Fruit Flyer

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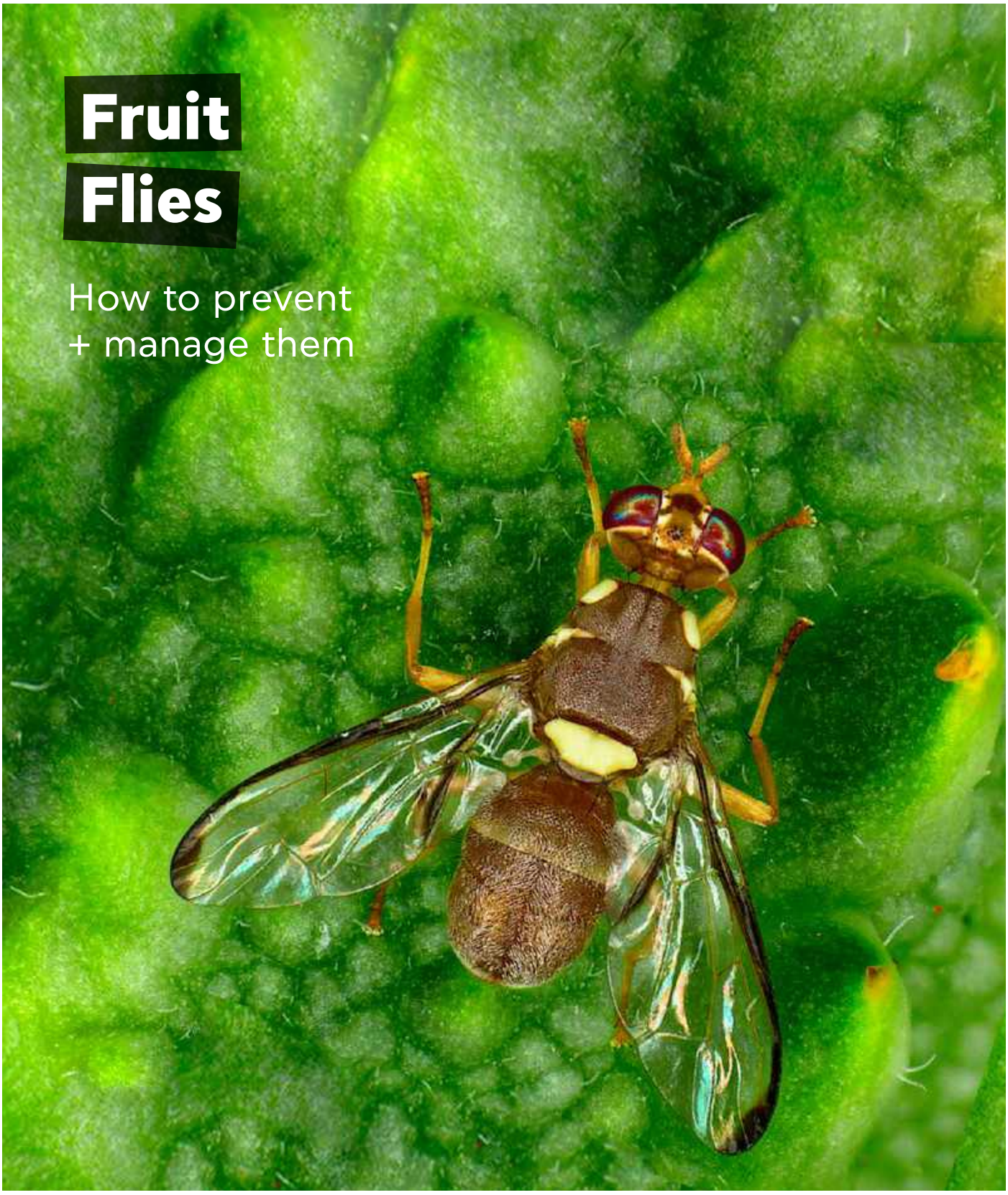

Fruit Flies

How to prevent
+ manage them

Horizon 2020
European Union Funding
for Research & Innovation

FF•IPM

Fruit Flies In-silico Prevention & Management

FF•IPM

This is the first 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 will be published quarterly, highlighting the actions, news, progress related to the issue at hand.

Editor: University of Thessaly

Contributors: FF-IPM partners and experts

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FF-IPM Project Manager

Editorial

Climate change, intense human mobility, and trading have brought biological invasions at the front of threats for agricultural production worldwide. The most important group of invasive pests for fruit production globally are the true fruit flies; species of the Tephritidae family. Out of a list of more than 5,000 species of true fruit flies identified, based on a recent list published by the European Food Safety Authority (EFSA), approximately **257** satisfy the criteria to be considered as potential quarantine pests for the European Union (EU).

On this list, two fruit fly species are included. These are the Oriental fruit fly (OFF), and the peach fruit fly (PFF), both are on the EFSA list of quarantine pests. Both species have been recently detected in Europe in very low numbers, thus considered as transient and not established. In addition, the Mediterranean fruit fly (Medfly), is established in the coastal Mediterranean area of the EU. Because of the huge economic impact on fruit trading in case of a massive invasion, fruit flies are a delegate issue often involving major political decisions and intense debates on scientific and regulatory aspects.

