FunShield4Med

SHIELDING FOOD SAFETY AND SECURITY BY ENABLING THE FORESIGHT OF FUNGAL SPOILAGE AND MYCOTOXINS THREATS IN THE MEDITERRANEAN REGION UNDER CLIMATE CHANGE CONDITIONS

D1.3 - Mid-Term Progress Report

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ACRONYMS LIST

ITAP	Institute of Technology of Agricultural Products
ELGO	Ellinikos Georgikos Organismos (Hellenic Agricultural Organisation)
EC	European Commission
HE	Horizon Europe EU Framework Programme for Research and Innovation
R&I	Research and Innovation
UNIPR	University of Parma
NKUA	National Kapodistrian University of Athens
UdL	University of Lleida
MS	Member States
CU	Cranfield University
AP	Associate Partner
SO	Specific Objectives
ATB	Agricultural Engineering and Bioeconomy
CIHEAM	International Centre for Advanced Mediterranean Agronomic Studies
ETSEAFiV	Higher Technical School of Agri-Food Engineering, Forestry, and Veterinary
UM	University of Malta
PRIMA	Partnership for Research and Innovation in Mediterranean Area
WIDERA	Widening participation and strengthening the European Research Area
GA	Grand Agreement
COO	Coordination
UniWA	University of West Attica
ONIRIS VetAgroBio	Nantes-Atlantique national veterinary, agrifood, and food school
IRTA	Institute of Agrifood Research and Technology
VUB	Vrije University of Brussels
USC	University of Santiago de Compostela
MSCA	Marie Skłodowska-Curie Actions
STSE	Short Time Staff Exchange (short secondment)
AFB1	Aflatoxin B1
MS	Mass Spectrometry
HR	High Resolution
CO_2	Carbon dioxide
JRP	Joint Research Project

M1-M16	Month 1 to Month 16
IEK	Vocational Training Institute
IAFP	International Association of Food Protection
SEO	Syndesmos Ellinikou Oinou (Greek Wine Federation)
OTA	Ochratoxin A
ELISA	Enzyme Linked Immunosorbent Assay
LC	Liquid Chromatography
SALLE	Salting-out assisted liquid-liquid extraction
HPLC	High Performance Liquid Chromatography
LC-QQQ-MS	Liquid Chromatography Triple Quadrupole Mass Spectrometry
ESR(s)	Early-Stage Researcher(s)
ECS(s)	Early Career Scientist(s)
MBK	MikroBioKosmos
WT	Working Teams
EFSA	European Food Safety Authority
Afs	Aflatoxins
AOH	Alternariol
AME	Alternariol monomethyl ether
ENNs	Enniatins
BEA	Beauvericin
PAT	Patulin
CIT	Citrinin
FBs	Fumonisins
TCT	Trichothecenes
DON	Deoxynivalenol
ZEN	Zearalenone
MRM	Multiple reaction monitoring
UPLC	Ultra Performance Liquid Chromatography
QuEChERS	Quick, Easy, Cheap, Effective, Rugged, and Safe
IAC(s)	Immuno-Affinity Column(s)
RASFF	Rapid Alert System for Food & Feed
FLD	Fluorescence Detector
ALT	Altenuene

TEN	Tentoxin
TeA	Tenuazonic acid
ATX-I	Altertoxin-I
ESI	Electro-Spray Ionisation
LOD	Limit Of Detection
LOQ	Limit Of Quantification
EC	European Commission
CAP	Cold Atmospheric Plasma
RONS	Reactive Oxygen And Nitrogen Species
QMEA	Quantitative Mycotoxin Exposure Assessment
DEC	Dissemination, Exploitation, Communication
DMP	Data Management Plan
DOI	Digital Object Identifier
STEV(s)	Short-Term Experts Visit(s)
QA/QC	Quality Assurance and Quality Control
AUA	Agricultural University of Athens

EXECUTIVE SUMMARY

FunShield4Med aims at the reinforcement of Research and Innovation (R&I) capacity of the Institute of Technology of Agricultural Products of the Hellenic Agricultural Organisation – DIMITRA (ELGO-ITAP), taking into consideration a special provision for upgrading project management and administrative skills of the institute's personnel. To achieve its scope FunShield4Med have built a network of excellence between the widening country participant and coordinator, ELGO-ITAP, and the 4 advanced research institutions with international recognition in the scientific area of mycotoxigenic fungi and mycotoxins in food and drinks. The 4 advanced partners are the University of Parma (UNIPR), Department of Food and Drugs, the National Kapodistrian University of Athens (NKUA), Department of Chemistry, the University of Lleida (UdL), Department of Food Technology, Engineering, and Science, all originating from Member States (MS), and the Cranfield University (CU), Environment and Agri-food Theme from UK, as Associate Partner.

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1.1. Executive summary

FunShield4Med aims at the **reinforcement of Research and Innovation (R&I) capacity** of the Institute of Technology of Agricultural Products of the Hellenic Agricultural Organisation – DIMITRA (ELGO-ITAP), taking into consideration a special provision for **upgrading project management and administrative skills** of the institute's personnel. To achieve its scope **FunShield4Med have built a network of excellence** between the widening country participant and coordinator, ELGO-ITAP, and the 4 advanced research institutions with international recognition **in the scientific area of mycotoxigenic fungi and mycotoxins in food and drinks**. The 4 advanced partners are the University of Parma (UNIPR), Department of Food and Drugs, the National Kapodistrian University of Athens (NKUA), Department of Chemistry, the University of Lleida (UdL), Department of Food Technology Engineering and Science, all originating from Member States (MS) and the Cranfield University (CU), Environment and Agri-food Theme from UK, as Associate Partner (AP).

To achieve the overall stepping-up of ELGO-ITAP R&I capacity and to stimulate scientific excellence, FunShield4Med has **5 specific objectives (SO) directly responding to Twinning call's expected outcomes**:

SO1. To level-up research and scientific cooperation of participants under EU funded projects.

The interaction between consortium members supports the formation of cooperation strategies for all partners to benefit through future proposal submissions and further collaborations of common scientific interest. For the 1st reporting period of the project (M1-M16), some of the collaborative actions are highlighted hereafter.

Preparation of common proposals between FunShield4Med partners:

- ELGO-ITAP and NKUA with Leibniz Institute ATB (DE), CIHEAM (FR), UM (MT), institutes from North African countries, and private sector companies as partners, have already achieved funding under a PRIMA call 2023, Section 2, Topic: Agro-food (NOVISHPAK; ELGO-ITAP COO) and one more with UM (MT) and CIHEAM (FR), and private companies, under Excellence Hubs (HE-WIDERA) call (GA101087147; EXCEL4MED; started 1 January 2023; NKUA COO).
- ELGO-ITAP and NKUA, together with ONIRIS VetAgroBio (FR), UniWA (EL), IRTA (ES), VUB (BG), and USC (ES), are preparing a HE-MSCA proposal for submission in November 2024.
- ELGO-ITAP, CU, UdL, and University of Thessaly (Prof. C. Athanasiou, Entomology), have started networking for the preparation of a proposal under HE-RIA calls on interaction between cereal pests and mycotoxins under climate change impact.

Secondments of ELGO-ITAP personnel to partners is scheduled taking account both expertise relevance and collaboration potential of participants:

- First STSE (October 2023) of Dr G. Markou (expertise in biotechnology, aquatic systems, and aquafeed) at UdL (expertise in mycotoxins, absorbents, and feed technology) had as subject of training the "Efficacy of mycotoxin binders in *Sparus aurata* fed with contaminated with fumonisin and aflatoxin feed".

- Next forthcoming STSEs of Mrs I. Panagopoulou and Mrs V. Merkouri to UNIPR (June 2024), with expertise on mycotoxins determination with GC and HPLC equipment, respectively, are going to receive training on modern protocols for mycotoxins detection on state-of-the-art equipment (e.g., tandem MS; Single and/or Triple Quadrupole MS; HR-MS etc.).

Preparation of common publications:

- A review paper has been submitted under FunShield4Med entitled "Review on the occurrence of mycotoxigenic fungi in dried fruits and the role of stored products insects: from Sméagol to Gollum" at "Frontiers in Sustainable Food Systems" with impact factor 4.7.
- A review paper is being drafted on "Common and emerging mycotoxins in Mediterranean food commodities" by the consortium of FunShield4Med.

SO2. To increase knowledge, expertise, and skills of ELGO-ITAP research staff in the field of spoilage mycotoxigenic fungi and mycotoxins prevalence for the further development of quantitative mycological exposure assessment (QMEA) considering the current climate change context.

Contamination of food with mycotoxins represents a huge global challenge which cannot be faced with a universal solution. Awareness, proper analytical tools, and special measures need to be implemented from all sides of the food supply chain to achieve a considerable control of this hazard. In addition, the rising of global temperatures (especially in the Mediterranean area), extreme weather phenomena, increase of atmospheric CO_2, and unusual rainfall variations, are all factors promoting growth opportunities of toxigenic fungi, and thus create an extra awareness to the scientific community, and an increased vigilance for agrifood stakeholders. ELGO-ITAP has the scientific background to contribute to a **higher level of mycotoxin control in the Mediterranean**, and with the proposed knowledge transfer and scientific expertise provision from the well-established advanced partners, it can further help to **safeguard EU's imports from countries with a long history in contaminated agricultural commodities**. In addition, the application and the development of quantitative mycological and mycotoxin risk assessments are of paramount importance for future food **safety and food security management** activities. FunShield4Med's overall methodology to achieve SO_2 foresees a **series of training measures** for ELGO-ITAP personnel, all being open for the wider scientific community, which briefly include: **5 seminars**, **4 workshops**, **2 summer schools**, **12 short-term staff exchanges** (STSEs) for training, **site-visits** (Open days), **research activities** under the Joint Research Project (JRP), **scientific publications**, and **participation to conferences**, **scientific round tables** and **meetings** with stakeholders. During 1st period of the project (M1-M16) the following measures have been realised.

Seminars - Workshops - Summer Schools:

- FunShield4Med Seminar 1 (16.05.2023, ELGO-ITAP campus, Greece) on "Identification of Mycotoxins in Mediterranean Food Products", 42 participants of which the 25 were ELGO-ITAP personnel.
- FunShield4Med Seminar 2 (21.07.2023, ELGO-ITAP campus, Greece) on "Food Contaminants: Mycotoxins, Heterocyclic Amines, Polycyclic Aromatic Hydrocarbons", 34 participants/22 ELGO-ITAP.

- FunShield4Med Seminar 3 (21.03.2024, ELGO-ITAP campus, Greece) on "The Occurrence of Non-Regulated Mycotoxins in Foods", 30 participants/15 ELGO-ITAP.
- FunShield4Med Workshop 1 (03-04.07.2023, UNIPR campus, Italy) on "Computational Methods for Mycotoxins", 19 participants/7 ELGO-ITAP.
- FunShield4Med Workshop 2 (28-29.11.2024, NKUA campus, Greece) on "Predictive Mycology & Quantitative Mycological Exposure Assessment (QMEA)", 34 participants/12 ELGO-ITAP.
- FunShield4Med Workshop 3 & Webinar 1 (25-26.04.2024, CU campus, UK) on "Impact of climate change scenarios and processing on food security related to mycotoxins", 29 participants/7 ELGO-ITAP/10 from distance.
- FunShield4Med Summer School 1 (03-07.07.2023, UNIPR campus, Italy) on "Mycotoxins under Climate Change", 25 participants/4 ELGO-ITAP.

Short-term Staff Exchanges (STSEs):

- 1 STSE (secondment) of ELGO-ITAP personnel (Dr G. Markou, 02-12.10.2023) at UdL.

Site-visits or Open days. Open days are visits of students and/or other public groups to ITAP and partner's premises to be informed, apart from institutes activities, on the FunShield4Med project, mycotoxins, and food safety:

- FunShield4Med Open day 1 (28.04.2023) with a group of Ilion (Athens/Greece) 1st Vocational High School students (25) with their teachers and some parents (7) visited ELGO-ITAP campus (laboratories, winery, and vineyard) at Likovrisi, where apart from ELGO-ITAP history and activities, were informed on FunShield4Med project, mycotoxins, and food safety.
- FunShield4Med Open day 2 (05.12.2023) with a group of Chalandri (Athens/Greece) Public Vocational Training Institute (IEK) students (7) and a teacher visited ELGO-ITAP campus.
- FunShield4Med Open day 3 (16.04.2023) with a group of Aegean College (Athens/Greece) students (14) of "Human Biologist-Biotechnologist" course with 3 teachers visited ELGO-ITAP campus.
- UdL Open day (01-02.02.2024) with several groups of secondary school students (96 persons in total) took place at UdL, including a training activity on fungi and food spoilage, and to present them, apart from FunShield4Med project aim & objectives, the research UdL develops at School of Agrifood and Forestry Engineering and Veterinary Medicine (ETSEAFiV).
- NKUA Open day (07.03.2024) with a group of students from Drapetsona (Athens, Greece) 1st High School (10) with a teacher visited the Dept of Chemistry and Food Chemistry Laboratory at NKUA campus.

Participation to Conferences, Scientific round tables & meeting with stakeholders:

- 2023 IAFP European Symposium (03-05.05.2023, Aberdeen, Scotland). FunShield4Med Coordinator presented the project's poster, disseminated flyers, and had networking with the Excel4Med project.

- 10th Mikrobiokosmos International Conference (30 November - 2 December 2023, Larissa, Greece). FunShield4Med common poster of ELGO-ITAP and NKUA on the results of the project.
- Prof. A. Medina was invited speaker for a plenary lecture at 10th Mikrobiokosmos International Conference (30 November - 2 December 2023, Larissa, Greece) co-organised by ELGO-ITAP and Mikrobiokosmos.
- Workshop (16.05.2023) of Greek Wines Federation (SEO) "The Oenoviticulture sector in front of climate crisis", 2 ELGO-ITAP project's members (Dr P. Natskoulis & Dr D. Miliordos) attended the event.
- 5th MS Wine day (22-24.05.2024, Asti, Italy). FunShield4Med oral presentation on OTA in wine results.
- Participation of FunShield4Med in the next World Mycotoxins Forum (2025) together with CU and UNIPR in a round table about mycotoxins.

A complete presentation of SO2 related activities is taking place under subchapters 1.2.2, 1.2.3, & 1.2.4 dedicated to progress of WPs 2, 3, & 4 respectively.

Research activities of JRP:

- ELGO-ITAP have sampled all commodities decided during project's meetings, and after a first screening with ELISA kits at ELGO-ITAP and NKUA laboratories, were delivered to the responsible partners for further analysis.
- ELGO-ITAP have sampled 72 wine samples from market and wineries, having already been analysed for OTA presence according to European Standard EN 14133 (CEN 2003) and HPLC-FD.
- UNIPR was supplied with 230 plant-based milk analogues for analysis with LC-MS/MS using a SALLE extraction for multi-mycotoxins detection.
- UdL was supplied with 72 samples of nuts (arachis, pistachios and peanuts) to be analysed with HPLC-FD for OTA and AFs presence.
- ITAP has purchased 145 sesame samples from the Regional Centre for Plant Protection, Quality, and Phyto-Hygiene Control, of Thessaloniki at the custom point, where all imported commodities are being gathered, and forwarded them to CU for further analysis. The analysis method for multi-detection of Alternaria toxins is being validated and the samples will be analysed before the end of May using a newly developed LC-MS/MS method. Moreover, the Cranfield team helped in sourcing samples of 230 plant-based milk analogues in collaboration with UNIPR.
- NKUA was supplied with 16 dried fruit samples (raisins, sultanas, currants) from the local market and a Raisin Cooperatives Union for multi-toxins (14) analysis with LC-QQQ-MS.

A complete presentation of research activities under the Joint Research Project is taking place under subchapter 1.2.0 Research component, dedicated to the progress of JRP.

SO3. To develop educational/training activities for academia and industry aiming at development of professional skills.

A special focus is given on training of **Early-Stage Researchers (ESRs)**, as well as industrial staff like **Early Career Scientists (ECSs)**, to provide young professionals with key knowledge and new competencies. **All training activities of FunShield4Med are open access**, while all training and new e-learning (i.e. **webinars** and **e-tutorials**) material developed will be provided freely to the public. Participating Universities, all higher-level educational institutions, are involving their BSc, MSc, and PhD students with the project to acquire advanced competencies. Additionally, ELGO-ITAP hosts many under- and post-graduate students originating either from several Greek or foreign universities, enabling a wider dissemination of educational/training activities.

- ESRs participation in project: From the 21 members of ELGO-ITAP's personnel engaged to the project 11 are considered at an early-stage career, and to facilitate their R&I capacity enhancement they are assigned with roles, responsibilities, and tasks. Additionally, until M16 one PhD candidate, one MSc, and two under-graduate students, are involved with research components of the project during their thesis preparation. But also advanced partners of the project have involved ESRs in the implementation, and more specifically NKUA research team numbers 4 ESRs out of total 8 team members, UNIPR 3 ESRs out of total 7, UdL 4 of 8, and CU 4 of 9.
- ESR participation in training: Until M16 and under the 3 Seminars, 3 Workshops and 1 Summer School already realised, from the 210 participants the 170 were either ESRs or ECSs.
- The 10th MBK international conference was attended by 345 persons from 23 countries with more than 215 being ESRs/ECSs.

A complete presentation of SO4 related activities is taking place under subchapters 1.2.2, 1.2.3, & 1.2.4 dedicated to progress of WPs 2, 3, & 4 respectively.

SO4. To level-up ELGO-ITAP administrative and financial staff's skills on attracting and managing internationally funded projects.

A complete **upgrading of R&I capacity** is directly correlated with the increase of skills of administrative staff **through infrastructural and training measures**. To achieve SO4, **working groups** from ELGO-ITAP personnel are created to undertake the tasks of **organisation of the training events, the conferences, and the preparation of R&I proposals for international fundraising**, and this way upgrade the administrative and financial skills related to the management of international projects.

- 3 Working teams (WT) on proposal preparation for international fundraising. WT1 on Food Safety: Dr C. Tassou, Dr A. Argyri, Dr O. Papadopoulou, proposals submitted 5; WT2 on Novel Technologies: Dr P. Natskoulis, Dr G. Markou, Dr G. Katsaros, proposals submitted 4; WT3 on Wine and Distillates: Dr D. Miliordos, Dr M. Metafa, Dr A. Nisiotou, proposals submitted 1.
- 1 WT on training activities organisation: Dr P. Natskoulis, Dr O. Papadopoulou, Dr D. Miliordos, Dr M. Metafa, Dr P. Sourri, Mrs I. Panagopoulou, Mrs P. Chrysanthou, and Mrs G. Charvourou, organised FunShield4Med Seminars 1, 2 & 3, and Open Days 1, 2 & 3 at ELGO-ITAP, while Dr P. Natskoulis and Dr D. Miliordos supported the organisation of FunShield4Med Workshop 2 by NKUA, Workshop 3 by CU, and Workshop 1 & Summer School 1 by UNIPR.

- 10th MBK international conference's organisation & scientific committee members: Dr C. Tassou, Dr A. Doulgeraki (ex-member of project's team), Dr P. Natskoulis (only in the organisation committee).

A complete presentation of SO4 related activities is taking place under subchapter 1.2.5 Work Package 5 "Upgrading R&I management and administration skills of ELGO-ITAP under international funding environment".

SO5. To raise public and scientific awareness by providing effective dissemination and exploitation of project's outcomes through scientific events open to all parties/stakeholders including industrial/commercial user groups.

FunShield4Med is creating different activities dedicated to raising awareness on emerging risks that CC will bring in relation to mycotoxins control. Such events are organised either exclusively by ELGO-ITAP or in cooperation with other R&I bodies and organisations, while it is foreseen a **direct interaction with EFSA on provision of data generated by FunShield4Med** on emerging mycotoxins (members of the consortium are serving as experts in EFSA panels while all beneficiaries are art.36 competent organisations of EFSA). This mix of activities will include, apart from a dedicated **website**, the participation and organisation of **scientific events**, engagement of **social media**, creation of **promotional material**, **publicity** events, and many other to disseminate the project's findings and provide a more integrated exploitation of project's outcomes.

- Relevant news reproduction through FunShield4Med news blog (https://funshield4med.eu/news/), with 6 posts on latest news concerning mycotoxins.
- Relevant posts reproduction through FunShield4Med social media accounts (Facebook, X, LinkedIn), with more than 15 posts from relevant authorities (e.g. WHO; FAO; EFSA) and scientific events (e.g. 10th MBK International conference; IAFP European Symposium 2023; 1st Med Future Congress; Summary Meeting of DiTECT Project EU/China), and posts dedicated to training events organised by the project.
- Participation (10th MBK International conference; IAFP European Symposium 2023; 1st Med Future Congress, etc.) and organisation of scientific events (10th MBK International Conference; FunShield4Med Seminars, Workshops, Summer Schools etc.).
- Creation of mycotoxins relevant posts and dissemination through FunShield4Med social media accounts (e.g. "What are mycotoxins"; "EU Legislation for mycotoxins"; "Mycotoxins & Floods").
- Creation of webinars and e-tutorials accessible from anyone through project's website and open repositories (e.g. Zenodo, YouTube)
- Promotional material on FunShield4Med and its objectives (e.g. 3-fold flyer of project; project's presentation with a poster in IAFP European Symposium 2023; project's banner posted in 1st Med Future Congress).
- Organisation of publicity events for FunShield4Med like Open Days at ELGO-ITAP (3) and participation in wider open events like European Researchers' Night 2023 (1). Also, there were two more Open days from NKUA and UdL.

A complete presentation of SO5 related activities is taking place under subchapter 1.2.6 Work Package 6 "Communication, dissemination, exploitation" following.

1.2. Explanation of the work carried out per WP.

1.2.0. Research component (FunShield4Med Joint Research Project)

FunShield4Med project is running a complementary joint research project (JRP, Tasks 2.3 & 3.2) through which propose proper sampling schemes and testing protocols as well as proactive measures to protect the health of consumers from mycotoxin contaminants. The status of the different mycotoxins' prevalence has been evaluated by an extended literature and scientific review to pinpoint the mycotoxins and food products of interest. Following, the presence of parent, emerging, and/or modified mycotoxins, in key food products is being evaluated by applying selected analytical methods for their single- and multi-detection as reported in Task 2.3. More specifically, traditional Mediterranean food products such as wine, nuts, cereals, and fruits, with high import and export dynamics in European trade through Greek custom points, are analysed to determine the current mycotoxin status with the collaboration of the laboratories of the advanced partners. The developed datasets, apart from their exploitation through Quantitative Mycotoxin Exposure Assessment (QMEA, Task 3.2), will also be communicated to relevant authorities (EFET for Greece & EFSA for EU), and published through Golden Open Access peer reviewed journals. In conjunction with QMEA studies ELGO-ITAP will evaluate methods for risk mitigation from mycotoxins presence in food through the investigation of modern processing procedures (Task 3.2). Currently is investigating methods of decontamination for two mycotoxins (OTA & PAT) through the application of Non-Thermal (a.k.a. Cold) Atmospheric Plasma technology.

FunShield4Med Joint Research Project on evaluation of mycotoxins prevalence in Mediterranean basin (Task 2.3).

Partners have identified the commodities of major interest in the Mediterranean area following specific criteria of mycotoxins prevalence:

- Market trends
- Geographical origin of the raw materials and international trade
- Commodities of interest for Greece and greater Mediterranean basin
- Gaps in EFSA occurrence data

Accordingly, a list of commodities of interest has been identified during the 1st EB meeting and further consolidated during the 2nd EB meeting (Table 1.1). The list was then used for sampling and samples analysis.

Table 1.1 Commodities of interest and mycotoxins investigation of FunShield4Med Joint Research project.

Commodities	Mycotoxin(s)	Partner	Progress
Sesame, Pepper, and Chili powder	Alternaria toxins (Alternariol - AOH & Alternariol[1] monomethyl ether - AME) & Multi-toxin detection	CU	Batches consisting of a total of 145 sesame samples were delivered to CU laboratories. STSEs from ITAP will deliver more samples.
Oats	HT-2 & T-2 toxins	CU	Pending sampling from the Greek market and industries.
Nuts (Pistachios & Peanuts)	AFs & OTA	UdL	72 samples were already collected and delivered and/or posted to UdL laboratories.
Plant-based milk products (from Oat, Barley, Soy, Rice, etc.)	AFs & multi-toxin detection	UNIPR	Part (50 ml) of the first 17 samples from the Greek market were delivered to NKUA and were further packed to falcons and posted under refrigerating conditions to UNIPR. Moreover, another 120 samples were sent from the UK and 97 are collected from the Italian market.
Beer ingredients (barley, corn, rice)	ENNs, BEA	UNIPR	ITAP will contact Greek breweries for samples to post to UNIPR. Already samples were sent from NISOS brewery (7). Pending sampling from VERGINA (Prof. C. Proestos contact) and ATHINAIKI breweries (Dr P. Natskoulis contact).
Apple products (juices, baby fruit purées, apple cider & vinegar)	PAT	ITAP	Analyses ongoing (only 5 samples until now). Pending sampling from the Greek market.
Wines	OTA & CIT	ITAP	Analyses ongoing (72 samples).
Wheat and baby food powders	AFs	ITAP	Analyses ongoing (10 samples).
Berries (straw-, rasp-, black- & blue-berries)	OTA, PAT, AOH & AME, and multi-toxins	NKUA	First samples (3) delivered to NKUA. Analysis ongoing.
Dried grapes (currants, sultanas etc.)	OTA & CIT, and multi-toxins	NKUA	First samples (16) delivered to NKUA. Analysis ongoing.

[1]Underlined mycotoxins refer to emerging ones.

Analysis will be carried on primarily by well-established ELISA methods at NKUA and ELGO-ITAP and following with validated procedures for regulated mycotoxins. On one hand, ELGO-ITAP was assigned for the determination of

OTA and PAT, since these 2 methods are already established in its ISO accredited physicochemical laboratory, and is adopting AFs determination, as transferred by advanced partners. On the other hand, HPLC and mass spectrometry based multi-toxins methods will be applied by CU, NKUA and UNIPR. Finally, all methods will be transferred to seconded scientists from ELGO-ITAP during STSEs, while their development and validation (i.e. sample preparation, chromatographic separation, identification, data treatment) will be presented during workshops and summer school, also providing hands-on tutorials.

NKUA was assigned in charge of mycotoxins analysis in **berries and dried grapes**. Plant-based food commodities that are highly susceptible to mycotoxin contamination, such as dried fruits (e.g. raisins) and fresh fruits (e.g. berries), present a crucial need for mycotoxins analysis, because of lack of information regarding the potential synergistic effects of the co-occurrence of multiple mycotoxins. These types of food commodities are important for mycotoxin analysis and were selected, as fresh berries soft and fragile skin is susceptible to small lesions, which allow the growth of spoilage fungi both during pre- and post-harvest stages, while these products contain high levels of sugar and water activity, as well as low pH, ideal for fungal growth[1]. For reference, the production of raspberries and blueberries amounts to 50 tons per year, blackberries to 10 tons, while imports of Raspberries, blackberries, and mulberries for Greece reached 1000 tons approx. for 2022, highlighting the great interest in these specific products. In addition, Greece is well known for dried vine fruits production. The production of the dehydrated fruit of the vine was a basic element of the ancient diet, with two types of raisins produced traditionally in Greece: Corinthian black currants and Greek Sultana blond raisins. Moreover, Greece imports a great number of dried grapes. Turkey for 2022 was the largest exporter for Greece with 3409 tons, followed by Pakistan with exports to Greece around 640 tons of dried grapes[2].

There are five target parent groups of mycotoxins for analysis: Aflatoxins (AFs), Ochratoxin A (OTA), Fumonisins (FBs), Patulin (PAT) and Trichothecenes (TCT) including deoxynivalenol (DON), T-2 and HT-2 toxins, and zearalenone (ZEN). Besides these main mycotoxins, there are also the so-called "emerging mycotoxins", such as Alternaria toxins, currently unregulated, that have shown to occur frequently in agricultural products. The most frequently reported occurrence of AFs is in dried fig and raisins, ranging from 2–550 μg/kg. OTA is common also in dried fruits, while damaged or mouldy fruits can be contaminated with OTA to a certain degree, even after the removal of the rotten parts. Different studies have shown contamination of OTA in strawberries (1.44 μg/kg) and in raisins (mean value: 1.4-9.2 μg/kg). Alternariol (AOH) and alternariol monomethyl ether (AME) are among the main mycotoxins of Alternaria reported as naturally occurring in various infected fruits, including berries, mandarins, lemons etc., but at very low levels. Regarding PAT, high levels of this mycotoxin have been detected in different berries (strawberry, 113 μg/kg; blueberry, 21 μg/kg; 746 μg/kg)[3]. FBs, DON, T-2 & HT-2 toxins, and ZEN are commonly found in cereals and various foods globally. The food processing industry, particularly the major market segment for dried fruits, utilises dried fruits as raw materials for creating products such as breakfast cereals. Consequently, dried fruits have the potential to be a notable dietary source of these mycotoxins for consumers[4].

