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In recent years, there has been a growing interest in identifying and valorizing plant-derived natural products with potential applications in the food, pharmaceutical, cosmetic, and agricultural sectors. Although the seeds and oil of Helianthus annuus L. have traditionally been the primary focus of research and utilization, sunflower aerial parts (particularly the reproductive structures) are known to be rich in various biologically active compounds that may exhibit antimicrobial, antioxidant, and anti-inflammatory properties. However, this aspect remains underexplored. In this context, the aim of the present study was to determine the phytochemical composition of the volatile and lipophilic fractions extracted from sunflower petals, with an emphasis on identifying bioactive compounds of potential industrial relevance. Samples were collected from a single hybrid cultivated in three distinct agro-ecological locations in the Republic of Moldova during the full flowering stage. The petals were subjected to two standard extraction techniques: steam distillation using a Clevenger-type apparatus for volatile oils, and Soxhlet extraction for non-polar compounds. The resulting extracts were analyzed by gas chromatography coupled with mass spectrometry (GC-MS), allowing for both qualitative and quantitative identification of phytochemical constituents. GC-MS analysis of the volatile oil extracts revealed a complex mixture of more than 50 individual components, with notable differences in composition across the three sites. The major compound identified was α-pinene, a compound known for its anti-inflammatory properties. Its content ranged from 66.71% to 77.62% of the volatile oil, depending on the locality. Other abundant terpenes included β-felandrene, γ-terpinene, α-gurjunene, α-terpineol, and terpinen-4-ol. Differences in the abundance of these compounds suggest that environmental factors, such as temperature, soil composition, and humidity, may significantly influence the biosynthesis of secondary metabolites in sunflower petals. The non-polar fractions yielded a similarly diverse composition, with a total of 27 identified compounds. The total terpene content in these fractions exceeded 67% in all three samples, highlighting their dominance in sunflower petal extracts. The identified compounds included monoterpenes, diterpenes, triterpenes, sesquiterpenes, long-chain alkanes, fatty acids, and fatty acid esters. Diterpenes accounted for the largest proportion of identified compounds, with α- and β-pimaric acids reaching concentrations of up to 17%. The comparative chemical profiling of samples from different locations demonstrated both qualitative and quantitative variability, indicating genotype × environment interactions in the biosynthesis of volatile and lipophilic phytochemicals. These findings support the notion that sunflower petals, often considered agricultural waste, can be repurposed as valuable raw material for natural product extraction. Their diverse composition of terpenes, fatty acids, sterols, and antioxidant molecules underscores their potential for industrial utilization, particularly in the development of health-promoting or functional products.