

Research Article



Phytochemical Screening, Antioxidant and Antibacterial Activities of *Pseuderanthemum carruthersii*

Gayatri Sandip Jagtap*, Anuja Prakash Shirke, Sneha Prakash Shinde, Sanika Balaso Kamble, Vinay Ashok Shinde

Shree Santkrupa College of Pharmacy, Ghogaon, Karad, Maharashtra, India.

*Corresponding author's E-mail: suryawanshigayatri7171@gmail.com

Received: 25-05-2026; Revised: 20-08-2026; Accepted: 27-08-2026; Published online: 20-09-2026.

ABSTRACT

Pseuderanthemum carruthersii (Seem.) Guillaumin (Acanthaceae) is an ornamental shrub with medicinal importance traditionally used to treat wounds, inflammation, skin infections and various microbial diseases. The present study was conducted to investigate the pharmacognostic characteristics, phytochemical constituents, antibacterial activity and antioxidant potential of methanolic leaf extract of *P. carruthersii*. Leaves were collected, air dried, powdered and extracted by maceration with methanol. A preliminary phytochemical screening was carried out to determine the presence of major bioactive constituents. The extract was subjected to standard qualitative tests for polysaccharides, alkaloids, proteins, amino acids, organic nitrogen compounds and flavonoids. The antibacterial activity was tested against *Escherichia coli*, *Bacillus subtilis*, *Staphylococcus aureus* and *Pseudomonas aeruginosa* by agar well diffusion method with ciprofloxacin as standard drug. The antioxidant activity was determined by the DPPH free radical scavenging assay and compared with ascorbic acid. Phytochemical analysis showed the presence of different bioactive compounds such as polysaccharides, alkaloids, proteins and flavonoids. The methanolic extract demonstrated significant antibacterial activity against *E. coli* (14 mm) and *B. subtilis* (12 mm), while moderate and weak activities were observed against *S. aureus* (6 mm) and *P. aeruginosa* (2 mm), respectively. The extract showed concentration-dependent antioxidant activity in DPPH assay with 61.14 % free radical scavenging at 100 µg/mL as compared to 82.90 % of ascorbic acid. The results indicated that *Pseuderanthemum carruthersii* has significant phytochemical, antibacterial and antioxidant activities, supporting its traditional medicinal use and indicating its potential as natural source of therapeutic agents for pharmaceutical applications.

Keywords: *Pseuderanthemum carruthersii* (Seem.) Guillaumin; Methanolic leaf extract; Phytochemical screening; Antibacterial activity; Antioxidant activity; DPPH radical scavenging assay; Medicinal plant; *In vitro* study; Acanthaceae.

INTRODUCTION

Pseuderanthemum carruthersii (Seem.) Guillaumin is a member of the Acanthaceae family. It is an ornamental and medicinal plant that occurs in all tropical regions. Traditionally this plant has been used for treatment of wound, inflammation, skin infection and various microbiological diseases. The therapeutic potential of *P. carruthersii* is mainly due to the presence of many phytoconstituents like polysaccharides, lignans and triterpenoids. According to recent research, *P. carruthersii* extracts and isolated chemicals offer important biological properties, especially anti-inflammatory and antioxidant properties. By preventing the generation of reactive oxygen species (ROS) and lowering inflammatory mediators in lipopolysaccharide (LPS)-activated macrophage cell lines, polysaccharide fractions extracted from the leaves have been demonstrated to minimize oxidative stress.¹

These results show that its phytochemical makeup and antioxidant capacity are strongly correlated. Numerous chronic and infectious diseases are mostly caused by oxidative stress and microbial resistance. As a result, pharmaceutical research is paying close attention to natural chemicals originating from plants that have both antibacterial and antioxidant qualities. Given its documented bioactive components and traditional therapeutic use, *P. carruthersii* stands out as a viable target for additional investigation. Nevertheless, there are still few thorough studies concentrating on its antimicrobial range and mode of action, suggesting the need for more research.²

