



H.F.R.I.
Hellenic Foundation for
Research & Innovation

TRUFFLES OF GREECE

Proposal ID: 01057

Description of the funded research project
2nd Call for H.F.R.I. Research Projects
to Support Post-Doctoral Researchers

Title of the research project: Diversity, phylogeny and chemical characterization of *Tuber* species from Greece – Establishment of fungal inocula to foster truffle cultivation on native plants

Principal Investigator: Elias Polemis

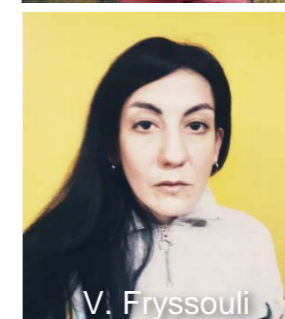
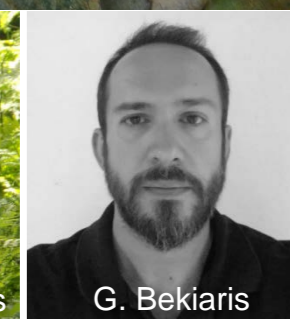
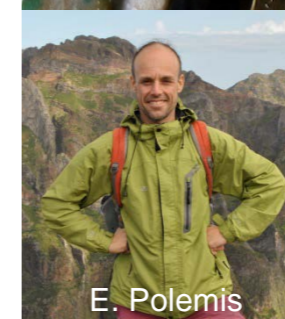
Reader-friendly title: TRUFFLES OF GREECE

Scientific Area: Agricultural Sciences–Food Science & Technology

Institution and Country: Agricultural University of Athens (AUA), GREECE

Host Institution: Laboratory of General and Agricultural Microbiology, Department of Crop Science (AUA)

Collaborating Institution(s): Laboratory of Chemistry, Department of Food Science and Human Nutrition (AUA)



Budget: 169,188.00

Duration: 36 months

Research Project Synopsis

This project aims to assess the diversity and distribution of *Tuber species* in Greece, to determine the content of selected elements and compounds in their ascomata (truffles), and to develop fungal inocula which will contribute at promoting/optimizing truffle cultivation under local conditions.

Therefore, the following objectives are set:

- **Objective 1:** Assessment of the diversity, distribution and phylogenetic relationships of *Tuber* species from Greece through a multidisciplinary approach, involving the implementation of morphoanatomical and molecular methodologies.
- **Objective 2:** Characterization of *Tuber* species from Greece with high gastronomic/commercial importance by determining/evaluating their volatile organic compounds (VOCs).
- **Objective 3:** Development of methods for the discrimination and authentication of *Tuber* taxa with emphasis on species of special commercial interest on the basis of their elemental profile (including rare earth elements, REEs), VOCs content and FTIR spectra in correlation with geographical origin and host preference.
- **Objective 4** Establishment of inocula deriving from indigenous *T. aestivum* truffles to develop optimized colonization of selected native plants.

Project originality

The genus *Tuber* is very well documented in Europe and large diversity of *Tuber* spp. is reported in the wider Mediterranean region; however, the Balkan area is poorly investigated and most likely the home of unreported -possibly- endemic species. The high rates of reported endemism and the remarkable diversity of habitats in Greece suggest that the number of existing truffle species is largely underestimated at national scale. Moreover, since the vast majority of the existing truffle identifications in Greece are based only on morphological criteria, the use of molecular approaches is absolutely necessary to confirm the validity of pertinent knowledge through large-scale sampling and the implementation of a holistic taxonomic approach involving the implementation of morphoanatomical and molecular methodologies.

The content of volatile organic compounds (VOCs) differs among various species and is influenced by the geographic area and collection season. A detailed evaluation of truffles VOCs would provide a species-specific chemical profile, which could be of significant value when developed as a biomarker/fingerprint for rapid determination of geographical and/or plant-host origin, conferring thus at minimizing fraud incidents in marketed products. Similarly, the use of elemental profile (including rare earth elements) obtained through Inductively Coupled Plasma Mass Spectrometry (ICP-MS) will be exploited as a possible reliable authenticity indicator.

FTIR spectra will be used to develop fast and inexpensive alternative methods for identifying truffle species/strains, while the use of multivariate analysis incorporating data obtained by FTIR, GC-MS (e.g. VOCs) and ICP-MS (e.g. REEs) could lead to the development of chemometric prediction models and authentication tools which are valuable in commercial applications related to truffle trade.

Expected results & Research Project Impact

- The implementation of this project is considered of high importance since new knowledge will be generated on the evolutionary history of the genus *Tuber* and the phylogeny and diversity of *Tuber* species occurring in the Balkan Peninsula, the wider Mediterranean region and in Greece.
- A library with FTIR spectra of indigenous truffle species will be constructed for the first time to provide valuable information.
- The determination of VOCs profile in several *Tuber* species of gastronomic interest will provide significant information related with their chemical characterization and will foster the potential of their commercial use/exploitation.
- The elemental profile of different *Tuber* species along with the previously acquired results from the VOCs chromatograms and FTIR spectra, will provide for the first time a robust database/tool for the authentication of truffle species.
- Establishment of suitable truffle inocula and elucidation of truffles/host-plants colonization dynamics will yield valuable data regarding further development of truffle cultivation in Greece. Moreover, it will provide information to be readily applied in commercial truffle cultivation with apparent benefits to the social life of rural communities.
- Collaboration with amateur mycologists and truffle hunters in Greece, the setting-up and operation (for the first time) of a network of “citizen-scientists’ who will participate and confer in a research study is of great importance for the wider scientific community and could be expanded in other domains.

The importance of this funding

Thanks to H.F.R.I. funding the Principal Investigator will have the opportunity to study in depth one of the most important genera of fungi worldwide, by supervising for the first time a scientific team or pioneering young Greek researchers, in collaboration with local citizen scientists, truffle hunters and traders. Among the members of the team V. Daskalopoulos will deploy the outcomes of this research in his ongoing Ph.D. studies, while the others will greatly expand their expertise to a subject that they have never worked with before, namely truffles. In short this funding will help both the PI and the members of the team to increase their scientific impact and will contribute to the existing knowledge regarding a unique natural product of high culinary and economical value.



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