Fruit Flyer

FFIPM Bulletin • ISSUE 10 • February 2024

Horizon 2020
European Union Funding
for Research & Innovation

FF•IPM

Fruit Flies In-silico
Prevention & Management
FF•IPM

4 the project

8 the research

12 communication & dissemination

15 news - updates

15 webinars

16 new + events

This is the t Newsletter Publication of the EU-funded research project FF-IPM, with the aim to protect fruit production and trade from threats posed by fruit flies.

The newsletter is published quarterly, highlighting the actions, news, progress related to the issue at hand.

Editor: University of Thessaly

Contributors: FF-IPM partners and experts

Editing & Graphic design: R&DO Ltd

Pia Addison (SU, right) and Aruna Manrakhan (CRI, left) introducing the workshop

Training workshop on fruit fly identification

The FF-IPM training workshop on fruit fly identification was successfully held from November 20 to 24, 2023, in South Africa. The event was organized by Stellenbosch University (SU) in collaboration with Citrus Research International (CRI) and the Royal Museum for Central Africa (RMCA) and took place in the premises of the SU.

The aim of the workshop was to present to the participants interception and detection tools developed within the FF-IPM project and to train them on using the FF-IPM mobile app for the morpho ID of fruit flies.

Among the participants NPPO officers, growers and representatives from cooperatives, research institutions specializing in horticultural pests, and companies engaged in the development and sale of pest control products were included. The course, attended by 23 delegates from seven countries, featured both theoretical lectures and hands-on practical sessions.

Instructor at this workshop was the researcher Marc De Meyer (RMCA) who presented various interception and detection tools developed within the FF-IPM project, focusing on utilizing the multi-entry keys designed for recognizing larval and adult stages of economically significant fruit flies. The attendees had the opportunity to come into contact with real fruit fly samples, study them under stereoscopes and with the use of applications for mobile phones, to arrive at the identification of the sample.

Marc De Meyer (RMCA) presenting the FF-IPM interception tools

Trainees at hands-on practical during the workshop

Workshop on Fruit Fly Prevention & Management

A two-day workshop on Fruit Fly Prevention & Management as part of the FF-IPM project, was successfully held on January 31 and February 1, 2024, in Parma, Italy. The event was organized by the project's partners in collaboration with the European Food Safety Authority (EFSA) and hosted by EFSA.

Presentations were integrated into the 119th Plant Health Plenary Meeting, offering an exceptional platform to showcase the project’s products and tools to numerous EU representatives.

This workshop was a unique opportunity to focus on the latest advancements in Fruit Fly Management, bringing together experts and stakeholders from various fields. Presentation of different detection and identification tools was combined with demonstration and use of the different tools. The hands-on sessions provided to approximately 20 delegates from EFSA, the local Italian Plant Protection Agency and University of Bologna students.

4 Workshop’s instructors together with EFSA representatives

Marc De Meyer (RMCA) presenting the FF-IPM identification mobile apps

Trainees at hands-on practical during the workshop

Instructors at the workshop were researchers Prof. Nikos Papadopoulos (University of Thessaly, Project coordinator), Marc De Meyer (Project's Technical Manager, Africa Museum) and Prof. Andrea Sciaretta (University of Molise) who presented the different parts of the workshop.

The first day was dedicated to taxonomy and identification of the fruit flies. The attendees had the opportunity to learn how to use the FF-IPM mobile app for the morpho ID of fruit flies. They

came into contact with real fruit fly samples, studied them under stereoscopes and with the use of the applications, arrived at the identification of the sample.

Andrea Sciarretta (UNIMOL) presenting the electronic trap for detection and remote identification through learning algorithm

Nikos Papadopoulos (UTH) presenting the management and detection methods of fruit fly populations

In the second day, management and detection methods of fruit fly populations were presented while the use of a delta type of electronic trap for detection and remote identification through learning algorithm was demonstrated.

It was a great opportunity to engage in insightful conversations on the challenges and opportunities in Fruit Fly Management and reflect on the progress made and discuss the future of FF-IPM tools.