This herb has been used to relieve inflammation and mend wounds in Vietnam. The MCF-7 cancer cell line had been blocked by pseudoresinol and magnolin, while the dried root of *P. Carruthersii* yielded two new lignans (pseudoresinol, pseudouderanoside) and a new triterpene (pseuderranic acid). Low-molecular-weight compounds have been the main focus of research on *P. Carruthersii*'s bioactive components. This tree's water extract produces a highly viscous fluid that has been used to treat wounds and lower inflammation.¹ Based on specimens collected by John MacGillivray on two southern islands (Aneityum and Erromango), Seemann (1866) initially recognized *Pseuderanthemum carruthersii* as *Eranthemum carruthersii*.³

P. carruthersii is a very valuable ornamental plant that was introduced several times from different sources and grown in European nurseries, particularly in the late 1800s. As a result, *Eranthemum* has multiple names, many of which have been published in horticultural publications under various authorships. Thus far, two names have been published that are genuinely relevant to our research. The first is the recently lectotyped *Pseuderanthemum maculatum* (G.Lodd.) I.M. Turner, which is likely to match *P. carruthersii* based on the assigned lectotype; if this is the case, *P. maculatum* would take precedence over *P. carruthersii*.³



Plant profile:

- Scientific Name: *Pseuderanthemum carruthersii* (Seem.) Guillaumin
- Synonym: *Eranthemum carruthersii* Seem.
- Family: Acanthaceae Common Name: Carruthers' false eranthemum, Purple false eranthemum
- Plant Type: Evergreen ornamental shrub
- Habit: Woody shrub, erect to spreading habit
- Distribution: Originating in the Pacific Islands, it is extensively grown in tropical and subtropical areas, including India.
- Parts Used: Leaves, roots
- Traditional Uses: used in traditional medicine to heal wounds, microbiological diseases, inflammation, and skin infections.
- Major Phytoconstituents: Polysaccharides, lignans, triterpenoids, flavonoids.³



Figure 1: *Pseuderanthemum carruthersii*

Taxonomical Classification of *Pseuderanthemum carruthersii*:

- Kingdom: Plantae
- Subkingdom: Tracheobionta (Vascular plants)
- Superdivision: Spermatophyta (Seed plants)
- Division: Magnoliophyta (Angiosperms)
- Class: Magnoliopsida (Dicotyledons)
- Subclass: Asteridae
- Order: Lamiales
- Family: Acanthaceae
- Genus: *Pseuderanthemum*
- Species: *Pseuderanthemum carruthersii* (Seem.) Guillaumin³

Macroscopic Characters of *Pseuderanthemum carruthersii*:

Pseuderanthemum carruthersii's exterior morphological characteristics are the basis for its macroscopic assessment. The plant has an erect to spreading form and is an evergreen

ornamental shrub. The leaves are petiolate, simple, and opposite. They have an acute apex, complete edges, and an ovate to elliptic form. The smooth, glossy leaf surface has a distinctive variegation that frequently exhibits scarlet, purple, or green hues. Depending on the surroundings, the leaves can range in size from medium to enormous. The stem is branched, green to purplish, and woody. The plant has a rather harsh flavor and no distinctive smell. These physical characteristics aid in the plant material's identification and verification.⁴

Microscopic Characters of *Pseuderanthemum carruthersii*:

Pseuderanthemum carruthersii leaves exhibit typical dicotyledonous characteristics when examined under a microscope. A distinct top and lower epidermis coated in a thin cuticle can be seen in the leaf's transverse section. The epidermal cells are compactly arranged and may contain stomata (most of them are diacytic). Under the upper epidermis is a layer of palisade parenchyma. This layer consists of long cells rich in chloroplasts, the organelles responsible for photosynthesis. Below this is the spongy parenchyma, a loose arrangement of cells that facilitates gas exchange. Collateral vascular bundles are made up of xylem and phloem tissues. The mesophyll cells may also contain starch grains and crystals of calcium oxalates. These microscopic characters are useful for the plant pharmacognostic identification and standardization.⁴

