

PHYTOCHEMICAL PROFILING OF *JURINEA HIMALAICA* ROOT EXTRACT

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Abstract

The study investigated the phytochemical makeup of the methanolic root extract of *Jurinea himalaica* collected from Kala Pani region. Initial screening showed the presence of bioactive secondary metabolites such as alkaloids, flavonoids, terpenoids, steroids, saponins, glycosides, and proteins. Further analysis with LC-MS identified three major polar components apigenin, quercetin, and sucrose. These biologically active constituents support the traditional medicinal use of *J. himalaica* and suggest its potential as natural source of pharmacologically valuable active components. The harsh alpine environment containing such low temperature and high UV radiations are expected to enhance the production of these bioactive compounds. However, increasing anthropogenic pressure and habitat disturbance threaten natural population of *Jurinea himalaica*. Integrated phytochemical research, coupled with conservation and sustainable utilization strategies, is essential to preserve its medicinal and ecological significance.

INTRODUCTION

Medicinal plants provide rich bioactive secondary metabolites that are important in both traditional and modern healthcare (Hai et al., 2022). Phytochemicals like flavonoids, alkaloids, terpenoids, and glycosides have anti-oxidant, antimicrobial, and anti-inflammatory activities (Bashir et al., 2018). *Jurinea himalaica* (Asteraceae) is used in northern areas for various therapeutic purposes, but little is known about its phytochemical composition. Similar species like *J. himalaica* and *J. macrocephala* contain sesquiterpene lactones and phenolic acids. *J. himalaica* may have a similar phytochemical profile (Kumar & Agnihotri, 2020). Ethno-medicinal surveys suggest *J. himalaica* may contain

flavonoids, tannins and phenolics like other wild medicinal plants in the region (Ijaz et al., 2019). Given its potential value and limited distribution, *J. himalaica* needs conservation and phytochemical research to ensure sustainable management (Raj et al., 2019). Detailed phytochemical analysis of *J. himalaica* confirmed the presence of secondary metabolites which exhibit antioxidant, enzyme inhibition and phytotoxic activities (Ullah et al., 2026). The harsh environment and climate changes affect the production of these compounds, affecting the plant's phytochemical makeup (Vats & Ahuja, 2013). Recent documentation and protection of phytochemical knowledge are crucial to ensure

ethical use and benefit sharing for species like *J. himalaica* (Sharma et al., 2024). This study performed a preliminary phytochemical screening and LC-MS analysis of the methanolic root extract of *J. himalaica* to fill that gap.

1. Materials and Methods

1.1. Plant Material and Extraction

Roots of *Jurinea himalaica* were gathered from the kala pani region. The plant material was dried in the shade, powdered, and then extracted with methanol. The resulting extract was filtered and methanol. The resulting extract was filtered and concentrated for subsequent phytochemical and LC-MS analysis.

1.2. Preliminary Phytochemical Screening

Qualitative test was carried out to identify alkaloids, flavonoids, glycosides (Raghuvanshi et al., 2021) it may also contain some carbohydrates, phenols, anthraquinones, and anthocyanin (Alamgir, 2017).

2.1. Primary phytochemical screening

Table 1. Phytochemical constituents of *Jurinea himalaica* root extract

Phytochemical Class	Result
Alkaloids	+
Anthraquinones	–
Anthocyanin	–
Proteins & Amino acids	+
Carbohydrates	–
Phenols	–
Terpenoids	+
Steroids	+
Saponins	+
Glycosides	+
Flavonoids	+

2.2. LC-MS identified compounds

Table 2. LC-MS identified compounds

Compound	Molecular Formula	Observed m/z	RT (min)	Ion Type	MS/MS Fragments
Apigenin	C ₁₅ H ₁₀ O ₅	271.0601	6.1	[M+H] ⁺	205.0, 251.0
Quercetin	C ₁₅ H ₁₀ O ₇	303.0499	7.0	[M+H] ⁺	287.9, 269.0
Sucrose	C ₁₂ H ₂₂ O ₁₁	343.1235	6.8	[M+H] ⁺	329.0, 259.2

1.3. LC-MS Analysis

The methanolic extract was examined using reverse-phase HPLC (Thermo Ultimate 3000) linked to Bruker maXis UHR-QTOF-MS. A mobile phase consisting of 0.1% formic acid and methanol was employed. The injection time was 0.5 min, with a 10min equilibrium time (Ullah et al., 2026). Data processing was performed with Bruker target analysis software (version 1.3).

