



Study of Antibacterial Activity and Antioxidant Activity and Phytochemical Analysis of *Artemisia pallens*

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Abstract:

The present study investigates the antibacterial, antioxidant, and phytochemical properties of *Artemisia pallens*. Plant extracts were prepared using methanol and aqueous solvents. Antibacterial activity was assessed against *Escherichia coli*, *Staphylococcus aureus*, and *Pseudomonas aeruginosa* using the agar well diffusion method. Antioxidant activity was determined by DPPH radical scavenging assay. Phytochemical screening was performed using standard qualitative tests. The results indicated significant antibacterial activity, notable antioxidant potential, and the presence of bioactive compounds such as alkaloids, flavonoids, tannins, and phenols. These findings support the medicinal value of *Artemisia pallens* and suggest its potential application in pharmaceutical development.

Keywords: *Artemisia Pallens*, Antibacterial Activity, Antioxidant Activity, Phytochemical Analysis, Medical Plants

Introduction:

Medicinal plants have been used traditionally for the treatment of various infectious and oxidative stress-related diseases. *Artemisia* species are well known for their therapeutic properties due to the presence of diverse secondary metabolites. Antibacterial resistance has become a major global health issue, emphasizing the need for alternative natural antimicrobial agents. Additionally, antioxidants play a crucial role in preventing oxidative damage caused by free radicals. Therefore, the present study aims to evaluate the antibacterial and antioxidant potential of *Artemisia pallens* along with its phytochemical constituents.

Therefore, the present study aims:

- To evaluate antibacterial activity of *Artemisia pallens* extracts

- To determine antioxidant potential using DPPH assay
- To perform qualitative phytochemical screening
- To correlate biological activity with phytochemical constituents

Materials and Methods:

Collection and Identification of Plant Material:

Fresh leaves of *Artemisia pallens* were collected from local regions of Maharashtra. The plant was authenticated by a botanist. Leaves were washed, shade-dried for 10–15 days, and powdered using a mechanical grinder.

Preparation of Extracts:

Powdered plant material (50 g) was subjected to Soxhlet extraction using:

- Methanol
- Distilled water

Extraction was carried out for 6–8 hours.

Extracts were filtered and concentrated using a rotary evaporator. The percentage yield was calculated.

Test Microorganisms:

The bacterial strains used were:

- Escherichia coli (Gram-negative)
- Staphylococcus aureus (Gram-positive)
- Pseudomonas aeruginosa (Gram-negative)

Pure cultures were maintained on nutrient agar slants.

Antibacterial Activity – Agar Well Diffusion**Method:**

- Mueller-Hinton agar plates were prepared.
- Bacterial suspension adjusted to 0.5 McFarland standard.
- Wells of 6 mm diameter were made.
- Extracts (100 μ L) were added into wells.
- Plates were incubated at 37°C for 24 hours.
- Zone of inhibition measured in mm.
- Ciprofloxacin used as positive control.
- Sterile distilled water used as negative control.

Determination of Minimum Inhibitory Concentration (MIC):

MIC was determined by broth dilution method using serial dilutions of extracts. The lowest concentration showing no visible growth was recorded as MIC.

Antioxidant Activity – DPPH Assay:

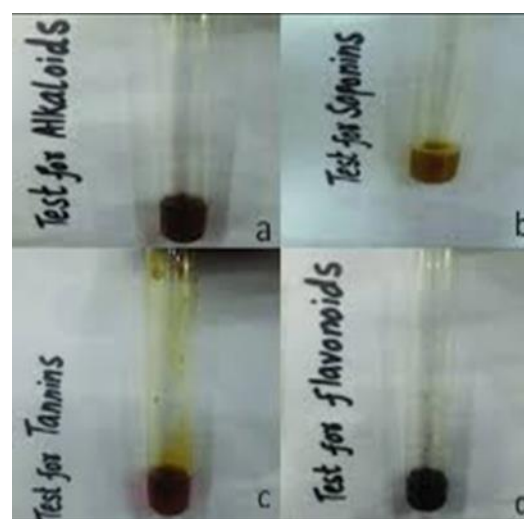
- mM DPPH solution prepared in methanol.
 - Various concentrations of extract mixed with DPPH solution.
 - Incubated in dark for 30 minutes.
 - Absorbance measured at 517 nm using spectrophotometer.
 - Ascorbic acid used as standard.
- % Inhibition calculated using formula:

$$\% \text{ Inhibition} = \frac{(\text{Control} - \text{Sample})}{\text{Control}} \times 100$$
 IC50 value was calculated.

