First Joint Meeting on Soil and Plant System Sciences (SPSS 2019)
"Natural and Human-induced Impacts on the Critical Zone and Food Production"
Bari, Italy • 23-26 September 2019

New chemiometric technique applied to traceability of Sicilian honey of Sulla (Hedysarum coronarium L.)

A. Ioppolo, M. Barbera, A. Vella, F.Saiano, E. Palazzolo

Department of Agricultural, Food and Forestry Sciences, University of Palermo, Palermo, Italy

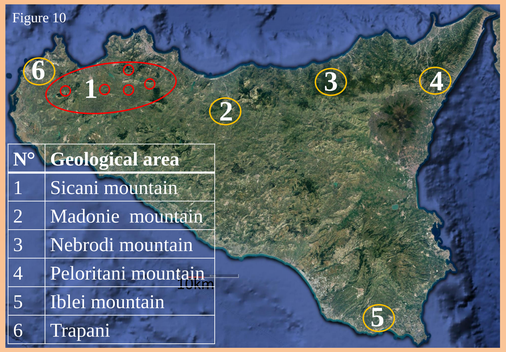
Introduction

The consumers have an increasing interest in food traceability concerning safety, quality and typicality issues. Furthermore, the possibility of tracing the origin of foodstuff is assuming an increasingly important role at the legislative level, as a tool that may allow to prove on product authenticity and to control adulteration. In the last years, several of analytical techniques have been tested to find ways to establish the geographical origin of different kinds of food and many works reported that the combination of different analytical methods associated a multifactorial analysis of the data seems to be the most promising system to establish univocal traceability systems. The honey is a natural food well appreciated in the world and the detection of potential fraud could be favored through tools linking the chemistry composition of this production to producing area. Recent works have been demonstrated the potentiality of the study of the distribution patterns of rare earth as a promising analytical method for traceability of food products due to the coherent and predictable chemical behavior of these compounds. Also, it has been demonstrated that their distribution in soil keeps unaltered in plants growing on that soil and eventually in agricultural products obtained from those plants and through the normalization of the REEs distribution, it is possible to appreciate their relative enrichments in soil-plant-agrofood products.

Objectives:

The aim of the research was to observe if the REEs normalized pattern of honey of Sulla (Hedysarum coronarium L.) was kept unaltered respect the soils of production to establish a correlation between geographic area and honey product.

Figure 10



N°	Geological area
1	Sicani mountain
2	Madonie mountain
3	Nebrodi mountain
4	Peloritani mountain
5	Iblei mountain
6	Trapani

Materials and methods

For this study, different production areas of Sulla in Sicily in "Sicani mountain" were considered (Fig 10). The production fields explored by the bees within 2 km of the hives were taken into consideration, the soil and the flowering plants were sampled. Flowers and leaves were analyzed from the plant. In the hive, pollen and honey were taken in three different days during the flowering period of the Sulla. The same areas were sampled by applying the same method in different periods in which other types of monofloral honey (Cardo) were produced, these samples were used for comparison. In this first study, the REE approach, give very intriguing results in the geographical traceability of honey samples. Aliquots of the sample (soil, leaves, flower pollen, and honey) dried at 105 ° C and ground, were mineralized (M) in Teflon containers with HNO_3 and H_2O_2 concentrated in a microwave oven. Quantitative analysis of REEs (Y, La, Ce, Pr, Nd, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu) was performed with an Agilent ICP-MS 7500ce, operating in mode quantitative with external calibration and internal standard online (^{187}Re 1mg L^{-1}). The REEs amount, expressed in the graphs below in nmol kg^{-1} of dry matter, the HREEs/LREEs relations (Figure 5) and their distribution in the leaves, flower, and pollen Sulla plants with respect to the own soil were determined and calculated. Furthermore, the REEs obtained from the honey of Sulla have been compared with those of other commercial honeys coming from different geographic and geomorphological areas.

Results:

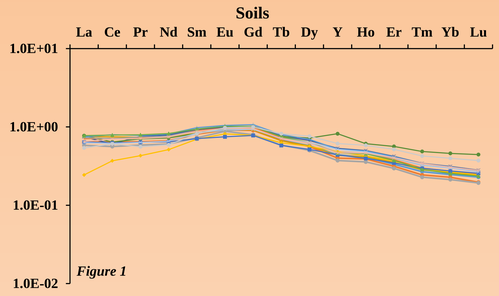


Figure 1

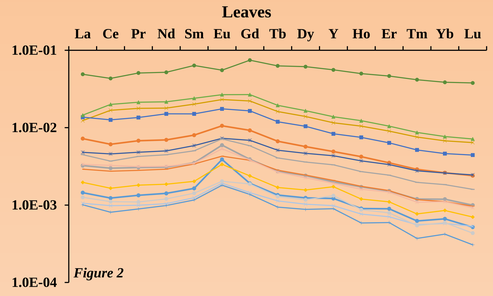


Figure 2

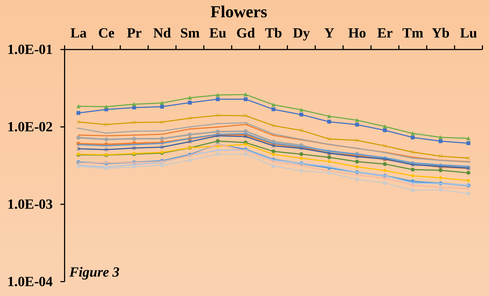


Figure 3

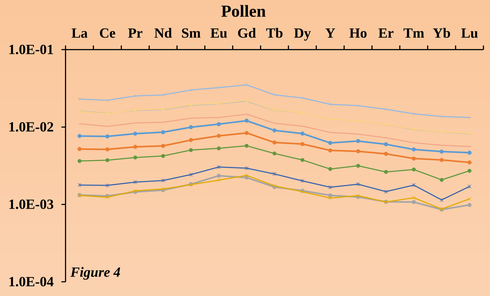


Figure 4

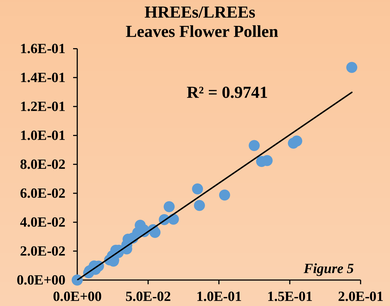


Figure 5

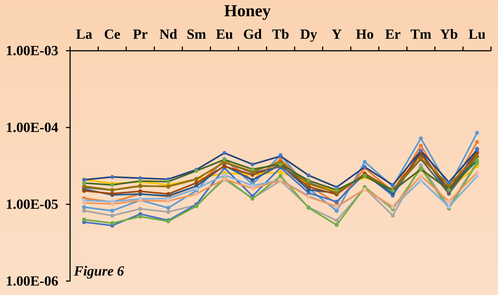


Figure 6

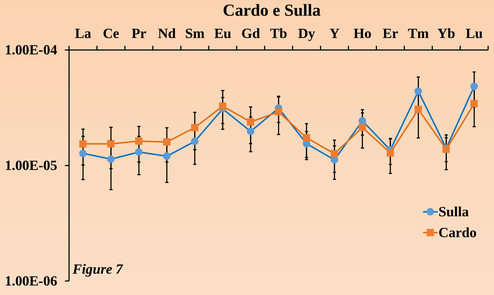


Figure 7

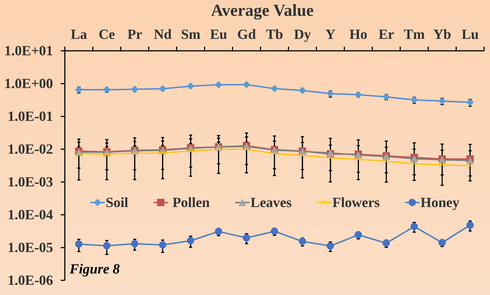


Figure 8

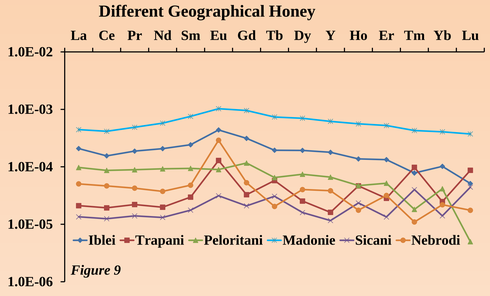


Figure 9

The good spatial homogeneity of the studied area is given by the values of the standard deviations found among the samples that reflect the hypothesis of "similar area" (Figure 8), in the REE model. The REE model shows a strong similarity within the different parts of the SULLA plant, as can be seen in the various graphs (Figure 2,3,4); furthermore, all retain the imprint of the soil, this is evident in Figure 8 where among the different parts of the plant (leaves, flowers, and pollen) there are no significant differences both in terms of footprint and in quantitative terms. Furthermore, for honey we can say that even here there is a good homogeneity of the sample, both as regards honey compared to thistle honey, as shown in Figure 7, there are no significant differences between the honey of the two species. Applying the REE technique to commercial honey with a known geographical origin (Figure 9) shows that the different kinds of honey differ from one another by having different imprints.

Conclusions

- **The plant fails to discriminate REE against them and maintains the imprint of the soil**
- **The REE trend depends on the geochemical origin of the soil.**
- **The REE technique is not valid for distinguishing the honey of different species in a similar geographic area.**
- **The REE technology can be applied to distinguish honey from different geographical areas**