2. Results

Analysis with LC-MS identified three major polar components apigenin, quercetin, and sucrose (Ahmed et al., 2020). The biologically active constituents support the traditional medicinal use of *J. himalaica* and suggest its potential as natural source of pharmacologically valuable active components (Thakur et al., 2026). Low temperature and high UV radiations are expected to enhance the production of these bioactive compounds (Barik et al., 2018).

TIC (comparative ion chromatogram) of methanolic extract of *Jurinea himalaica*

TIC (comparative ion chromatogram) of methanolic extract of *Jurinea himalaica* acquired.

The basic peak chromatograms of roots and the TIC chromatograms of roots (figures given beneath) (Ullah et al., 2026).

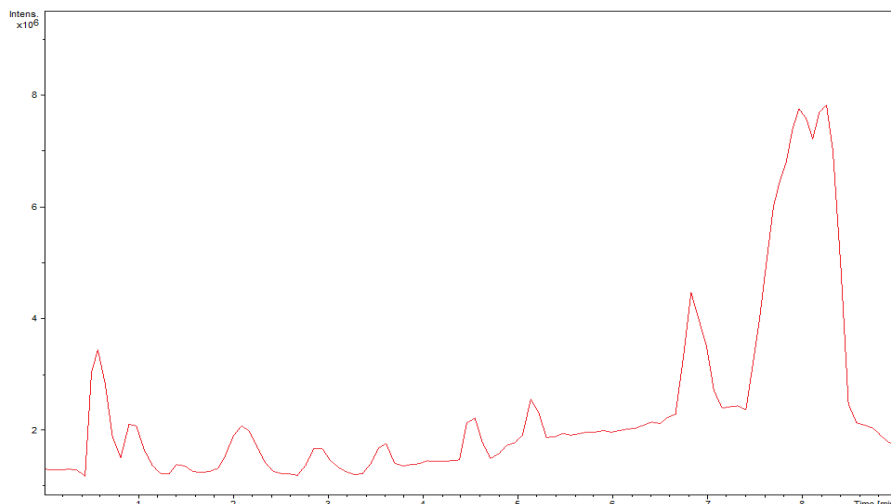


Figure 2.1. Broad bend chromatogram of LC-MS analysis for the root extract of *Jurinea himalaica*

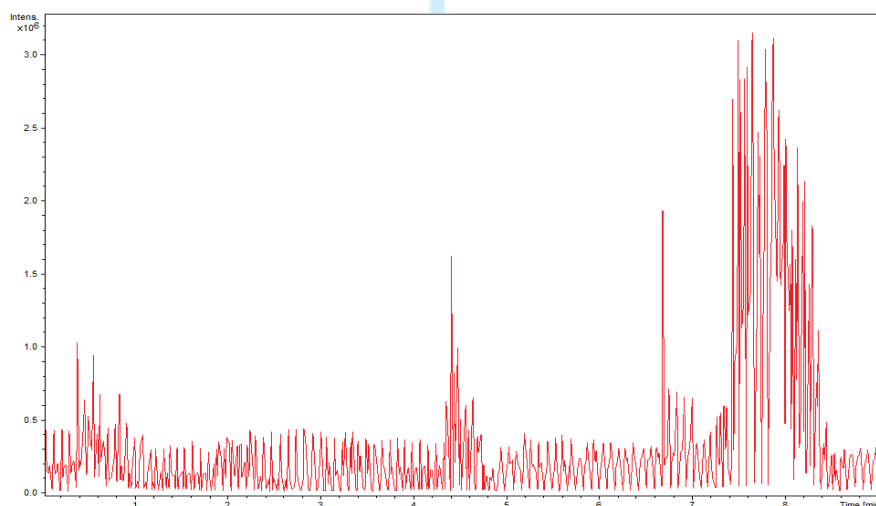


Figure 2.2. LC-MS analysis of *Jurinea himalaica*

For further compound identification, the obtained data from LC-MS was further analyzed with Bruker target analysis (1.3 version). Mass data, chemical formula, retention time, accurate masses and ppm errors used for compound identification. (Kumar & Agnihotri, 2020)

The first step was TIC scan for each sample in positive mode or negative mode. Target analysis was the second step where index of plants screened against the LC-MS to generate several

variables i.e. Compound name, m-sigma value, molecular formula and ppm errors etc. The last step was compass data analysis used to obtained EIC analyte and used to create MS/MS data for specific compound characterization.