Workshop "The PESTonFARM platform and its applications under the virtual farm concept"

The workshop "The PESTonFARM platform and its applications under the virtual farm concept" concerning the virtual-farm concept and PESTonFARM modelling approach was successfully held on November 19, 2024, in Dossenheim/Heidelberg, Germany. The event was organized by inSilico-IPM in collaboration with the University of Thessaly (UTH).

The aim of the workshop was to present and introduce to the participants the newly developed PESTonFARM model and the virtual-farm concept and discuss with them probable applications of the model. Among the participants researchers of Universities and Institutes were included.

Instructor at this workshop was the researcher Slawomir Lux (inSilico-IPM) who presented the approach of virtual-farm concept and PESTonFARM model. Specifically, he outlined the biological processes simulated by the model and gave an overview of platform structure and auxiliary applications supporting farm characterization, simulation process, service provision and data exchange. For better understanding, he presented some case studies and gave examples of the model applications. The attendees had the opportunity to learn about this new tool and understand the range of its use.

Slawomir Lux (inSilico-IPM) presenting the PESTonFARM modelling approach

Slawomir Lux (inSilico-IPM) outlined the biological processes simulated by the model

Discussion on the workshop

Discussion on the workshop

Publications

New articles have been published during the last months in the framework of the FF-IPM Project.

1

Management of the Mediterranean fruit fly, Ceratitis capitata: past, present, and future.

JOURNAL NAME
Entomologia Generalis

AUTHORS
G. GIUNTI, G. BENELLI, O. CAMPOLO, A. CANALE, A. KAPRANAS, P. LIEDO, M. DE MEYER, D. NESTEL, L. RUIU, F. SCOLARI, X. WANG AND N. T. PAPADOPOULOS

ABSTRACT
Population monitoring and management of the Mediterranean fruit fly (medfly), Ceratitis capitata (Diptera: Tephritidae), are still challenging, and are tightly connected to a deep understanding of its biology and ecology. Within this framework, new innovative control approaches and tools are frequently proposed and developed to integrate the available techniques and to overcome the difficulties involved in designing effective Integrated Pest Management programs. Indeed, some biological, ecological, and genetic characteristics of C. capitata can limit the efficacy of classical pest management strategies. This article provides a comprehensive review of the currently available tools, devices and approaches used to monitor and control medfly populations worldwide.

Read the article HERE

2

Biology, ecology and invasiveness of the Mediterranean fruit fly, Ceratitis capitata: a review.

JOURNAL NAME
Entomologia Generalis

AUTHORS
G. GIUNTI, G. BENELLI, O. CAMPOLO, A. CANALE, A. KAPRANAS, P. LIEDO, M. DE MEYER, D. NESTEL, L. RUIU, F. SCOLARI, X. WANG AND N. T. PAPADOPOULOS

ABSTRACT
The Mediterranean fruit fly (medfly), Ceratitis capitata, is a highly polyphagous pest that is economically important for fruit production in tropical, subtropical and temperate regions. It is considered a cosmopolitan pest due to its extreme invasiveness and has established populations in all continents except Antarctica. The medfly's broad range of host plants and distinctive biological, behavioral, and genetic traits help it easily adapt to and colonize novel environments. This review provides an overview of the specific characteristics of this species and its current distribution and invasiveness. It also outlines future challenges for medfly bioecology and invasiveness.

Read the article HERE

3

Latitudinal variation in survival and immature development of Ceratitis capitata populations reared in two key overwintering hosts.

