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Honeybees play a crucial role in maintaining plant diversity through pollination, thereby supporting ecosystem stability. However, the adverse effects of climate change on bee populations and the quality of honeybee products are an increasing global concern.

Portugal possesses significant potential for beekeeping due to its favorable climatic conditions and diverse vegetation. However, according to data from the National Institute of Statistics, honey production in Portugal has declined by more than 20% since 2022, which is caused by climatic shifts. A key step in formulating effective mitigation strategies of environmental impact is closely monitoring the compositional changes in honey in response to environmental variations, which is particularly relevant in regions where honey is certified as a product with a protected denomination of origin (PDO). This study aims to analyze honey samples from five different regions of Portugal with honey certified as PDO, "Mel do Parque de Montesinho", "Mel de Barroso", "Mel da Terra Quente", "Mel da Serra da Lousã" and "Mel do Ribatejo Norte" and evaluate their potential for distinguishing regional variations. The findings indicate that the botanical origin of the samples was mostly polyfloral, while the monofloral honeys were *Castanea* sp., *Echium* sp., *Erica* sp., *Lavandula* sp., *Rubus* sp., and *Stachys* sp. The total phenolic and flavonoid contents were 17-136 mg GAE/100g and 1.5-7.7 mg QE/100g, respectively. The fructose, glucose and maltose contents varied between 35-44 g/100mL, 22-31 g/100mL, and 3.0-6.5 g/100mL, respectively. Additionally, some honey samples contained low concentrations of rare sugars, including turanose, kojibiose, melibiose, and raffinose. The findings of this study contribute to the development of methodologies for assessing honey based on regional and climatic characteristics and will serve as the scientific information required to update the certification parameters for those PDOs.

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