MATERIALS AND METHODS

Plant Material Preparation:

- **Collection:** After being carefully selected from their native habitat, the plants were cleaned to get rid of dust and other impurities.¹
- **Drying:** In order to prevent the natural components from heat and sunlight, they were afterwards placed in the shade at room temperature.¹
- **Powder Preparation:** The dried plant material was carefully powdered to a fine powder for research.¹
- **Storage:** The powder was stored in clean, airtight containers until needed for tests to prevent moisture and contamination.¹

Extraction Process:

- **Ratio & Solvent:** The extraction was performed with a ratio of 1:10 of plant powder to methanol.²
- **Maceration:** To ensure that the phytoconstituents properly macerated and dissolved, the mixture was kept at room temperature for seven days.²
- **Filtration:** After seven days of extraction, the liquid was filtered from the plant residue.²
- **Concentration:** In order to allow the solvent to evaporate gradually without harming the heat-sensitive compounds, the filtrate was placed in a water bath with a temperature regulated between 30 and 40°C.²

- **Collection:** The concentrated extract was completely dried, then collected and stored in sealed containers for further research.²

PHYTOCHEMICAL ANALYSIS

1. Tests for Polysaccharides

a) Iodine Test- A test tube was filled with dried leaf powder. A 0.01 M iodine solution was added in two to three drops. The presence of starch was revealed by the development of a blue-black color.⁵

2. Tests for Nitrogen Compounds

- Test for Alkaloids

a) Dragendorff's Test- Diluted hydrochloric acid was mixed with plant extract. Dragendorff's reagent was applied in a few drops. Alkaloids were found when a reddish-brown precipitate formed.⁵

b) Wagner's Test- The sample was made into an acidic extract. Then add Wagner's reagent. Alkaloids were present when a brown or crimson precipitate formed.⁵

c) Mayer test (Potassium-mercuric-iodide solution)- This reagent reacts with alkaloids to produce an a creamy shade precipitate.⁵

- Test for Amino Acids

a) Ninhydrin Test- Extract was treated with 0.25% ninhydrin reagent. The mixture was heated gently. The appearance of a blue-violet coloration confirmed the presence of proteins and amino acids.⁵

- Test for General Organic Nitrogen

a) Soda Lime Test- In a test tube, soda lime and dried powder extract were combined. The presence of organic

nitrogen was suggested by the development of a strong odor.⁵

3. Detection of Proteins

a) Test for Picric Acid- To the extract, add the picric acid solution. Take note of the hue shift. Proteins are confirmed by their brown hue.⁵

b) The Biuret Test- To the extract, add sodium hydroxide. Present the solution of copper sulphate. Take note of the hue shift. Proteins are indicated by a violet-red hue.⁵

d) The Xanthoproteic Test- To the extract, add a few drops of strong nitric acid. Take note of the hue shift. Proteins with aromatic amino acids are colored yellow.⁵

4. Flavonoids

a) Alkaline Reagent Test- To the extract, add a solution of sodium hydroxide. Take note of the yellow hue. Add hydrochloric acid that has been diluted. Watch as the color fades. Flavonoids are confirmed by a yellow hue that turns colorless when acid is added.⁵

b) Test for Lead Acetate- To the extract, add the lead acetate solution. Flavonoids are confirmed by yellow precipitate.⁵

ANTIBACTERIAL ACTIVITY

Bacterial Culture: The four pathogenic bacterial strains used in the study were *Pseudomonas aeruginosa*, *Bacillus subtilis*, *Staphylococcus aureus*, and *Escherichia coli*.⁶

Culture medium: Nutrient broth was used to prepare the bacterial inoculum, and nutrient agar was used for the screening procedure. Studies were conducted using nutrient agar medium.⁷

