Research paper **OP 2**

PHYTOCHEMICAL ANALYSIS, DETERMINATION OF ANTIOXIDANT, AND ANTIMICROBIAL ACTIVITIES OF LICHEN SPECIES, *Heterodermia diademata* and *Parmotrema tsavoense*

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DOI: 10.68725/FDSQ_WORKSHOP.2026.9.11

ABSTRACT

Lichens, symbiotic associations between fungi and photosynthetic partners, are increasingly recognized as prolific sources of diverse secondary metabolites with significant pharmaceutical, agricultural, and biotechnological applications. This study delves into the phytochemical composition, antioxidant properties, and antimicrobial effectiveness of two lichen species, *Heterodermia diademata* and *Parmotrema tsavoense*, particularly against phytopathogens *Xanthomonas oryzae*, *Colletotrichum gloeosporioides*, *Pyricularia oryzae*, and *Sclerotinia sclerotiorum*. Qualitative phytochemical screening revealed the presence of a variety of bioactive compounds, including alkaloids, flavonoids, phenolic compounds, tannins, and triterpenoids, indicating their rich metabolite profile and potential therapeutic value. Quantitative estimation of total phenolic content and total flavonoid content was performed using the Folin-Ciocalteu and aluminum trichloride methods, respectively, demonstrating substantial levels of antioxidant-associated compounds in both lichen extracts. The antioxidant activity of the extracts was evaluated using in vitro assays, i.e., phosphomolybdenum total antioxidant capacity, ferric reducing antioxidant power (FRAP), and 2,2-diphenyl-1-picrylhydrazyl (DPPH) radical scavenging assays. The results revealed notable antioxidant potential, which can be attributed to the abundance of phenolic and flavonoid constituents capable of neutralizing reactive oxygen species and reducing oxidative stress. Furthermore, the antimicrobial efficacy of the lichen extracts was assessed against four economically important plant pathogens, including *Xanthomonas oryzae*, *Colletotrichum gloeosporioides*, *Pyricularia oryzae*, and *Sclerotinia sclerotiorum*, using the disc diffusion method. Among them, *Parmotrema tsavoense* exhibited comparatively stronger antimicrobial activity, producing larger zones of inhibition against the targeted pathogens. The observed

antioxidant and antimicrobial activities suggest that these lichens possess significant potential as natural sources of bioactive compounds for the development of eco-friendly plant disease management strategies and novel antimicrobial formulations. Overall, the findings highlight the value of *H. diademata* and *P. tsavoense* as promising reservoirs of biologically active metabolites and provide a scientific basis for their further exploration in agricultural, pharmaceutical, and biotechnological applications. Future studies focusing on the isolation, characterization, and mode of action of individual bioactive compounds are warranted to fully exploit their practical potential.

Keywords: Antimicrobial, crop plants, lichen, plant pathogens