These procedures were used for the identification of 3 compounds from the roots of *Jurinea himalaica*. The LC and mass spectra of the compounds 1-3 along with their description shown in figures.

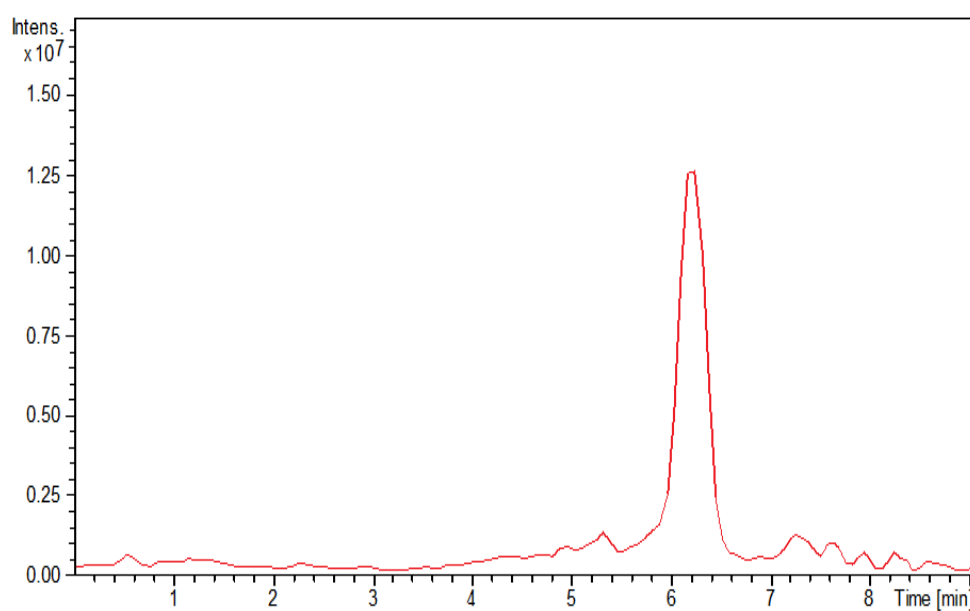


Figure 2.3. LC spectra of Apigenin

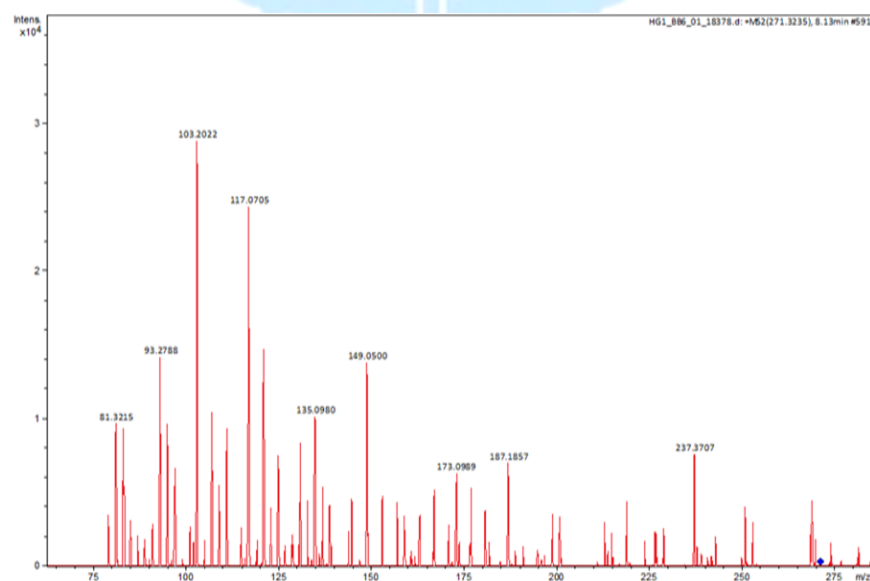


Figure 2.4. MS spectra of Apegnin

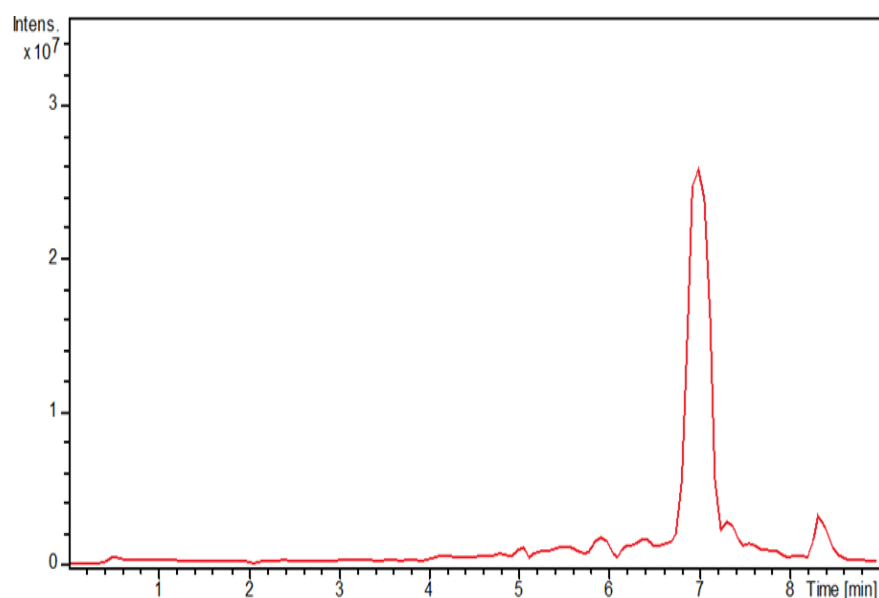


Figure 2.5. LC Spectra of Quercetin

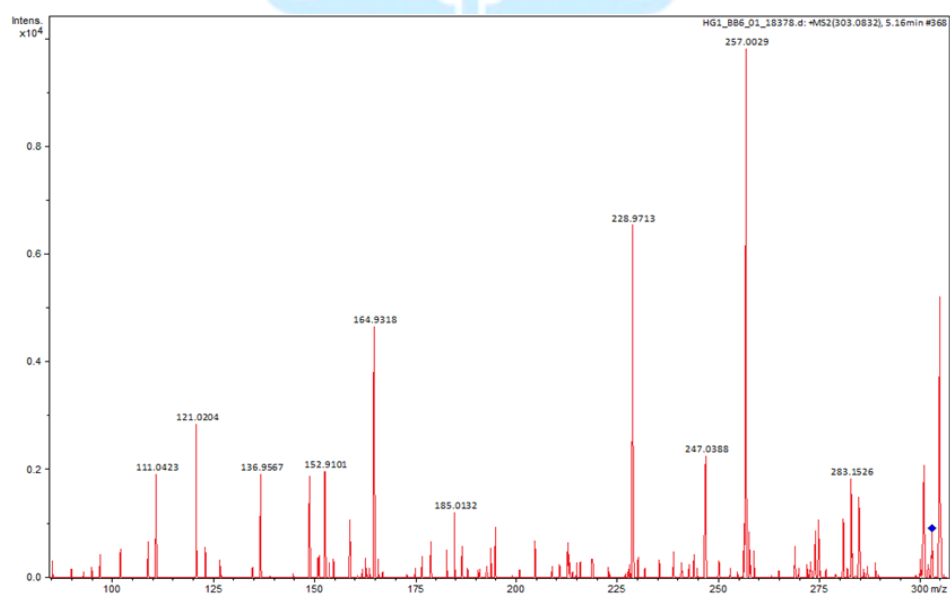


Figure 2.6. Mass Spectra of Quercetin

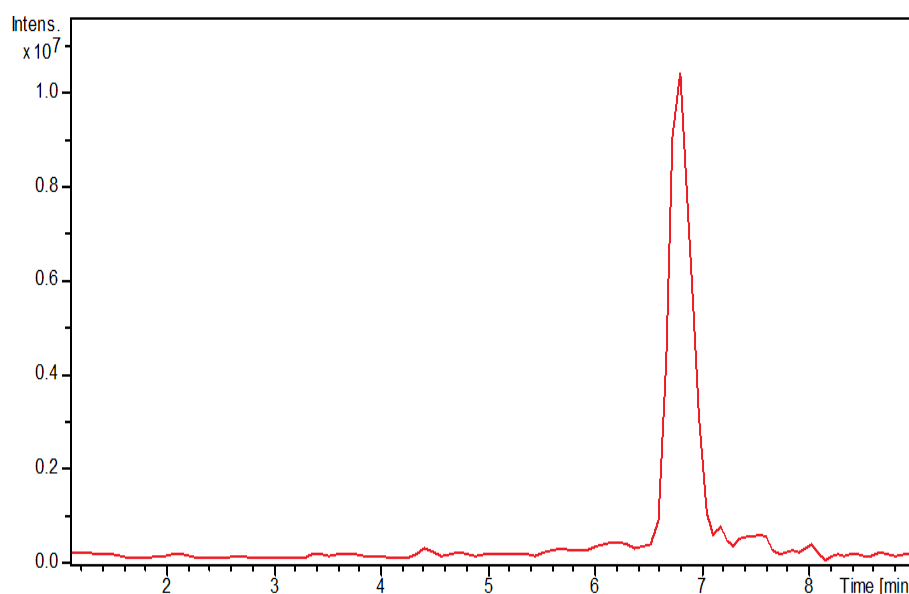


Figure 2.7. LC Spectra of Sucrose

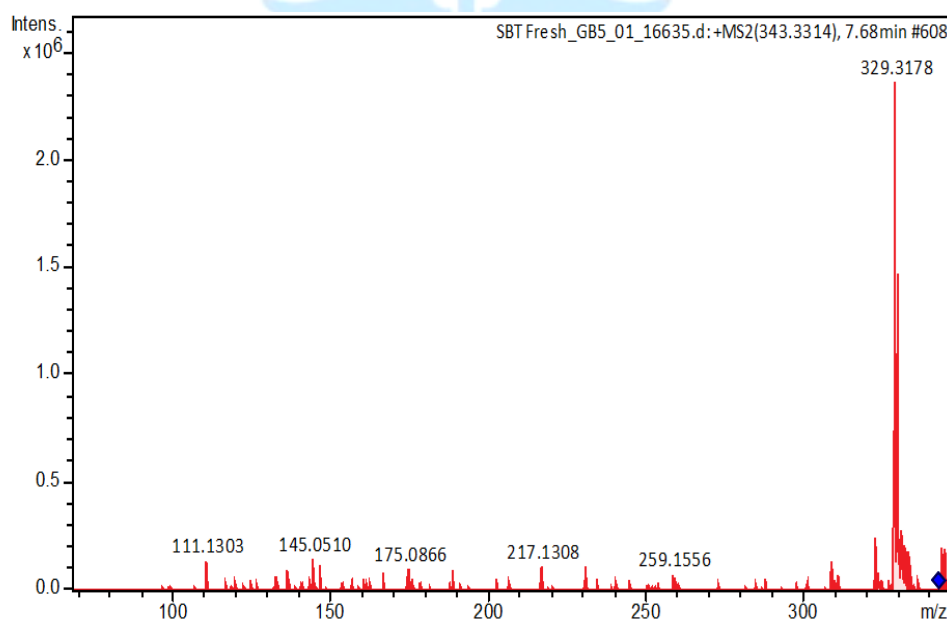


Figure 2.8. Mass Spectra of Sucrose

3. Discussion

The detection of specific flavonoids apigenin and quercetin in *Jurinea himalaica* confirms that the plant possesses potent antioxidant and anti-inflammatory properties. These phytochemicals are extensively documented for their therapeutic applications in medicine. The preliminary phytochemical screening also revealed multiple classes of secondary metabolites

including phenolics, glycosides, and other flavonoid derivatives indicating a broad and diverse chemical profile. Local communities value medicinal plants with bioactive compounds, highlighting the need to study *J. himalaica*'s phytochemistry (Hussain et al., 2024). The finding endorses the traditional medical use of *J. himalaica* and suggests it is a valuable source of

bioactive natural products that could be exploited for drug discovery.

4. Conclusion

The methanolic extract of *Jurinea himalaica* root contain a rich assortment of secondary metabolites such as flavonoids, sugar and related phytoconstituents. liquid chromatography-mass spectrometry (LC-MS) analysis verified the presence of notable flavonoids such as apigenin, quercetin and sugar moieties. Consequently, the plant demonstrates considerable potential for further pharmacological investigations and drug development programs aimed at isolating and optimizing its bioactive components.

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