[1] Juan, C., Mañes, J., Font, G., & Juan-García, A. (2017). Determination of mycotoxins in fruit berry by-products using Quechers extraction method. *LWT, 86*, 344–351. https://doi.org/10.1016/j.lwt.2017.08.020

[2] https://agriexchange.apeda.gov.in/IntTrade/prdwise_expctrydetails.aspx?pcode=080620&ctryc=GRC&ctryn=GREECE (accessed 23/03/2024)

[3] Fernández-Cruz, M. L., Mansilla, M. L., & Tadeo, J. L. (2010). Mycotoxins in fruits and their processed products: Analysis, occurrence and health implications. *Journal of Advanced Research*, *1*(2), 113–122. https://doi.org/10.1016/j.jare.2010.03.002

[4] Azaiez, I., Font, G., Mañes, J., & Fernández-Franzón, M. (2015). Survey of mycotoxins in dates and dried fruits from Tunisian and Spanish markets. *Food Control*, *51*, 340–346. https://doi.org/10.1016/j.foodcont.2014.11.033

NKUA Laboratory of Food Chemistry developed an advanced LC-MS methodology for the determination of 14 mycotoxins in berries and dried fruits: AF B1, B2, G1 & G2, OTA, AOH & AME, ZEN, DON, FBs B1 & B2, T-2 & HT-2 toxins, and PAT. For the qualitative and quantitative determination of these 14 mycotoxins, two sample preparation protocols were developed and optimised: a QuEChERS protocol and a solid phase extraction protocol using immunoaffinity columns (IAC). As for the second sample preparation, IAC cartridges of 11+Myco MS-PREP (R-Biopharm AG, DE) were used for the determination of 11 mycotoxins, including: AFs, OTA, ZEN, DON, FBs, T-2 & HT-2 toxins. The extracts were analysed, taking advantage of the excellent accuracy, sensitivity, and selectivity of LC-QQQ-MS (6500+ triple quadrupole mass spectrometer, AB Sciex LLC, USA) in the multiple reaction monitoring (MRM) mode, with the separation of the mycotoxins taking place using reversed phase liquid chromatography in a Acquity UPLC BEH C18 column (100 mm × 2.1 mm, 1.7 μm).

So far, the analysis of 8 raisins and 3 fresh berries samples with QuEChERS method and the analysis of 5 raisins using the IAC method have been carried out, and the following results were obtained:

- OTA in 5 raisin samples ranging from 0.13-0.86 ng/g
- PAT in 1 raisin sample: 30.2 ng/g
- AFB1 in 1 raisin sample: 0.76 ng/g
- AFB2 in 1 raisin sample: 0.82 ng/g
- AFG1 in 2 raisin samples ranging from 0.16-0.76 ng/g
- AOH in 1 berry sample: 0.34 ng/g
- AME in 6 raisin sample ranging from 0.020-0.477 ng/g and in 2 berry samples ranging from 0.031-0.070 ng/g
- ZEN in 2 raisin samples ranging from 0.25-5.6 ng/g and in one berry sample: 0.035 ng/g

Neither of the regulated mycotoxins excluded the legislative framework[5], nonetheless AME & AOH are not regulated yet, ZEN is regulated only for cereals and their products, FBs are regulated only in maize and its products, and PAT is regulated only for apples, their products, fruit juices, and baby-foods.

UdL undertook the analysis of OTA and AFs in **nuts** (i.e. pistachios and peanuts). Such commodities are of great interest and represent some of the most common market recalls in Europe. Aflatoxins in nuts is a very relevant issue for trade, according to RASFF, and as emerging mycotoxins will be covered by CU, NKUA and UNIPR, also in terms of method development, UdL will be analysing these commodities for presence of AFs and OTA. 72 samples of peanuts and pistachios (either raw or roasted, some salted, some celled) were purchased in Greece, but had their origin in either Argentina, Egypt, Brazil, or Greece. They are being analysed for AFs and OTA. These nuts were chosen for analysis as they are the main cause of notifications through the RASFF system (with 229, 257, 261 and 230 total notifications in 2020, 2021, 2022 and 2023, and 120 in the ongoing present year 2024). In 2024, 63 notifications originated from peanuts and 41 from pistachios. AFs were the reason for border rejection in most cases, with OTA being involved in 4% of the cases[6]. The method of analysis includes extraction, clean-up of extracts

[5] Commission Regulation (EU) 2023/915 of 25 April 2023 on maximum levels for certain contaminants in food and repealing Regulation (EC) No 1881/2006.
[6] https://webgate.ec.europa.eu/rasff-window/screen/search (Accessed 12/04/2024)

by IACs (AFLAOCHRA PREP®, R-Biopharm AG), and detection and quantification by HPLC-FLD with post-column photochemical derivatization. The method was in-house validated. Analysis is undergoing and results will be reported in forthcoming deliverables.

UNIPR proposed a particular pilot study on **plant-based milk products**. Although widely present on the UK market since almost a decade, consumption of such products has increased dramatically over the past 2 years on the Mediterranean market, too. Recent studies underline the potential occurrence of mycotoxins in plant-based milk and meat analogues, also in view of the raw material used for production (i.e. oats, nuts, soy). Fusarium mycotoxins (i.e. among them DON, T2 and HT2) may be easily found in oats, while aflatoxins and OTA can be found in nuts and rice[7,8,9]. Nonetheless, data are scant, and no official survey has been performed so far on an international level. Therefore, also taking advantage of the presence of a UK associated partner, UNIPR has undertaken the development of a multi-toxin method for 39 mycotoxins in plant-based milk (M6-M12). The protocol involves a salting-out assisted liquid-liquid extraction (SALLE) followed by ultra-high performance liquid chromatography-mass spectrometry in tandem (UHPLC-MS/MS) analysis. Specifically, the extraction has been optimized for the regulated mycotoxins aflatoxin B1 (AFB1), aflatoxin B2 (AFB2), aflatoxin G1 (AFG1), aflatoxin G2 (AFG2), fumonisin B1 (FB1), fumonisin B2 (FB2), T-2, HT-2, ochratoxin A (OTA), zearalenone (ZEN) and deoxynivalenol (DON); and the emerging mycotoxins alternariol (AOH), alternariol monomethyl ether (AME), tentoxin (TEN), enniatin B (ENNB), enniatin B1 (ENNB1), enniatin A (ENNA), enniatin A1 (ENNA1), and beauvericin (BEA). All quality parameters have been tested, among them linearity, intra- and inter-day repeatability, reproducibility, accuracy, sensitivity, and recovery. In the meantime, 230 samples have been collected from the UK (n = 120), Italy (n = 93), and Greece (n = 17). Samples will be analysed starting from M18 and results will be later transferred to EFSA (M24-M36). Seconded researchers from ELGO-ITAP will be involved in sample preparation and analysis at UNIPR. The method will be also presented as a case-study during the SS2 (June 2024).

CU, as proposed in the project has taken leadership on the analysis of **sesame** samples. A method for the detection and quantification of six *Alternaria* toxins in sesame seeds was developed and validated. The method was optimised for the quantification of alternariol (AOH), alternariol monomethyl ether (AME), altenuene (ALT), altertoxin-I (ATX-I), tentoxin (TEN), and tenuazonic acid (TeA). The extraction was adapted from the method originally developed by Walravens et al. (2014) for cereals[10]. Some changes were implemented to adapt the method and ground sesame seeds were extracted for 60 min with 10 mL of acetonitrile:water:acetic acid (79:19.5;1.5,v/v/v). A double defatting step with 5 mL hexane was performed. An aliquot of 4 mL of the extract was transferred to a clean tube and was evaporated. The residue was redissolved in 200 µL of injection solvent, consisting of mobile phase A and mobile phase B (70/30, v/v). After shaking in vortex, the extract was centrifuged for 15 min at 13000 g and a portion of 100 µL was transferred to a vial with insert for LC-MS/MS analysis (Exion LC series HPLC linked to a 6500 + qTRAP-MS

[7] Miró-Abella E, Herrero P, Canela N, Arola L, Borrull F, Ras R, Fontanals N. Determination of mycotoxins in plant-based beverages using QuEChERS and liquid chromatography-tandem mass spectrometry. Food Chem. 2017 Aug 15; 229:366-372. doi: 10.1016/j.foodchem.2017.02.078

[8] Pavlenko R, Berzina Z, Reinholds I, Bartkiene E, Bartkevics V. An Occurrence Study of Mycotoxins in Plant-Based Beverages Using Liquid Chromatography-Mass Spectrometry. Toxins (Basel). 2024 Jan 17;16(1):53. doi: 10.3390/toxins16010053

[9] Augustin Mihalache O, Carbonell-Rozas L, Cutroneo S, Dall'Asta C. Multi-mycotoxin determination in plant-based meat alternatives and exposure assessment. Food Res Int. 2023 Jun; 168:112766. doi: 10.1016/j.foodres.2023.112766

[10] Walravens J, Mikula H, Rychlik M, Asam S, Ediage EN, Di Mavungu JD, Van Landschoot A, Vanhaecke L, De Saeger S. Development and validation of an ultra-high-performance liquid chromatography tandem mass spectrometric method for the simultaneous determination of free and conjugated Alternaria toxins in cereal-based foodstuffs. J Chromatogr A. 2014 Dec 12;1372C:91-101. doi: 10.1016/j.chroma.2014.10.083

system in Electrospray Ionisation (ESI) mode (Sciex Technologies, Warrington, UK). Chromatographic separation was achieved using an Acquity UPLC HSS T3 C18 column (2.1 × 100 mm, 1.8 µm) (Waters Corporation, MA, USA). The validation of the method is currently under process. For this purpose, ground sesame seed samples were spiked with the six *Alternaria* toxins standards and two labelled internal standards (U-[$^{13}C_{10}$]-Tenuazonic acid and U-[$^{13}C_{14}$]-alternariol) at concentrations of 0.2-200 µg/ml. The spiked samples were mixed in vortex and allowed to equilibrate overnight before extracting as previously described and analysed by LC-MS/MS. Preliminary data can be observed in Figure 1.1.

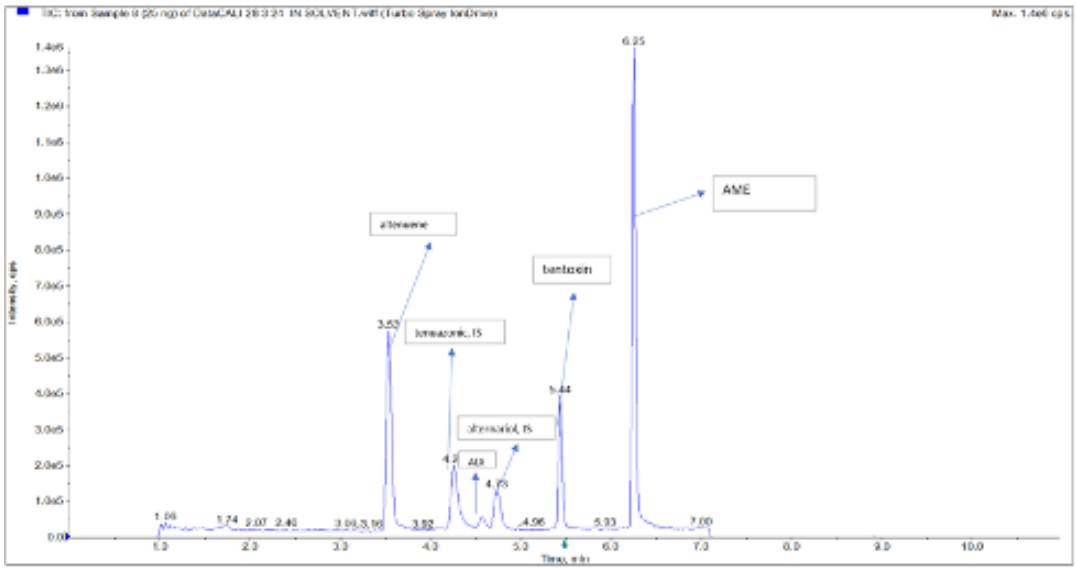

Figure 1.1 Plot of a chromatogram after an LC-MS/MS run with the 6 Alternaria toxins that will be subject to study.

The analysis of the results is currently underway. Further modifications of the method will be made to optimise the parameters based on the performance criteria stipulated in the Commission Regulation (EC) No. 401/2006[11] and Commission Decision (EC) No. 2002/657[12]. Analysis of the 145 samples of sesame seed from Greek imports will be completed before the end of May.

ELGO-ITAP undertook, apart from commodities sampling and initial ELISA screenings together with NKUA, the analysis of OTA in **wine** and PAT in **apple products**. OTA is produced by several species of filamentous fungi from the genera *Penicillium* and *Aspergillus*, and exhibits nephrotoxic, immunosuppressive, teratogenic and carcinogenic effects on animals, being classified as a possible human carcinogen within the 2B Group by IARC (1993)[13]. Moreover, there are reports from many countries describing the high frequencies in wine and dried grapes, with the former commodity accounting for 13–21% of the total human exposure[14]. FunShield4Med have foreseen an extended study

[11] Commission Regulation (EC) No 401/2006 of 23 February 2006 laying down the methods of sampling and analysis for the official control of the levels of mycotoxins in foodstuffs.
[12] Commission Decision of 12 August 2002 implementing Council Directive 96/23/EC concerning the performance of analytical methods and the interpretation of results.
[13] IARC Monographs on the Evaluation of Carcinogenic Risks to Humans. 1993; Volume 56, p. 599.
[14] Ortiz-Villeda, B., Lobos, O., Aguilar-Zuniga, K., & Carrasco-Sánchez, V. (2021). Ochratoxins in Wines: A Review of Their Occurrence in the Last Decade, Toxicity, and Exposure Risk in Humans. Toxins, 13(7), 478. https://doi.org/10.3390/toxins13070478

on OTA presence in wine having already analysed 72 samples from Greek market and wineries. PAT is a neurotoxic secondary metabolite produced by fungi like *Aspergillus*, *Byssochlamys*, and *Penicillium* spp. which poses significant health risks. Its toxicity is well-documented, causing severe symptoms such as renal congestion, pulmonary edema, and tissue necrosis in animals. Fruits, vegetables, and even water sources can be contaminated, with concentrations reaching up to 1000 μg/L[15]. Regulatory limits, such as 50 μg/kg in fruit juices, highlight the need for effective control of this specific mycotoxin, which apart from presence in feeds can potentially be present as well to apple products, such as ciders, juices, and even fruit puree intended for babies' consumption[5]. ELGO-ITAP has already started the screenings to such products (5) and is going to extend to a larger number of sampled commodities.

ELGO-ITAP has already established 2 mycotoxin determination methods in its laboratories, for the determination of OTA in wines, and PAT in apple products, under the European Committee for Standardisation (CEN) protocols, EN 14133:2009 and 14177:2004, respectively. The European Standard of CEN EN 14133:2009 specifies a method for the determination of ochratoxin A content in wine and beer using IAC clean up and HPLC coupled with FLD, while EN 14177:2004 specifies a method for the determination of patulin in apple juices and apple puree using HPLC-UV after liquid/liquid partition clean-up step[16]. Additionally, and in line with Task 2.4, the method of determination of AFs in **wheat products** with HPLC-FLD and IAC (and/or QUECHERS) extraction is currently under transfer from NKUA and UdL, to ELGO-ITAP physicochemical laboratory.

The results of the applied ELISA methods are presented under Tables 1.2, 1.3 and 1.4, while HPLC results under Tables 1.5 and 1.6.

Of all the cereal samples, products, and by-products of brewing, intended to be used by the brewing industry for human consumption or for animal feed, respectively, the 31 of them were contaminated with ZEN. The three negative results for the presence of the ZEN, below the detection limit of 10 μg/kg, concerned the raw barley sample and the two samples of different varieties of barley malt used in the production of beer. Maize was the cereal sample with the highest average ZEN level, followed in descending order by oats, rice, wheat and malt. A high amount of ZEN was detected in the different varieties of hops. Cereal flours were also positive for the toxin. According to Regulation (EC) 2023/915, the maximum permitted levels of zearalenone in unprocessed cereals other than maize are 100 μg/kg, for raw maize 350 μg/kg and for processed cereals and milling fractions of 75 μg/kg[5].

Concerning the FBs for each cereal sample, the corresponding concentration was determined from the standard curve obtained by the standards of each ELISA kit (Table 1.2). It is necessary to highlight that the ELISA kit detects FB1 by 100% and FB2 by 62%. Moreover, has a limit of detection of 0.015 ppm (LOD) and a limit of quantification of 0.05 ppm (LOQ). Results below the limit of quantification, i.e. 0.05 ppm, were treated as negative for the ELISA test. In addition, it is worth mentioning that in the European Legislation, so far, higher fumonisin limits have been set for oat, rice bran, wheat, barley, malt, and hops. From the ELISA assay, samples of oat (I and II), malts, rice bran (I and II), wheat flour (I and II), sunflower seeds, wheat pellets, soft wheat (II and III), durum wheat, rice, barley, and maize flour III, were negative to Fumonisin. In total 14 samples were detected positive to Fumonisin mycotoxin. More specifically, Oat Flour I and II, maize flour I and II, maize kernels, all hops, rice bran III and IV, and common wheat I. First, grouping was done based on type sample (Table 1.3).

[15] Malir F, Ostry V, Pfohl-Leszkowicz A, Malir J, Toman J. Ochratoxin A: 50 Years of Research. Toxins (Basel). 2016 Jul 4;8(7):191. doi: 10.3390/toxins8070191

[16] https://www.cencenelec.eu/european-standardization/european-standards/ (accessed 01/04/2024)

Sesame Samples

Even though sesame is non-included in the cereals, the European Commission is making efforts to set regulatory limits. The EC proposed recommended levels for T-2 and HT-2 toxins in cereals and cereal-based products. Therefore, according to European Recommendation EC 165/2013[17] the recommended maximum level for the sum of T-2 and HT-2 toxins in cereals intended for human consumption is 200 μg/kg. Among the 145 sesame samples that have been delivered to the CU, 38 samples were tested by ELISA assay for the detection of T-2 mycotoxin, at the ITAP laboratory. According to the ELISA kit the limit of detection (LOD) of the ELISA test is 13 ppb, while the limit of quantification (LOQ) 17.5 ppb. Among the 38 sesame samples 17 were positive to T2 mycotoxin. Only in two samples the T2 concentration level was high. One sample from India (181.7±15.5 ppb) and another one from Pakistan (73.02±4.65 ppb), with both samples being collected in March 2023.

Wine Samples

Table 1.5 shows the results of 30 wine samples among the 72 all over Greece obtained directly from the wineries or from supermarkets. All wines were produced between 2020 and 2023. The highest concentrations of OTA were recorded in Xinomavro (2.23±0.04 ppb from the Rapsani area), a Greek autochthonous red grapevine variety like the international Syrah (0.24±0,04 ppb from Thiva area). Among the Xinomavro wine samples the highest OTA concentration level was recorded in the Rapsani, area which is characterised with high rainfall over the year. Whilst, between the two white ones, Sauvignon blanc wines presented higher concentration (3.63±0.75 ppb from the Elassona area) than the Assyrtiko wines. However, among the Assyrtiko wines the higher OTA concentration was recorded in Drama area (0.94±0.06 ppb) and in Karditsa (1.03±0.06 ppb), area which during the winter and autumn period area characterised with high rainfall levels.

Apple products Samples

All apple products sampled were analysed for the presence of PAT at the Laboratory of ITAP. All samples analysed were negative for PAT presence (Table 1.6).

Table 1.2 Fumonisin, Zearalenone, and T-2 toxin standards for ELISAs protocols

Standards	Concentration FBs (ppm)	Concentration ZEN (ppb)	Concentration T2 (ppb)
AL-1	0	0	0
CAL-2	0.05	10	17.5
CAL-3	0.15	25	87.5
CAL-4	0.5	75	350
CAL-5	1.5	200	875
CAL-6	5	500	1750

Table 1.3 Concentrations (Mean±StDev) of Fumonisins and Zearalenone in cereals after ELISA determination

[17] Commission Recommendation of 27 March 2013 on the presence of T-2 and HT-2 toxin in cereals and cereal products

Sample Number	Cereal Type	Country of Origin	Zearaleone (Mean±StDev; ppb)	Fumonisin (Mean±StDev; ppm)	Intended consumption
1	OAT I	Greece	11.19±5.12	n.d.[1]	Human
2	OAT II	Greece	81.43±13.95	n.d.	Human
3	Barley Malt	Greece	114.37±21.47	n.d.	Animal
4	Rice Bran I	Greece	147.03±16.08	n.d.	Animal
5	Rice Bran II	Russia	171.65±32.91	n.d.	Animal
6	Wheat Flour I	Russia	56.80±13.51	n.d.	Human
7	Wheat FlourII	Russia	57.87±18.47	n.d.	Human
8	Corn flour I	Greece	89.01±14.50	0.17±0.02	Human
9	Sunflower seeds	Greece	76.80±17.30	n.d.	Animal
10	Wheat pellet	Greece	83.45±17.36	n.d.	Animal
11	OAT Flour I	Greece	135.56±19.43	0.05±0.03	Animal
12	OAT flour II	Greece	143.56±29.67	0.05±0.03	Animal
13	Corn Flour II	Greece	84.91±13.42	5.76±0.54	Human
14	Soft Wheat I	Greece	21.25±3.02	0.08±0.01	Animal
15	Soft Wheat BIO II	Greece	37.62±11.98	n.d.	Animal
16	Soft Wheat BIO III	Greece	33.93±11.3	n.d.	Animal
17	Rice	Greece	38.15±14.94	n.d.	Human
18	Durum Wheat	Greece	16.14±1.67	n.d.	Human
19	Corn Flour III	Russia	43.87±4.35	n.d.	Human
20	Barley	Greece	n.d.	n.d.	Human
21	Rice Bran 2022	Greece	24.57±11.94	0.12±0.01	Animal
22	Rice Bran 2023	Greece	74.50±24.39	0.10±0.02	Animal
23	Malt- Local brewery	Greece	30.15±8.62	n.d.	Animal
24	Malt Blonde 1	Greece	n.d.	n.d.	Human
25	Malt Blonde 2	Greece	11.14±2.51	n.d.	Human
26	Malt Dark	Greece	16.97±1.67	n.d.	Human
27	Malt Vienna	Greece	n.d.	n.d.	Human
28	Hop HERSBRUCKER	France	615.30±144.55	3.42±0.96	Human
29	Hop HALLERTAU	Germany	321.72±86.47	1.32±0.14	Human
30	Hop SAPHIR	Germany	286.98±63.85	1.13±0.11	Human
31	Corn Kernels	Greece	1255.43±257.36	10.46±1.14	Human
32	Corn Kernels	Greece	529.99±135.98	3.21±0.6	Animal
33	Corn (*Zea mais*)	Greece	277.92±77.05	1.12±0.11	Human
34	Corn (*Prostephanus*)	Greece	668.58±155.61	4.08±1.44	Human

[1] n.d.: not detected (<LOD)

Table 1.4 Preliminary results on T-2 concentrations (Mean±StDev) in sesames seeds after ELISA determination

Sample #	Type	Country of Origin	Day	Month	Year	Sampling Lot Number	T2 (ppb)
1	Sesame	NIGERIA	18	March	2023	745-749	n.d.[1]
2	Sesame	NIGERIA	20	March	2023	750-754	16.4± 2.3
3	Sesame	PAKISTAN	22	March	2023	795-804	73.02±4.65
4	Sesame	NIGERIA	22	March	2023	755-759	15.37±1,21
5	Sesame	NIGERIA	23	March	2023	713-717	n.d.
6	Sesame	NIGERIA	27	March	2023	718-727	18.53±3.8
7	Sesame	NIGERIA	28	March	2023	728-737	26.31±3.2
8	Sesame	INDIA	29	March	2023	760-769	15.79±2.3
9	Sesame	INDIA	30	March	2023	775-784	181.7±15.5
10	Sesame	NIGERIA	30	March	2023	770-774	n.d.
11	Sesame	NIGERIA	30	March	2023	785-794	16.7±4.3
12	Sesame	MOZAMBIQUE	7	April	2023	805-809	n.d.
13	Sesame	INDIA	7	April	2023	820-829	n.d.
14	Sesame	PAKISTAN	10	April	2023	809-819	n.d.
15	Sesame	TURKEY	11	April	2023	831-835	n.d.
16	Sesame	INDIA	25	April	2023	845-854	n.d.
17	Sesame	NIGERIA	27	April	2023	855-859	n.d.
18	Sesame	ETHIOPIA	28	April	2023	860-864	n.d.
19	Sesame	ETHIOPIA	28	April	2023	865-869	n.d.
20	Sesame	INDIA	3	May	2023	895-904	n.d.
21	Sesame	NIGERIA	3	May	2023	905-909	n.d.
22	Sesame	NIGERIA	3	May	2023	910-914	15.48±4.3
23	Sesame	TURKEY	4	May	2023	917-921	16.7±4.5
24	Sesame	INDIA	4	May	2023	922-931	n.d.
25	Sesame	ETHIOPIA	4	May	2023	932-936	25.28±5.4
26	Sesame	ETHIOPIA	4	May	2023	937-941	21.69±3.4
27	Sesame	BURKINA FASO	4	May	2023	942-946	n.d.
28	Sesame	ETHIOPIA	4	May	2023	947-951	n.d.
29	Sesame	CHAD	9	May	2023	952-956	n.d.
30	Sesame	NIGERIA	18	May	2023	969-973	n.d.
31	Sesame	NIGERIA	19	May	2023	974-978	n.d.
32	Sesame	INDIA	22	May	2023	979-988	23.78±4.5
33	Sesame	NIGERIA	24	May	2023	994-998	25.285.4

34	Sesame	INDIA	25	May	2023	1004-1008	15.34±3.2
35	Sesame	ETHIOPIA	25	May	2023	1009-1013	25.79±4.6
36	Sesame	ETHIOPIA	26	May	2023	1014-1018	n.d.
37	Sesame	SENEGAL	26	May	2023	1019-1023	n.d.
38	Sesame	NIGERIA	30	May	2023	1030-1034	15.86±3.4

[1] n.d.: not detected (<LOD)

Table 1.5 Preliminary results on OTA concentration (Mean±StDev) in wines after HPLC determination

Wine Code	Variety	Area	Vineyard	Vintage	Mean OTA (Mean±StDev; ppb)
1	Xinomavro	Amyntaio	Amyntaio	2019	n.d.[1]
2	Xinomavro	Amyntaio	Amyntaio	2020	n.d.
3	Xinomavro	Tsantalis	Maronia	2021	n.d.
4	Xinomavro	Amyntaio	Kir Yiannis	2021	n.d.
5	Xinomavro	Amyntaio	Chalkidiki	2021	1.628±0.183
6	Xinomavro	Amyntaio	Fanos	2020	n.d.
7	Xinomavro	Amyntaio	Goymenisa	2021	n.d.
8	Assyrtiko	Evia	Evia	2020	n.d.
9	Syrah	Viotia	Viotia	2023	n.d.
10	Syrah	Evia	Evia	2020	n.d.
11	Syrah	Evia	Evia	2022	n.d.
12	Xinomavro	Rapsani	Rapsani	2020	2.225±0.039
13	Xinomavro	Naousa	Naousa	2021	n.d.
14	Assyrtiko	Elassona	Elassona	2021	0.733
15	Assyrtiko	Elassona	Elassona	2022	0.814±0.273
16	Assyrtiko	Spata	Spata	2020	0.589±0.013
17	Assyrtiko	Nemea	Nemea	2020	0.571±0.010
18	Assyrtiko	Santorini	Santorini	2020	0.589±0.013
19	Assyrtiko	Karditsa	Karditsa	2020	1.030±0.064
20	Assyrtiko	Drama	Drama	2020	0.936±0.058
21	Xinomavro	Amyntaio	Goyni	2020	0.546±0.014
22	Xinomavro	Amyntaio	Skatzoxiros	2020	0.663±0.089
23	Xinomavro	Amyntaio	Amyntaio	2020	n.d.
24	Xinomavro	Drama	Drama	2021	0.563±0.028
25	Sauvignon blanc	Amyntaio	Amyntaio	2022	1.188±0.056
26	Sauvignon blanc	Amyntaio	Amyntaio	2023	n.d.
27	Syrah	Thiva	Thiva	2022	0.241±0.039
28	Sauvignon blanc	Larissa	Elassona	2023	3.627±0.746
29	Syrah	Larissa	Elassona	2020	n.d.

30	Assyrtiko	Larissa	Elassona	2021	0.322±0.115

[1] n.d.: not detected (<LOD)

Table 1.6 Patulin concentration (Mean±StDev) in apple products after HPLC determination

Supplier	code	Company	Product name	Product Type	Sampling date	Patulin
Supermarket	P1	Strongbow	Gold apple	Cider	12.10.2023	n.d.[1]
Supermarket	P2	Athenian Brewery	Milokleftis	Cider	12.10.2023	n.d.
Supermarket	P3	Nutri valley	Apple- Orange-Pear	Fruit Juice	12.10.2023	n.d.
Supermarket	P4	Nutri valley	Apple/Strawberry/Grape berries	Fruit Juice	12.10.2023	n.d.
Supermarket	P5	HBH	Apple/Pomegranate/Apricot	Fruit Juice	12.10.2023	n.d.

