahardehi AM, Ibrahim D, Sulaiman SF. Antioxidant activity and total phenolic content of some medicinal plants in Urticaceae family. *Journal of Applied Biological Sciences*. 2009 May 1;3(2):27-31.
2. Scafidi F, Raimondo FM. First record of Pilea microphylla (Urticaceae) in Sicily. *Flora Mediterranea*. 2018; 28:79-84.
3. Ogoma CA, Liu J, Stull GW, Wambulwa MC, Oyebanji O, Milne RI, Monro AK, Zhao Y, Li DZ, Wu ZY. Deep insights into the plastome evolution and phylogenetic relationships of the tribe Urticeae (Family urticaceae). *Frontiers in plant science*. 2022;13.
4. Godofredo U. Stuart Jr., M.D. / **StuartXchange**; December 2018; Philippine Medicinal Plants [Alabong, Pilea microphylla, artillery plant, Xiao ye leng shui hua: Philippine...]
5. Bansal P, Paul P, Shankar G, Munjal D, Nayak PG, Priyadarsini KI, Unnikrishnan MK. Flavonoid rich fraction of Pilea microphylla (L.) attenuates metabolic abnormalities and improves pancreatic function in C57BL/KsJ-db/db mice. *Biomedicine & Preventive Nutrition*. 2011 Oct 1;1(4):268-72.
6. Paul P, Bansal P, Nayak PG, Pannakal ST, Priyadarsini KI, Unnikrishnan MK. Polyphenolic fraction of Pilea microphylla (L.) protects Chinese hamster lung fibroblasts against  $\gamma$ -radiation-induced cytotoxicity and genotoxicity. *Environmental toxicology and pharmacology*. 2012 Jan 1;33(1):107-19.
7. Heidari R, Alizadeh R, Abbasi N, Pasbakhsh P, Hedayatpour A, Farajpour M, Khaleghi MR, Abbasi M, Dehpour AR. Do pilea microphylla improve sperm DNA fragmentation and sperm parameters in varicocele rats? *Acta Medica Iranica*. 2015 Oct 6:547-54.
8. Modarresi Chahardehi A, Ibrahim D, Fariza Sulaiman S. Antioxidant, antimicrobial activity and toxicity test of Pilea microphylla. *International journal of microbiology*. 2010;2010.
9. Chahardehi AM, Ibrahim D, Abolhassani F, Sulaiman SF. Antidepressant-like effects of selected crude extracts of Pilea microphylla in mice model of depression. *American Journal of Agricultural and Biological Sciences*. 2013 Jan 1;8(1):75.
10. Bansal P, Paul P, Nayak PG, Pannakal ST, Zou JH, Laatsch H, Priyadarsini KI, Unnikrishnan MK. Phenolic compounds isolated from Pilea microphylla prevent radiation-induced cellular DNA damage. *Acta Pharmaceutica Sinica B*. 2011 Dec 1;1(4):226-35.
11. Intiaj Hossain Chowdhury, SM Riajul Wahab\*et al. In vivo Studies of Anti-Inflammatory and Anti-Diabetic Activities of the Methanolic Extract of Pilea microphylla on Experimental Mice. *Journal of Traditional Medicine & Clinical Naturopathy*. 2020 July 16;9(2).