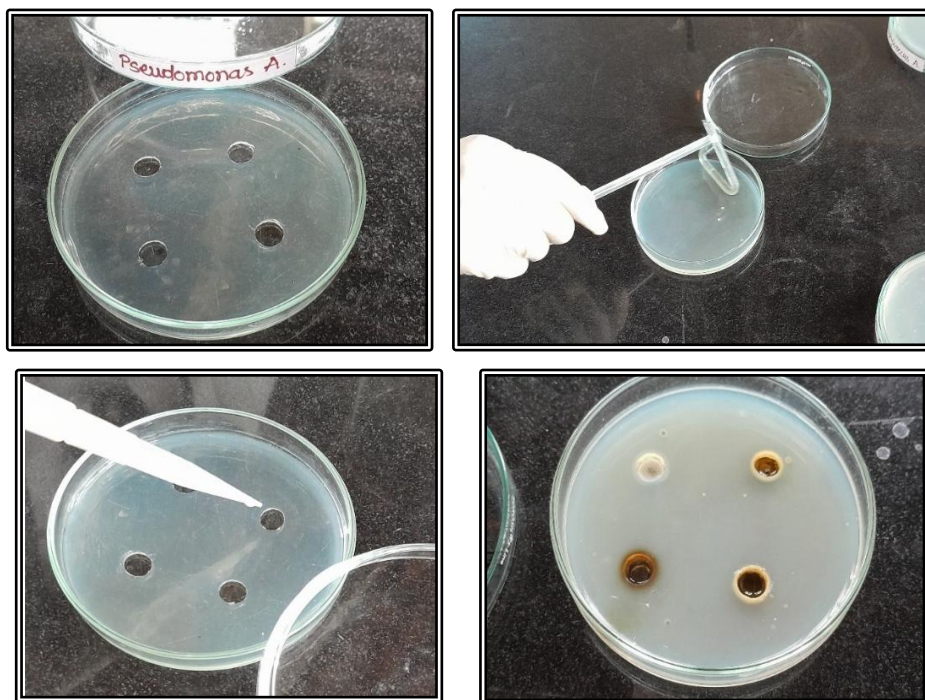


Figure 2: Preparation of Bacterial culture

Nutrient Agar Preparation: Both nutrient agar and broth are sold commercially in powdered (uniform, free-flowing) form. For instance, 28 grams of dehydrated nutritional agar in 1000 ml of distilled water was used to dissolve the dried medium. Boil the mixture for one minute, stirring often, to fully dissolve the powder. Autoclave the medium for 15 minutes at 121°C to sterilize it. They are put onto Petri dishes and quickly covered once they have cooled to roughly 50 °C (122 °F). The dishes are kept upside down and frequently chilled until needed once they contain hardened agar.⁷

Antibacterial assay:

• Well diffusion method:

The agar well diffusion method was used to determine the plant extracts' antibacterial activity. The nutrient agar plates were swabbed with 0.1 ml of the diluted inoculum of the bacterial strains (105cfu/ml). A sterile cork borer (5 mm) was used to punch wells with a diameter of 5 mm into the agar plates. Each well of the plate was then filled with 100 µl of the plant extracts using a micropipette. The plates were aerobically incubated at 37°C for a full 24 hours. The antibacterial activity was assessed through calculating the zone of inhibition (mm).⁸

ANTIOXIDANT ACTIVITY BY DPPH METHOD

1. The antioxidant activity of test compounds was assessed using DPPH (2, 2-Diphenyl-1, Picryl-Hydrazyl) free radicals.
2. The microwell plates were filled with 100 µL of a variety of concentrations (20, 40, 60, 80, and 100 µg/mL). The samples were treated with 100 µL of 0.1% methanolic DPPH and then left in the dark for a period of 30 minutes.
3. A colorimeter had been used to measure the absorbance at 510 nm after the samples were examined for discoloration, which ranged from purple to yellow.
4. The radical scavenging activity was calculated using the corresponding formula:⁹

DPPH radical scavenging activity (%) =

(Absorbance of control - Absorbance of test sample) / Absorbance of control x 100

RESULT AND DISCUSSION

Pharmacognostic tests

1. Tests for Polysaccharides

a) Iodine Test: The methanolic extract passed the iodine test, forming a bluish-black color.