[1] n.d.: not detected (<LOD)

ELGO-ITAP research on mitigation measures on mycotoxins through food processing (Task 3.2)

Cold plasma has recently attracted the attention of researchers around the world for both fungi growth inhibition and mycotoxin degradation with initial studies on the topic published over a decade ago. **Cold atmospheric plasma** (CAP) is widely known for its microbial decontamination of food products, mainly due to the interaction with reactive oxygen and nitrogen species (RONS), energetic charged particles, UV photons, and strong transient electric fields generated in the gas phase during processing, and which can interact simultaneously and synergistically with food[18]. These species may lead to degradation of mycotoxins in various food products by destroying their molecular structures related to toxicity[19]. The aim of the two studies was to investigate the effect of CAP on detoxification of OTA in wine and PAT in apple juice. A kinetic approach was applied to understand how the CAP processing conditions may affect the mycotoxins molecules related to toxicity.

CAP treatment in a preliminary study led to patulin detoxification in water. Patulin decomposition efficiencies reached 99% at an applied voltage of 25 kV for a 4 min treatment period, respectively. The applied voltage greatly affects the formation of oxidising species and decomposition of patulin. Increasing the applied voltage and treatment time both promoted patulin decomposition. After 1 min treatment, the patulin degradation efficiency reached 16, 72 and 83% at applied voltages of 19, 21 and 25 kV, respectively. The feasibility of efficient patulin detoxification in water using CAP led to a highly efficient patulin decomposition. Further research is planned on apple juices to understand the CAP mechanisms responsible for patulin decomposition and to evaluate the toxicity of the byproducts generated during the CAP process.

Preliminary studies on synthetic wine inoculated with a final concentration of 5 ppb OTA and treated CAP preset at different high voltage (12%, 25%, 40% and 50% of total generator voltage) and processing durations (1-4 min) was evaluated. After exposure to CAP for 3 min at 40% of the total generator voltage, a reduction of OTA was observed by approximately 55% ($p < 0.05$). By increasing the generator voltage and duration, OTA concentration in synthetic wine decreased significantly. Significant differences in the reduction of OTA were observed between CAP and

[18] Pankaj, S. K., Wan, Z., Colonna, W., & Keener, K. M. (2017). Effect of high voltage atmospheric cold plasma on white grape juice quality. Journal of the Science of Food and Agriculture, 97(12), 4016–4021. https://doi.org/10.1002/jsfa.8268

[19] Casas-Junco, P. P., Solís-Pacheco, J. R., Ragazzo-Sánchez, J. A., Aguilar-Uscanga, B. R., Bautista-Rosales, P. U., & Calderón-Santoyo, M. (2019). Cold Plasma Treatment as an Alternative for Ochratoxin A Detoxification and Inhibition of Mycotoxigenic Fungi in Roasted Coffee. Toxins, 11(6), 337. https://doi.org/10.3390/toxins11060337

artificial methods as disinfectants ($p<0.05$). The artificially solution of OTA had corresponding values for H_2O_2, NO_2^- and NO_3^- equal to 77.42, 1.75 and 0.0060 mg/L, respectively. It was observed that the reduction of OTA in artificial solution was almost only 5% of the initial OTA concentration. These findings suggest that the use of CAP may affect OTA concentration. This indicates that this technique may be useful in the food industry, providing an alternative solution for the mitigation of OTA consequences. The recorded reduction of OTA is considered high enough to meet the requirements set by the European Union, with maximum acceptable levels of OTA at 2 μg/kg for wines. Thus, this method appears to be promising for the removal of OTA in the wine.

QMEA studies are going to initiate as data gathered from Tasks 2.3 and 3.2 will increase enough to be efficient for the scientific approach. For this 1st project's period, training is being completed on QMEA techniques through forthcoming Workshop 3 and Summer School 2 going to take place next two months. Also, undergoing analysis of selected commodities and interaction with EFSA will pave the road to select the proper approach for QMEAs realisation.

1.2.1. Work Package 1 "Project management and dissemination plan"

The objective of WP1 is to manage and coordinate overall FunShield4Med activities, to deliver timely scheduled deliverables and milestones, and respond to technical and financial reporting requirements. Moreover, specific objectives of this WP include the facilitation of plans for dissemination of project results and data management, ethics, and gender equality plan issues.

Task 1.1. Data Management (M1-M36; Task leader: ELGO-ITAP)

Purpose of the Data Management Plan (DMP) is to contribute to proper data handling by indicating what research data FunShield4Med project expects to generate. Next, describe which parts of the data could be shared in public, and furthermore to include instructions on naming conventions, metadata structure, storing of the research data, and how to make data publicly available.

So far, during the 1st project's period (M1-M16), Google Drive repository is being used as the online working space and collaboration platform among the project's partners (Figure 1.2). The FunShield4Med Google Drive is only accessible to project's participants and can provide further access and/or control by establishing sub-folders and sub-sites with stricter access. During the project all data generated during project's lifespan are being uploaded to Google Drive and to the GitHub platform and stored in accordance with the ethics and privacy strategy. Additionally, datasets are being stored to the ELGO-ITAP's local servers, and to an external hard-drive handled under the responsibility of project's coordinator. All these means of back-up are not shared or distributed in any way to others outside the consortium. Metadata is being added to all datasets, and 'README' files with instructions are created in GitHub, offering guides on how to use and upload more research data.

Moreover, for the educational material and publications created through FunShiled4Med, the consortium uses the open research data repository Zenodo. Zenodo applies for research data of publications, but beneficiaries can also voluntarily make other datasets open. In FunShield4Med, all deliverables, publications, datasets, and other material like educational outputs are being uploaded to GitHub and/or in Zenodo platforms depending on their type and scope of use. The Deliverable of DMP is a living document and is being updated during the lifespan of the project,

while at the end of the project will reflect the actual research data generated during the project and will include updated instructions on how to facilitate open access of data. Day-to-day data management and monitoring will be done using an online list in the Google Drive that is being continuously updated to reflect actual data generation.

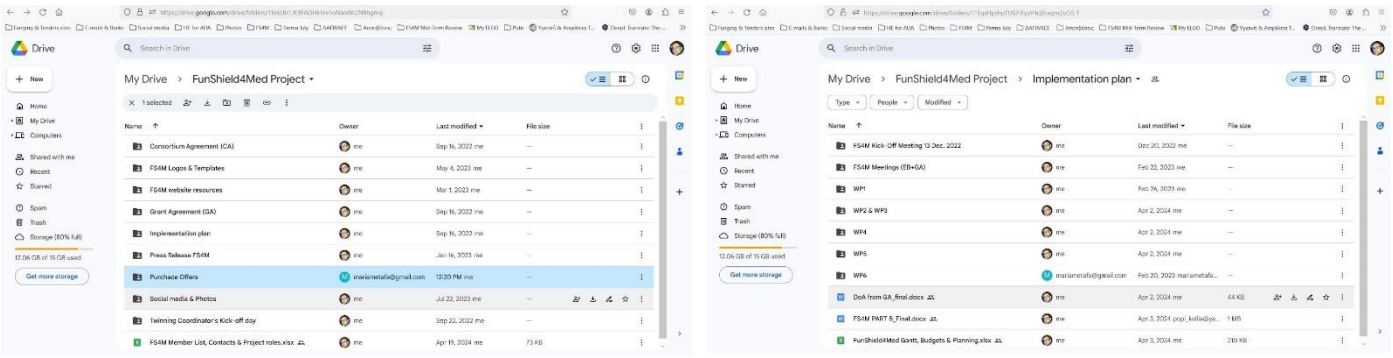

Figure 1.2 An overview of FunShield4Med Google Drive folder

Data Management Tools

To explain the workflow, it is separated into steps focused on the challenges and solutions for each part of the overall data workflow. In these steps described below, it is also discussed the series of tools used. To provide a central place for storing and managing FunShield4Med data, we use GitHub (https://github.com) (Figures 1.3 & 1.4), an online service and platform, offered freely to the public, and used in software development for managing version control. GitHub is a website and cloud-based service that assists researchers and developers in storing and managing projects, as well as tracking and controlling changes. Putting a project into GitHub brings increased and widespread exposure. Packages can be published privately, within the team, or publicly to the open-access community. The packages can be used or reused by downloading them from their repository. GitHub helps all the project's members stay on the same page and organise. Project's members can discuss any implementation and proposal before changing the source. GitHub uses dedicated tools to identify and analyse vulnerabilities.

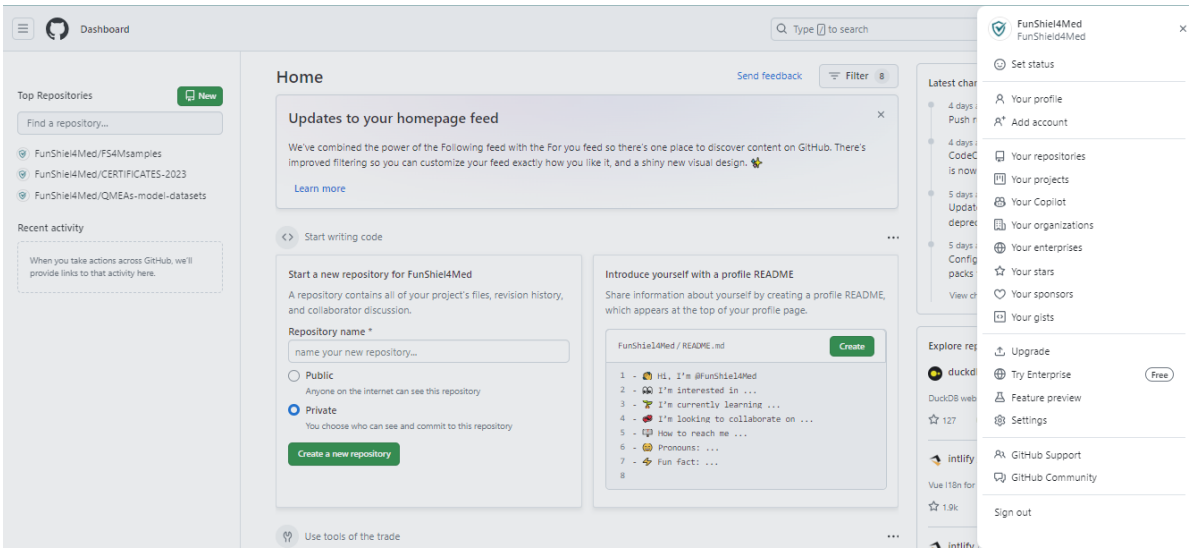

Figure 1.3 An overview of GitHub core features

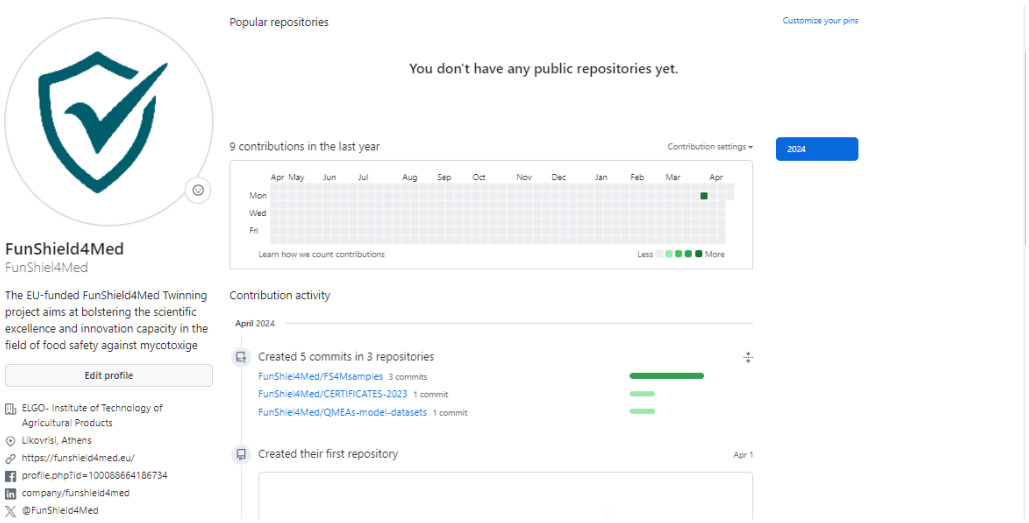

Figure 1.4 An overview of GitHub profile.

Furthermore, an important tool being used by the FunShield4Med project is Zenodo (https://zenodo.org/) (Figures 1.5 and 1.6). Zenodo is an online repository hosted at CERN facilities which allows sharing publications and supporting data. Launched in May 2013, the Zenodo repository was specifically designed to help 'the long tail' of researchers based at smaller institutions to share results in a wide variety of formats across all fields of science. Zenodo builds and operates a simple and innovative service that enables researchers, scientists, EU projects, and institutions to share and showcase multidisciplinary research results (data and publications) that are not part of the existing institutional or subject-based repositories of the research communities. Zenodo enables to: easily share the long tail of small research results in a wide variety of formats including text, spreadsheets, audio, video, and images (Figure 1.5), display their research results, get credited by making the research results citable, while easily integrating into the reporting guidelines of funding agencies like the European Commission, helping further the free access and reuse of shared research results.

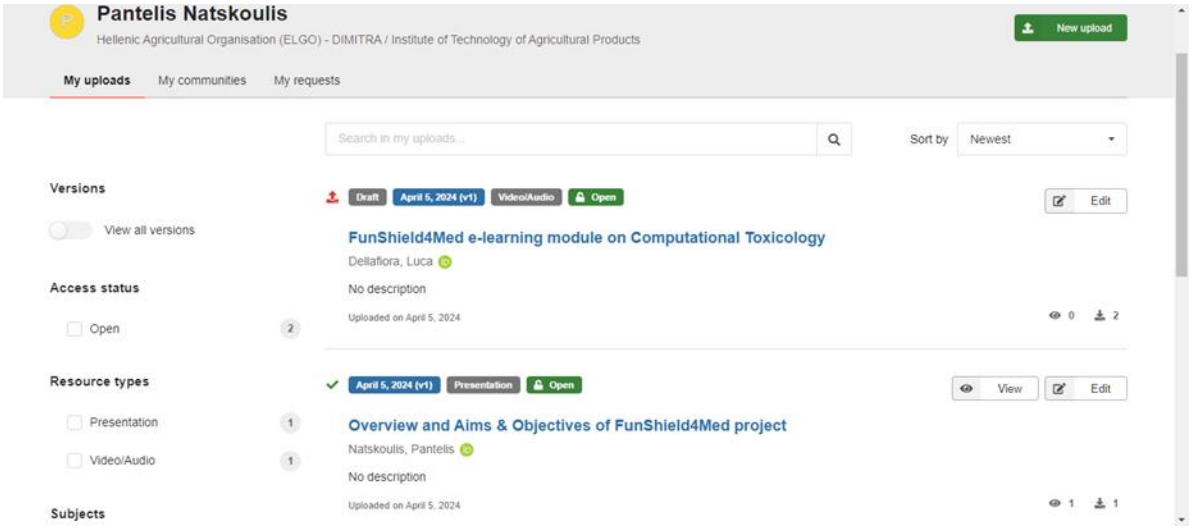

Figure 1.5 FunShield4Med documents uploaded in Zenodo online repository.

Zenodo's data records are also indexed in other databases, which is paramount to gaining visibility and along with it, drive to the easiness of reuse of data records. Some communities are already using Zenodo in their archival workflows, taking benefits also from their integration with the GitHub platform (https://github.com/), ORCID (https://orcid.org/), and OpenAIRE platforms (https://www.openaire.eu/) (Figure 1.6).

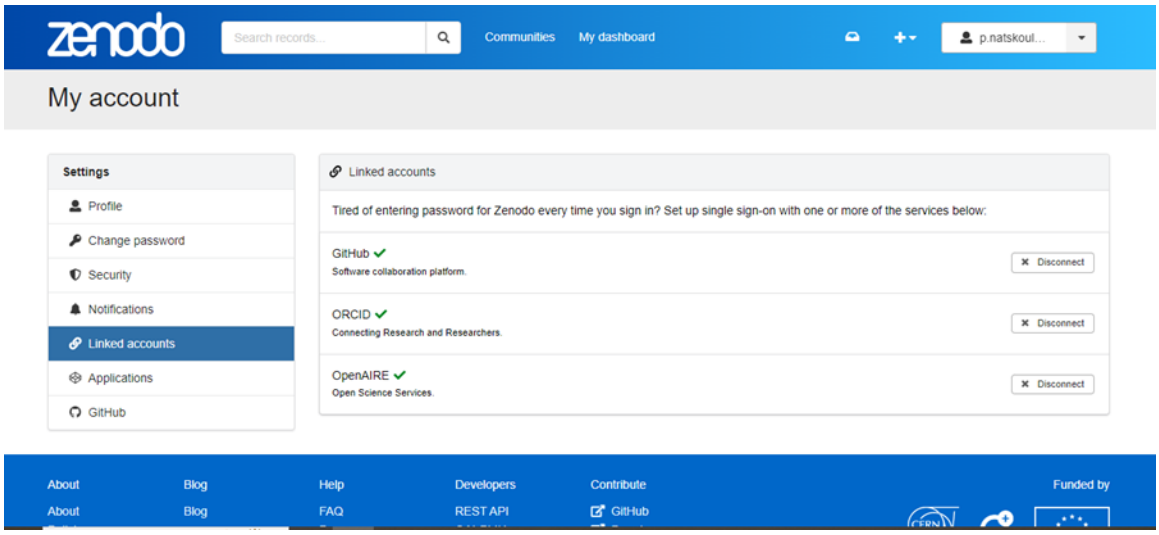

Figure 1.6 FunShield4Med Zenodo profile linked accounts.

Within the spectrum of cloud-based services for collaboration, GitHub is uniquely positioned (Table 1.7) to benefit scientists because it is specifically designed to store, track changes, and enable collaboration under fundamental components of modern research.

Table 1.7 A comparison of technologies commonly used for collaborating on research in Ecology and Evolutionary Biology.

Guild	Software	Version control	Cloud-storage backup	Passive collaboration	Active real-time collaboration	Does it provide a reasonably unrestricted free version?	Is it permanent (e.g. through a DOI)?	Storage limits	GitHub integration
Multi-tool	GitHub	Yes	Yes	Yes	No	Broadly used free version. Advanced features are provided for free to students and education professionals	A DOI can only be obtained when integrating to other services that can mint a DOI (e.g. Zenodo, OSF)	100 MB per file, 500 MB per private repository (2 GB for paid accounts). 100 GB for public repositories. Larger files (up to 2 GB) can be attached to release	N/A
Long-term (public) data repositories	Zenodo	After published	After published	Yes	No	Yes	Yes	50 GB per dataset	Yes

Quality assurance in data entry

For data collected onto datasheets (excel), the initial processing requires human interaction to enter the data and check that data entry lacks errors. Upon returning from the laboratory, new data were manually entered into Excel spreadsheets (Figure 1.7). Datasets from experimentation, surveys, and models, produced during the project, will be maintained pertaining to their own tasks with naming conventions (e.g., "DATASETNAME VERSION YYYY.MM.DD".csv or .xlsx) (Figure 1.8) to make it easily searchable and discoverable, while a relative metadata file (stored as a .txt file) created with the appropriate information is linked to the dataset (Figure 1.9). Excel spreadsheets are often used as a multipurpose tool for data entry, storage, analysis, and visualisation. The heterogeneity of data present in these sources often requires users to format the data into a consistent format to make it usable. Comma separated values (CSV) is a widely used format that stores tabular data (numbers and text) as plain text. Its popularity and viability are because CSV files are supported by many different applications and systems at least as an alternative import/export format. The CSV format allows the researchers to glance at the file and immediately diagnose the problems with data, change the delimiter, text qualifier, etc. All this is possible because a CSV document is plain text and an average user or even a novice can easily understand it.

Variety	Area	Vineyard	Vintage	wine co	replicat	v/v %	pH	Total Acic	Volatile	Density	malic A	Lactic A	Residu	Total PI	OTA	concent	tR	mean Temp (	Total Rain(mm)
Xinomavro	Amydeo	Amydeo	2019	1	a	12,4	3,1	7,77	0,49	0,9931	0,4	0,9	0,1	24,08	-				
Xinomavro	Amydeo	Amydeo	2019	1	b	11,9	3,1	7,79	0,46	0,9924	0,5	1	0,3	23,85	-				
Xinomavro	Amydeo	Amydeo	2019	1	c	12	3,1	7,71	0,42	0,9927	0,4	1,1	0,1	24,23	-				
Xinomavro	Amydeo	Amydeo	2020	2	a	12,7	3,4	6,8	0,49	0,9925	0,4	1,5	0	20,52	+	0,95	8.875		
Xinomavro	Amydeo	Amydeo	2020	2	b	12,6	3,3	6,72	0,47	0,9926	0,3	1,4	0,3	19,37	-				
Xinomavro	Amydeo	Amydeo	2020	2	c	12,6	3,4	6,81	0,43	0,9931	0,1	1,5	0,5	21,32	-				
Xinomavro	Tsantalis	Maronia	2021	3	a	13,2	3,5	6,15	0,53	0,9934	0,4	1,5	0	62,43	-				
Xinomavro	Tsantalis	Maronia	2021	3	b	12,9	3,6	6,31	0,49	0,9932	0,5	1,4	0	59,99	-				
Xinomavro	Tsantalis	Maronia	2021	3	c	13	3,6	6,23	0,48	0,993	0,3	1,3	0,1	61,93	+	0,65	8.725		
Xinomavro	Kir Yiannis	Amydeo	2021	4	a	14,2	3,7	5,09	0,63	0,9929	0	1,4	0	60,89	-				
Xinomavro	Kir Yiannis	Amydeo	2021	4	b	14,3	3,8	5,09	0,64	0,9931	0	1,3	0	63,48	+	0,692	8.600		
Xinomavro	Kir Yiannis	Amydeo	2021	4	c	14,1	3,8	5,08	0,62	0,9932	0,2	1,4	0	63	-				
Xinomavro	Amydeo	Chalkidiki	2021	5	a	13,1	3,2	6,87	0,78	0,9902	0,3	0,9	0	33,87	+	1.542	8.500		
Xinomavro	Amydeo	Chalkidiki	2021	5	b	12,9	3,3	6,72	0,7	0,9907	0,5	1,2	0,1	42	+	1.839	8.550	16	757
Xinomavro	Amydeo	Chalkidiki	2021	5	c	13	3,3	6,76	0,65	0,991	0,2	1,3	0	39,89	+	1.505	8.633		
Xinomavro	Amydeo	Fanos	2020	6	a	13,4	3,3	6,97	0,49	0,9926	0,2	1,5	0,1	31,7	-				
Xinomavro	Amydeo	Fanos	2020	6	b	13,2	3,3	6,92	0,5	0,9931	0,1	1,6	0,1	34,8	-				
Xinomavro	Amydeo	Fanos	2020	6	c	13,5	3,3	6,98	0,44	0,9929	0,2	1,2	0,2	33,22	-				
Xinomavro	Kir Yiannis	Goymenisa	2021	7	a	12,6	3,3	6,55	0,46	0,9933	0,1	1,2	0,5	39,41	-				
Xinomavro	Kir Yiannis	Goymenisa	2021	7	b	12,7	3,3	6,52	0,5	0,9932	0	1,3	0,1	41,87	-				
Xinomavro	Kir Yiannis	Goymenisa	2021	7	c	12,8	3,3	6,53	0,48	0,9935	0,1	1,3	0,3	40,3	-				
Assyrtiko	Avantis	Evia	2020	8	a	12,4	3	6,83	0,34	0,991	0,4	1,3	1	8,19	-				
Assyrtiko	Avantis	Evia	2020	8	b	12,4	3	6,88	0,4	0,9908	0,6	1,3	0,5	8,1	-				
Assyrtiko	Avantis	Evia	2020	8	c	12,7	3	6,87	0,38	0,9911	0,5	1	0,6	8,5	-				
Syrah	Muses Estate	Viotia	2023	9	a	14,9	3,5	5,55	0,48	0,9919	0	1	1	57,91	-				
Syrah	Muses Estate	Viotia	2023	9	b	14,8	3,6	5,43	0,49	0,992	0	0,8	1,3	60,32	-				
Syrah	Muses Estate	Viotia	2023	9	c	15	3,6	5,49	0,5	0,9911	0	1,3	0,9	59,32	-				

Figure 1.7 A dataset in an excel spreadsheet with data and information about wine samples analysed for ochratoxin A detection.

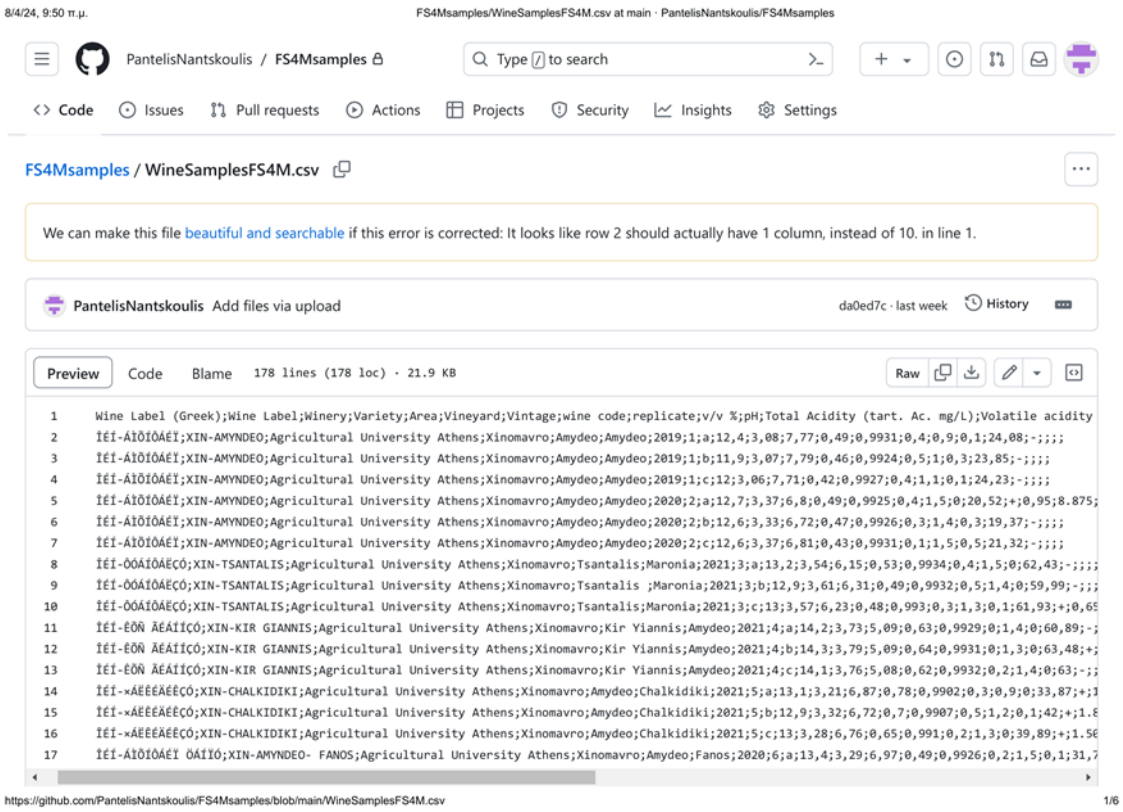

Figure 1.8 A metadata file (stored as a .txt file) with the wine samples collected with all the information linked to each sample (e.g. Wine label, Winery, Variety, etc.)

Project management can happen via three GitHub repository features (Figure 1.8): "Issues", "Discussion" and "Projects". GitHub Issues allow for discrete tasks and sub-tasks to be identified, assigned to team members, and categorised with custom labels. GitHub Discussions serve as a message board for conversation. GitHub collaborators can share files, give feedback, brainstorm ideas, even troubleshoot problems, as well multi-faceted components allow small data storage, manuscript writing, and project management to be done all in one place. README.md files allow new team members, or others wanting to use materials, to understand the project components and learn how they can engage with the project and existing team members.

