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Bioactivity of *Pseudevernia furfuracea* Extracts: Antioxidant and Antibacterial Assessment

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INTRODUCTION & AIM

Lichens represent a unique and successful symbiotic association between a fungal partner (mycobiont) and a photosynthetic partner (photobiont), typically algae or cyanobacteria **(Parrot et *al*., 2016)**. These remarkable organisms have evolved complex biochemical pathways to survive in extreme environmental conditions, producing a diverse array of secondary metabolites with significant biological activities.

Pseudevernia furfuracea, a fruticose lichen species widely distributed across various regions, has been traditionally used in folk medicine but remains substantially underexplored in modern scientific research. Particularly in the context of Algerian biodiversity, the pharmacological potential of this species warrants comprehensive investigation. This study aims to systematically evaluate its antioxidant and antibacterial properties to assess its potential for valorization.

METHOD

Plant materiel:
Pseudevernia furfuracea was commercially acquired from a traditional herbal vendor in Naama, northwectern Algeria.

Morphological characterization

- Preliminary morphological characterization of the thallus was performed by observing general characteristics (length, width, color, branching type) and examining under a binocular loupe for presence/absence of isidia. Species identification was based on descriptions by **Aoussar et al., 2017**

Extraction procedure

- Extraction was performed via maceration using three solvents: methanol, ethyl acetate, and dichloromethane

Antioxidant activity evaluation

- Antioxidant capacity was quantified using three distinct methods: DPPH free radical scavenging assay, FRAP (Ferric Reducing Antioxidant Power) assay, and CAT (Total Antioxidant Capacity) assay

Antibacterial activity testing

- Antibacterial efficacy was evaluated using the agar diffusion technique against four ATCC-referenced bacterial strains:
  - ✓ *Enterobacter cloacae* ATCC 13047,
  - ✓ *Klebsiella pneumoniae* ATCC 700603,
  - ✓ *Staphylococcus aureus* ATCC 25923,
  - ✓ *Staphylococcus aureus* ATCC 43300.

RESU$LTS & DISCUSSION

The lichen is characterized by a fruitcose thallus. The upper surface is greyish-green, while the lower surface is black. The thallus measures 10,5 cm in length and 7,3 cm in width. The presence of isidia, serving as reproductive structures, was noted on the upper surface.

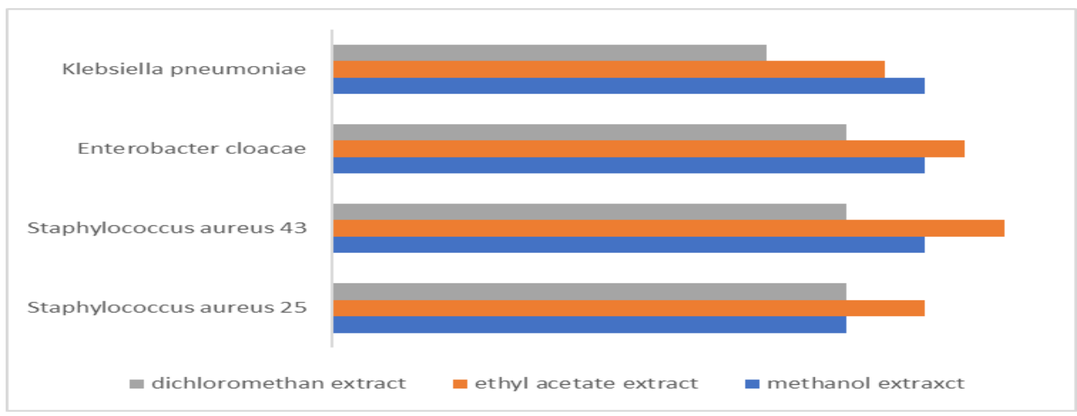
Antioxidant Activity: Quantitative Analysis

DPPH Free Radical Scavenging Assay:
The ethyl acetate extract demonstrated remarkable radical scavenging activity with an IC_{50} value of 71.72 µg/mL, indicating potent antioxidant capacity. Both methanolic and dichloromethane extracts showed significantly lower activity, requiring higher concentrations for 50% radical neutralization.

Total Antioxidant Capacity (CAT Assay)
The ethyl acetate extract exhibited the highest total antioxidant capacity, quantified at 66.66 mg EAA/g extract (Equivalent Ascorbic Acid). This substantial value confirms its richness in reducible antioxidants.

FRAP (Ferric Reducing Antioxidant Power)
Contrary to other assays, the methanolic and dichloromethane extracts demonstrated superior ferric ion reducing power compared to the ethyl acetate extract demonstrating a significant capacity to reduce Fe^{3+} to Fe^{2+}.

Antibacterial Efficacy: Zone of Inhibition Analysis



Gram-positive bacteria showed greater susceptibility than Gram-negative strains. Methicillin-resistant *S. aureus* (MRSA) was effectively inhibited by ethyl acetate extract. **Türk H et al., 2006** demonstrated that ethanol and diethyl ether extracts exhibited significant antibacterial activity against Gram-positive bacteria, notably Staphylococcus aureus.

CONCLUSION

Pseudevernia furfuracea is a rich source of bioactive compounds. The Ethyl Acetate extract is the most promising, exhibiting a powerful antioxidant properties and significant and broad-spectrum antibacterial activity. The efficacy is attributed to its richness in bioactive secondary metabolites extracted due to its optimal solvent polarity. The findings underscore the high potential of *P. furfuracea*, particularly its ethyl acetate extract, for applications in medicinal and cosmetic formulations.

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