2. Tests for Nitrogen Compounds

• Test for Alkaloids

a) Dragendorff's Test: A reddish-brown precipitate forms.

b) Wagner's Test: Alkaloids are confirmed when a brown-red precipitate forms.

c) Mayer test (potassium-mercuric-iodide solution): Alkaloids use this reagent to create a precipitate that is cream in color.

• Test for Amino Acids

a) Ninhydrin Test: The appearance of a blue-violet hue indicates the presence of an amino acid.

• Test for General Organic Nitrogen

a) Soda Lime Test: The formation of a pungent smell suggested the existence of organic nitrogen.

3. Detection of Proteins

a) Picric Acid Test: Protein content is confirmed by brown coloring.

b) Biuret Test: The presence of proteins is shown by the violet-red coloring.

c) Xanthoproteic Test: The methanolic extract passed the xanthoproteic test. Proteins are shown by the color yellow.

4. Flavonoids

a) Alkaline Reagent Test: When acid is added, the yellow hue turns colorless, indicating the presence of flavonoids.

b) Lead Acetate Test: The methanolic extract passed the lead acetate test (yellow precipitate suggests flavonoids).

Assessment of antibacterial activity

Pseudomonas aeruginosa, *Bacillus subtilis*, *Escherichia coli*, and *Staphylococcus aureus* were examined for their ability to be inhibited by the alcohol-based extract of *Pseuderanthemum carrutharsii* leaves. The activity was calculated through the measurement of the zone of inhibition (mm).

Table 1: Zone of inhibition (mm)

Bacterial Stain	<i>Pseuderanthemum carrutharsii</i> Extract	Positive control (Ciprofloxacin)
<i>Escherichia coli</i>	14	12
<i>Pseudomonas aeruginosa</i>	2	12
<i>Bacillus subtilis</i>	12	8
<i>Staphylococcus aureus</i>	6	12



When tested with different bacterial strains, the alcohol based leaf extract of *Pseuderanthemum carruthersii* exhibited a variable but promising antibacterial profile. The extract worked especially well against *Bacillus subtilis* (12 mm) and *Escherichia coli* (zone of inhibition: 14 mm).

However, it very slightly inhibited *Pseudomonas aeruginosa* (2 mm) and had a moderate effect on *Staphylococcus aureus*

(6 mm), whereas ciprofloxacin continued to be significantly more effective (12 mm).

It demonstrates that the plant extract has bioactive substances that can target certain bacteria, namely *B. subtilis* and *E. coli*. However, it had little effect on *Pseudomonas aeruginosa*.