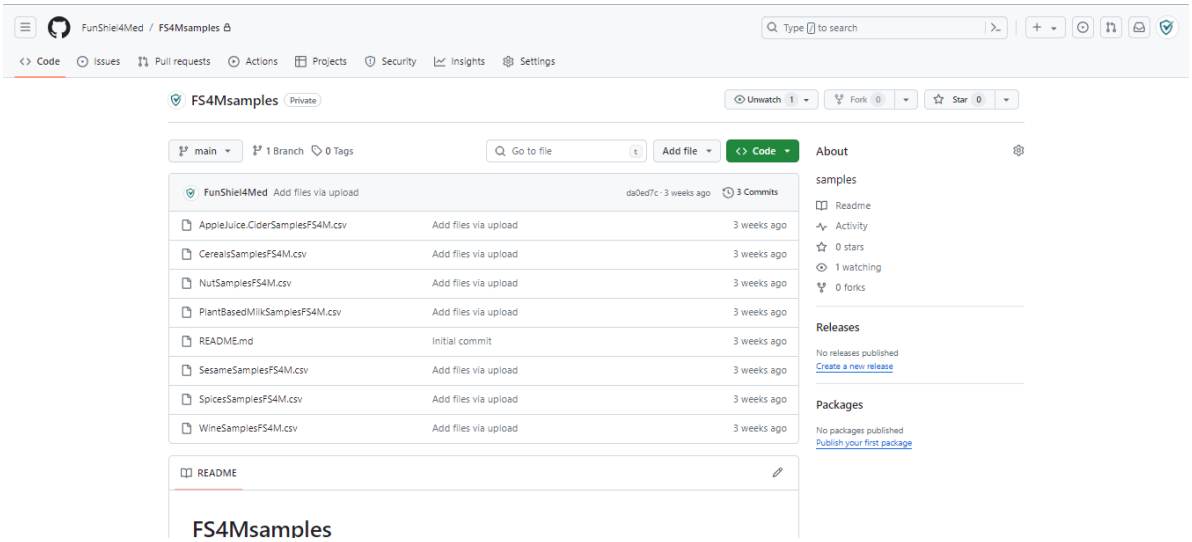

Figure 1.9 Sample Datasets uploaded in GitHub.

Data archiving

Through GitHub, data is made publicly available by making the repository public, or it can simply restrict access by making the repository private and giving permissions to select users. While repository settings allow data to be made available within or across research groups, GitHub does not guarantee the long-term availability of the data. GitHub repositories can be deleted at any time by the repository owners, resulting in data suddenly becoming unavailable. Zenodo incorporates the versioning described above so that version information is available in the permanently archived form of the data. Each version receives a unique DOI (Digital Object Identifier) to provide a stable web address to access that version and a top-level DOI is assigned to the entire archive, which can be used to collectively reference all versions of the datasets. This allows someone publishing a paper using the Portal Project data to cite the exact version of the data used in their analyses, to allow fully reproducible analyses, and to cite the dataset to allow accurate tracking of the usage of the dataset.

Adding data to databases on GitHub

To add data to FunShield4Med database, a system is designed for managing and tracking changes to files called "Version Control". Version Control can be used to track changes to any digital file, including datafiles. A specific version control system is applied for FunShield4Med, with the associated GitHub website, for managing version control. The master version of the Portal data files is stored on GitHub's website

(https://github.com/FunShield4Med/). The data, for management, are stored in the version control equivalent of a folder, called a repository. Through this online repository, all partner researchers in the project have access to the most up-to-date version of data.

Task 1.2. Coordination and DEC plan (M1-M36; Task leader: ELGO-ITAP)

This task performs the Coordination of the project, while sets the plans for its Dissemination, Exploitation and Communication (DEC). Through the meetings that are taking place every time either in person or as a virtual (Table 1.10). It provides procedures and guidelines for activity planning and updating, submission of periodic progress reports, and submission of deliverables to the Commission. As part of the project coordination and management, the coordinator, Dr Pantelis Natskoulis is the primary contact person for all correspondence among the consortium partners. The coordinator so far is planning all meetings with the project partners, is initiating, and coordinating the in-person meetings, and coordinating the teleconference meetings that are being conducted throughout the 16 months duration of this project. Project coordinator is in close contact with the partners' leaders (Prof. C. Proestos, NKUA; Prof. S. Marin, UdL; Prof. C. Dall'Asta, UNIPR; Prof. A. Medina, CU), controls the project planning, and ensures that the deliverables are finalised in time. In addition, all administrative and financial work that is foreseen in this project will be conducted as part of this WP1.

So far coordination meetings were organised in which representatives of all five institutions (ELGO, NKUA, CU, UdL and UNIPR) were present. Additionally, online meetings were organised regularly every 3 to 4 months to oversee realisation of process deliverables and milestones.

Progress on Coordination during 1st reporting period

The first face-to-face (Kick-off) meeting took place in NKUA campus/Athens with the whole consortium on 13 December 2023. During this meeting the milestones and deliverables of the work packages were discussed, a brainstorming session about the framework was held and important dates throughout the project were set.

The 1st Executive Board meeting was held with Teams on 21 February 2023 to discuss the challenges and to build the implementation plan.

The next face-to-face 2nd Executive Board meeting with the whole consortium was held on 4th of July 2024 in Parma. During this meeting the milestones and deliverables of the work packages were discussed, a brainstorming session about the framework was held, and important dates throughout the project were set about the upcoming events.

At the end of Workshop 2 which took place in NKUA, Athens, the 1st Grand Assembly Meeting took place on 24 November 2023. The meeting was held to discuss the challenges and to monitor the progress of the project and the upcoming steps.

The last meeting was held virtually on 27 of March 2024. The 3rd Executive Board Meeting was set up by gathering and rearrangement of the technical outputs produced by partners. Moreover, included information and further debates on:

- the handling of research data
- what data will be collected, processed, and/or generated
- whether data will be shared/made open access

- organising of upcoming events

Table 1.8 FunShield4Med meetings (Grand Assembly and Executive Board meetings)

Date	Location	Meeting	Description
13 December 2023	NKUA Campus, Athens, Greece	Kick-Off meeting	The starting point of FunShield4Med journey, KO meeting. All partners had the chance to meet, present their teams and plans, and discuss the FunShield4Med organisation and implementation plan.
Photo from the kick off meeting			
21 February 2023	Virtual Call	1st Executive Board Meeting	The 1st EB meeting on FunShield4Med implementation planning and JRP schedule
Screenshot from the Virtual call			
4 July, 2023	UNIPR Campus, Parma, Italy	2nd Executive Board meeting	The 2nd EB meeting took place on FunShield4Med implementation planning and JRP schedule
Photo from the 2nd Executive Board meeting			

24 November, 2023	NKUA Campus, Athens, Greece	1st Grand Assembly Meeting	The 3rd meeting of project (1st GA) took place at the campus of NKUA after completion of Workshop 2
Photo from Grand Assembly Meeting			
27 March, 2024	Virtual Call	3rd Executive Board Meeting	The last Consortium's meeting (3rd EB - 5th meeting) for implementation planning and organisation of forthcoming events

D1.1: Data Management Plan (ELGO-ITAP, M6, DMP)

A formal Data Management Plan has been drawn up and delivered due time (M6). maintained, and implemented. The DMP is currently updated to be delivered as an intermediate version at M17 and will be finalised M36. DMP outlines the type of data generated during research: metadata, standards, and quality assurance measures; plans for sharing data; copyright and intellectual property rights of data; data storage and back-up measures; data management roles and responsibilities. In addition, any technical risks are identified, regularly monitored, while mitigation measures are planned to deal with potential issues.

D1.2: Dissemination, Exploitation and Communication Plan (ELGO-ITAP, M6, R)

A Dissemination, Exploitation and Communication Plan was delivered timely on M6. The DEC plan sets the basis of scheduled relevant measures and will be regularly updated to compose the Final Report on DEC going to be delivered under D6.3 on M36.

D1.3: Mid-Term Progress Report (ELGO-ITAP, M17, R)

A Mid-Term Progress Report is prepared and delivered timely on M17 to be the basis for the interim review meeting.

Milestones achievements

Milestones achievements related to WP1 are presented under Table 1.9. Milestone 1 relating the initiation of the project, achieved in line with DoA at M1 with the realisation of Kick-Off Meeting (13 December 2022). The rest of Milestones are to be verified at M36, with exception of Milestone 9 relating the fulfilment of Mid-term Review and all Deliverables submission due to date (M18).

Table 1.9 Milestones achievements of WP1

No	Milestone name	Lead Beneficiary	Means of verification	Due to (month)
1	Project's Kick-Off	ELGO-ITAP	- Kick-off meeting with all partners, - WP activities for 1st year discussed in detail	M1
2	Management and Dissemination Plans	ELGO-ITAP	- Delivering updated DMP (D1.1) due to M6, M17 and M36 - Final Report on promotion and DEC (D6.1, D6.2, & D6.3)	M36
3	Increase of scientific competencies in R&I	ELGO-ITAP	- Midterm & Final Reports on Training Events (D1.4, D2.1 & D3.1) - Release of webinars recordings and e-tutorials (D2.1 & D3.1)	M36
9	Midterm scientific and technical review with EC	ELGO-ITAP	- Milestones and deliverables until M18 completed	M18
10	Final scientific and technical review with EC	ELGO-ITAP	- Milestones and Deliverables up to M36 completed - Final meeting with all partners	M36

Risks and mitigation measures

Risks and their mitigations measures related to WP1 are presented under Table 1.10. Until now (M16) no risk was realised and although mitigation measures are foreseen no need for their implementation was generated.

Table 1.10 Risks & Mitigation measures of WP1

Risk No	Description of risk (levels of likelihood (L) & severity (S): Low/Medium/High)	Proposed risk-mitigation measures
1	Ineffective management and/or administrative response of widening co-ordinator due to limited experience. (L: Medium / S: High)	Administrative and management support provided by the advanced partners to widening co-ordinator. Highest grade researchers and professors are included in all research teams with the experience in project coordination and management.
5	Conflicts among partners. (L: Low / S: Low)	Amicable solution according to legal framework in place (consortium agreement and grant agreement). All partners have long and close fruitful cooperation.

1.2.2. Work Package 2 "Enhancing scientific knowledge on analytical and computational mycotoxicology".

WP2 is devoted to the transfer of knowledge in state-of-the-art methods for the identification of mycotoxins with advanced analytical techniques. Moreover, a specific activity is dedicated to enhancing capacity on quantitative methods in computational toxicology, while specific case studies are scheduled (e.g. presence of mycotoxins in cereal-based milk analogues).

Task 2.1. Transfer of knowledge on identification of mycotoxins (M1-M18; Task leader: UNIPR)

Seminars and workshop activities have been carried out as expected.

Seminar 1 (M6; 16.05.2023) and Seminar 3 (M16; 21.03.2024) have been held at ELGO-ITAP premises according to the program reported in Table 1.11, with main subjects "Identification of Mycotoxins" and "The Occurrence of Non-regulated Mycotoxins in Foods", respectively. Staff from UNIPR have taken part in Seminars 1 & 3, while NKUA was involved in Seminar 3. Seminars have been attended by ELGO-ITAP research staff, as well as from young researchers from ELGO-ITAP and NKUA, as well as other universities/institutes (e.g. Kaunas University of Technology, LT; Traka University, BG; Wageningen University, NL; Benaki Phytopathological Institute, EL) and private sector's ECSs (Nielsen Company LLC, USA; Shisan Restaurants, EL). Time for discussion has been allowed at the end of each seminar day, to favour interaction and scientific exchange.

As a complementary activity, two workshops (WS) have been organised to enhance capabilities of ELGO-ITAP's research personnel and young scientists (ECSs and ESRs) through interactive learning and laboratory activities. Workshop 1 (M8; 03-04.07.2023) was organised at UNIPR premises with experts from NKUA, UNIPR and CU, covering subjects on "Computational methods for Mycotoxins". Apart from ELGO-ITAP personnel who travelled to participate, young researchers from NKUA, UNIPR and University of Valencia, attended the event. Workshop 2 (M12; 28-29.11.2023) was held at NKUA premises with the main topic addressed over the 2 days of lectures being "Impact of Climate Change Scenarios and Processing on Food Security Related to Mycotoxins". In addition, a specific training was given on exposure assessment and on the use of the EFSA supported ImproRisk platform. Experts from NKUA, CU and UNIPR, as well as an invited member of Cyprus State General Laboratory (SGL) for the presentation of ImproRisk platform were actively involved in the training, with attendance from young researchers and students from NKUA, as well as staff from ELGO-ITAP and others (Jotis S.A., EL; University of West Attica, EL; Benaki Phytopathological Institute, EL). Interactive training took place through case studies, ImproRisk platform, and equipment demonstrations.

The wider subjects addressed under all these training events of Task 2.1 are presented in Table 1.11.

Table 1.11 Training activities under Task 2.1

Training event	Date	Topics	Lecturer
Seminar 1 "Identification of Mycotoxins"	May 16, 2023	FunShield4Med project presentation	Dr. D. Milliordos, ELGO-ITAP
		Identification of Mycotoxins (parent, emerging, modified)	Prof. C. Dall'Asta, UNIPR
		EFSA Methodology on mycotoxins and relevant EU legislation	Prof. C. Dall'Asta, UNIPR
Seminar 3	March 21, 2024	The Occurrence of Non-Regulated Mycotoxins in Foods	Prof. C. Dall'Asta, UNIPR

"The Occurrence of Non-Regulated Mycotoxins in Foods"		Fusarium mycotoxins: Commodities of interest, determination methods, and EU legislation perspectives	Prof. C. Dall'Asta, UNIPR
		Fast molecular methods for the detection of mycotoxigenic fungi	Dr F. Roumani, NKUA
		Hands-on experiment on the design of qPCR primers for the detection of mycotoxigenic fungi	Dr F. Roumani, NKUA
Workshop 1 "Computational Methods for Mycotoxins"	July 3, 2023	Welcoming: introduction, & presentation of program	Prof. C. Dall'Asta, UNIPR
		New secondary metabolites of toxigenic fungi - masked, modified, emerging mycotoxins	Prof. C. Dall'Asta, UNIPR
		Invited companies to speak about analyses and/or instruments	All
		Visit to UNIPR experimental plant for wheat trials	All
	July 4, 2023	Chemometric and multivariate pattern recognition techniques	Prof. C. Dall'Asta, UNIPR
		Computational methods in toxicology	Prof. L. Dellafiora, UNIPR
		Case studies on exposure assessment	Dr. O. Mihalache, UNIPR
		Visit of facilities	All
Workshop 2 "Predictive Mycology & Quantitative Mycological Exposure Assessment (QMEA)"	November 28, 2023	Introduction to fungal ecophysiology	Dr A. Patriarca, CU
		Introduction to mathematical modelling for predictive mycology and risk assessment	Prof. V. Valdramidis, NKUA
		Acquisition of data	Dr A. Patriarca, CU
		Modelling case studies (Hands-on)	Dr A. Patriarca, CU & Prof. V. Valdramidis, NKUA
		Hands-on activities (Predictive Mycology)	Dr A. Patriarca, CU & Prof. V. Valdramidis, NKUA
	November 29, 2023	Introduction to ImproRisk platform	Dr G. Stavroulakis, Cyprus SGL

		Hands-on use of the ImproRisk platform (QMEA)	Dr G. Stavroulakis, Cyprus SGL
		Quantitative Mycotoxins Exposure Assessment (Hands-on)	Dr O. Mihalache, UNIPR
		Mycotoxins & Climate Change	Prof. A. Medina, CU
		Analytical equipment demonstration	NKUA technical personnel

Activities foreseen for Task 2.1 have been therefore fully completed according to the DoA.

Task 2.2. Training of researchers of the ELGO-ITAP on analytical and computational methods (M8-M24; Task leader: NKUA)

The STSEs of ELGO-ITAP personnel at UNIPR have been defined and organised through a series of bilateral meetings, QMEAs are going to take place after completion of data set acquired by partners (ELGO-ITAP & NKUA), and webinars and e-tutorials are partially completed as are being under progress.

Two short visit stays have been organised for ELGO-ITAP staff (Physicochemical Laboratory, one staff on GC and one on HPLC equipment) at UNIPR premises and scheduled for June 2024 (16-28.06.2024). Seconded staff will be trained on state-of-the-art analysis of mycotoxins (and/or modified), multi- or emerging toxins, while they will be involved in the analysis of plant-based milk samples collected within the common research project activities (Task 2.3). Following is programmed one more STSE to take place at UNIPR premises.

Collection of data acquired for the realisation of QMEA is undergoing through samplings and analysis performed under Task 2.3 with the participation of all partners, while training on QMEA has been successfully accomplished through the received training under Task 2.1.

As far as the preparation of e-tutorials, one video tutorial was developed by Prof. Luca Dellafiora, UNIPR, about fundamentals computational toxicology. The tutorial was then expanded with a practical case-study on ochratoxin A toxicity. The video was uploaded to the public repository Zenodo (DOI: 10.5281/zenodo.10931843) and soon will be further disseminated through the FS4M YouTube channel. A second e-tutorial is under preparation by UNIPR staff on data treatment and chemometrics in mycotoxin analysis. It will be uploaded to Zenodo and further released on the FS4M YouTube channel in June 2024.

Further planned activities, i.e. 2 webinars, are scheduled for M18-M24 and will be prepared by CU, NKUA, and UNIPR.

Activities foreseen for Task 2.2 are therefore fully aligned with the DoA schedule.

Task 2.3 Evaluation of mycotoxins prevalence in Mediterranean food products and imports (M8-M36; Task leader: UNIPR)

Presented under sub-chapter 1.2.0 Research component (FunShield4Med Joint Research Project)

Task 2.4 Advisory activities in the establishment of harmonised methods of detection to EU regulations (M25-M36; Task leader: UNIPR)

Activities will be carried out in the second half of the project. ELGO-ITAP personnel have already started applying an HPLC-FLD method after IAC treatment, for detection of AFs in cereal products, and upon completion of Task 2.4 will be validated through ring tests between consortium relevant laboratories.

D2.1: Seminars organised at ELGO-ITAP, and training and workshops performed at UNIPR and NKUA (UNIPR, M36, R).

The present deliverable is under preparation and will be finalised once all the training activities will be completed according to the schedule. It will include a report on Seminars organised at ELGO-ITAP premises by experts of advanced partners (Seminars 1 & 3), Workshops organised at UNIPR (Workshop 1) and at NKUA (Workshop 2), and Training of ELGO-ITAP personnel performed at UNIPR through STSEs.

D2.2: Report on validation results of EU official mycotoxins determination methods and on food surveys (UNIPR, M36, R).

D2.2 will be a report on validation results of the EU official mycotoxins determination methods employed to ELGO-ITAP and on the results of food surveys performed in the context of the JRP. It will be delivered upon completion of all Tasks assigned under WP2.

Milestones achievements

Milestones achievements related to WP2 are presented under Table 1.12. Most of them are to be verified at M36, with exception of Milestone 9 relating the fulfilment of Mid-term Review and all Deliverables submission due to date (M18).

Table 1.12 Milestones achievements of WP2

No	Milestone name	Lead Beneficiary	Means of verification	Due to (month)
3	Increase of scientific competencies in R&I	UNIPR	- Midterm & Final Reports on Training Events (D1.4, D2.1 & D3.1) - Release of webinars recordings and e-tutorials (D2.1 & D3.1)	M36
4	Establishment of harmonised methods of mycotoxins detection	UNIPR	- Validation results of 2 EU official mycotoxins determination methods (D2.2)	M36
8	Research network for long-term scientific cooperation	ELGO-ITAP	- Submission of joint proposals for international research calls and joint publications in journals	M36
9	Midterm scientific and technical review with EC	ELGO-ITAP	- Milestones and deliverables until M18 completed	M18
10	Final scientific and technical review with EC	ELGO-ITAP	- Milestones and Deliverables up to M36 completed - Final meeting with all partners	M36

Risks and mitigation measures

Risks and their mitigations measures related to WP2 are presented under Table 1.13. Until now (M16) no risk was realised and although mitigation measures are foreseen no need for their implementation was generated.

Table 1.13 Risks & Mitigation measures of WP2

Risk No	Description of risk (levels of likelihood (L) & severity (S): Low/Medium/High)	Proposed risk-mitigation measures
2	Limited prevalence data on modified mycotoxins and/or limited data available to be able to separate uncertainty and variability. (L: Medium / S: High)	Increase of the sampling size of the benchmarking data, literature data will be incorporated and/or advanced statistical methods will be applied.
4	Poor organisation or difficulties in organising training, DEC and/or conference events. (L: Low / S: High)	Project coordinator and consortium will regularly review training actions, research projects and staff exchange to prepare them efficiently.
5	Conflicts among partners. (L: Low / S: Low)	Amicable solution according to legal framework in place (consortium agreement and grant agreement). All partners have long and close fruitful cooperation.

1.2.3. Work Package 3 "Enhancing scientific knowledge on fungal molecular ecology and ecophysiology".

The objective of WP3 is to transfer knowledge in ecophysiology and molecular ecology and the impact of climate change on food security related to mycotoxins. Advanced bioinformatics tools will be used to analyse big data related to these aspects.

Task 3.1. Transfer of knowledge on strategic foresight scenarios (M1- M24; Task leader: CU)

Seminars and workshop activities are being carried out as expected.

Seminar 2 (M8; 21.07.2023) has been held at ELGO-ITAP premises according to the program reported in Table 1.14, with main subject "Food Contaminants: Mycotoxins, Heterocyclic Amines, Polycyclic Aromatic Hydrocarbons". Staff from NKUA undertook lectures while 2 guest lecturers from Ataturk University in Turkey have been involved, to enlarge networking and collaboration opportunities, and engage audience to a wider perspective on food contaminants by including presentations on Heterocyclic Amines & Polycyclic Aromatic Hydrocarbons. Seminar 2 was attended apart from ELGO-ITAP personnel, as well as from young researchers from ELGO-ITAP, NKUA, and Agricultural University of Athens (EL). Time for discussion has been allowed at the end of seminar day, to favour interaction and scientific exchange. Seminar 4 is programmed to take place again in ELGO-ITAP premises (M18; 24.06.2024) with lecturers from CU, UdL and NKUA, while there is a thought to be delivered additionally as a webinar to reach an increased audience of interest. Its subjects will be decided at the next EB meeting, which is going to take place within May 2024.

As a complementary activity, two workshops being organised to enhance capabilities of ELGO-ITAP's research personnel and young scientists (ECSs and ESRs) through interactive learning and laboratory activities. Workshop 3 (M17; 25-26.04.2024) was organised at CU premises with experts from NKUA, UdL and CU, covering subjects on "The impact of Climate Change Scenarios on Food Security Related to Mycotoxins". A more detailed presentation

of Workshop 3 content is presented under Table 1.14. Apart from ELGO-ITAP personnel (5) who travelled to participate, young researchers from CU, and UdL, attended the event. Moreover, the theoretical part of Workshop 3 was offered as a webinar with distance access for participants that could not attend in person. Eleven researchers and scientists attended by distance the event with 8 of them being ESRs/ECSs. Workshop 4 (M24) is going to be held at ELGO-ITAP premises, while the exact date, lecturers, and main topic to be addressed will be decided in the forthcoming meetings of the consortium.

The wider subjects addressed under past and forthcoming but already organised training events of Task 3.1 are presented in Table 1.14.

Table 1.14 Training activities under Task 3.1

Training event	Date	Topics	Lecturer
Seminar 2 "Food Contaminants: Mycotoxins, Heterocyclic Amines, Polycyclic Aromatic Hydrocarbons"	July 21, 2023	Sampling techniques for mycotoxins in foods according to EU regulations. Case study for aflatoxins, ochratoxin A and patulin	Prof. C. Proestos, NKUA
		Mass Spectrometric analysis of mycotoxins – Sample preparation and target screening approaches	Prof. M. Dasenaki, NKUA
		Determination of Heterocyclic Amines in foods, EU regulation, sampling techniques	Prof. F. Öz, Ataturk University
		Determination of Polycyclic Aromatic Hydrocarbons (PAHs) in foods, EU regulation, sampling techniques	Prof. E. Öz, Ataturk University
Seminar 4 & Webinar 2	M18 (June 2024)	TBA[1]	TBA
Workshop 3 & Webinar 1 "The impact of Climate Change Scenarios on Food Security Related to Mycotoxins"	April 25, 2024	Climate change and its impact on food safety and spoilage: a farm to table and an energy to sustainability journey (Distance access/Webinar 1)	Prof. V. Valdramidis, NKUA
		Fate of mycotoxins during processing of food products (Distance access/Webinar 1)	Prof. V. Sanchis, UdL
		Introduction of case studies to evaluate risks of mycotoxin contamination	Prof. S. Marin & Prof. V. Sanchis, UdL
		Working in groups to prepare a PPT presentation for discussion	ELGO-ITAP team
	April 26, 2024	Principles of molecular ecology, and integration of big datasets to study fungal behaviour under	Prof. A. Medina, CU

		interacting environmental conditions and processing (Distance access/Webinar 1)	
		Hyperspectral imaging for the identification of contaminated foodstuff (Distance access/Webinar 1)	Prof. S. Marin, UdL
		Case study presentation	Mr G. Froutis, ELGO-ITAP
		Tour in CU laboratories and equipment demonstration	All
Workshop 4	M24 (November 2024)	TBA	TBA

[1]TBA: To Be Announced

Activities foreseen for Task 3.1 are partially completed and foreseen actions are fully aligned with the DoA schedule.

Task 3.2. Training of researchers of the ELGO-ITAP on molecular ecology and ecophysiology (M8-M36; Task leader: UdL)

The STSEs of ELGO-ITAP personnel at CU and UdL will be defined and organised through a series of bilateral meetings, QMEAs are going to take place after completion of data set acquired by partners (ELGO-ITAP & NKUA), and webinars are partially organised and will be delivered with the completion of present Task 3.2. Until now (M16) only one STSE of ELGO-ITAP personnel have been completed with the secondment of Dr G. Markou at UdL Laboratory of Food Technology (2-12 October 2023) and had as subject of training the "In vitro study of the efficiency of a clay-based adsorbent to prevent the release of AFB1 from aquafeed into a fish digestion system". As Dr G. Markou has a career orientation to aquaculture, while UdL is currently developing research on mycotoxins absorbents, the STSE subject was arranged accordingly to increase potential of future collaboration between partners. In the second half of the project, one more STSE to UdL and 5 STSEs to CU are programmed to take place.

Activities foreseen for Task 3.2 are partially completed and foreseen actions are fully aligned with the DoA schedule.

Task 3.3. Advisory activities for the establishment of the Mycotoxins Mediterranean Training Hub (MyMedHub) and in computational toxicology tools (M25-M36; Task leader: CU)

As this Task is going to take place after M25 there is no progress yet to be reported. Briefly, this task is dedicated to the creation of a mycological and computational toxicology centre at ELGO-ITAP aiming at compiling computational tools to support integrative approaches to toxicological research and chemical safety assessments via predictive modelling, and analyses of complex and multifaceted data sets. Researchers from UdL, CU, UNIPR, NKUA and ELGO-ITAP will develop problem-based learning activities and a multi-criteria decision analysis that will aim at balancing microbial risks and environmental impacts, and that will provide specific management tools for combating emerging mycotoxin issues on several different Mediterranean products.

Activities foreseen for Task 3.3 are going to take place after M25 as scheduled within the DoA.

D3.1: Decision Support System (DSS) based on algorithms (CU, M36, DEM)

D3.1 will provide a Decision Support System (DSS) based on algorithms by CU and NKUA to support the relevant QMEAs from ELGO-ITAP.

D3.2: Seminars organised at the ELGO-ITAP, training performed at CU and UdL, and workshops at CU and ELGO-ITAP (UdL, M24, R)

The present deliverable is under preparation and will be finalised once all the training activities will be completed according to the schedule. It will include a report on Seminars organised at ELGO-ITAP premises by experts of advanced partners (Seminars 2 & 4), Workshops organised at CU (Workshop 3) and at ELGO-ITAP (Workshop 4), and Training of ELGO-ITAP personnel performed at CU and UdL through STSEs.

Milestones achievements

Milestones achievements related to WP3 are presented under Table 1.15. Most of them are to be verified at M36, with exception of Milestone 5 relating to the establishment of MyMedHub due to M24 and Milestone 9 relating the fulfilment of Mid-term Review and all Deliverables submission due to date (M18).

Table 1.15 Milestones achievements of WP3

No	Milestone name	Lead Beneficiary	Means of verification	Due to (month)
3	Increase of scientific competencies in R&I	UNIPR	- Midterm & Final Reports on Training Events (D1.4, D2.1 & D3.1) - Release of webinars recordings and e-tutorials (D2.1 & D3.1)	M36
5	MyMedHub Establishment	ELGO-ITAP	- Application to relevant authorities for establishment MyMedHub (T3.3)	M24
8	Research network for long-term scientific cooperation	ELGO-ITAP	- Submission of joint proposals for international research calls and joint publications in journals	M36
9	Midterm scientific and technical review with EC	ELGO-ITAP	- Milestones and deliverables until M18 completed	M18
10	Final scientific and technical review with EC	ELGO-ITAP	- Milestones and Deliverables up to M36 completed - Final meeting with all partners	M36

Risks and mitigation measures

Risks and their mitigations measures related to WP3 are presented under Table 1.16. Until now (M16) no risk was realised and although mitigation measures are foreseen no need for their implementation was generated.

Table 1.16 Risks & Mitigation measures of WP3

Risk No	Description of risk (levels of likelihood (L) & severity (S): Low/Medium/High)	Proposed risk-mitigation measures

2	Limited prevalence data on modified mycotoxins and/or limited data available to be able to separate uncertainty and variability. (L: Medium / S: High)	Increase of the sampling size of the benchmarking data, literature data will be incorporated and/or advanced statistical methods will be applied.
4	Poor organisation or difficulties in organising training, DEC and/or conference events. (L: Low / S: High)	Project coordinator and consortium will regularly review training actions, research projects and staff exchange to prepare them efficiently.
5	Conflicts among partners. (L: Low / S: Low)	Amicable solution according to legal framework in place (consortium agreement and grant agreement). All partners have long and close fruitful cooperation.

