Gas Chromatography-Mass Spectrometry Based Identification Of Bioactive Compounds And Evaluation Of Anticancer Effects Of *Spilanthes Acmella*

Sultan Bhupen Singh,[a], Kusum Arunachalam,[a] and Kirankumar Salam[b]*

[a] School of Environment and Natural Resources, Doon University, Dehradun, India

[b] Department of Zoology, Hindu College, University of Delhi, Delhi, India

**Email of Corresponding author: bsnit290@gmail.com*

ABSTRACT

Introduction: Spilanthes acmella has been efficiently used as multidimensional traditional medicine primarily for treatment of toothache due to the presence of several bioactive compounds.

Objectives: Determination of free radical scavenging potential of *S. acmella* and its anticancer effects on cancer cell lines. Further metabolite profiling of the plant extracts to identify bioactive compounds that explains relationship with its biological activities and therapeutic applications.

Material and methods: Antioxidant potential and phytochemical constituents of *S. acmella* were analyzed by using UV-Visible spectrophotometer and metabolite profiling was performed by Chromatography-Mass Spectrometry (GC-MS). Further, anticancer effects of the plant extracts on three cancer cell lines MCF-7, A549 and Saos-2 were examined by MTT assay.

Results: The plant possesses high antioxidant potential and also contains abundant phenolics and flavonoids. The leaves of the plant showed the highest ABTS^{+} and DPPH radical scavenging potential (IC_{50} 11.92 and 14.79 µg/ml). Moreover, MTT assay illustrated significant inhibition of viability of cancer cells by the plant extracts at higher concentrations (50 and 100 µg/ml) ($p<0.05$). The flower extract exhibited the highest cytotoxic effect against the three cancer cell lines MCF-7, A549 and Saos-2 with IC_{50} values of 22.20, 18.39 and 25.98 µg/ml respectively. Metabolite profiling of the plant extracts revealed the presence of several potential compounds including four bioactive compounds that have never been reported earlier to be present in the plant namely (1) 2-Methoxy-4-vinylphenol (2) Neophytadiene (3) N-Isobutyl-10-(isobutylcarbonyloxy)(2E,6Z,8E)-decatrienamide and (4) α-tocopherol.

Conclusion: The anticancer property of *S. acmella* is likely due to entity or synergistic effects of anticancer compounds such as 2-Methoxy-4-vinylphenol, α-tocopherol, β-caryophyllene, β-caryophyllene oxide, sitosterol, stigmasterol, scopoletin, and palmitic acid present in the plant.

Keywords: Gas chromatography-mass spectrometry, Metabolite profiling, Bioactive compounds, Antioxidant, Anticancer

INTRODUCTION

The importance of several medicinal plants for treatment of numerous diseases has been reiterated around the world including ancient records of Chinese, Native Americans, Africans, Egyptians, Indian Ayurveda etc [1]. The World Health Organization (WHO) also reported a major proportion of the world population (70-80%) to depend on herbal medicines for health care activities [2]. *Spilanthes acmella* is an important medicinal plant that has been traditionally used for treatment of toothache, fever and infections. Recently the plant has been reported to exhibit anaesthetic, antipyretic, antifungal, vasorelaxant, and immunomodulatory effects [3]. The plant contains several medicinally important bioactive compounds that are produced as secondary metabolites in response to genetic as well as various biotic and abiotic stress conditions. Amongst, spilanthol has been illustrated to possess anti-inflammatory and insecticidal properties [3,4]. Besides, *S. acmella* has also been reported to contain abundant nutrient elements (K, Mg, N, Fe, Na, Mn, Cu and Zn) that play crucial roles in the growth, development and regulatory mechanisms of biological processes [5]. In recent years persistent search for potentially bioactive compounds essentially from medicinal plants has been prioritized understanding the essence of their applications in modern drug development. About 25% of modern medicines including morphine, quinine, artemisinin, paclitaxel etc. are derivatives of herbal products or their analogues [6].

While cancer is one of the major causes of death in the world that accounted for around 9.6 million deaths in 2018 [7]. It is caused as a result of complex and heterogenous mechanisms that affect various cellular signalling and regulatory pathways, consequently leading to unusual behavior of cells including incessant growth and proliferation, inhibition of apoptosis, neoangiogenesis and metastasis [8]. Moreover oxidative stress induced excessive production of free radicals and subsequent alteration cellular mechanisms through damage of DNA or mutation are associated with cancer development. In the last few decades progression of our understanding on cancer biology has changed the paradigm of cancer treatment and several key cellular signaling molecular targets have been identified. However, detrimental side effects and other limitations of the currently available anticancer drugs further necessitate a continual search for other pharmaceutically important bioactive compounds. Therefore, exploration of more effective and non-toxic compounds from