Phytochemical Screening:

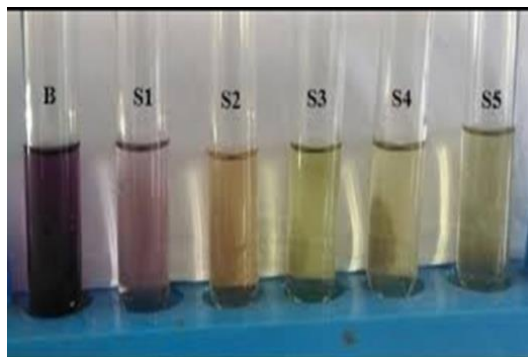
Standard qualitative tests were performed:

- Alkaloids – Mayer's test
- Flavonoids – Alkaline reagent test
- Tannins – Ferric chloride test
- Saponins – Frothing test
- Phenols – Lead acetate test
- Glycosides – Keller-Killiani test



Statistical Analysis:

All experiments were performed in triplicates. Results expressed as Mean \pm Standard Deviation. Statistical significance determined using ANOVA ($p < 0.05$ considered significant).

**Results:****Percentage Yield of Extracts:**

Methanolic extract showed higher yield (12.5%) compared to aqueous extract (8.2%).

Antibacterial Activity:

Table 1: Antibacterial Activity of *Artemisia pallens* Extracts (Zone of Inhibition in mm)

Bacterial strains	Methanolic Extract	Aqueous Extract
<i>E.coli</i>	18 \pm 0.5	12 \pm 0.4
<i>S.aureus</i>	22 \pm 0.6	15 \pm 0.5
<i>P.aeruginosa</i>	16 \pm 0.3	10 \pm 0.2

Maximum inhibition observed against *S. aureus*. MIC values ranged from 125–250 $\mu\text{g/mL}$ for methanolic extract.

Antioxidant Activity:

Methanolic extract showed higher DPPH scavenging activity.

- IC₅₀ (Methanol extract) = 62 $\mu\text{g/mL}$
- IC₅₀ (Aqueous extract) = 110 $\mu\text{g/mL}$
- IC₅₀ (Ascorbic acid) = 40 $\mu\text{g/mL}$

Activity increased with concentration.

Phytochemical Screening:

Photo chemical	Methanolic Extract	Aqueous Extract
Alkaloids	Present	Present
Flavonoids	Present	Present
Tannins	Present	Present
Saponins	Present	Absent
Phenols	Present	Present
Glycosides	Present	Present

Discussion:

The present study demonstrates significant antibacterial activity of *Artemisia pallens*, especially against Gram-positive bacteria (*S. aureus*). Gram-negative bacteria showed slightly lower sensitivity due to outer membrane barrier. Methanolic extract showed higher activity, indicating that organic solvents extract more bioactive compounds. Flavonoids and phenolic compounds are known to disrupt bacterial cell walls, inhibit nucleic acid synthesis, and interfere with enzyme systems. Antioxidant activity correlates with phenolic content. Phenols donate hydrogen atoms to neutralize DPPH radicals. The IC₅₀ value indicates strong antioxidant potential. Similar studies on *Artemisia* species reported comparable antimicrobial and antioxidant activities, supporting present findings. The statistical significance confirms reliability of results.

Limitations of Study:

- Only three bacterial strains tested
- Quantitative phytochemical analysis not performed
- No in vivo studies conducted
- No compound isolation or GC-MS analysis

Future Scope:

- Isolation and purification of active compounds
- GC-MS and HPLC analysis
- Cytotoxicity studies
- Formulation development (ointment, gel, capsules)
- In vivo animal model studies
- Synergistic studies with antibiotics

Conclusion:

Artemisia pallens exhibits promising antibacterial and antioxidant potential supported by phytochemical constituents. Further studies including isolation and characterization of active compounds are recommended for pharmaceutical applications.

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