1.2.4. Work Package 4 "Enhancement of mobility and scientific potential of young scientist".

The objective of WP4 is to unlock scientific potential of Early-stage Researchers (ESRs) and Early-Career Scientists (ECSs) by facilitating their increased mobility and learning of novel skills, techniques, and knowledge. The multidisciplinarity of the project's consortium will facilitate expanding of their scientific work to different research avenues. ESRs will take the lead in this WP's actions, which will be particularly beneficial to the ELGO-ITAP personnel as it will foster scientific talent within the Institute and enhance their potential in becoming independent research leaders.

Task 4.1. The enhancement of mobility of ESRs (M1-M36; Task leader: ELGO-ITAP)

During this task ESRs from ELGO-ITAP personnel can gain knowledge and skills in complementary fields of expertise during visits to partner institutions and to form a network of young scientists focused on future co-operations and projects. Activities include 10 short-term staff exchanges (STSEs) for ELGO-ITAP researchers to advanced partners, of which 6 are intended for young researchers. Also, researchers from advanced partners will come to ELGO-ITAP through short-term expert visits (STEVs) for lectures in training events (Summer Schools, Seminars, Workshops). This way the project also provides the intensified mobility of young scientists, and eventually improves international competitiveness for future projects. ESRs are already stimulated to apply for international and mobility funding applications (e.g. Marie-Curie fellowships; ERC grants; HE grants).

Until now, one STSE has been realised with the secondment of Dr G. Markou, ESR from ELGO-ITAP, to the Laboratory of Food Technology of UdL, during the period of 2-12 October 2023. The topic of training was the "Efficacy of mycotoxin binders in *Sparus aurata* fed with contaminated with fumonisin and aflatoxin feed". Dr Markou who has expertise in biotechnology, aquatic systems, and aquafeed, worked in this secondment in collaboration with Dr. X. Pascari of UdL research team, with expertise in mycotoxins' absorbents and feed technology. The work was designed for feeding the fishes with six experimental diets, namely the control feed (Ctrl), the control feed contaminated with aflatoxin B1 (AFB1), control with fumonisin B1 (FB1), control with binder, control with AFB1 and binder, and control with FB1 and binder. Each treatment was applied to three tanks containing 20 fish/tank, with a total count of 18 tanks. Zootechnic parameters were calculated, and histological study of the intestine and liver and blood analysis were carried out in laboratories of Food Technology, Engineering, and Science Dept of UdL. Analysis of mycotoxins (AFB1 & FB1) and their biomarkers (sphinganine and sphingosine) in plasma, liver, and kidney of fish followed, with HPLC-MS/MS system, after LLE. All samples' extracts were

deposited at -20°C until analysis. The feed composition and structure can facilitate the release of the mycotoxin or might interact with the adsorbent agent. The results will help understand this interaction and the levels of AFB1 that could be expected in an in vivo study. Dr Markou with Dr Pascari designed and executed the experiment, while next STSE to UdL from ELGO-ITAP will be trained on HPLC-MS/MS analysis of the samples retrieved during the experiment.

Moreover, there are 2 more STSEs of Mrs P. Merkouri and Mrs I. Panagopoulou, senior scientists from technical personnel of Physicochemical Laboratory of ITAP, organised at UNIPR Analytical Laboratory in June 2024 (16-28.06.2023). During their stay at UNIPR they will acquire training on state-of-the-art equipment for the analysis of mycotoxins. Mrs Panagopoulou and Mrs Merkouri, with expertise on mycotoxins determination with GC and HPLC equipment, respectively, are going to receive training on modern protocols for mycotoxins detection on state-of-the-art equipment (e.g., tandem MS; Single and/or Triple Quadrupole MS; HR-MS etc.). Their training will be presented in the relative deliverable D4.1.

From the remaining 9 STSEs for researchers of ITAP going to take place in the 2nd period of the project, the 5 are going to be for ESRs and 4 for senior research and/or administrative personnel. Until now the programmed STSEs of FunShield4Med of EGLO-ITAP personnel are presented in the following Table 1.17.

Table 1.17. ELGO-ITAP secondments (STSEs)

Person (Research stage)	Career Stage	Receiving partner	Subject of training	Period of STSE
Dr G. Markou (ESR)	C1 (Recognised Researcher)	UdL	Experimentation with mycotoxins absorbents	02-12.10.2023
Mrs P. Merkouri	D2 (Other First Stage Researcher – Technical personnel)	UNIPR	Analytical protocols and hands-on for mycotoxins determination with state-of-the-art equipment	16-28.06.2024
Mrs I. Panagopoulou	D2 (Other First Stage Researcher – Technical personnel)	UNIPR	Analytical protocols and hands-on for mycotoxins determination with state-of-the-art equipment	16-28.06.2024
Mr G. Froutis (ESR)	D1 (First Stage Researcher – PhD student)	CU	Molecular basis of secondary metabolite production and integration and use of "big data" for mycotoxins	Sep-Nov 2024
Dr P. Natskoulis (ESR)	C1 (Recognised Researcher)	UdL	Non-destructive detection of mycotoxins using NIR hyperspectral analysis	Sep-Nov 2024
Dr D. Miliordos (ESR)	C2 (Recognised Researcher)	CU	Molecular basis of secondary metabolite production and integration and use of "big data" for mycotoxins	Sep-Nov 2024

Mrs C. Sourri (ESR)	D2 (Other First Stage Researcher – Technical personnel)	CU	Molecular ecophysiology and integration and use of "big data" for mycotoxins	Mar-Apr 2025
Mrs G. Charvourou	D2 (Other First Stage Researcher – Technical personnel)	UNIPR	State-of-the-art multi-toxins analysis (and/or modified forms)	Jun-Jul 2025
Mrs P. Chrysanthou	D2 (Other First Stage Researcher – Technical personnel)	UNIPR	Use of chemometric and multivariate pattern recognition techniques on large data sets for classification, feature selection, prediction, and data curation	Jun-Jul 2025
Mrs E. Trifylli	Administration personnel	UNIPR	Budgets planning, constraints of financial and ethical regulations, IPR plans, administration in efficient project management	Sep-Nov 2025
Dr O. Papadopoulou (ESR)	B (Senior Researcher)	CU	Mechanisms used for ecophysiological tolerance, and molecular basis of secondary metabolite production for mycotoxins	Sep-Nov 2025

Additionally, within the project's dissemination activities are foreseen expenses for the participation to international conferences and which are going to provide an extra mobility action for ESRs. From this point of view, there are already realised a participation of Dr P. Natskoulis, ELGO-ITAP ESR, to the 2023 IAFP European Symposium held during the period of 3-5 May 2023 at Aberdeen, Scotland, where he presented the project's aims and objectives through a poster, and also participation of Dr D. Miliordos, ELGO-ITAP ESR, to the 5th MS Wine day, 22-24 May 2024, at Greek Wines Federation, Italy, for the presentation of OTA results in wines analysed by ELGO-ITAP.

Finally, the enhancement of scientific potential of ELGO-ITAP ESRs is further highlighted by the achievements in international fundraising, as during the 1st period of the project, have been submitted 10 proposals of which 2 have achieved funding (EXCEL4MED, under WIDERA Excellence Hubs and NOVISHPAK, under PRIMA Section 2).

Activities foreseen for Task 4.1 are therefore fully aligned with the DoA schedule.

Task 4.2. The enhancement of management experience of young scientists (M1-M36; Task leader: NKUA)

This task focus on the capacities improvement of ESRs regarding managing experiences by taking responsibility in the organisation of their STSEs to advanced partners, on the dissemination of project scientific results, the organisation of presentations at annual Science Festivals and Research Nights, and finally the organisation of an International Conference for Young Scientists (M30) in the field of Mycology, with participation of ESRs and ECSs. In addition, 12 Short-term expert visits (STEV) are foreseen from advanced partners who will visit and train EGLO-ITAP's personnel and ESRs/ECSs during the 2 Summer Schools organised (M7 & M19). Moreover, the establishment of MyMedHub at ELGO-ITAP will further support the acquisition of managerial skills of its research personnel since the hub's organisation and management will be assigned to ESRs.

The progress achieved under the present task encompasses the organisation of the 1st STSE of Dr G. Markou to UdL, the participation of ESRs to international conferences (IAFP European Symposium 2023, Dr P. Natskoulis; ASTI 5th MS Days, Dr D. Miliordos; 10th MBK International Conference, Dr P. Natskoulis, Dr A. Argyri, Mr G. Froutis, Dr A. Doulgeraki), the organisation and participation in 2023 European Researcher's Night (Dr A. Argyri, Mr G. Fortis), the co-organisation of 10th MBK International Conference (Dr A. Doulgeraki, Dr P. Natskoulis). Also, within 2024 NKUA Dept of Chemistry organise the biannual conference for ESRs "Athens Conference on Advances in Chemistry" for which is already under planning the participation of FunShield4Med in its organisation with enrolment of its ESRs to relevant tasks. FunShield4Med is under debate also with the administrative board of ICPMF International Conference, either for the co-organisation of the whole event or the organisation of a Predictive Mycology session within its program. With regards to the STEVs for FusShield4Med Summer Schools, there have been already 7 experts visits to 1st Summer School that took place at UNIPR (4 from CU and 3 from NKUA), while there are going to take place more (6-8, from CU, UNIPR) during the 2nd Summer School at Athens in June 2024. Finally, the establishment of MyMedHub is organised to start actions after M25 of the project.

The wider subjects addressed under the training events of Task 4.2 are presented in Table 1.17.

Table 1.18. Training activities under Task 4.2 (Summer School 1 at UNIPR, Summer School 2 not presented as to be organised in June 2024)

Training event	Date	Topics	Lecturer
Summer School 1 "Mycotoxins under Climate Change"	July 3, 2023	Welcoming: introduction, & presentation of program	Prof. C. Dall'Asta, UNIPR
		Presentation of teamwork	Prof. C. Dall'Asta, UNIPR
		Fungal Biology	Prof. A. Medina, CU
		Introduction to food mycology	Dr A. Patriarca, CU
		Toxigenic fungi & mycotoxins	Dr Carol Verheecke-Vaessen, CU
	July 4, 2023	MS analysis of mycotoxins – target & non-target screening approaches	Prof. M. Dasenaki, NKUA
		Computational methods in toxicology	Prof. L. Dellafiora, UNIPR
		Case studies on exposure assessment	Dr O. Mihalache, UNIPR
		Visit of facilities	All
	July 5, 2023	ELISA technique for mycotoxins	Prof. C. Proestos, NKUA
		Food sampling: basic principles, protocols, techniques, EU Regulation and International standards	Prof. C. Proestos, NKUA

		Risk assessment	Dr E. Kollia, NKUA
	July 6, 2023	Mycotoxin mitigation strategies	Dr C. Cervini, CU
		Intro to Mycotoxins & Climate Change	Prof. A. Medina, CU
		Mycotoxin mitigation - Case studies	Dr C. Cervini, Dr C. Verheecke-Vaessen & Dr A. Patriarca, CU
		Teamwork	All
	July 7, 2023	Presentations of Risk Assessment by the groups	All

Activities foreseen for Task 4.2 are therefore fully aligned with the DoA schedule.

D4.1: Career development plan of participating young researchers (NKUA, M24, R).

Career development plan of participating young researchers will present the mobility outcomes of young scientists of ELGO-ITAP personnel through STSEs and the relevant training material from STEVs contribution to the project. The intermediate update of the deliverable for M12 is finalised and will be updated and delivered at M24.

D4.2: International conference for young scientists (ELGO-ITAP, M30, DEC).

The deliverable is dedicated to the organisation of the international conference for young scientists for their enhancement on management experience. Its delivery is programmed for M30.

D4.3: Summer Schools for ESRs & ECSs (ELGO-ITAP, M20, R).

Deliverable 4.3 encompasses a report on the outcomes of the 2 Summer Schools organised at UNIPR (Summer School 1, M7) and at ELGO-ITAP (Summer School 2, M18) for ESRs & ECSs, and it is under preparation to be submitted due to M20.

Milestones achievements

Milestones achievements related to WP4 are presented under Table 1.18. Most of them are to be verified at M36, with exception of Milestone 6 relating STSEs and international conference organisation due to M30 and Milestone 9 relating the fulfilment of Mid-term Review and all Deliverables submission due to date (M18).

Table 1.19 Milestones achievements of WP4

No	Milestone name	Lead Beneficiary	Means of verification	Due to (month)
6	Young researchers' mobility and scientific potential (Personnel, ECSs, ESRs)	NKUA	- Midterm Report on STSEs outputs (M17) and International Conference organisation (D4.1 & 4.2)	M30

8	Research network for long-term scientific cooperation	ELGO-ITAP	- Submission of joint proposals for international research calls and joint publications in journals	M36
9	Midterm scientific and technical review with EC	ELGO-ITAP	- Milestones and deliverables until M18 completed	M18
10	Final scientific and technical review with EC	ELGO-ITAP	- Milestones and Deliverables up to M36 completed - Final meeting with all partners	M36

Risks and mitigation measures

Risks and their mitigations measures related to WP4 are presented under Table 1.19. Until now (M16) no risk was realised and although mitigation measures are foreseen no need for their implementation was generated.

Table 1.20 Risks & Mitigation measures of WP4

Risk No	Description of risk (levels of likelihood (L) & severity (S): Low/Medium/High)	Proposed risk-mitigation measures
3	Successful educational outcome is dependent on mobility of ESRs & ECSs. Their number at scientific institutions is prone to fluctuations due to the usual choice of thesis preparation or training in university registered, hence unexpected decrease could be a drawback to implementation of WP4. (L: Low / S: Medium)	Over 20 ECSs or ESRs from different universities are within research projects of ELGO-ITAP and more are expected to respond through dissemination of projects before its initiation. In addition, the fact that is also foreseen the participation of advanced partners ESRs & ECSs, further secure execution of planned activities.
5	Conflicts among partners. (L: Low / S: Low)	Amicable solution according to legal framework in place (consortium agreement and grant agreement). All partners have long and close fruitful cooperation.

1.2.5. Work Package 5 "Upgrading R&I management and administration skills of ELGO-ITAP under international funding environment".

The objective of WP5 is to improve competitiveness of researchers of the ELGO-ITAP in future Horizon calls and other international calls, by transfer of relevant management experiences and skills from partner institutions. These experiences and skills are the formation of successful teams and proposals for EU grants, planning budgets, financial and ethical regulations, intellectual property plans, project reporting and role of agile administration in efficient project management.

Task 5.1. Transfer of project management skills and knowledge from advanced partners of consortium to ELGO-ITAP (M1-M24; Task leader: NKUA)

This task includes the organisation of a seminar in Athens (M23) and one visit of two ELGO-ITAP's administration officers through STSE (refer to Task 4.1) to the administration unit of UNIPR for training. Seminars will be attended by ELGO-ITAP staff including ESRs and experienced scientists, members of the management, and members of the administration unit (financial and legal officers) and will be held by advanced partners of the consortium at ELGO-ITAP premises. Lectures from members of Grant Support Offices from CU, UNIPR and NKUA will be primarily dedicated to directors and key members of the administration unit to facilitate improvement of administration capacity necessary to provide better service in proposal preparation and project management. Of course, as any training activity of FunShield4Med the event will be open to greater audiences.

The programming of both Seminar 5 (M23) and STSEs are under schedule.

Task 5.2. Final evaluation of acquired capacity in research management (M25-M36; Task leader: UNIPR)

Members of Grant Support Offices from CU, UNIPR and NKUA will perform evaluation of delegates of administration staff, research staff, and management staff with respect to their competences in project management and recommend further measures.

Task 5.2 is scheduled to start after completion of all relevant to the WP training at M25.

D5.1: Seminar organised at the ELGO-ITAP, and training performed at UNIPR (NKUA, M24, R)

The present deliverable will include a report on Seminar 5 organised at ELGO-ITAP premises by experts of CU and NKUA (Seminar 5 - M23) and on training of ELGO-ITAP personnel performed at UNIPR through STSEs. D5.1 is under schedule and will be delivered on M24 after completion of training on administrative and managerial skills.

D5.2: Report on final operational evaluation (UNIPR, M36, R)

D5.2 is going to be submitted at the end of project and will be a report by advanced partners on final operational evaluation of ELGO-ITAP personnel (administration, research, and management staff) with respect to their competences in project management.

Milestones achievements

Milestones achievements related to WP5 are presented under Table 1.20. Most of them are to be verified at M36, with exception of Milestone 9 relating the fulfilment of Mid-term Review and all Deliverables submission due to date (M16).

Table 1.21 Milestones achievements of WP5

No	Milestone name	Lead Beneficiary	Means of verification	Due to (month)
7	Upgrade in project management and administrative skills	NKUA	- Report on final evaluation of personnel capacity advancement (D4.2)	M36

8	Research network for long-term scientific cooperation	ELGO-ITAP	- Submission of joint proposals for international research calls and joint publications in journals	M36
9	Midterm scientific and technical review with EC	ELGO-ITAP	- Milestones and deliverables until M18 completed	M18
10	Final scientific and technical review with EC	ELGO-ITAP	- Milestones and Deliverables up to M36 completed - Final meeting with all partners	M36

Risks and mitigation measures

Risks and their mitigations measures related to WP5 are presented under Table 1.21. Until now (M16) no risk was realised and although mitigation measures are foreseen no need for their implementation was generated.

Table 1.22 Risks & Mitigation measures of WP5

Risk No	Description of risk (levels of likelihood (L) & severity (S): Low/Medium/High)	Proposed risk-mitigation measures
3	Successful educational outcome is dependent on mobility of ESRs & ECSs. Their number at scientific institutions is prone to fluctuations due to the usual choice of thesis preparation or training in university registered, hence unexpected decrease could be a drawback to implementation of WP4. (L: Low / S: Medium)	Over 20 ECSs or ESRs from different universities are within research projects of ELGO-ITAP and more are expected to respond through dissemination of projects before its initiation. In addition, the fact that is also foreseen the participation of advanced partners ESRs & ECSs, further secure execution of planned activities.
4	Poor organisation or difficulties in organising training, DEC and/or conference events. (L: Low / S: High)	Project coordinator and consortium will regularly review training actions, the joint research project, and staff exchanges in order to prepare them efficiently.
5	Conflicts among partners. (L: Low / S: Low)	Amicable solution according to legal framework in place (consortium agreement and grant agreement). All partners have long and close fruitful cooperation.

1.2.6. Work Package 6 "Dissemination, Exploitation, Communication".

The primary objective of this work package is to ensure a comprehensive and effective online presence through the design and maintenance of FunShield4Med website, and in addition to create promotional material engaging and informing the target audience about the project and the widening participant, ELGO-ITAP. Moreover, the organisation of outreach activities plays a crucial role in engaging with the public, disseminating project information, and fostering a sense of community involvement and awareness around the project's goals and outcomes. Communication, dissemination, and exploitation (DEC) activities are integrated into the overall project implementation plan and are crucial to spread findings and innovation to the scientific community, policymakers, media representatives, potential new collaborators, and society. All foreseen DEC activities contribute to increasing

the impact of the project and are, thus, aligned with the project's objectives and coordinated by a dedicated work package.

Task 6.1: Design, implement & maintain project's website (M1-M36; Task leader: ELGO-ITAP)

FunShield4Med website

According to the HE Twinning call expected outcomes, one of the main objectives of the project is to raise public and scientific awareness on mycotoxin risks. To respond to this demand, the creation of an effective, easily accessible, and informative website is essential. The FunShield4Med website was designed and started to operate at M4 of the project, providing to both public and expert target groups continuously not only the aim and objectives of the project, but also the progress of its implementation, up to the present, news and events (e.g., forthcoming workshops, seminars, meetings, etc.), training videos, newsletters links, and generally every outcome and material produced by the project (datasets, deliverables, etc.).

The website will be kept active for at least a further 5 years after the project's end. Google Analytics is being used to collect statistics on the number of pages visited, number of materials downloaded, country of the visitors, etc. This data is being periodically reviewed by consortium partners and the website is being upgraded accordingly. Additionally, and in accordance with DoA, repository platforms were created with open access services which soon will be linked to the project website and will allow users to share Quantitative Mycological Exposure Assessment (QMEA) models implemented in several languages (e.g., R, Python).

The FunShield4Med website can be accessed at URL: https://funshield4med.eu. It communicates the project's aim and objectives to the scientific community, stakeholders, and concerned public. In addition, it provides constant updates about the progress of the project's implementation, new achievements, scientific news about mycotoxins, and information about forthcoming events.

Components of FunShield4Med website

The **Home page** (Figure 1.10) briefly introduces the project.

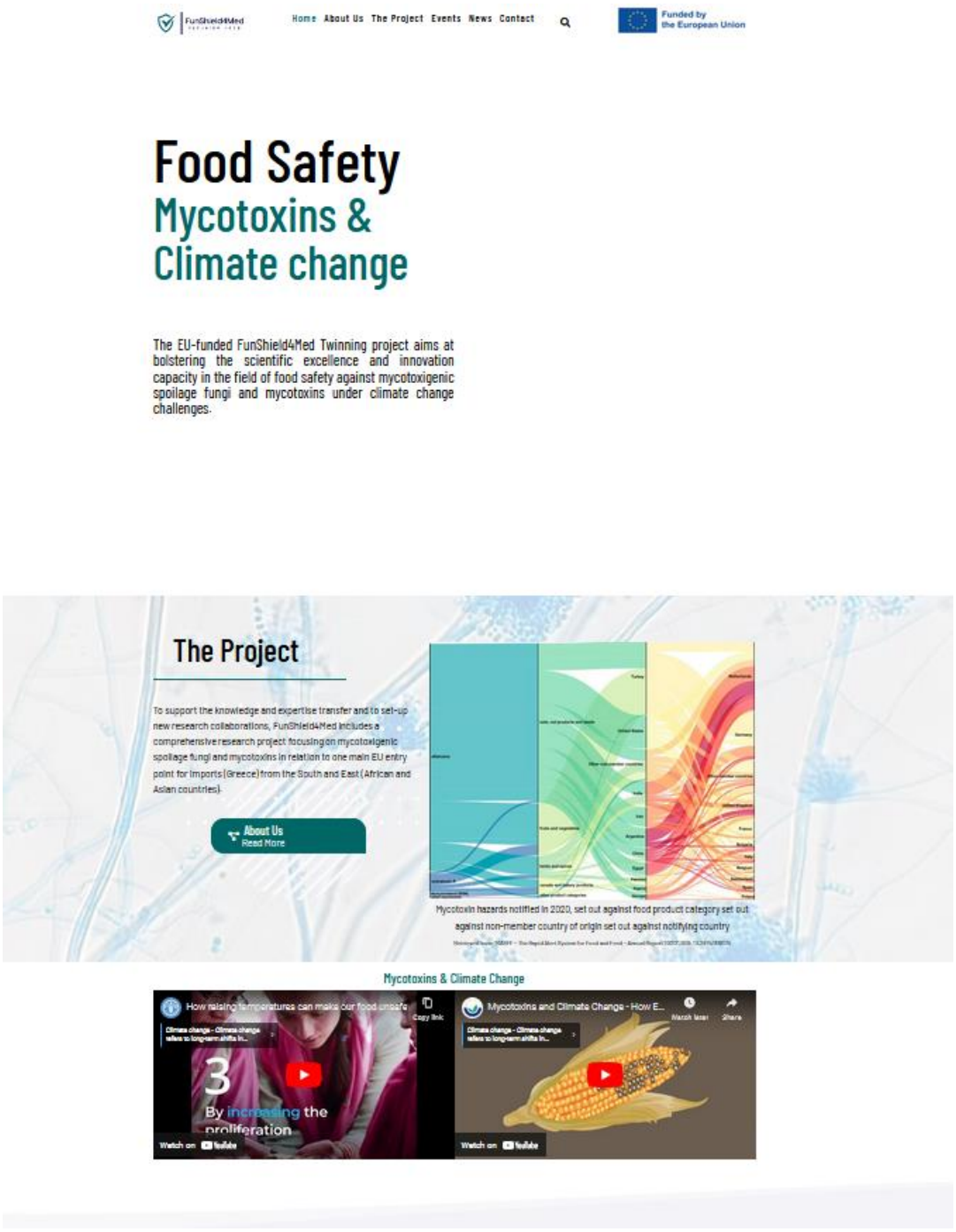

Figure 1.10 FunShield4Med website home page section

The **About Us** section provides information about the FunShield4Med consortium, links to the websites of each participating organisation, and the research interests of each team member.

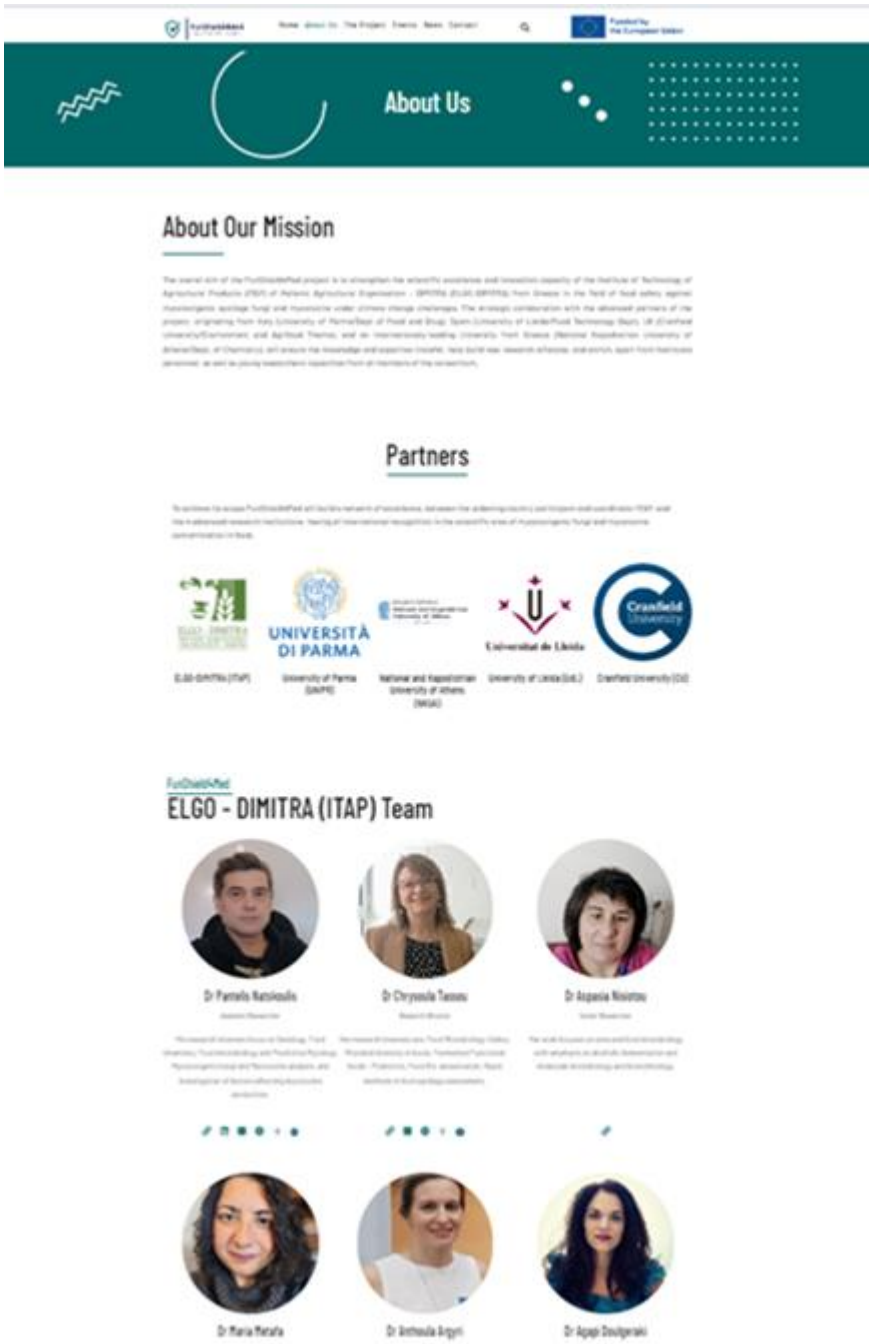

Figure 1.11 A part of FunShield4Med website About Us section

The Project section (Figure 1.12) of the FunShield4Med website presents an overview of the project's ambitions and objectives. More detailed information is provided through the following submenus:

- Aim and Objectives: This section describes the aim and objectives of the project,

- Work Packages: This section describes the six work packages of the project,
- Deliverables: In this section are presented the specific deliverables of the project,
- Joint Research Project: This section describes the goals of the complementary to FunShield4Med joint research project,
- Mycotoxins Mediterranean Training Hub: This section describes an outcome of the FunShield4Med project which is the development of a Mycotoxins Mediterranean Training Hub (MyMedHub).

Figure 1.12 The FunShield4Med website Project section

The **Events** section presents all events (e.g., conferences, workshops, seminars, summer schools, open days etc.) organised in the context of the project, those already completed with the relevant photos and forthcoming ones with information on dates, registration, program of the event, lecturers, etc.