JOURNAL NAME
Scientific reports

AUTHORS
G. D. PAPADOGIORGOU, A. G. PAPADOPOULOS, C. A. MORAITI, E. VERYKOUKI AND N. T. PAPADOPOULOS

ABSTRACT
Ceratitis capitata, a major agricultural pest, is currently expanding its geographic distribution to northern, temperate areas of Europe. Its seasonal biology and invasion success depend on temperature, humidity and host availability. In warmer coastal Mediterranean regions and cooler temperature areas, bitter oranges and apples serve as overwintering hosts during the larval stage. We assessed the overwintering capacity of C. capitata populations obtained from different areas of the northern hemisphere by studying the survival and development rates of immature stages in both fruits under laboratory conditions. Eggs from each population were artificially inserted in the flesh of the two hosts and kept at 15, 20, or 25 °C until pupation and adult emergence. Climatic analysis of the area of the population origin showed combined effects of latitude, host and macroclimatic variables on immature survival and development rates. Egg to adult survival rates and developmental duration were longer in apples than in bitter oranges. For populations originated from southern-warmer areas, egg to adult developmental duration was prolonged and adult emergence reduced at 15 °C compared to those populations obtained from northern regions. Our findings reveal varying plastic responses of medfly populations to different overwintering hosts and temperatures highlighting the differential overwintering potential as larvae within fruits. This study contributes towards better understanding the medfly invasion dynamics in temperate areas of Northern Europe and other parts of the globe with similar climates.

scientific reports

Read the article HERE

4

Compatibility of soil application of *Metarhizium brunneum* and cover crops against *Ceratitis capitata* soil-dwelling stages.

JOURNAL NAME
Journal of Pest Science

AUTHORS
J. CRUZ-MIRALLES, I. GARRIDO-JURADO, M. YOUSEF-YOUSEF, M. V. IBÁÑEZ-GUAL, Ó. DEMBILIO, E. QUESADA-MORAGA AND J. A. JAQUES

ABSTRACT
Fruit fy ground-dwelling stages (late third instar larvae, pupae, and teneral adults) are susceptible to predation from generalist ground-dwelling predators and to infection by entomopathogenic fungi (EPF). The effect of predators can be enhanced with cover crops and that of EPF by augmentative releases. However, whether these two biological control methods could be combined has not been studied under field conditions yet. Here, we studied in the field whether the enhanced activity of predators against the medfly, Ceratitis capitata, already observed in a Lolium arundinaceum ground cover could be impaired by a soil application of Metarhizium brunneum. Our results show that C. capitata adult emergence was reduced by this EPF for up to three months after fungal application, with the combination of the cover and M. brunneum being the most effective at reducing C. capitata emergence relative to bare soil (92.5% reduction). Although M. brunneum reduced the activity density of ground-dwelling predatory beetles up to 93 days after application, it showed no clear negative effects on earwigs, no effects on spiders, and a positive effect on ants up to 65 days after application. Therefore, the combined use of a ground cover of L. arundinaceum and M. brunneum against the soil-dwelling stages of C. capitata seems to work synergistically and appears as a strong and sustainable control tactic against the medfly and other fruit orchard pests.

SPRINGER LINK

Read the article HERE

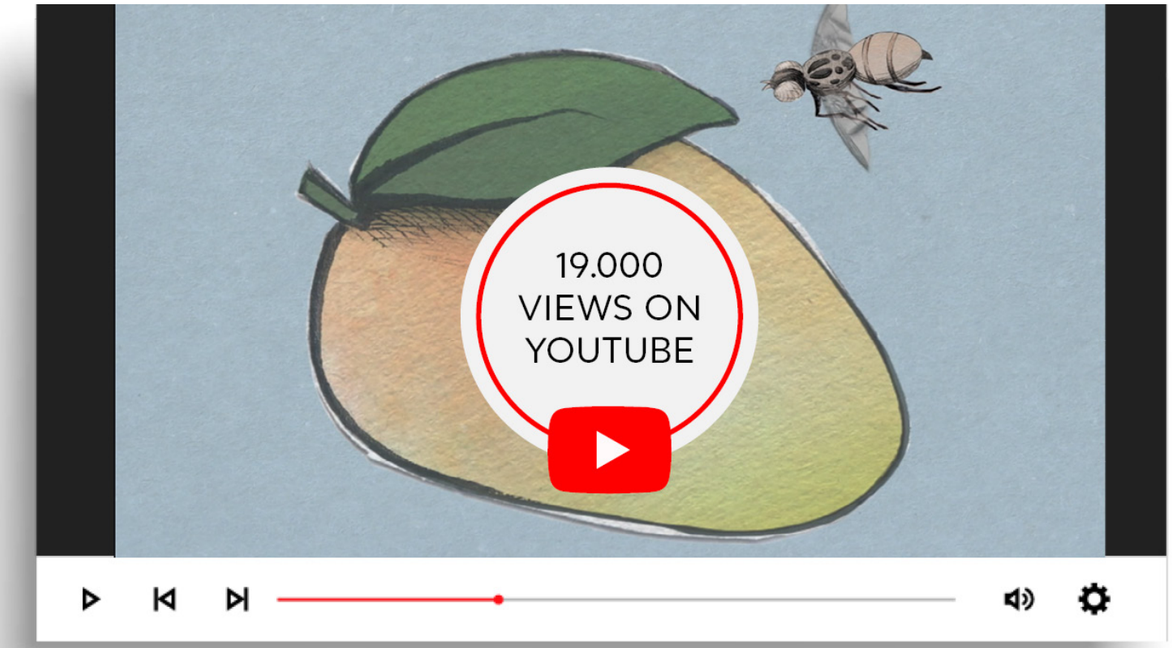
As we are approaching the project's closure, it's crucial to highlight the various ways we capitalized on opportunities throughout the FF-IPM project duration. Enhancing our communication and dissemination strategies has been essential to ensure maximum outreach and engagement with our target audiences, all of you. Recognizing the significance of remaining connected and responsive to stakeholder needs, we meticulously organized a diverse range of activities, as described below.