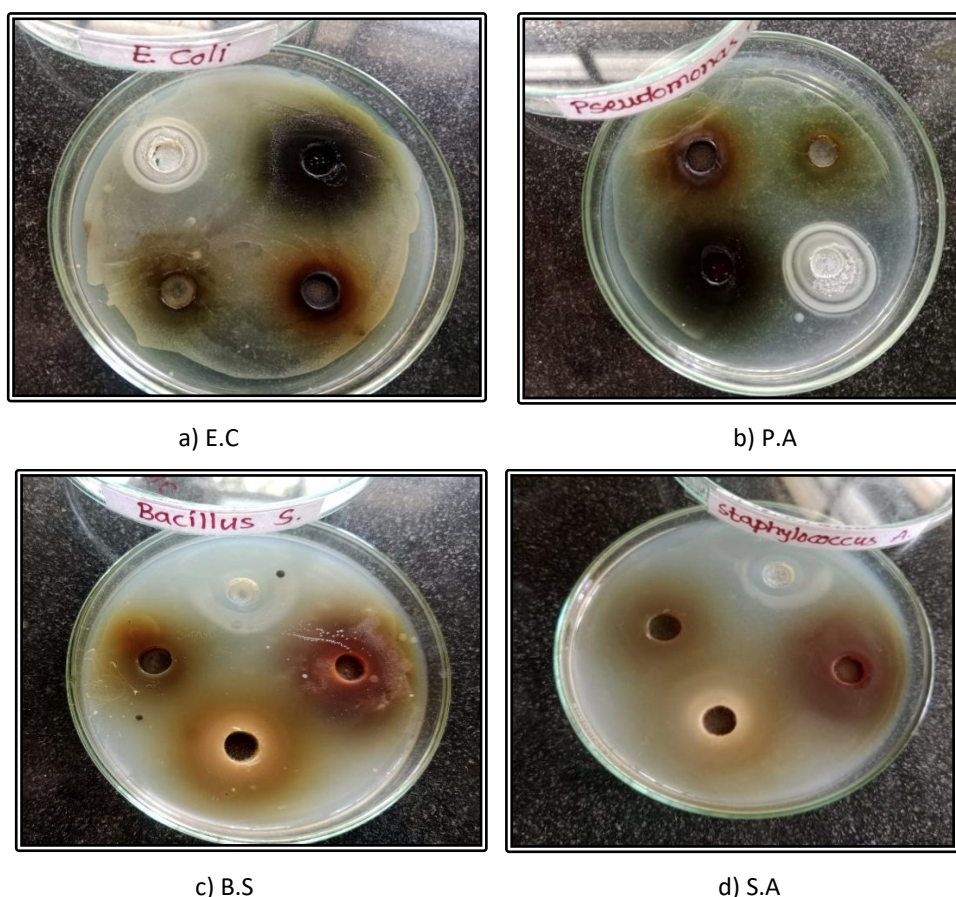
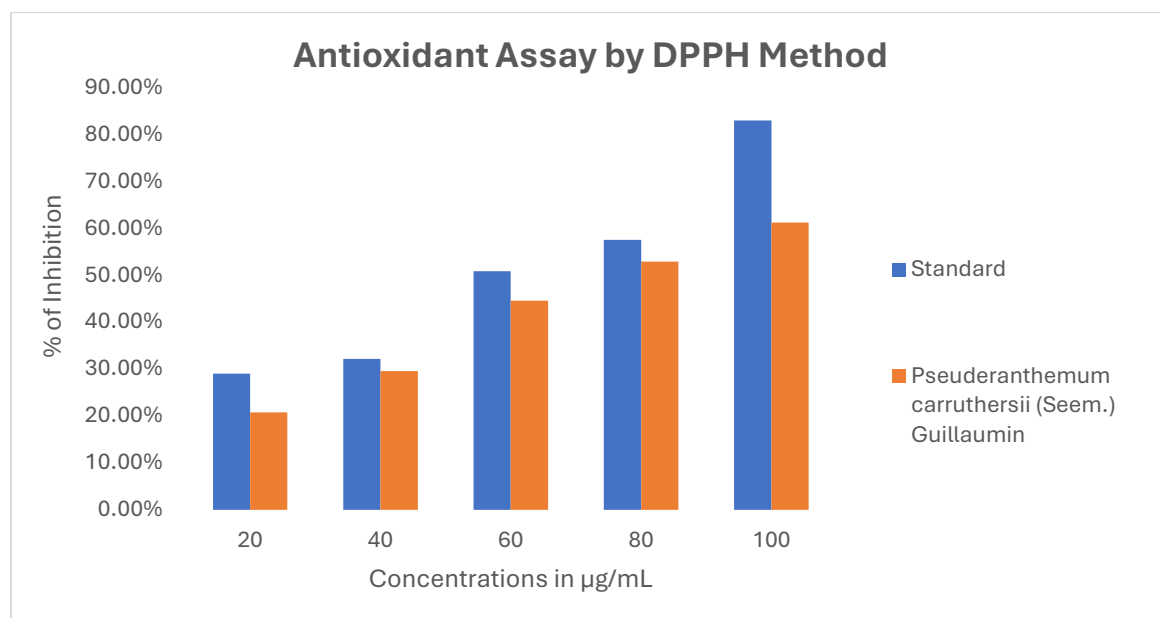
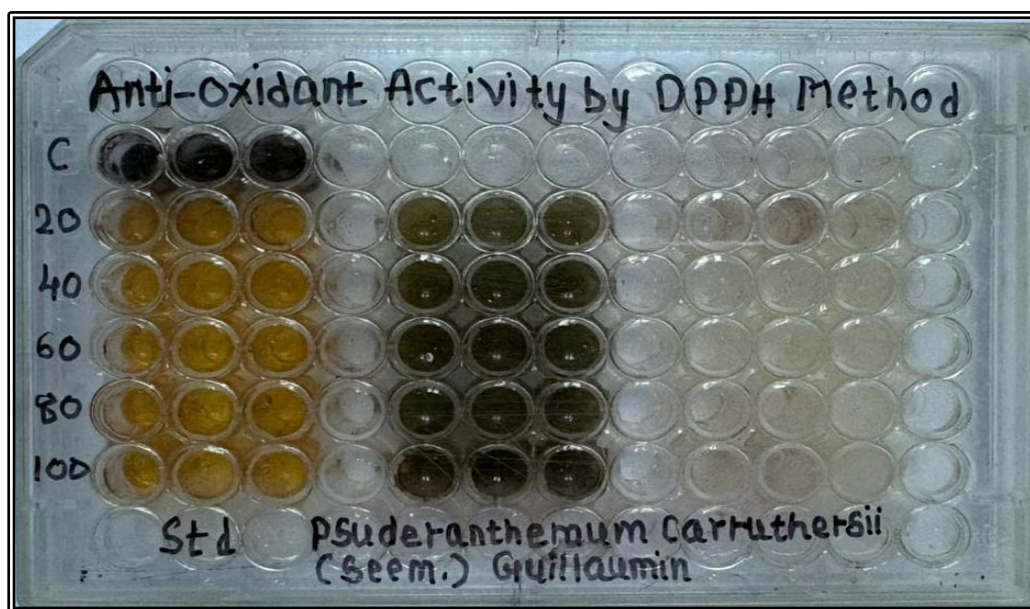