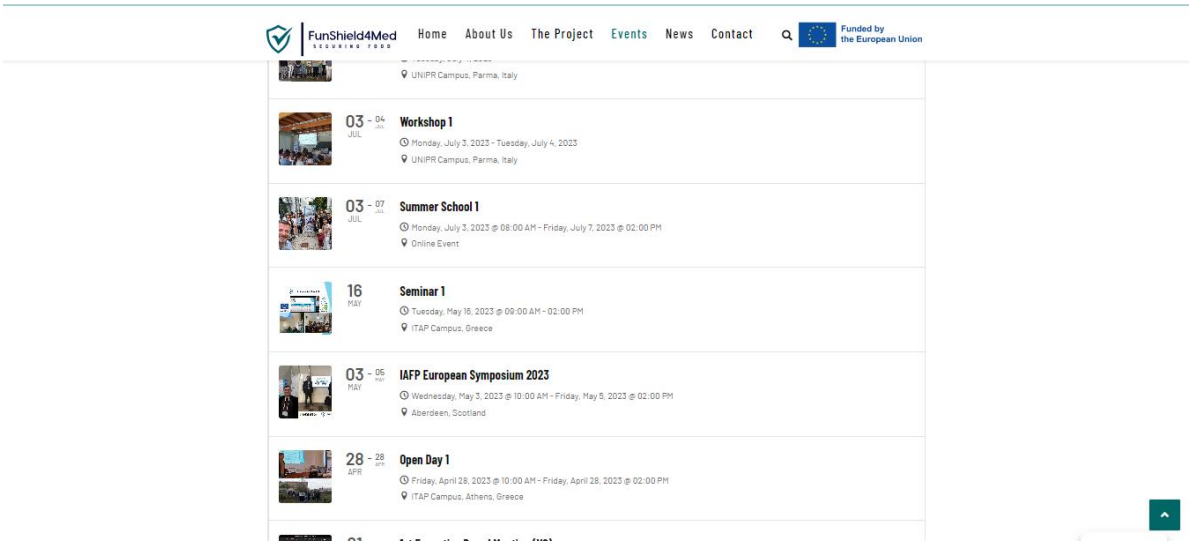

Figure 1.13 The FunShield4Med website Events section

Additionally, and in accordance with the other scheduled DEC activities, a project's leaflet, a poster, and a PowerPoint presentation were produced, distributed, and presented in scientific events to provide an overview of the project. The relative material is also uploaded to FunShield4Med Deliverables section with free access to website visitors.

The News section (or News from our Blog, Figure 1.14) presents the latest headlines on scientific news and articles related to mycotoxins.

Figure 1.14 The FunShield4Med website News section

The **Contact** section contains contact information, social media links, and a form for inquiries about the FunShield4Med project.

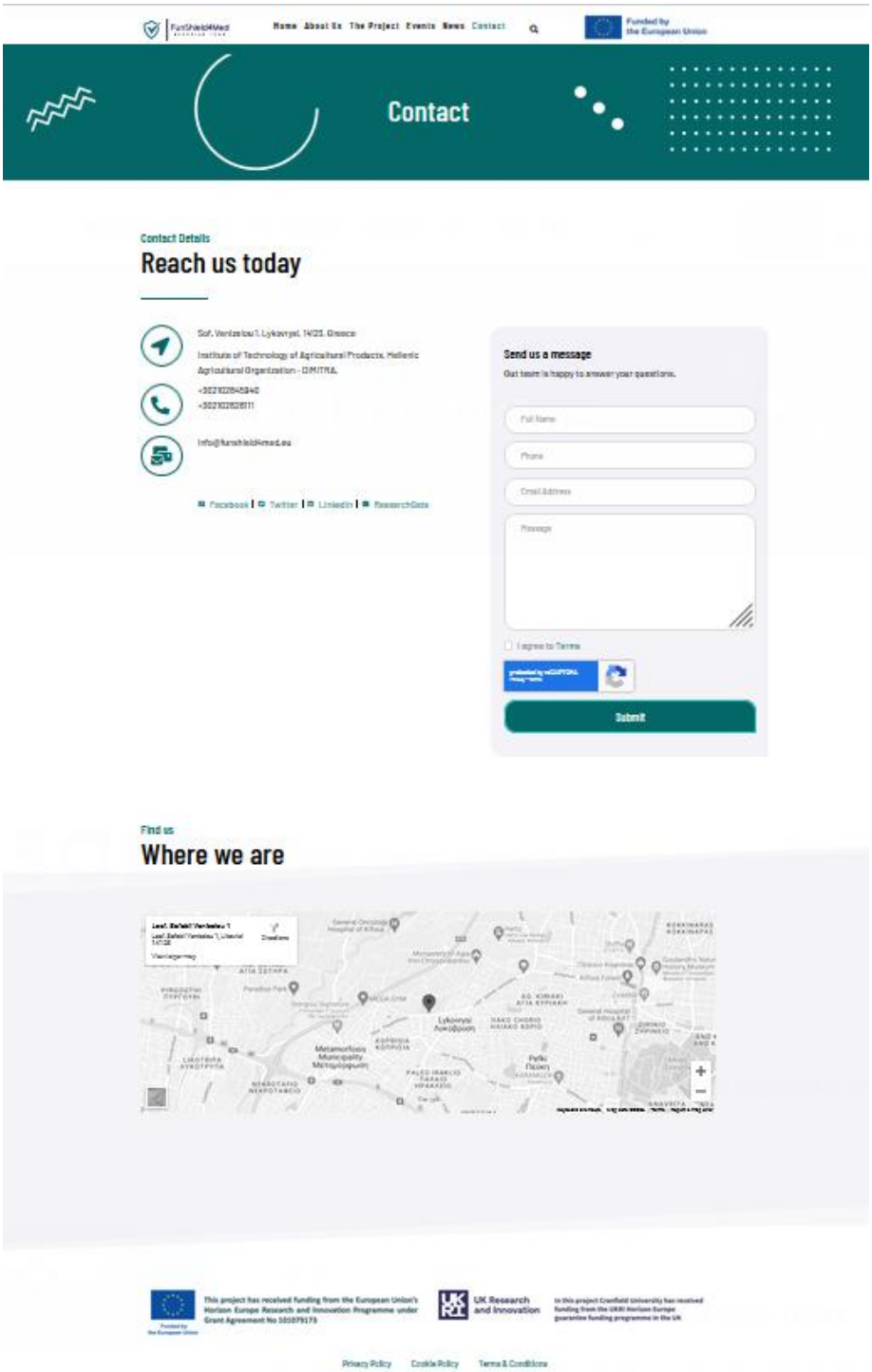

Figure 1.15 The FunShield4Med website Contact section.

As a conclusion all the activities of Task 6.1 are therefore completed according to the DoA.

Task 6.2: Production of promotional materials (M1-36; Task leader: ELGO-ITAP)

Under this task all the material for publicity and promotion is organised, designed, and produced, namely:

- A project's leaflet (2 pages, A4 size) and a PowerPoint presentation providing overview of the project.
- Promotion guide about ELGO-ITAP.
- Project banner (A1 size).
- 1-2 newsletters/year over the duration of the project.
- Project news will also be distributed through broader scientific news channels e.g. Cordis wire, Alpha Galileo, LinkedIn interest groups, and a maintained project mailing list.
- Publications of conference/research papers on results arising from the staff exchanges.

The promotional materials (e.g. leaflet, banner, poster, and newsletters) are printed and distributed during relevant European scientific events. This material helps to raise the awareness of recipients about ELGO-ITAP's research excellence and innovation capacity. The objective is twofold: i) initiate contact with European-leading counterparts and develop future cooperation; and ii) attract more followers to the project website.

The Project's Leaflet

Apart FunShield4Med website, the present Task 6.1 includes the production of a high-quality project leaflet (Figure 1.16) from the start of the project with regular updates to distribute at various events, such as international conferences (IAFP'S European Symposium on Food Safety, Aberdeen, Scotland, 3-5 May 2023; 10th MBK International Symposium, Larissa, Greece, 30 November - 2 December 2023; 1st International Conference MedFuture 2024, Athens, Greece, 23-25 February 2024), project's training events (Seminars, Workshops, and Summer Schools) and Open days. The leaflet aims to inform scientific and public audiences about the project's objectives, its implementation, the expected results, and forthcoming events.

Figure 1.16 The FunShield4Med leaflet (cover and front)

The FunShield4Med PowerPoint Presentation

A PowerPoint presentation template (Figure 1.17) was created to provide to the audience an overview of the project's aims and main objectives. It was presented in various events as the Kick-off meeting, Seminar 1 and Open days.

Figure 1.17 FunShield4Med power point presentation

Promotion guide about ELGO-ITAP

The leaflet regarding the Promotion Guide about ELGO ITAP (Figure 1.18) targets both public and research institutions. A simple language and infographics are used to visualise the objectives and duties of the ITAP institute. This leaflet is an A4 double sided format, and it is designed to ensure a good printing quality.

Figure 1.18 The ELGO-ITAP promotion flyer

The FunShield4Med banner

A high-quality banner was produced at the start of the project, and it is presented in various events such as the project's Kick-off meeting, training events, conferences, and the Open days (Figure 1.19). The banner aims to inform the audience about the project.

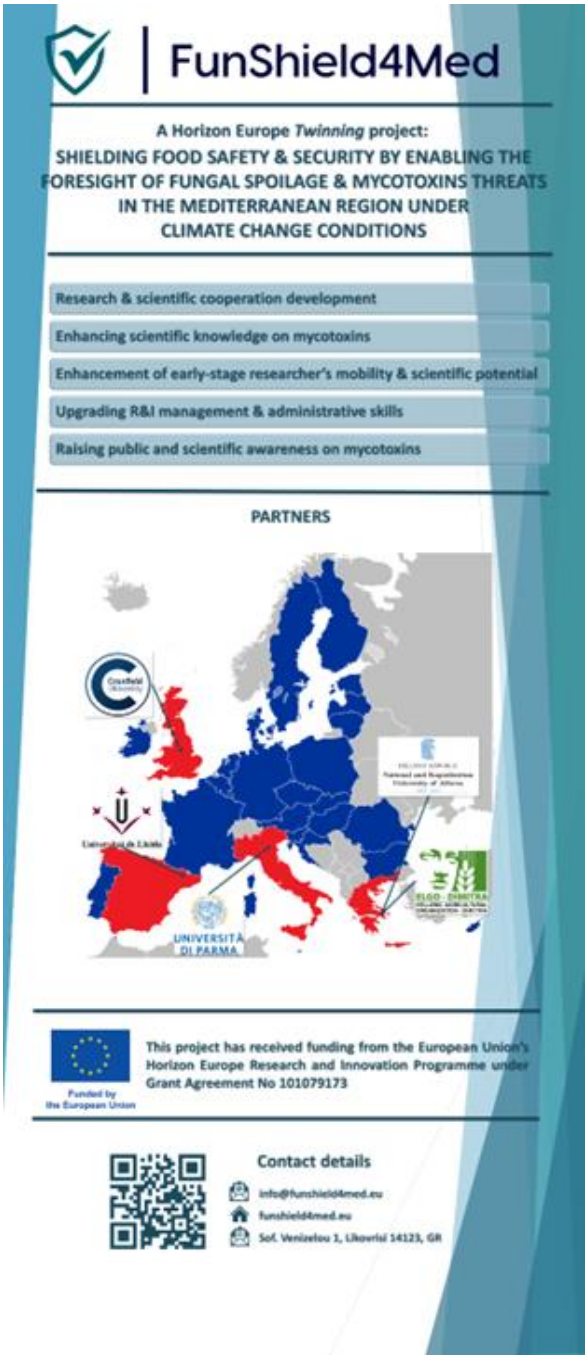

Figure 1.19 FunShield4MEd banner and photos from several postings in events.

FunShield4Med Newsletters

To disseminate the results of the FunShield4Med project it is crucial to reach a selected audience and provide key information and means for further dissemination of collected and produced knowledge by the FunShield4Med research consortium. The FunShield4Med project determines the regular newsletters as one of the tools to reach the scientific and public audiences with the information about the project's progress. Newsletters, being a traditional tool of dissemination to reach a wider audience, are planned to be delivered in electronic form through the different social media platforms (Facebook, Linkedin, X), the project's website, and directly through a relevant registration from the website to receive the newsletters from the project at personal emails.

1st Newsletter

The 1st Newsletter (Figure 1.20, left) was published on 2 October 2023 (Facebook, Linkedin, X, project's website). The content of the newsletter delivers information covering the period from the beginning of the project until June 2023 with special emphasis to the events which took place. It aims to deliver basic information about the project including:

Its goal and objectives, the aim, interaction among the partners in the project, brief information about the events carried out so far, as well as ongoing events. The newsletter also presents information about the project research partners, and their official logos, funding acknowledgments, as well as the projects' social media.

The creation of the first newsletter of the FunShield4Med project has been performed by the ITAP- ELGO and UNIPR research teams. The newsletter covers 5 pages in the printed-out form or can be delivered through electronic means of communication as a PDF file (FunShield4Med 1st Newsletter).

the structure of the Newsletter contains the following sections and information:

"The FunShield4Med in a nutshell" provides a short description of the project and its overall goal. It also provides a few words from the coordinator of the project and few details about the duties and research work from the Prof. Chiara Dall'Asta from UNIPR university. Moreover, "News and events" is devoted to the latest events:

- The first "kick-off" meeting of the consortium that has taken place in Athens in NKUA in December 2023
- Brief details about the 1st Open Day held in ITAP campus in April 2023
- Participation of the project coordinator Dr Pantelis Natskoulis and a project's partner Prof. Vasilis Valdramidis at the IAFP European Symposium that took place at Aberdeen on May 2023
- Brief details about the 1st Seminar which took place in ITAP campus in May 2023 with the participation of Prof. Chiara Dall' Asta
- Short description about the 1st Funshield4Med Workshop and Summer school in Parma during July 2023 with participants from ITAP, NKUA, UNIPR and CU

In the last page of the 1st Newsletter, it is provided with the forthcoming project's events, as well as urging the readers to learn more about the FunShield4Med project through the provided link to the FunShield4Med website, links to the FunShield4Med social media accounts (Facebook, Twitter, LinkedIn). In addition, the newsletter provides logos of the FunShield4Med consortium's coordinator and other partners. The final information presented

in the newsletter, the FunShield4Med project's communication. The newsletter conveys information about the source of funding.

2nd Newsletter

The 2nd Newsletter (Figure 1.20, right) was published online in February 2024, and consisted of 6 pages. The structure of the newsletter contains the following sections and information.

"Project's progress" providing descriptions of the events which took place during this period. Provides short interviews from Prof. Charalampos Proestos (NKUA team leader) and Prof Sonia Marin Sillue (UdL team leader) answering questions regarding the duties of their research groups in the project, the impact of Climate Change in the presence of Mycotoxins in Agri-Food Sector, and what the project potentially could achieve. It can be reached, apart from social media platforms, also from the project's website as a PDF file (2nd FunShield4Med Newsletter). More specifically it contains:

- Brief details about the 2nd Seminar which took place in ITAP campus, Athens, on 21 of July 2023.
- A short description concerning the Short-Term Staff Exchange of Dr G. Markou from ITAP to the lab of Prof. A. Ramos and Prof. S. Marin, Department Food Technology, UdL, in October 2023.
- Brief details about the Workshop 2, took place in the Food Chemistry Lab in NKUA campus in November 2023, concerning Predictive Mycology with the participation of researchers from NKUA, CU, UNIPR and Cyprus State General Lab.
- A short communication about the 10th International Conference of MIKROBIOKOSMOS where FunShield4Med was co-organiser with the Scientific Society MIKROBIOKOSMOS in Larissa at the Divani Hotel on 30/11- 2/12/2023.

In the last page of the 2nd Newsletter are provided the forthcoming project's events, and the logos of the FunShield4Med consortium's coordinator and other partners. The final information presented in the newsletter, the FunShield4Med project's communication.

Figure 1.20 1st (left) & 2nd (right) FunShield4Med Newsletters front pages

Publication of conference/research papers

- **IAFP European Symposium 2023 at Aberdeen**

Regarding the participation of FunShield4Med to IAFP European Symposium 2023 at Aberdeen, Scotland, a poster was prepared and presented highlighting the aim and objectives of the project (Figure 1.21).

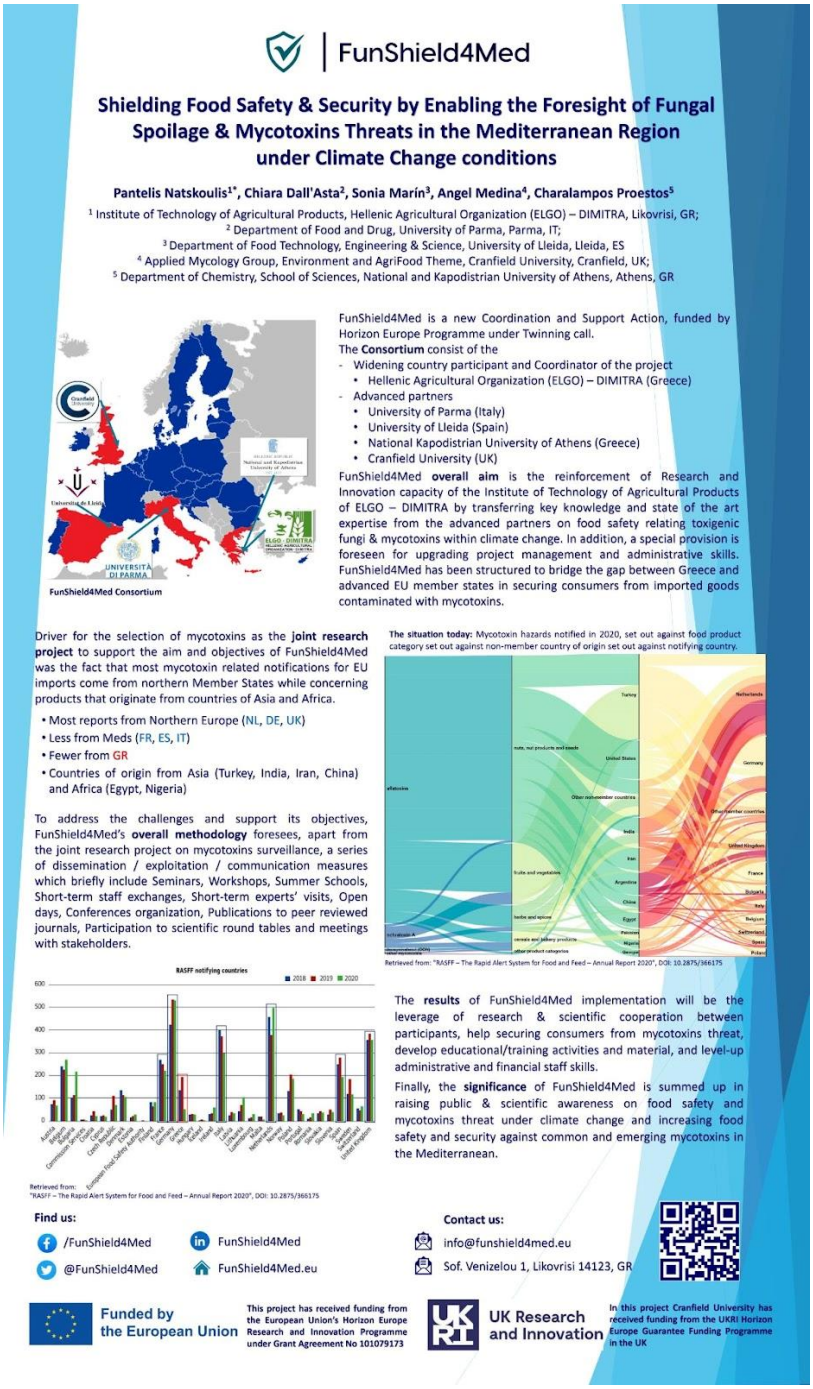

Figure 1.21 FunShield4Med poster presented at the IAFP European Symposium 2023 at Aberdeen, Scotland, 3-5 May 2023.

- **10th International Conference MIKROBIOKOSMOS**

Funshield4Med partners (Dr Eleni Kollia and Prof. Vasilis Valdramidis) and the coordinator of the FunShield4Med project participated to the Mikrobiokosmos Conference which took place in Divani Hotel in Larissa with a poster presentation (Figure 1.22) entitled: "Mycoflora and mycotoxin characterisation of berries cultivated in Mediterranean farms".

The objective of this work was to characterise the mycoflora found on the surface of fresh berries that are cultivated in the Mediterranean region and determine their potential on mycotoxins production.

PP003

Mycoflora and mycotoxin characterisation of berries cultivated in Mediterranean farms

A Peppas[1], Eleni Kollia[1], D Kizis[2], P Natskoulis[3], **Vasilis Valdramidis[1,4]**

[1]National And Kapodistrian University Of Athens, Greece, [2]Benaki Phytopathological Institute, , Greece, [3]Institute of Technology of Agricultural Products ELGO - DIMITRA, , Greece, [4]University of Malta, Faculty of Health Sciences, Msida, Malta

Berries are perishable fruits and very susceptible to fungi contamination due to their high acidity and water activity. The most predominant fungal contaminants reported in literature are Botrytis cinerea, Alternaria spp., Cladosporium spp., Penicillium spp. and Rhizopus spp. The purpose of this study was to characterise the mycoflora found on the surface of fresh berries that are cultivated in the Mediterranean region and determine the potential presence of mycotoxins (e.g., ochratoxin A, patulin and alternariol). Fresh blueberries (2), blackberries (2), strawberries (2), and raspberries (5) were collected from different farmers in Greece and Cyprus and were stored in freezing conditions (-20o C). Each sample was incubated at 25o C for 5 days in DG18, PDA and MEA media. A direct plating method was used with DG18 in order to isolate and identify the fungi. PDA medium was used for the enumeration of fungi and yeasts, while MEA for growing the isolates. Isolates were characterized by macro- and microscopic observation to the genus level, and by Sanger sequencing at the ITS locus for species identification. Mycotoxins were determined by using HPLC – FD and HPLC – DAD methods. A total of 181 isolates were collected from fresh berries and nearly half of the microscopically characterized fungi belonged to Penicillium (29.3 %), Cladosporium (18.8 %) and Aspergillus section Nigri (14.4 %) genus. Other identified isolates included Alternaria (11 %), Botrytis (8.8 %) and Rhizopus (5.5 %) species, while the rest of the isolates, (12.2 %), assigned to other fungal genera such as, Ulocladium, Seiridium and Arthrinium. Quantification of fungi and yeasts varied between 2.18 – 2.98 log cfu/g and 1.67 – 3.00 log cfu/g, respectively.

This research has been partly funded by the European Union's Horizon 2020 research and innovation programme HORIZON-WIDERA-Twinning of the project FunShield4Med (Grant agreement No 101079173) and under the Marie Skłodowska-Curie RISE programme (FRIETS) (grant agreement No 101007783)

Figure 1.22 Abstract of the presentation published in the Abstract book of the MIKROBIOKOSMOS conference.

- **5th MS Wine day, 22-24 May 2024, Asti, Italy**

A short presentation of the results arising from JRP already realised is going to take place by the ITAP team (Figure 1.23) entitled: "Climate Change effects on the Occurrence of ochratoxin A in red and white commercial wines from the Greek Territory".

More especially, results are presented regarding the detection of ochratoxin A from wine samples originating from Greek and international nobble grapevine varieties. Samples were analysed using a HPLC-FLD analytical method. Mycotoxin-contaminated wines showed low concentrations (<2 ppb), with higher concentrations of OTA recorded in red wines in comparison to the white ones. In addition, the highest OTA concentrations were recorded in wines produced in areas either with high mean annual temperatures, Santorini island (19.1 °C) for white and Halkidiki (16 °C) for red wines or with high rainfall (Drama 842 mm) for white wines.

Title: Climate change effects on the occurrence of ochratoxin A in red and white commercial wines from the Greek territory.

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Figure 1.23 Title and authors of the publication planned to take place at 5th MS Wine Day at Asti.

- A manuscript is under publication with title: "Review on the occurrence of mycotoxigenic fungi in dried fruits and the role of stored product insects: from Sméagol to Gollum".

This manuscript (Figure 1.24) was prepared by the research ITAP team in collaboration with the research team from the Laboratory of Entomology and Agricultural Zoology from the University of Thessaly. This manuscript concerns the importance of gaining a comprehensive understanding of the interaction between insects, fungi, and mycotoxins, to effectively mitigate this problem. This manuscript preparation is finalised and currently is under submission to the journal "Frontiers in Sustainable Food Systems" with impact factor 4.7. The Journal is

multidisciplinary of basic and applied research exploring sustainable solutions to address the issue of global food security.

frontiers

Review on the occurrence of mycotoxigenic fungi in dried fruits and the role of stored product insects: from Sméagol to Gollum

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Keywords: Fungi, mould, mycotoxins, pests, dried fruits, food safety

Figure 1.23 Manuscript under submission to "Frontiers in Sustainable Food Systems" journal.

As a conclusion all the activities of Task 6.2 are therefore fully aligned with the DoA schedule.

Task 6.3: Organisation of outreach activities (M1-M36; Task leader: ELGO-ITAP)

In addition to the international conferences and various scientific events, project partners are getting engaged with students on local public events. FunShield4Med aims to attract more attention of young generations to R&I projects and broaden knowledge of students about various opportunities that exist within the scientific community. The target group of the specific task is the public but with an orientation to the student's community and the key objectives are to promote FunShield4Med project, engage with younger communities, and reach other audiences outside of the project channels.

Several outreach activities took place so far. More especially, three Open Days at ITAP, one in UdL, one in NKUA, a participation of the ITAP research team at the European Researchers Night 2023, and more which are briefly presented below, and in more detail in Table 1.22.

- Open Day 1 was held at ITAP premises on 28 of April 2023. The coordinator of the FunShield4Med Dr Pantelis Natskoulis made a presentation about the Mycotoxins and Food Safety issues among others. Moreover, 25 students of Ilion's (Athens/Greece) 1st Vocational high school visited the experimental vineyard, winery, and ITAP premises.
- Coordinator of the FunShield4Med Dr Pantelis Natskoulis participated with a poster of FunShield4Med overview and realised promotion actions (project's leaflet distribution, networking meetings with other projects and interested parties) at the IAFP European Symposium on 3-5 May 2023.
- An important outreach activity was held at the National Technical University of Athens during the European Researchers' Night on 29 September 2023. During this event the public (several students from the primary and secondary educational levels, as well as university students) was informed by the ITAP's ESRs about food microorganisms and food safety.

- Partner and co-leader of FunShield4Med Dr Chrysoula Tassou presented the FunShield4Med aims and objectives to the Summary Meeting of DiTECT Project EU/China "Digital Technologies as an Enabler of a Continuous Transformation of Food Safety System", on 7th November 2023, to students and member staff of Shandong University, Shandong, China.
- Open Day 2 took place on 5 December 2023 at ITAP campus. Dr Olga Papadopoulou and Dr Dimitrios Miliordos presented the Laboratories of Microbiology and Physicochemical Analysis at ITAP campus premises, winery, and vineyards, to 7 students from Public Vocational Training Institute (IEK Chalandri). Furthermore, students were informed on Mycotoxins and Food Safety issues among others (History of the Institute, activities etc.).
- An Open Day was held at the ETSEAFiV, UdL campus (Spain) on 1-2 February 2024, as well. Secondary school centres (97 students) visited ETSEAFiV of UdL to be trained on the activity of fungal identifications relating to food spoilage and were informed about the project.
- Concerning the partners from the NKUA, an Open Day was held in their campus (NKUA). Ten (10) high school students from the 1st High School of Drapetsona (Athens, Greece) visited and guided by Prof. Charalampos Proestos and the Post Doctoral researcher Dr Eleni Kolia to the Laboratory of Food Chemistry, Department of Chemistry, National and Kapodistrian University of Athens of NKUA.
- Open Day 3 took place on ITAP campus during 16 of April 2024. A group of 14 Aegean College (Athens, Greece) students of "Human Biologist-Biotechnologist" course with 3 teachers visited ELGO-ITAP campus. Dr Dimitrios Miliordos made a presentation concerning Food Safety as well as a short presentation about the aim of the FunShield4Med project. Moreover, Dr Olga Papadopoulou presented the main duties of the ITAP's microbiology and physicochemical lab. In addition, Dr Dimitrios Miliordos guided the students to the experimental vineyard and at the Enology Laboratory.

