Multi-Elemental Analysis Using Inductively Coupled Plasma Mass Spectrometry for the Geographical Origin Discrimination of Greek Giant Beans "Gigantes Elefantes"

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Abstract : "Gigantes Elefantes" is a particularly dynamic crop of giant beans cultivated in western Macedonia (Greece). This variety of large beans growing in this area and specifically in the regions of Prespes and Kastoria is a protected designation of origin (PDO) species with high nutritional quality. Mislabeling of geographical origin and blending with unidentified samples are common fraudulent practices in Greek food market with financial and possible health consequences. In the last decades, multi-elemental composition analysis has been used in identifying the geographical origin of foods and agricultural products. In an attempt to discriminate the authenticity of Greek beans, multi-elemental analysis (Ag, Al, As, B, Ba, Be, Ca, Cd, Co, Cr, Cs, Cu, Fe, Ga, Ge, K, Li, Mg, Mn, Mo, Na, Nb, Ni, P, Pb, Rb, Re, Se, Sr, Ta, Ti, Tl, U, V, W, Zn, Zr) was performed by inductively coupled plasma mass spectrometry (ICP-MS) on 320 samples of beans, originated from Greece (Prespes and Kastoria), China and Poland. All samples were collected during the autumn of 2021. The obtained data were analysed by principal component analysis (PCA), an unsupervised statistical method, which allows for to reduce of the dimensionality of the enormous datasets. Statistical analysis revealed a clear separation of beans that had been cultivated in Greece compared with those from China and Poland. An adequate discrimination of geographical origin between bean samples originating from the two Greece regions, Prespes and Kastoria, was also evident. Our results suggest that multi-elemental analysis combined with the appropriate multivariate statistical method could be a useful tool for bean's geographical authentication. Acknowledgment: This research has been financed by the Public Investment Programme/General Secretariat for Research and Innovation, under the call "YPOERGO 3, code 2018SE01300000: project title: 'Elaboration and implementation of methodology for authenticity and geographical origin assessment of agricultural products.

Keywords : geographical origin, authenticity, multi-elemental analysis, beans, ICP-MS, PCA

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