Figure 3: Antibacterial activity of *Pseuderanthemum carruthersii* (Seem.) Guillaumin

Antioxidant activity by DPPH method

Table 2: % Inhibition and IC₅₀ (Observation table)

SR.NO	Sample Code	Concentration (µg/mL)	Absorbance at 510 nm				% Inhibition	IC ₅₀ (µg/mL)
			Test 1	Test 2	Test 3	Mean		
1	Control	-	1.93	1.93	1.93	1.93	-	
2	Standard (Ascorbic Acid)	20	1.34	1.37	1.39	1.37	29.02%	72.49
		40	1.31	1.29	1.33	1.31	32.12%	
		60	0.95	0.97	0.93	0.95	50.77%	
		80	0.82	0.85	0.79	0.82	57.51%	
		100	0.35	0.32	0.32	0.33	82.90%	
3	<i>Pseuderanthemum carruthersii</i> (Seem.) Guillaumin	20	1.51	1.53	1.54	1.53	20.73%	77.15
		40	1.33	1.36	1.38	1.36	29.53%	
		60	1.06	1.07	1.09	1.07	44.56%	
		80	0.87	0.91	0.95	0.91	52.85%	
		100	0.72	0.74	0.78	0.75	61.14%	

Graphical Data:**Figure 4:** Antioxidant assay by DPPH method**Images of the Activity:****Figure 5:** Anti-oxidant activity by DPPH method

By conducting the DPPH free radical scavenging assay, the antioxidant activity of the experimental sample *Pseuderanthemum carruthersii* (Seem.) Guillaumin extract was assessed and contrasted with the standard ascorbic acid. The findings showed that the percentage inhibition for both the plant extract and the standard increased in a concentration-dependent manner.

Pseuderanthemum carruthersii extract also demonstrated significant free radical scavenging activity, with 61.14% inhibition at 100 µg/mL. Ascorbic acid, the standard, exhibited strong antioxidant activity, with a maximum inhibition of 82.90% at 100 µg/mL.