Table 1.23 Outreach activities of FunShield4Med project during M1-M16

Date And Time	Location	Event	Description
28 April 2023	ITAP Campus, Athens, Greece	ITAP Open day 1	A group of Ilion's (Athens/Greece) 1st Vocational high school students visited ITAP premises, winery, and vineyard. Public and students were informed on Mycotoxins and Food Safety issues among others (History of the Institute, activities, etc.) by the coordinator of FunShield4Med project.
Photos from Open Day 1	 Presentation of FunShield4Med aims and objectives and tour at ITAP's vineyards		

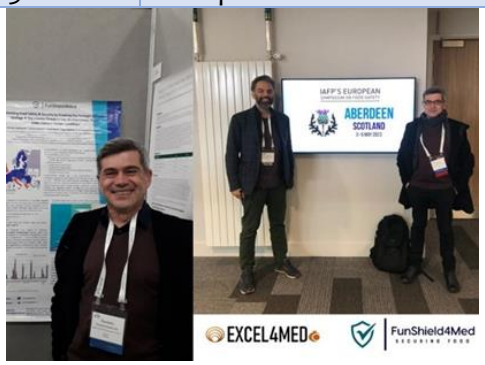
3-5 May 2023	Aberdeen, Scotland	IAFP European Symposium 2023	Coordinator of the FunShield4Med Dr Pantelis Natskoulis participated with a poster on FunShield4Med overview and promotion actions took place.
Photos from IAFP European Symposium 2023	 Dr P. Natskoulis in front of the FunShield4Med poster (left) and during networking with Prof. V. Valdramidis, Coordinator of the EXCEL4MED project (right).		
29 September 2023	National Technical University of Athens, Athens	European Researcher's Night Athens	The European Researchers Night is a Europe-wide public event, which displays the diversity of science and its impact on citizen's daily lives. ESRs members of ITAP undertook organisation, were present at the event, and informed public about the food safety and microorganisms
Photos from European Researcher's Night Athens	 ESRs presenting their work to students (left) and stand of ITAP (right)		
7-8 November 2023	Shandong University, Jinan, China	Project Summary Meeting of DiTECT Project EU/China	Partner and co-leader of FunShield4Med Dr C. Tassou presented the FunShield4Med project at students and staff of Shandong University.

Photo from the Project Summary Meeting	 Dr C. Tassou presenting FunShield4Med at Shandong University		
5 December 2023	ITAP Campus, Athens, Greece	ITAP Open day 2	A group of students (7) from the Public Vocational Training Institute (IEK Chalandriou) with a teacher visited the Laboratories of Microbiology and Physicochemical Analysis at ITAP premises of ITAP, winery, and vineyard. They were informed on Mycotoxins and Food Safety issues among others (History of the Institute, Activities etc.).
Photo from Open Day 2	 Dr O. Papadopoulou touring students at ELGO-ITAP's Lab. of Microbiology		
1-2 February 2024	ETSEAFiV, Udl, Spain	UdL Open day	Several secondary schools visited ETSEAFiV UdL to be trained on the activity of fungi identification, food spoilage, and project's aims and objectives
Photo from UdL Open Day			

	Students of Lleida's secondary schools on hand-on activities at ETSEAFiV labs		
7 March 2024	NKUA campus, Athens, Greece	NKUA Open Day	A group of students (10) from Drapetsona (Athens, Greece) 1st High School with their teacher visited NKUA Lab of Food Chemistry and had a tour and a presentation relevant to the project.
Photo from NKUA Open Day	 Students of Drapetsona 1st High School on Lab touring and hand-on activities at NKUA Food Chemistry Lab		
16 April 2024	ITAP Campus, Athens, Greece	ITAP Open day 3	A group of Aegean College (Athens/Greece) students (14) of "Human biologist-Biotechnologist" course with 2 teachers visited ELGO-ITAP campus. They were informed on Mycotoxins and Food Safety issues among others (History of the Institute, Activities etc.).
Photos from ITAP Open Day 3	 Dr D. Miliordos presenting FunShield4Med project		

Outreach activities are being carried out as expected, thus actions foreseen under Task 6.3 are fully completed and going to continue according to the DoA.

D6.1: Project leaflet, poster, and website (ELGO-ITAP, M6, DEC).

Deliverable 6.1 includes project's website presentation with the following sections: home, project summary, ELGO-ITAP and Twinning partner profiles, news & events (e.g. forthcoming workshops), training videos, newsletters, links, and downloads; Project's leaflet (2 pages, A4 size), poster, and PowerPoint presentation providing overview of the project. It was delivered due to time (M6).

D6.2: Promotion material about ELGO-ITAP & Project's newsletters (ELGO-ITAP, M36, DEC).

The deliverable, with intermediate updates at months 6, 12, 18, 24 & 30, includes Promotion material about ELGO-ITAP, Project's newsletters. For now, an updated version of M17 is ready, while its deliverance will take place on M36 according to DoA.

D6.3: Final report on DEC plan (ELGO-ITAP, M36, R).

The Final report on DEC Plan will includes Project news distribution through broader scientific news channels e.g. Cordis wire, Alpha Galileo, LinkedIn interest groups, and a maintained project mailing list; Publications of conference/research papers on results arising from the staff exchanges and joined research project; Promotion actions during relevant European scientific events; Outreach activities through press conferences, regional and national news media. It has a deliverance date on M36 at the end of the project to include all relevant material created during project's lifespan.

In line with the recommendation of Twinning call for students' participation to the tasks of the project, several ESRs that are not part of the assigned research teams of beneficiaries, are involved with tasks of FunShield4Med JRP. These ESRs theses and students' involvement in FunShield4Med Tasks (JRP), are going to be presented under the "D6.3 Final Report on DEC plan" with all relevant information (expertise acquired, involvement in tasks, thesis title and abstract, defence date and score achieved). Until M16 have already participated to the JRP of FunShield4Med 4 undergraduate students, and 4 postgraduate students (1 PhD candidate and 3 MSc students) which are briefly presented in Table 1.24 following.

Mr G. Froutis, who apart PhD candidate of AUA is also member of ELGO-ITAP's research team and temporary personnel of the institute with a work-oriented contract, will not be included in D6.3 as he is included in the CDPs of ELGO-ITAP personnel under D4.1.

Table 1.24. Students' participation in FunShield4Med JRP.

Name	University	Degree	Thesis title	Thesis defence
Giorgos Froutis	AUA	PhD	Use of sensors for rapid microbiological and physicochemical assessment of maize and maize-based products	May 2025
Andreas Peppas	NKUA	MSc	Mycoflora and mycotoxin characterisation of fresh berries cultivated in Mediterranean farms	October 2023
Labrini Roussou	AUA	MSc	Investigation of Ochratoxin A (OTA) presence in Greek wines	September 2024
Christos Giannopoulos	NKUA	MSc	Characterization of fungi and mycotoxins from fruits and effect of new technologies on their inactivation	September 2024

Margaritis Tsirikas	NKUA	BSc	Effect of new processing technologies for the mitigation of Patulin (PAT) in apple juice	September 2024
Katerina Lamprou	NKUA	BSc	Effect of new processing technologies for the mitigation of Ochratoxin A (OTA) in wines	September 2024
Elephteria Avgouli	AUA	BSc	Control of the presence of Zearalenone (ZEN) in cereals from Greek market by the application of a rapid immunological detection method (ELISA)	June 2024
Maria Lalioti	AUA	BSc	Control of the presence of Fumonisins (FUMs) in cereals from Greek market by the application of a rapid immunological detection method (ELISA)	June 2024

Milestones achievements

Milestones achievements related to WP6 are presented under Table 1.23. Most of them are to be verified at M36, with exception Milestone 9 relating the fulfilment of Mid-term Review and all Deliverables submission due to date (M18).

Table 1.25 Milestones achievements of WP4.

No	Milestone name	Lead Beneficiary	Means of verification	Due to (month)
2	Management and Dissemination Plans	ELGO-ITAP	Delivering updated DMP (D1.1) due to M6, M17 and M36 - Final Report on promotion and DEC (D6.1, D6.2, & D6.3)	M36
9	Midterm scientific and technical review with EC	ELGO-ITAP	- Milestones and deliverables until M18 completed	M18
10	Final scientific and technical review with EC	ELGO-ITAP	- Milestones and Deliverables up to M36 completed - Final meeting with all partners	M36

Risks and mitigation measures

Risks and their mitigations measures related to WP6 are presented under Table 1.24. Until now (M16) no risk was realised and although mitigation measures are foreseen no need for their implementation was generated.

Table 1.26 Risks & Mitigation measures of WP4.

Risk No	Description of risk (levels of likelihood (L) & severity (S): Low/Medium/High)	Proposed risk-mitigation measures

4	Poor organisation or difficulties in organising training, DEC and/or conference events. (L: Low / S: High)	Project coordinator and consortium will regularly review training actions, research project and staff exchange to prepare them efficiently.
5	Conflicts among partners. (L: Low / S: Low)	Amicable solution according to legal framework in place (consortium agreement and grant agreement). All partners have long and close fruitful cooperation.

1.3. Impact

FunShield4Med is a Coordination and Support Action of Horizon Europe programme aiming to achieve Scientific & Educational, Technological, & Economic, as well as Societal impact through co-learning and co-development approaches. The involvement of project partners in various EU initiatives and projects will be fully utilised in the cluster activities on the EU level. An outline plan for the dissemination and exploitation including communication activities is being provided during the project under Tasks 1.2 and 6.3 and respond to Deliverables 1.3 and 6.3. DEC is a living process initiated under D1.2 DEC Plan, being updated regularly through the present D1.3 Mid-Term Progress Report, and finalised under D6.3, to allow it to evolve over time, following new or emerging information, opportunities, or trends.

Scientific and educational impacts

FunShield4Med is going to have significant scientific and educational impacts, particularly in the subject of food security. It will contribute to the advancement of knowledge in various interdisciplinary scientific domains, such as the identification of emerging mycotoxins, the simultaneous detection of multiple mycotoxins, the anticipation of the potential impacts of climate change on mycotoxigenic fungi, and the formulation of strategies to prevent mycotoxin contamination. This newly generated knowledge will not only benefit the research staff at ELGO-ITAP but also a broader scientific community comprising Early-Stage Researchers (ESRs), academics from different higher education and research institutions, stakeholders in the agrifood sector, and end users, including Early Career Scientists (ECSs) from the private sector and policymakers like the European Food Safety Authority (EFSA). By providing toxicological data for assessing food contamination risks and devising preventive measures, FunShield4Med will support policymakers in making informed decisions. The dissemination of knowledge is being facilitated through the mobility of researchers and grant officers, who will impart their expertise in administrative and management skills. Moreover, the project promotes knowledge diffusion by implementing a data management plan in line with the principles of Open Research Europe and FAIR pathways. These collective efforts enhance the human capital in the Research and Innovation (R&I) sector of Greece, fostering the retention of existing research talents and attracting new ones, aligning with the objectives of the Widening programme. Additionally, MyMedHub, as part of this initiative, will enhance educational outcomes and bolster the capabilities of ESRs and ECSs. It will achieve this by engaging in communication initiatives to educate school and university students through on-site visits, organising informational events at national and international conferences, participating in higher educational activities such as student internships, and collaborating with ELGO-ITAP on undergraduate and postgraduate theses. This holistic approach aims to not only disseminate knowledge but also build a sustainable educational ecosystem for the future.

Technological and economic impacts

The amplification of ELGO-ITAP R&I capacity, and subsequently of its umbrella organisation, ELGO, in the realm of mycotoxins, is poised to establish a critical mass of researchers who have been equipped with comprehensive training in a wide array of analytical and ecophysiological techniques, encompassing chemical, biological, molecular, and bio-mathematical methodologies (workshops, summer schools and seminar organised so far). These methodologies are anticipated to play a pivotal role in ensuring the stability of food production in Greece and the broader Mediterranean region, as well as in facilitating the effective monitoring of EU imports at Greek customs checkpoints. The technological breakthroughs achieved by FunShield4Med are expected to usher in a new wave of investment in R&I actions, either through forging partnerships with the private sector or by securing augmented R&I funding, consequently leading to a boost in the profitability of the regional agrifood sector and instilling a heightened level of trust among consumers regarding food and beverage. Noteworthy Greek products such as grapes, raisins, wine, nuts, and cereals, which remain susceptible to the menace of mycotoxins, stand to gain significantly from the establishment of a conducive trading environment, thereby augmenting their market value on the global stage and paving the way for the creation of more lucrative employment opportunities within the Agrifood sector. The findings stemming from QMEA pertaining to mycotoxigenic fungi and mycotoxins, alongside toxicological data, are poised to be further leveraged in the long run by relevant bodies such as EFSA to furnish indispensable insights for stakeholders and consumers, thereby safeguarding food production and public health, while also fostering innovation-driven growth in both regional and European contexts. The ongoing research and innovation advancements within the framework of FunShield4Med, coupled with the enhanced outreach efforts on an international scale targeting both the Greek and Mediterranean agrifood sectors, are expected to align with the overarching technological and economic objectives aimed at fostering advancement and prosperity.

Societal impacts

The communication and utilisation of FunShield4Med outcomes and results are expected to lead to a variety of broader societal impacts. These societal impacts will be continuously assessed for their long-term effectiveness, involving successful promotion through various social media platforms (Facebook, X platform, LinkedIn), engagement with news media, as well as participation in ELGO-ITAP's open days for students (3 Open Days in ELGO, 1 Open Day in NKUA and UdL and participation at the European Researcher Night in Athens). In addition to maintaining and developing the project's website for public access over an extended period, there are plans for engaging with relevant authorities that play significant roles in raising societal awareness. This interaction may involve international bodies such as FAO, EFSA, and EUFIC for Europe, and Hellenic Food Authority (EFET) for Greece, with a commitment to deliver at least 2 presentations and/or participate in round table discussions during the project's duration and up to 5 years after its conclusion. These efforts aimed at raising societal awareness and facilitating knowledge transfer on food safety issues related to the prevalence of mycotoxins under Climate Change are anticipated to have a positive impact on policymakers and managers in the agrifood sector, encouraging a more responsible approach to risk control and promoting resilient farming systems. FunShield4Med is set to enhance the project's societal impact through the creation and dissemination of new knowledge, as well as by fostering economic growth and job creation. Active engagement in dissemination and communication activities by the food industry, agrifood stakeholders, and universities will be facilitated through specialised scientific meetings, presentations, and panel discussions. These initiatives will not only support ongoing research efforts in maximising the utilisation of the project's scientific outputs but also contribute to reinforcing the uptake of research and innovation in society.

Table 1.27 Funshield4Med Dissemination Plan and 1st reporting period achievements.

Project Result	Dissemination Activity	Target Audience	Indicator and Target	Goals Achieved (M1-M16)
Project leaflet and poster	Distributed during international conferences (e.g. Agrifood cooperation platform, Hellenic Federation of Enterprises), training workshops and outreach events	Scientists, engineers, and public	250+ leaflets distributed, 20+ posters displayed	**>100 leaflets & 13 posters/banner** at 3 Seminars, 3 Open days, 3 Workshops, 1 Summer School, 3 Conferences.
Project news	Publish project news releases and distribute through broader scientific news channels e.g. Cordis Wire and Alpha Galileo	Scientists, engineers, and public	3+ press releases	**2 newsletters** were published in the social media platforms (**1st Newsletter** published in October 2023 & **2nd Newsletter** published in February 2024)
Project website	Publish project summary, regular news, and event updates on website	Scientists, engineers, and public	2500+ visitors	**551 visitors / 4199 page views / 9739 hits** **2 newsletters** were published in the social media platforms: 1st Newsletter published in October 2023 2nd Newsletter published in February 2024 **4 updates** at the Latest News section of the FunShield4Med website: **23/1/204** EFSA update on Ergot Alkaloids in feed **16/1/2024** Cranfield University established the Magan Centre for Applied Mycology

				25/9/2023 The top 5 lessons learned from World Mycotoxins Forum (WMF) **3/4/2023** How fungi make potent toxins that can contaminate food. **All events** are being published in the Events section of FunShield4Med website. **All Deliverables** submitted and **Material** created are openly accessed through the Deliverables section of FunShield4Med website.
Short project film	Publish project film on YouTube and project website.	Scientists, engineers, and opublic	500+ hits	The **YouTube account** of the project is already created and some relevant videos on Food Safety are published from organisations (WHO, FAO, EFSA). One more **video in project's aims and objectives** is under preparation. **Two e-tutorials** are ready for publication as soon as are assigned a DOI through Zenodo platform.
Training workshops	Training workshops on technology-transfer, innovation management and media relations	Scientists and engineers	4 workshops, 100+ participants	**3/4** Workshops realised with **90** participants of which **60** were ESRs/ECSs. Workshop 1, 3-4/7/2023, UNIPR campus. Computational methods for Mycotoxins. **Participants: 19; ELGO-ITAP: 7; ESRs/ECSs: 16.** Workshop 2, 28-29/11/2023, NKUA campus. Predictive mycology & Quantitative Mycological Exposure Assessment (QMEA). **Participants: 42; ELGO-ITAP: 25; ESRs/ECSs: 31.**

				Workshop 3 & Webinar 1, 25-26/4/2024, CU campus. Impact of Climate Change scenarios and processing on food security related to mycotoxins. **Participants: 29; ELGO-ITAP: 5; ESRs/ECSs: 19; Webinar: 10.**
Summer Schools	Summer schools on science and innovation issues concerning mycotoxins and computational toxicology	PhD & MSc students	2 summer schools, 50+ participants	**1/2** Summer Schools realised with **25** participants of which **22** were ESRs/ECSs. **Summer School 1,** 3-7/7/2023, UNIPR. Mycotoxins under Climate Change. **Participants: 25; ELGO-ITAP: 4; ESRs/ECSs: 22.**
International conference	International conference covering spoilage fungi and mycotoxins organised by ELGO-ITAP	Scientists and engineers	1 conference, until 2025, 75+ participants	**1/1** Conference with **345** participants of which more than **147** were ESRs/ECSs. **MIKROBIOKOSMOS 10th International Conference** 30/11-3/12 2024. Hellenic Scientific Society MIKROBIOKOSMOS and FunShield4Med are co-organised the 10th International Conference of MIKROBIOKOSMOS "All microbes for a sustainable future"
Open days	Tours at the partners' laboratories and facilities. Also, scientific demonstrations and engaging lectures	General public and young students	3 open days, 100+ visitors	**5/3** open days with **164** participants **Open day 1, 28/4/2023,** ITAP campus, Athens, Greece, Participants: **32** **Open Day 2**, 5/12/2023, ITAP campus, Athens, Greece, Participants: **8** **Open Day UdL**, 1-2/2/2024, ETSEAFiV, Udl, Spain, Participants: **96** **Open Day NKUA**, 7/3/2024, NKUA campus, Athens, Greece, Participants: **11**

				Open Day 3, 16/4/2024, ITAP campus, Athens, Greece, Participants: **17**
School visits	Partners send "school ambassadors" to local schools to promote higher education, research, and innovation	Secondary school students	1-2 schools/year	**0/3-6 visits to schools** Not realised yet.
Scientific results concerning mycotoxins and ecophysiology of mycotoxigenic fungi	Publish results in international peer-reviewed journals (Science Citation Index catalogue)	Scientific research community	10+ journal papers	**1/10** papers under publication process or published. **Review under publication:** "Review on the occurrence of mycotoxigenic fungi in dried fruits and the role of stored product insects: from Sméagol to Gollum", at the Journal "Frontiers in Sustainable Food Systems" with impact factor 4.7
	Present results at international and national scientific conferences (e.g. ICFM, EFFoST, Mikrobiokosmos)	Scientific research community	4+ conferences	**3/4** presentations **IAFP European Symposium 2023 at Aberdeen**/poster was prepared and presented highlighting the aim and objectives of the project. **10th International Conference MIKROBIOKOSMOS**/poster "Mycoflora and mycotoxin characterisation of berries cultivated in Mediterranean farms". **5th MS Wine day, 22-24 May 2024, Asti, Italy**/presentation "Climate Change effects on the Occurrence of ochratoxin A in red and white commercial wines from the Greek Territory".
Administrative and management skills	Utilisation of ELGO's Central Services for dissemination of	Scientific research community	E-learning material and videos of	**To be realised during 2nd period of the project**

	training material to research infrastructures of the Organisation		training events	

Table 1.28 Funshield4Med Communication Plan and 1st reporting period achievements.

Community	Communication Activity	Description	Purpose	Goals Achieved (M1-M16)
Public	Project website and social media	Project's website will be launched to cover and promote all activities within project	Communicate projects goals and ambitions to scientific community and concerned public, and to provide fast update about new achievements of the project and its wider significance. Also, it will increase the attractiveness of the ELGO-ITAP to future students and collaborations with food industry and research.	The **FunShield4Med website** can be accessed at URL: https://funshield4med.eu (launched 02. 04.2023; visits: **551 visitors / 4199 page views / 9739 hits**)
	Social media	Profiles on social media (LinkedIn, RG, X, Facebook, etc.) will be set-up.	Promotion through social media will provide spread of social impact of project beyond already interested social groups to public. Also, it will provide increase of attractiveness of the ELGO-ITAP to future students and collaborations with food industry and research.	• **LinkedIn** (lunched 23.01.2023 with 67 content posts; **Unique visitors: 215; Page views: 646; Total followers: 300+**), • **X** (lunched 23.01.2023; with 65 posts; **Followers: 25; Likes: 75**), • **Facebook** (launched 28.12.2022; with 67 posts **Followers: 117; Likes: 106; Impacts: 485** for last 90 days). • **RG** (launched 23.01.2023; but soon the "projects"

				modules were repealed from the provider.
	Open days	Young students and the public will be invited to visit the institutes' laboratories and facilities to learn about their scientific and innovation activities	Demonstrate scientific experiments and engage purpose.	**5** Open days until M16 with more than 164 visitors (3 at ELGO-ITAP, 1 at UdL, and 1 at NKUA, with 164 participants in total)
Scientific	Publications of peer-reviewed journals (10+)	Consortium partners will publish their scientific outputs to high impact factor scientific journals.	Consortium partners will promote and disseminate their research results to internationally communicate and show the impact of FunShield4Med to the scientific community	**One** manuscript is under publication, **6** more are expected within 2024.
	Presentation to international conferences (4+)	Participation to international acknowledged conferences, e.g., FoodMicro; EFFoST conference; World Mycotoxin Forum; ICPMF etc.	Communicate and expand the scientific network and its impact to the scientific society	**3/4** Conferences presence (2 posters, 1 presentation) • IAFP European Symposium 2023 • 10th International Conference MIKROBIOKOSMOS • 5th MS Wine day
	Interaction with other EC projects and European Technology Platforms	Communicate with other related EC projects and exchange non-confidential information with them	Ensure coherence of the European research and avoid useless replication of work and resources	• IAFP European Symposium 2023: networking with EC funded project EXCEL4MED (GA 101087147) • 10th International Conference MIKROBIOKOSMOS: networking with EC

				funded projects ARISTO (GA 956496) & BioICEP (GA 870292), which organised workshops under the conference. • 1st International MedFuture congress: presentation of FunShield4Med (Banner & Flyers). • FunShield4Med Workshop 3: networking with and presentation of EU funded project Protect (GA 813329; NKUA) • Project Summary Meeting of DiTECT, November 2023, Shandong University, Jinan China
Industrial/ stakeholders	Participation to international climate related and business events (3+)	During project timeline two joint participations of project members at climate change, and business fair will be realized to promote project activities and novel technologies.	It will provide the most efficient way to spread the network of future investors by direct approach to international business partners.	**1/3** Participation at the Seminar "The Oenoviticulture field facing the Climatic change" organized by Greek Wine Federation: Communication carried out specifically with winery owners and viticulturists on the impacts of Climate Change on their end products.

	Participation to relevant authorities round tables and forums (2+)	Project presentation and interaction with relevant authorities (e.g. FAO, EFSA, EUFIC, EFET) on aspects related to climate change.	Raise the understanding of on-going research and research outputs at international forums	**0/2** Participation is planned to the forthcoming World Mycotoxin Forum's round table (2025)

Exploitation: The primary objective of FunShield4Med and its consortium is to advance, broaden, and foster new scientific insights into computational mycotoxicology and various aspects pertaining to the molecular ecology and eco-physiology of mycotoxigenic fungi. Establishment of the MyMedHub will enable the ELGO-ITAP to provide more and better detection services, as well as educational and research capacities to interested parties in mycotoxins. In the same exploitation context is planned the delivery and adoption of two more official EU methods for determination of mycotoxins (with the adoption of AFs determination in cereal projects already being realised), apart from the already adopted EN protocols for OTA in wine and PAT in apple juice. These high-quality and practical mycotoxigenic analytical approaches will be offered as services of ELGO-ITAP to both business and the research community. Hence, the outcomes of FunShield4Med will have an economic impact by launching novel analytical procedures and services within agrifood area of Greece. Outcomes of FunShield4Med will trigger further scientific exploitation, beyond dissemination measures. Participation of ESRs in training and workshops have direct contribution to the quality of their Ph.D. theses. At least **1 Ph.D. thesis** (already Dr G. Froutis from ELGO-ITAP personnel is a PhD candidate of AUA), and **2 MSc theses** (already 1 MSc thesis is under preparation with its research section directly involved to FunShield4Med JRP) with significant portion of expertise acquired during the project will be finalized during the project timeline, and 2 theses after the project's end. Moreover, **4 BSc research theses** are involved, with 2 already finalised and 2 more are under preparation, within the FunShield4Med JRP.

Access to the research outcomes by the public is carefully managed by the consortium to ensure the protection of privacy and confidentiality concerns, as well as to uphold any proprietary or intellectual property rights that may be involved. In cases where necessary, experts of participating organisations' legal departments will be consulted to address and resolve any arising concerns. As an integral part of the comprehensive project management approach, intellectual property (IP) management plan will be considered if need to guarantee the successful execution and maximise the impact of the FunShield4Med project. Initially, the existing background IP held by the partners of the consortium will be identified and assessed, along with an evaluation of the risks and opportunities associated with sharing knowledge during collaboration. Each project partner will be granted minimum access rights, ensuring that the background information and outcomes of other participants are available as required for project-related tasks (without royalties) or for the exploitation of their own results (under equitable and reasonable terms). The project's results will be the property of the beneficiaries, with the specific contributions, conditions for licensing, costs of protection, and potential revenue sharing to be outlined as per the default regulation on Joint Ownership stipulated in the Consortium Agreement.

2. Open Science

Open Science embodies a progressive initiative that has evolved from prior actions aimed at facilitating unrestricted access to research findings, fostering interdisciplinary in resource sharing, and addressing the imperatives of enhanced efficiency, transparency, and replicability in research. The concept of open science reflects the concerted activity of diverse stakeholders within scientific communities, encompassing researchers, governmental bodies, and funding entities, to ensure the dissemination of publications and research data in a digital format without or with minimal constraints. Nevertheless, this conventional understanding of open science is considered somewhat limited, with a contemporary interpretation defining open science as a comprehensive array of scientific activities. According to this recent perspective, open science entails conducting scientific inquiry in a manner that encourages collaboration and contributions from others, whereby research data, laboratory records, and other research procedures are made freely accessible, subject to conditions that facilitate the reuse, distribution, and reproduction of both the research findings and the associated data and methodologies. The European Commission advances an even broader conceptualization of open science, characterising it as a novel paradigm for the scientific process that emphasises collaborative actions and innovative approaches for disseminating knowledge through the utilisation of digital technologies and collaborative platforms. This conceptualization signifies a departure from the traditional paradigm of knowledge creation through publications towards a model that emphasises the early sharing and utilisation of all available knowledge throughout the research process.

Data management and publication are core components of the research process. An emerging challenge that has received limited attention in biology is managing, working with, and providing access to data under continual active collection. “Evolving data” presents unique challenges in quality assurance and control, data publication, archiving, and reproducibility. FunShield4Med developed an evolving data workflow for a long-term ecological study that addresses many of the challenges associated with managing this type of data. This will be achieved by leveraging existing tools to: 1) perform quality assurance and control; 2) import, restructure, version, and archive data; 3) rapidly publish new data in ways that ensure appropriate credit to all contributors; and 4) automate most steps in the data pipeline to reduce the time and effort required by researchers. The workflow uses two tools from software development, version control and continuous integration, to create a modern data management system that automates the pipeline (see sub-chapter 1.2.1 WP1 “Project management and dissemination plan” under Task 1.1 Data Management).

In recent decades, the field of biology has evolved from one where data were manually recorded in notes by individual scientists to a domain increasingly characterised by extensive research teams coordinating data gathering efforts across various sites and data formats. While there has been considerable discourse on the repercussions of this shift on data volume, there has also been a revolution in the frequency of data collection. Rather than one-time data acquisition, biologists are now posing queries and gathering data necessitating the continuous updating of databases with fresh information. Long-term observational studies, experiments involving repeated sampling, as well as physical (e.g., temperature, relative humidity), chemical (e.g., mycotoxins analysis), and biological data (e.g., sequencing data, microbial populations data) from other initiatives and/or from preceding research undertaken by consortium members, alongside ongoing literature reviews to construct data compilations, all yield data that are consistently updated. Consequently, whether examining alterations in gene expression over time or the enduring microbial dynamics, the analysis of data while still in the process of collection has emerged as a prevalent facet of biology. This kind of data is denoted as "evolving data" (dynamic data) to signify its continual evolution and expansion.

Because evolving data are frequently updated, even during analysis, they present unique challenges for effective data management. These challenges have received little attention, especially regarding data that are collected by individual labs or small teams. All data must undergo quality assurance and quality control (QA/QC) protocols before being analysed to find, correct, or flag inaccuracies due to data entry errors or instruments' malfunctions. If data collection is finite, or if analysis will not be conducted until data collection is completed, these activities can be conducted on all the data at once. Evolving data, however, are continually being collected, and new data require QA/QC before being added to the core database. This continual QA/QC demand places an extra burden and increases the potential for delays between when data are collected and when they are available to researchers to analyse. Thus, to be maximally useful, evolving datasets require protocols that promote rapid, ongoing data entry (either from field or lab notes or downloads from instrument data) while simultaneously detecting, flagging, and correcting data issues.