STAKEHOLDER WORKSHOPS

Over 20 stakeholder meetings and workshops were conducted in different countries in addition to the final major stakeholder event.

SCIENTIFIC PUBLICATIONS

More than 20 scientific journal articles in peer review journals were published, while another 10 are submitted for publication.

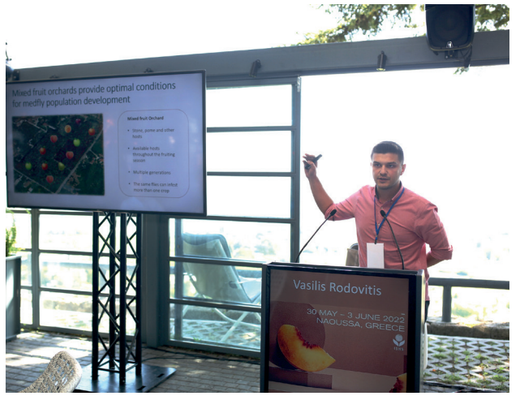


VIDEO

A promotional video was created to visually convey key project messages and achievements, offering scalable and cost-effective communication.

PRESENTATION AT CONFERENCES

More than 20 presentations of FF-IPM took place at national and international conferences, workshops, meetings and other events.



INTERCEPTION

DETECTION

MANAGEMENT METHODS

BIOSECURITY & POPULATION MODELING

MANAGEMENT STRATEGIES

WEBINARS

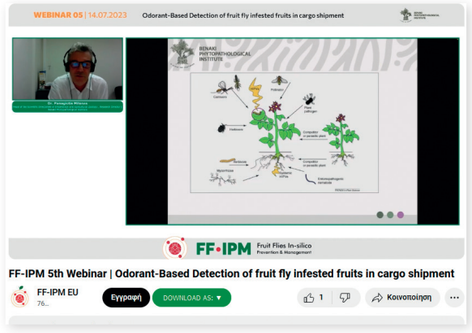
A series of webinars supported and organized by the FF-IPM Consortium were launched since April 2022.

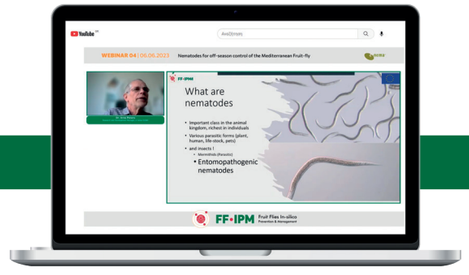
These webinars are related to the FF-IPM project, its scope, deliverables, and scientific suggestions towards an in-silico supported Integrated Pest Management approach for the detection and prevention against new and emerging fruit flies.

TRAINING MODULES

A series of 25 training modules across 5 training entities were developed.

These training materials are used in training events and workshops and uploaded on the FF-IPM platform for continued availability to end-users/ stakeholders.





