Short Communication *Open Access*

Journal of Psychiatric Insight Review

ISSN: 3067-9249

DOI: doi.org/10.63721/25JPIR0115

Cordyceps spp. as a Source of Bioactive Compounds with Therapeutic Potential

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Citation: Patrycja Wrońska, Katarzyna Michalak (2025) Cordyceps spp. as a Source of Bioactive Compounds with Therapeutic Potential. J. of Psy Ins Review 1(4), 01-02. WMJ/JPIR-115

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Submitted: 19.09.2025 **Accepted:** 23.09.2025 **Published:** 06.10.2025

Introduction

Cordyceps spp. are entomopathogenic fungi widely recognized for their unique capacity to synthesize secondary metabolites with diverse biological activities. Traditionally applied in Asian medicine, particularly Cordyceps sinensis and Cordyceps militaris, these fungi have recently attracted increasing attention as natural sources of compounds with pharmacological potential. The main bioactive constituents include cordycepin (3′-deoxyadenosine), polysaccharides, sterols, peptides, and phenolic derivatives, which exhibit multifunctional effects at cellular and systemic levels.

Cordycepin is the most extensively studied metabolite, displaying anticancer, immunomodulatory, anti-inflammatory, and antiviral properties through modulation of signaling pathways, induction of apoptosis, and suppression of aberrant cell proliferation. Polysaccharides isolated from Cordyceps spp. demonstrate antioxidant activity, stimulation of macrophage and lymphocyte functions, as well as regulation of glucose and lipid metabolism, which highlights their potential use in supportive therapy of metabolic and degenerative disorders. Furthermore, extracts from Cordyceps spp. have been investigated for protective effects on the cardiovascular, hepatic, and renal systems, suggesting broad therapeutic applications.

Recent biotechnological advances, including submerged fermentation and genetic engineering, have significantly improved large-scale production of bioactive metabolites, overcoming limitations related to natural sources. Such approaches enable the development of standardized preparations with defined chemical composition and reproducible biological activity. Nevertheless, challenges remain regarding clinical validation, safety assessment, and regulatory approval of Cordyceps-derived formulations.

In conclusion, Cordyceps spp. represent a promising reservoir of bioactive compounds with multifaceted therapeutic potential. Their integration into modern

pharmacology requires further elucidation of mechanisms of action, rigorous preclinical and clinical trials, as well as harmonized quality control standards to ensure safe and effective application. as well as harmonized quality control standards to ensure safe and effective application.