The need to analyse data still undergoing collection also presents challenges for managing data availability, both within research groups and while sharing with other research groups. Continually updating data regularly creates new versions of the data, resulting in different versions of the same dataset undergoing analysis at different times and by different researchers. Understanding differences in analyses over time or across researchers becomes more difficult if it is unclear which version of the data is being analysed.

As a group of researchers managing an ongoing, long-term project, FubShield4Med have grappled with the challenges of managing evolving data and making them publicly available. Project's research involves manual data collection efforts, through daily and weekly frequencies, conducted over a few months by a regularly changing group of personnel who all deserve credit for their contributions. Thus, the research team's experience covers much of the range of evolving data challenges that biologists, agronomists, and chemists are struggling to manage. FunShield4Med designed a modern workflow system to expedite the management of data streams ranging (data recorded on datasheets in the laboratory) and use a variety of tools that range from those commonly used in biology (e.g., MS Excel) to tools that biology is just beginning to incorporate (e.g., version control, continuous integration, GitHub platform). In a previous sub-chapter (1.2.1. Work Package 1 "Project management and dissemination plan") these steps in processes are presented together with the tools (e.g. GitHub, Zenodo) used to allow others to implement similar evolving data systems.

Research reproducibility has been on the radar for some time and is certainly gaining more attention, as can be seen in changes in funders and publishers' policies regarding data availability and the emergence of the FAIR data principles. FAIR data principles require data to be Findable, Accessible, Interoperable, and Reusable. Therefore**, planning for reproducibility** started at the very beginning of the FunShield4Med project.

The next important step was to **carefully design the whole project**. Think about research questions and think about the methodology to be applied to answer the question, think as well about the data that could be collected.

Write Up and Publish the Design of Study as a "Registered Report". Publishing this design as a Registered Report helps to tackle publication bias: all outcomes, "positive" and "negative," are equally important for science to move forward. Publishing registered reports is a recent practice.

Start a Data Management Plan (DMP) for the Project. When building a Data Management Plan (DMP), crucial decisions were made regarding the storage location and methodology for data throughout the project, as well as strategies for data tracking and versioning, all of which will significantly impact the reproducibility of research work. Moreover, the process of DMP creation facilitated the acquisition of valuable resources pertaining to ethical

considerations and data privacy, which are fundamental components for project execution. In a broader sense, a DMP functions as a structured framework outlining data management protocols agreed upon by all project stakeholders. The DMP is a living document, delivered as D1.1 under Task 1.1 of WP1, and which is being updated throughout the implementation of the whole lifespan of FunShield4Med project.

Document the Work. Initiating data documentation with a traditional paper notebook poses challenges in detailing information predominantly generated in digital formats. Conversely, leveraging electronic lab notebooks, such as **Google Drive** and **GitHub,** streamlines the digital documentation process, enabling seamless linkage of data and samples, event logging, and result annotation. Furthermore, the searchability and version control features enhance traceability of all modifications made. Complementing electronic notebooks, the inclusion of a **README.txt** file in the corresponding dataset folder further enhances data documentation practices. During the FunShield4Med project consortium partners upload all their information that is being collected, observed, created, or generated. For instance, photos taken from FunShield4Med events (meetings, seminars, workshops), data generated and collected from research, such as mycotoxin concentrations from different commodities, presentations and videos have been uploaded in Google Drive as described in Task 1.1 Data Management.

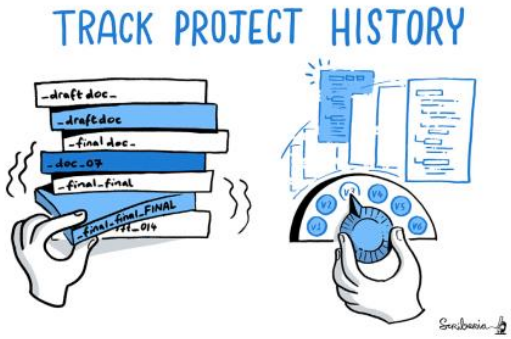


Figure 2.1 The figure produced by Scriberia for The Turing Way Community used under a CC-BY licence (The Turing Way Community; Scriberia 2020)

Use Version Control. Version control systems, such as in GitHub, helps keep track of all changes made but also who performed them. For instance, during the FunShield4Med project, data collected regarding the mycotoxin concentrations in different commodities are increasing, hence consortium partners are updating the existing files in the repositories. Therefore, with this tool FunShied4Med partners can improve the ability to consistently track and retrieve each version of the file and leads to a more efficient collaboration among the consortium partners and increase the accuracy of the research results.

Share the work in order other researchers can reproduce it. Given the substantial investment of time, resources, and effort in research pursuits, coupled with varying access levels to research facilities among scholars, and sharing research findings facilitates broader accessibility and potential reuse by individuals with limited resources. Furthermore, scientific progress hinges on the ability to build upon existing findings, with results validation and reproduction serving as foundational steps. Advocating for adherence to the FAIR principles when archiving research outputs is paramount. The FAIR principles stand for Findability, Accessibility, Interoperability, and Reusability of research data. However, being FAIR is not a binary state, and one can strive to make their data

"FAIRer." In this section, we highlight what FunShield4Med considers to be critical for both long-term archiving and the FAIRness of research outputs while offering the most tangible self-benefits. Therefore, FunShied4Med partners present and share their work and study findings at open events that have been announced and promoted on social media and the FunShield4Med website, allowing other researchers to engage and reproduce it.

Archive Your Outputs. Instead of sharing, FunShield4Med archives the outputs in a repository, which is a place where things can be stored and shared. A place where things can be stored and shared is a repository, in which FunShield4Med data/outputs can be archived. There are repositories for archiving datasets, protocols, software, and other outputs. Such a platform which is generally used in Horizon projects is Zenodo, a generic repository, suitable for all domains. Zenodo platform is being used to archive FunShield4Med outputs as described in Task 1.1 Data Management (Figure 1.4 and Figure 1.5).

Increase our Citations. The most significant aspect to increase a researchers' citation is publishing the data in a repository, so the work will get a Digital Object Identifier (DOI). Repositories, such as Zenodo, provide citation statements for the archived outputs, like academic papers. Moreover, after the publication of a research manuscript, it will immediately post it in several social media (Facebook, LinkedIn, X platform) and in ResearchGate which is a European commercial social networking site for scientists and researchers to share research papers, ask and answer questions and find collaboration. Furthermore, by publishing all our outputs, we are able not only share the full of FunShield4Med research but also get more credit for the hard work made and acquire increased visibility and impact. During the lifetime of the FunShield4Med, several presentations have been made in conferences as posters to share the project's results so far (IAFP European Symposium 2023 at Aberdeen, 10th International Conference MIKROBIOKOSMOS Larisa 2024, 5th MS Wine day, 22-24 May 2024, Asti, Italy). In addition, by signing up for an ORCID ID can ensure that all outputs are linked and collected in one location, regardless of changes in surname, email address, or affiliation.

Share analysed data and research. Using the metadata and pairing them with online sharing platforms, such as GitHub, makes it even easier to collaborate, share and archive FunShield4Med work with other researchers. For instance, there is a direct integration between Zenodo and GitHub, which gives the opportunity to get a DOI for the work and make it citable. Data collected during the 16 months of the FunShield4Med project were uploaded in GitHub platform as described in Task 1.1 data management.

Share protocols. Many projects start with reproducing the outcomes of an existing study with the aim of building on top of it. FunShield4Med partners/ researchers spend time developing / optimising protocols. For instance, NKUA Laboratory of Food Chemistry developed an advanced LC-MS/MS methodology for the determination of 14 mycotoxins in berries and dried fruits: AF B1, B2, G1 & G2, OTA, AOH & AME, ZEN, DON, FBs B1 & B2, T-2 & HT-2 toxins, and PAT as described in Task 2.4. Therefore, they will share detailed experimental protocols in GitHub, and as the protocols are getting optimised make it possible to add the new versions and link them with the original one. Therefore, each published protocol could take a DOI later and can be linked to the existing academic publication.

There is a lot that can be done to improve **research reproducibility**. First, research reproducibility should be considered as a process. There are many steps that could be taken, and there is no single definition of "reproducible research". So perhaps it is better to think about small steps and efforts that can be made today to make your research more reproducible. This should not be seen as a daunting task. Start small and build on as a research group goes along. Second, sometimes people wonder whose responsibility it should be to tackle the reproducibility crisis. Should someone wait for funders to only fund reproducible research? Should wait for the publishers to start publishing only reproducible papers? Should the institutions only hire and promote researchers who adhere to

reproducible research practices? There are multiple stakeholders involved, all of whom could play a role in improving research reproducibility.

Table 2.1 Draft summary of FAIR Data management plan in FunSHield4Med

Findability of data/research outputs	• All the data collected, and variables simulated will be documented once in a standardised and unique way (concept defined in the final DMP). • Each dataset generated will be documented using metadata standards defined in the final DMP. • Research data will be deposited in open repositories as soon as feasible, unless a decision has been taken to protect the results until their publication.
Accessibility of data/research outputs	The "as open as possible, as close as only necessary" principle will be implemented by FunShield4Med, whereas, in the case of open-metadata, accessibility to both original collection and modelled/simulated data will be guaranteed. All partners will have full access to the data and metadata. Dissemination will be performed to any related end-user.
Interoperability of data/research outputs	The FunShield4Med database will be developed in a format respecting the major international open standards.
Reusability of data/research outputs	The documentation of each collected or simulated variable will specify its origin and meaning, as well as the organisation of the database into several components according to the object and/or the scale of analysis to make this database easily understandable and totally reusable
Data preservation	A first agreement in principle between the project partners has been concluded for the data to be stored on the ELGO server (through MS OneDrive repository). The datasets will be deposited as well in the Zenodo repository for at least 5 years after the conclusion of the project.
Allocation of resources	There are no immediate costs anticipated to preserve datasets. Publication costs under open science policy are included in the budget of the project.
Curation and storage of data	An initial agreement exists with the partners that the leader of each WP will develop / mobilise a database according to its needs and according to precise specifications. The storage of these data will be in open repositories (Google Drive, MS OneDrive etc.). Then, these databases will be transferred to the FunShield4Med platform, and they will be fully operational and accessible for the members of the consortium.

One more solution for improving reproducibility is to raise researchers' awareness on the importance of planning their work with strict adherence to procedures. It has been recommended to require full transparency for the entire process, so that all researchers can examine the quality of the methodology and thus to lay the basis for their own replication of the work. To assist researchers who wish to conduct replication, archives of work data will be established so that the data could be tested. The difficulties in the work entailed in carrying out replication have spurred a search for alternatives, such as meta-analytical studies. Such studies do not contain replicated measurements, but they are based on conclusions drawn from many papers each of which may be limited in scope

by itself but taken together constitute a broad sample. Analysis of comparative findings from many studies from around the world provides knowledge about the extent of repetition of results for the same measurement. Because of their complexity, reproducible work requires cooperation among researchers. The average number of cooperating research partners in projects has risen over the years. The number of research partners is influenced mostly by the desire for complex examination and multidimensionality of each issue under study, which stimulates the creation of partnerships. The integration of experts from diverse fields expands the interdisciplinary perspective of the examination and enhances the probability of the findings meeting the test of reproducibility.

3. Deviations from Annex 1 and Annex 2.

3.1. Tasks/objectives

Past tasks deviations (M1-M16)

1. Seminar 1 was delivered from distance due to COVID flu. Tutor Prof. C. Dall'Asta got positive test 2 days before her flight to Athens for the Seminar. Also, under Seminar 1 content, one more presentation on Aims & Objectives of the project delivered by ELGO-ITAP.
2. Summer School 1 moved from M7 to M8 to be organised together with Workshop 1 at UNIPR, to save resources (for both categories expenses of Travel and Subsistence & Other Goods, Works, and Services), increase participating personnel of ELGO-ITAP, and for ecological reasons (less CO_2 emissions from flights). Also, UNIPR undertook most of teaching in Workshop 1, while NKUA and CU most of Summer School teaching, as subjects of these events were more relevant to each partner's expertise.
3. The same was decided for meetings of the project. Commonly are being scheduled together with an event (e.g. 2nd EB meeting during WS1 at UNIPR, 1st GA meeting during WS2 at NKUA). Again, these small deviations offered economy of resources and flights' emissions reduction.
4. Under Seminar 2 two more tutors were invited from Atatürk University to widen the subjects of the event, as they were already present in Athens for other events. Only their accommodation was charged to the project from budget of Short-Term Experts Visits allocated under training events and conferences organisation.
5. Under Workshop 2 one more tutor from Cyprus State General Laboratory (SGL) was invited for presenting ImproRisk platform of EFSA for QMEA, without expenses charged to the project.
6. Workshop 3 moved forward 1 month (from M16 to M17) due to limited availability of tutors.
7. Part of ESRs' training on financial and administration aspects for international fundraising and projects management, was initially scheduled to take place at UNIPR through 2 dedicated STSEs of ELGO-ITAP personnel. Unfortunately, even for HE projects, there are great differences between member states in project and financial management. Additionally, for the administrative and financial personnel of ELGO-ITAP it is difficult to leave their positions and travel abroad due to heavy duty obligations (understaffing is very common in Greek institutions due to the austerity measures of last decade). To overcome the situation Consortium have agreed, and asks for the permission of REA, to transfer this training from UNIPR to NKUA, for the relative personnel (admin & financial), while the 2 STSEs (up to 5 days) will remain to UNIPR (so no changes in financial and effort resources will be made), but for training on computational toxicology and analytical techniques, that there is increased interest for secondments by ELGO-ITAP research personnel. To have enough time to address the respective training objectives, the 2 STSEs of up to 5 days could be joined to 1 STSE of up to 10 days. If an amendment is needed for this reallocation of tasks between beneficiaries, we will have no problem to go through.
8. Regarding the comment made by project's PO and external reviewer during the Mid-Term Progress Review meeting on duration reduction of STSEs and the required time to fulfil the training requirements, we would like to add the following information: In DoA and Part B of GA, under "Table 3.1h: Purchase costs items (travel & subsistence, equipment and other goods, works and services)" it was stated that secondments (STSEs) will be "up to 18 days". Also, under the communication with the previous PO during GA preparation, this matter

was addressed by allowing us to have shorter visits for training, as far as the dedicated visits are at least extended to more than a week (to be considered as secondment and not a short visit), and of course the dedicated training duration to fulfil training objectives. According to the advanced partners responses during the review meeting, they clearly committed to fulfil their obligations and meet the respective training outcomes by simply adjusting to a more intensive training program under the reduced in duration STSEs. If the relative deviations need to be further clarified, they will be addressed under an amendment.

9. As regards to the planning of the remaining STSEs, again according to advanced partners responses under the review meeting, we have reported that it is extremely difficult to know in advance the exact period that each seconded person is going to be at the advanced partners premises, as this requires firstly to investigate the availability of the relevant tutoring personnel of receiving partners, and secondly the seconded persons to secure their absence in relation to their professional obligations due to their duties in ELGO-ITAP. Considering the above limitations, we have planned the STSEs within a range of 2-3 months to secure their realisation (Table 1.17, page 51).
10. In Table "FunShield4Med Dissemination Plan", under paragraph "2.2 Measures to maximise impact – Dissemination, Exploitation, and Communication" of Part B of GA, was reported the organisation of an International Conference until 2025 with a KPI of more than 75 participants. This conference, after prior notice to our previous PO, was finally delivered in the end of 2023 under co-organisation with the scientific community of MIKROBIOKOSMOS (10th International Conference of MIKROBIOKOSMOS 2023; Larissa, Greece, 30 November – 2 December 2023). The justification given and accepted by REA was the fact that a small Institute like ELGO-ITAP couldn't organise such a large event on its own, and of course that the co-organisation with a scientific community would reach a broader audience with less resources charged to the project. Moreover, the interaction of our personnel with experienced researchers of MIKROBIOKOSMOS in organisation of such big events, would be by far more beneficial in terms of training for management skills leveraging. Additionally, the savings by the co-organisation format could be re-directed to additional similar events (e.g., one more international conference co-organisation, or a project-dedicated session under a more renowned conference) giving a higher added value to our project's outcomes in terms of DEC. The directions given by REA were to respect the relevant financial obligations according to AGA, and to be visually apparent the funding acknowledgment and the relevant logos (EU and FunShield4Med) in every aspect of DEC activity of the event, which were fully fulfilled. Finally, the co-organisation format, indeed gave higher added value to our project, since not only we have achieved the expected KPI (+75 participants), but we covered it by far, reaching an audience of participants of almost 350 persons from 23 countries, with more than 215 being ESRs/ECSs.
11. Three members of the ELGO-ITAP project's research team were resigned from their positions. Specifically, Dr A. Doulgeraki moved to Aristotle University of Thessaloniki, Dr N. Chorianopoulos moved to Agricultural University of Athens, and Dr D. Dourou moved to Benaki Phytopathological Institute. Their replacement was crucial for the proper implementation of the project, as they were assigned, the two formers with its Management, and the latter with mycotoxins analysis. Their positions were occupied by Dr O. Papadopoulou and Dr G. Katsaros, while for the work of analysing samples Mr G. Froutis, a PhD candidate of ELGO-ITAP personnel under short-term, work oriented contract (relative WPs 2, 3, & 4, JRP). The resources assigned to each new member remained the same as for the ex-members of the team, thus no resources changes took place.

12. UNIPR research team went under some changes also, as these were the resignment of Prof. G. Galaverna and his replacement by Prof. A. Caligiani, without any change in resources and duties assigned. Moreover, for the proper implementation of the project's tasks, 3 new members were included to UNIPR research team: Mrs H. Gjoni and Mrs I. Picicci, both PhD students, and Dr Racquel Torrijos (post-doc researcher).

Future tasks deviations – if approved by REA (M17-M36)

13. In accordance with previous point (10) we kindly asked REA to permit the co-organisation as well of ESRs conference with NKUA. Dept of Chemistry of NKUA organise a biannual international conference for ESRs in its premises, the "Athens International Conference on Advances in Chemistry". As with the already successful co-organisation of 10th MBK Conference, we would prefer to follow the same format, and FunShield4Med co-organise with our partner, Dept of Chemistry of NKUA, the next "Athens International Conference on Advances in Chemistry" (2024) to reach a broader audience and utilise better the foreseen expenses for the event. The resources allocated for this event will be less in terms of expenses, while those saved could be redirected to the organisation of additional outreach activities, e.g. for a Workshop or Thematic Session to a more renowned International Conference, multiplying this way the impact of the project. The relevant conferences/activities will be disseminated with the acknowledgment on EU funding, EU funding emblem and logo, and FunShield4Med logo.
14. One final deviation necessary for the proper implementation of the project is the postponement of Task 2.2, D3.2, D4.1, & D5.1 from M24 to M36. The reason is that as reported in Annex I of GA (DoA, Part A), the delivery of D2.1 linked with Task 2.2 due to inclusion of STSEs outputs is set for M36, but Task 2.2 duration is until M24. Also, the delivery of D3.2, D4.1 & D5.1 are set for M24, but their relative Tasks 3.2, 4.1 & 5.1, all linked with the relative STSEs outputs of seconded ELGO-ITAP personnel, have a duration until M36. To fulfil our commitment to include these training (STSEs) outputs of these Tasks to their Deliverables we kindly ask for the necessary postponement in duration of Task 2.2, and delivery of D3.2, D4.1 & D5.1, to M36.

Table 3.1 List of training activities (Foreseen / Actual up to M16)

Date (approx.)	Host	Duration (days)	Related WP(s)	Training activity	Instructors (persons)
M6	ELGO-ITAP	1	WP2	Seminar 1	UNIPR (2/1) + ELGO-ITAP (0/1)
M7 (M8)	UNIPR	5	WP4	Summer School 1	UNIPR (2) + CU (3/4) + NKUA (3/3)
M8	UNIPR	2	WP2	Workshop 1	UNIPR (3) + CU (2/0) + NKUA (2/0)
M8	ELGO-ITAP	1	WP3	Seminar 2	NKUA (2/2) + Atatürk Uni. (2)
M12	NKUA	2	WP2	Workshop 2	UNIPR (2/1) + CU (2/2) + NKUA (1) + Cyprus SGL (0/1)
M16	ELGO-ITAP	1	WP2	Seminar 3	UNIPR (1/1) + NKUA (1)
M16 (M17)	CU	2	WP3	Workshop 3	UdL (2/2) + CU (1) + NKUA (2/1)
M18	ELGO-ITAP	1	WP3	Seminar 4	UdL (1) + CU (1) + NKUA
M19 (M18)	ELGO-ITAP	5	WP4	Summer School 2	UNIPR (3) + CU (3) + NKUA
M23	ELGO-ITAP	1	WP5	Seminar 5	CU (1) + NKUA
M24	ELGO-ITAP	2	WP3	Workshop 4	UNIPR (2) + CU (2) + NKUA
M30	ELGO-ITAP	2	WP4	ESRs Conference	All
N/A	CU	18	WP3 & WP4	5 STSE	CU

N/A	UNIPR	18 and 5	WP2, WP4 & WP5	5 STSE	UNIPR
N/A	UdL	18	WP3 & WP4	2/1 STSE	UdL

3.2. Use of resources

Past resources deviations (M1-M16)

1. A critical deviation in budget of ELGO-ITAP took place between the categories of "Equipment" and "Other Goods, Works, and Services": As for ELGO-ITAP laboratories the proposal has foreseen large equipment services and upgrades, and spare parts were by mistake encountered under services category, an amount of 25000€ was transferred from "Other Goods, Works, and Services" to "Equipment category" to cover expenses on spare parts or upgrades (e.g. an autosampler module for GC, replacement of broken parts from equipment, etc).
2. Regarding expenses of training events and the relevant discussion in review meeting, we admitted that there wasn't a balanced distribution between their budgets. Seminars (1 day event) have a foreseen budget of 3000€, Workshops, 2-day events but with expensive consumables for state-of-the-art equipment demonstrations, have a foreseen budget of 5000€, and Summer Schools that is a 5-day event with foreseen invitations for STEVs, have only 2000€ foreseen budget. Upon communication with previous PO for these small deviations between same category costs, we had his confirmation to move on by just giving a prior notice to PO and having a justification to prove the need of deviation. As it is obvious, seminars need the less financial resources, while Workshops will again leave enough resources unused to be transfer for the Summer Schools realization, which considering the length and the STEVs will need more resources.

Future resources deviations – if approved by REA (M17-M36)

3. One more deviation we kindly ask for its approval by REA is the transfer of "Travel and Subsistence" expenses between different training events (e.g. between STSEs to other training events). From the preparation of GA, global financial situation has been dramatically altered: There is an increased revaluation in travel and accommodation expenses (firstly due to Russia-Ukrainian war that increased prices of fuels, secondly due to the fact that all consortium countries are touristic and thus present higher travel prices for certain periods, and thirdly because of changes of institutional reimbursement in Greece from 100€/day to 130€/day in 2023), thus the foreseen expenses might not be enough to cover the actual expenses for travels abroad. For this reason, the resources saving from a shorter visit of personnel to a partner (e.g., for a 12 days STSE instead of 18 days) will be redirected to cover potential surpluses under the same costs category. As an example, we present how financial resources were managed during Dr G. Markou secondment at UdL: Dr Markou's STSE duration lasted 10 days and travelled from Athens, Greece, to Lleida, Spain, with airplane. The foreseen budget for this STSE according to DoA, and before the above-mentioned revaluations realised, was up to 400€ for the 2-way air-tickets, and 200€/day for accommodation & daily subsistence. These resources were set for up to 18 days, resulting to an overall budget of 4000€ (400€ air-tickets + 18 days x 200€/day = 400€+3600€ = 4000€). The actual expenses finally charged to the project were 619.6€ for the 2-way air-ticket (due to the prices increase because of revaluation, and as there was not a direct flight to Lleida from Athens); 130€ daily subsistence and 83.86€/day accommodation, resulting to an amount of 213.86€/day, which for the 10 days of the STSE sum up to a total amount of 2758.2€. The unforeseen expenses surpluses of 219.6€ for the 2-way air-ticket (619.6€ instead of 400€)

and of 13.86€/day for daily subsistence and accommodation (213.86€ instead of 200€/day) could be covered from the foreseen budget of the 18 days STSE which was up to 4000€ (the actual total amount was finally 2758.2€ but for 10 days instead of 18). Of course, and as advanced partners verified during review meeting, the objectives of training were fulfilled due to a more intensive program realised during these 10 days of Dr Markou stay in UdL. By this management of resources, we can address both revaluation of international prices on air-tickets, and surpluses of daily subsistence and accommodations, without harming neither the project's budget, nor the expected training outcomes.

4. The same is proposed to be followed when we are receiving fewer tutors from a partner for training purposes, e.g., during Seminar 1 no tutor travelled from UNIPR to ELGO-ITAP due to COVID illness (the training was delivered by VC through Teams – as webinar), and the saved resources will be re-directed to travel more tutors from UNIPR to Summer School 2 in Athens.
5. In the same sense, we also trying to co-organize meetings during training events, so that we can again save resources for more travels or to cover potential surpluses of a travel.

Table 3.2 Staff effort (Foreseen / Actual up to M16)

	WP1	WP2	WP3	WP4	WP5	WP6	Total PM
1/ELGO-ITAP	10/6	15/7	15/4	8/5	6/1	6/3	60/26
2/UNIPR	2/1	12/6	4/1	6/2	3/1	2/1	29/12
3/UdL	1/0.5	2/1	8/3.5	1/0.5	1/0	1/0.5	14/6
4/NKUA	2/1	5/4	4/3	12/8	8/3	4/3	31/22
5/CU	1/0.5	2/1	4/2.5	1/0.5	1/0	1/0.5	10/5
Total Person Months:	16/9	36/19	35/14	28/16	19/5	14/8	148/71

Regarding Table 3.2 on foreseen and actual PMs consumption, all beneficiaries confirmed during review meeting that they are going to consume the assigned PMs, in line with the foreseen staff effort in DoA.

Table 3.3 ESTIMATED BUDGET FOR THE ACTION / ACTUAL COSTS UP TO M16

	Estimated eligible costs (per budget category)										Estimated EU contribution			
	Direct costs								Indirect costs	Total costs	EU contribution to eligible costs			
	A. Personnel costs			B. Subcontracting costs	C. Purchase costs			D. Other cost categories	E. Indirect costs		Funding rate %	Maximum EU contribution	Requested EU contribution	Maximum grant amount
	A.1 Employees (or equivalent) A.2 Natural persons under direct contract A.3 Seconded persons		A.4 SME owners and natural person beneficiaries	B. Subcontracting	C.1 Travel and subsistence	C.2 Equipment	C.3 Other goods, works and services	D.2 Internally invoiced goods and services	E. Indirect costs					
Forms of funding	Actual costs	Unit costs	Unit costs	Actual costs	Actual costs	Actual costs	Actual costs	Unit costs	Flat rate costs					
	a1	a2	a3	b	c1	c2	c3	d2	e=0,25*(a1+a2+a3+c1+c2+c3)	f=a+b+c+d+e	U	g=f*U%	h	m
1 - ELGO - ITAP	180 000.00	0	0	0	61 800.00	35 000.00	240 000.00	0	129 200.00	646 000.00	100	646 000.00	646 000.00	646 000.00
	64 563.25				29 140.75	10 777.30	74 488.07		44 742.34	223 711.71		223 711.71	223 711.71	
2 - UNIPR	81 200.00	0	0	0	19 200.00	0	34 800.00	0	33 800.00	169 000.00	100	169 000.00	169 000.00	169 000.00
	38 411.50				2 177.86		14 346.87		13 734.06	68 670.29		68 670.29	68 670.29	
3 - UdL	35 000.00	0	0	0	8 800.00	0	8 400.00	0	13 050.00	65 250.00	100	65 250.00	65 250.00	65 250.00
	14 120.00				1 500.02		0		3 905.01	19 525.03		19 525.03	19 525.03	
4 - NKUA	75 250.00	0	0	0	11 400.00	0	31 600.00	0	29 562.50	147 812.50	100	147 812.50	147 812.50	147 812.50
	48 440.55				4 476.00		6 378.75		14 823.83	74 119.13		74 119.13	74 119.13	
5 - CU														
Σ consortium	371 450.00				101 200.00	35 000.00	314 800.00		205 612.50	1 028 062.50		1 028 062.50	1 028 062.50	1 028 062.50
	165 535.30				37 294.63	10 777.30	95 213.69		77 205.24	386 026.16		386 026.16	386 026.16	386 026.16

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SHIELDING FOOD SAFETY AND SECURITY BY ENABLING THE FORESIGHT OF FUNGAL SPOILAGE AND MYCOTOXINS THREATS IN THE MEDITERRANEAN REGION UNDER CLIMATE CHANGE CONDITIONS

D1.3 - Mid-Term Progress Report

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