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# Bee Pollen Extracts: Chemical Composition, Antioxidant Properties, and Effect on the Growth of Selected Probiotic and Pathogenic Bacteria

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**Citation:** Ilie, C.-I.; Oprea, E.; Geana, E.-I.; Spoiala, A.; Buleandra, M.; Gradisteanu Pircalabioru, G.; Badea, I.A.; Ficai, D.; Andronescu, E.; Ficai, A.; et al. Bee Pollen Extracts: Chemical Composition, Antioxidant Properties and Effect on the Growth of Selected Probiotic and Pathogenic Bacteria. *Antioxidants* **2022**, *11*, 959. https://doi.org/10.3390/antiox11050959

Academic Editors: Evangelos Zoidis

Received: 8 April 2022
Accepted: 10 May 2022
Published: 12 May 2022



**Abstract:** This paper evaluated the chemical and biological properties of bee pollen samples from Romania. Firstly, the bee pollen alcoholic extracts (BPEs) were obtained from raw bee pollen harvested by *Apis mellifera carpatica* bees. The chemical composition of BPE was obtained by determination of total phenol content and total flavonoid content, UHPLC-DAD-ESI/MS analysis of phenolic compounds, and GC-MS analysis of fatty acids, esters, and terpenes. Additionally, the antioxidant activity was evaluated by the Trolox Equivalent Antioxidant Capacity method. Furthermore, the biological properties of BPE were evaluated (antimicrobial and cytotoxic activity). The raw BP samples studied in this paper had significant phenolic acid and flavonoid content, and moderate fatty acid, ester, and terpene content. P1, P2, and P4 have the highest TPC and TFC levels, and the best antioxidant activity. All BPEs studied had antimicrobial activity on pathogenic strains isolated from the clinic or standard strains. A synergistic antimicrobial effect of the BPEs was observed along with the soluble compounds of *L. rhamnosus* MF9 and *E. faecalis* 2M17 against some pathogenic (clinical) strains and, considering the tumour proliferation inhibitory activity, makes BP a potential prebiotic and antitumour agent for the gut environment.

**Keywords:** bee pollen; phenolic compounds; antimicrobial activity; prebiotics; tumour proliferation inhibitory agents

Supplementary material

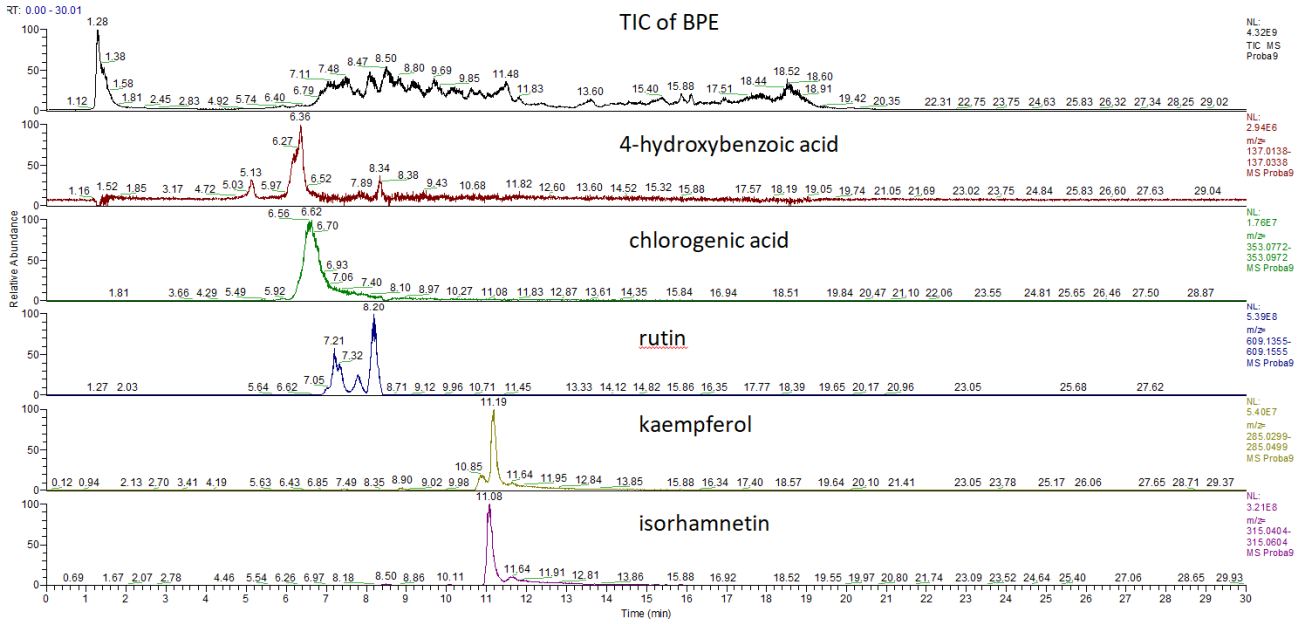


**Figure S1.** TIC and the extracted chromatograms of the main phenolic compounds identified in BPE (the chromatogram were extracted from TIC using a 5 ppm mass accuracy window; negative ion mode, full scan, mass range 100-1000 m/z).