FF•IPM

WEBINARS

536 PARTICIPANTS **1.960** VIEWERS

		PRESENTER	PARTICIPANTS	VIEWERS
WEBINAR 01	Fruit Fly detection and interception, the FF-IPM project response	Marc de Meyer	195	547
WEBINAR 02	Smart-trapping & deployment strategy for surveillance of invasive fruit flies	David Nestel	160	400
WEBINAR 03	Modelling the population dynamics of Oriental Fruit Fly, Bactrocera dorsalis: Progress and prospects for a real-time fruit fly forecasting system	Darren Kriticos	70	250
WEBINAR 04	Nematodes for off-season control of the Mediterranean Fruit-fly	Dr. Arne Peters	60	220
WEBINAR 05	Odorant-Based Detection of fruit fly infested fruits in cargo shipment	Dr Panagiotis Milonas	51	543

Invited presentation to Hortgro Science

Marc De Meyer from RMCA was invited by Hortgro Science to present collaborative research activities between RMCA and SU within the FF-IPM framework and other initiatives.

Hortgro Science is a research institution dedicated to benefiting South African fruit growers, particularly in the stone and pome fruit industry. In this framework, it organizes monthly hybrid meetings to update industry stakeholders on new developments. During one such meeting, Marc De Meyer presented the FF-IPM program, engaging with participants both physically present and online.

Marc De Meyer (RMCA) during discussion with participants of the Hortgro Science meeting

Final webinar

In our recent (and final) webinar titled "Fruit Flies' Pre-Border Risk: Linking Pathways and Climate Suitability," held on February 26, 2024, we delved into the intricate dynamics of global trade and its unintended consequences on pest transportation. Presented by Anna Szyniszewska, our discussion journeyed through the phenomenon of globalization, shedding light on how it has inadvertently paved the way for pests like C. capitata, B. dorsalis, and B. zonata to traverse borders into previously unaffected regions.

By analyzing historical trade patterns and fruit fly interception data, we uncovered the underlying pathways facilitating the movement of these pests. Additionally, we explored

detailed climatic data from their origin locations, providing invaluable insights into the evolving spatio-temporal patterns of pest importation into Europe. Armed with this innovative methodology, we are better equipped to proactively manage pest risks, illuminating the complexities of pest movement and the inherent challenges it poses to our agricultural ecosystems. sk: Linking Pathways and Climate Suitability for Fruit Flies.

Stakeholders meeting in Reunion Island

A stakeholders meeting was successfully held on November 2023, in Reunion Island.

The event was organized by the CIRAD institute. In the event, a presentation of the FF-IPM project was made and some results of the project were presented regarding the tools developed in the framework of the project, by H. Delatte. There were representatives of growers (mango producers), researchers from the technical institute ARMEFLHOR, CIRAD, the regional chamber of agriculture and the regional Ministry of Agriculture and Food sovereignty subsection linked to plant protection services.

Stakeholders meeting in Volos

A stakeholders meeting was successfully held on February 29, 2024, in Volos. The event was organized by the University of Thessaly (UTH).

This collaborative event brought together key stakeholders from diverse sectors to engage in fruitful discussions and strategize on important matters pertaining to our shared objectives. With UTH's commitment to fostering collaboration and knowledge exchange, the meeting served as a pivotal platform for enhancing synergies and advancing initiatives aimed at driving positive change within our community.

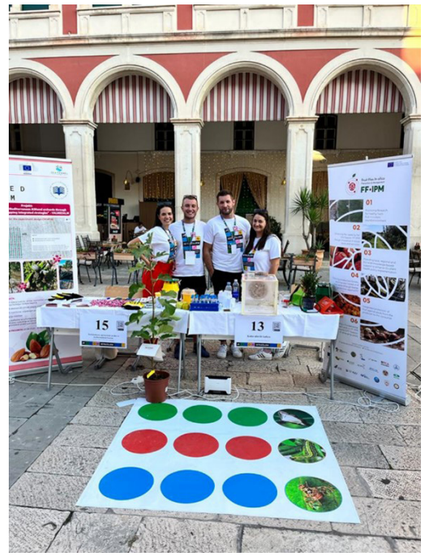
Upcoming Events

XX International Plant Protection Congress will be held on July 1-5, 2024, in Athens, Greece:
ippcathens2024.gr