CONCLUSION

The recent study on *Pseuderanthemum carruthersii* (Seem.) Guillaumin, which combines ethnopharmacological and modern pharmacological data, demonstrates that the plant is more than just an ornamental shrub, but also a source of bioactive substances with significant therapeutic promise. The phytochemical screening confirmed the presence of the chemical building blocks of its therapeutic qualities polysaccharides, flavonoids, proteins and alkaloids. Biological investigations have confirmed the alcoholic leaf extract's remarkable antibacterial effectiveness. It was most potent against *Bacillus subtilis* and *Escherichia coli*, least effective against *Pseudomonas aeruginosa*, and effective

against *Staphylococcus aureus*. The plant could be useful in treating some bacterial diseases based on its selective profile. The extract showed further pharmacological importance through antioxidant evaluation. The extract demonstrated a concentration-dependent free radical scavenging activity (61.14% inhibition at 100 µg/mL). Although not as potent as ascorbic acid, this activity is beneficial and validates the plant's traditional use in lowering oxidative stress and inflammation. *P. carruthersii* is essentially a potential constituent of the newer phytopharmaceuticals, rather than a conventional remedy.

Source of Support: The author(s) received no financial support for the research, authorship, and/or publication of this article

Conflict of Interest: The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

REFERENCES

1. Bac VH, Paulsen BS, Truong LV, Koschella A, Trinh TC, Wold CW, Yogarajah S, Heinze T. Neutral polysaccharide from the leaves of *Pseuderanthemum carruthersii*: Presence of 3-O-Methyl galactose and anti-inflammatory activity in LPS-stimulated RAW 264.7 cells. *Polymers*. 2019 Jul 22;11(7):1219-24.
2. Vo TN, Nguyen PL, Tuong LT, Pratt LM, Vo PN, Nguyen KP, Nguyen NS. Lignans and triterpenes from the root of *Pseuderanthemum carruthersii* var. *atropurpureum*. *Chemical and Pharmaceutical Bulletin*. 2012 Sep 1;60(9):1125-33.
3. Gâteblé G, Ramon L, Butaud JF. A new coastal species of *Pseuderanthemum* (Acanthaceae) from Loyalty Islands (New Caledonia) and Vanuatu with notes on *P. carruthersii*. *PhytoKeys* 128: 73–84 [Internet]. 2019
4. Umoh RA, Johnny II, Idio ER, Andy NA, Charles GE, Udoh AE. Pharmacognostic Studies of *Pseuderanthemum Carruthersii* (Seem.) Guillaumin (Acanthaceae) Leaf. *Nigerian Journal of Pharmaceutical and Applied Science Research*. 2025 Mar 31;14(1):9-22.
5. Batchu R, Pranathi G. Pharmacognostic and preliminary phytochemical evaluation of the leaves of *Pseuderanthemum carruthersii* (Seem) Guillaumin leaves. *Icon Res Engineer J*. 2024;7(9):67-73.
6. Manandhar S, Luitel S, Dahal RK. In vitro antimicrobial activity of some medicinal plants against human pathogenic bacteria. *Journal of tropical medicine*. 2019;2019(1):1895340.
7. Dhanavade MJ, Jalkute CB, Ghosh JS, Sonawane KD. Study antimicrobial activity of lemon (*Citrus lemon* L.) peel extract. *British Journal of pharmacology and Toxicology*. 2011 Aug;2(3):119-22.
8. Shama M, Hridhya KV, Kulandhaivel M. Evaluation of antimicrobial activity and minimum inhibitory concentration of ethanolic extract of three medicinal plants against bacteria causing skin infection. *J. Pure Appl. Microbiol*. 2018 Mar 1;12:375-9.
9. Siddartha Baliyan, Determination of Antioxidants by DPPH Radical Scavenging Activity and Quantitative Phytochemical Analysis of *Ficus religiosa*, *Molecules* 2022.

For any questions related to this article, please reach us at: globalresearchonline@rediffmail.com
New manuscripts for publication can be submitted at: submit@globalresearchonline.net and submit_ijpsrr@rediffmail.com