XXVII International Congress of Entomology will be held on August 25-30, 2024, in Kyoto, Japan:
https://ice2024.org/

European Researchers Night Shines Spotlight on Innovative Insect Trapping Methods

In a captivating evening at Prokurative, Split, the European Researchers Night event showcased groundbreaking advancements in insect trapping methods. Hosted by the EU HORIZONT 2020 MSCA project Blue-Connect, attendees were treated to a presentation titled "How to Catch an Insect," featuring esteemed speakers and demonstrators from UNIST. Mario Bjeliš, Ivan Tavra, Ana Romana Armanda, Gabriela Bartulin, and Krešimir Roguljić unveiled various trapping systems, including the innovative E-trap developed as part of the FF-IPM project. The interactive session engaged 25 participants in games and demonstrations, shedding light on the tracking of the Mediterranean fruit fly (Ceratitis capitata) and its impact on ecosystems.



CEKOM 3LJ Final Conference Highlights Successes in Combating Mediterranean Fruit Fly

The town of Trilj became a focal point for discussions on pest management during the CEKOM 3LJ Final Conference. With a turnout of 95 participants from esteemed institutions and local governments, Prof. Mario Bjeliš of UNIST presented findings from the FF IPM project. Addressing the spread of the Mediterranean fruit fly across Split Dalmatia and Šibenik-Knin counties, Prof. Bjeliš emphasized the project's achievements in monitoring and controlling this invasive species. The unveiling of the E-traps as a promising detection tool marked a significant milestone in the fight against agricultural pests.

66th Croatian Plant Protection Society Meeting Explores Climate Change Impacts on Biodiversity

At the 66th Croatian Plant Protection Society Meeting in Opatija, Prof. Mario Bjeliš led a thought-provoking panel discussion on the repercussions of climate change on agricultural crops, forests, and biodiversity. Drawing from the FF IPM project's research, Prof. Bjeliš highlighted the Mediterranean fruit fly's resilience to changing environmental conditions. With over 90 participants engaged

in the discourse, attention was drawn to the evident influence of climate change on the invasion patterns of Ceratitis capitata in Split-Dalmatia and Šibenik-Knin counties.

Stakeholders Meeting: Addressing the Invasion of Ceratitis capitata in Inland Croatia

In Dugopolje, stakeholders convened to address the pressing issue of the Mediterranean fruit fly invasion in inland areas of Split Dalmatia and Šibenik Knin County. Prof. Mario Bjeliš delivered key insights from the FF IPM project, shedding light on the Medfly's overwintering capacity and the impact of climate change on its proliferation. With 16 participants actively engaged, the meeting underscored the urgency of collaborative efforts in mitigating the threat posed by Ceratitis capitata to agricultural ecosystems.

17th Scientific and Professional Consultation Empowers Croatian Fruit Growers with Innovative Solutions

Zagreb, Croatia - On March 6th, 2024, the Croatian Fruit Growing Association hosted the 17th Scientific and Professional Consultation, drawing over 100 participants including international experts. Among the highlights was an invigorating lecture titled "Non-Pesticide Methods in the Cultivation and Storage of Citrus Fruits - An Example of Good Practice," delivered by renowned expert Prof. Mario Bjeliš from UNIST.

During his presentation, Prof. Bjeliš shared groundbreaking insights from the FF IPM project, emphasizing its potential as additional control measures in the National Action Plan for Medfly Suppression. Leveraging results published in scientific journals, Prof. Bjeliš delved into various aspects of pest management. He discussed the Medfly's remarkable overwintering capacity, shedding light on its ability to survive not only as larvae in infested fruits but also as adults and pupae.

Moreover, attendees gained valuable insights into the utilization of entomopathogenic nematodes for Medfly control, a novel approach explored within the framework of the project. Prof. Bjeliš also addressed the pressing issue of climate change and its evident impact on Medfly invasion patterns in interior regions of Split-Dalmatia and Šibenik-Knin counties.

The 17th Scientific and Professional Consultation served as a platform for fruitful discussions and knowledge exchange, reinforcing Croatia's commitment to innovation and excellence in fruit cultivation.