Having a deep understanding of all aspects of fruit fly invasion and recognizing the international dimension of the phenomenon, we have established a consortium of 21 partners (15 from EU, 2 from South Africa, 1 from Israel, USA, China, Australia) to work towards providing scientific answers and practical solutions for the whole range of stakeholders dealing in fruit production and trading in Europe and elsewhere.

Our project, FF-IPM - "In-silico boosted, pest prevention and off-season focused IPM against new and emerging fruit flies", was awarded a Horizon2020 grant and kicked off in Volos, Greece from the 16th - 20th September 2019

Horizon 2020
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The vision of the FF-IPM project is "To protect the European horticulture and trade from the current and imminent threats posed by selected emerging (existing) and new (invasive) frugivorous fruit flies (FF)."

Medfly is on the spot as a major emerging issue for EU horticulture in the mainland and northern cooler areas since it seems it expands its traditional geographic boundaries from the Mediterranean coasts to the north, while the OFF and PFF are the emerging species.

Marc De Meyer, the technical manager of FF-IPM, gives below an overview of the FF-IPM objectives and approaches.

The fruit fly invasion problem is multidimensional and involves EU, international, regional, and local stakeholders and organizations. The FF-IPM newsletter will discuss fruit fly invasion and management with prominent stakeholders' representatives to acquire a spherical approach to the problem.

Along these lines, Ana Larcher Carvalho and Ulrich Schiefer discuss with Françoise Petter, the Assistant Director of EPPO (European and Mediterranean Plant Protection Organization) regulatory and other aspects of pests invasions including that of fruit flies.

Our colleague Slawomir Lux provides an interesting paper on the status and implementation of Integrated Pest Management in Europe that I am sure will offer the ground for fertile discussion.

Over the last 10 months, and despite the COVID-19 epidemic, the FF-IPM project has concluded and submitted seven deliverables, conducted six workshops involving a wide range of stakeholders, established 10 major field testing experiments in Greece, Italy, Spain, Croatia, Israel, and South Africa and progressed on many other aspects. The progress made will be presented in the next newsletter.

Stay tuned not only for the FF-IPM development but also for additional discussion on such matters.

We hope the current newsletter will become an important forum of knowledge exchange and discussion.

Fruit Flies In-silico
Prevention & Management
FF•IPM

Introduction to FF-IPM objectives and approaches

Marc De Meyer

Agriculture is one of the main drivers of the European economy. The output of the EU agricultural industry was €373 million creating gross value added of €160 in 2019 [1], providing work and income to millions of Europeans, while also providing a large part of our food requirements. Grassland and cropland together make up 39 % of Europe's land cover [2], making it the major land occupation activity.

Horticulture, including the production of fruits and vegetables, is one of the main constituents of the agricultural industry. Some horticultural production lines are an integral part of our European food tradition. Think of Valencia oranges from Spain, French vineyards, olive groves in the Mediterranean, or apple orchards in Poland.

1 European Union: agriculture statistical factsheet, June 2020
2 EEA Report No 10/2017

However, these industries are at a continuous risk because of pests and diseases, often novel ones being introduced from foreign areas. The *Xylella fastidiosa* spread in the last decade, causing havoc in the olive plantations of several Mediterranean countries, is a well-known example, but several others have passed through in recent years. Such invasive pests affecting food production is not new, but the number is on the rise because of several reasons, including an increase in international and intercontinental trade and travel.

On top of this, climate change aggravates the problem. Because of changing conditions (rising temperatures, persistent droughts, fewer days of frost, and snow) within Europe, climatic barriers disappear providing opportunities for pest organisms to spread to other parts of the continent. The EU, therefore, aims to develop pro-active measures that could prevent or mitigate the impact of such new and emerging risks and secure sustainable food production. FF-IPM aims to address these issues.

FRUIT FLY CHALLENGE & SOLUTION AT A GLANCE

GLOBAL CHALLENGE

Fruit flies cause significant damage to fruit & vegetable industry

Why FF threaten EU fruit crops?

Carried by global trade can quickly take root and spread, impacting fruit production

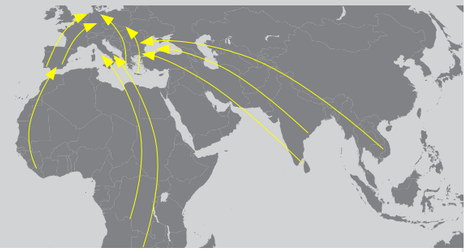
VALENCIA
30% fruit production damage

AFRICA
$2 billion in annual losses

AUSTRALIA
$4.8 billion in annual losses

GLOBAL
16% of harvests lost to pests

Fruit flies can spread from one continent to another



RESEARCH + SOLUTION

Healthy fruit in a clean & secure environment

TARGET

30%
Decrease pestiside use
Reduce infected fruits

>30%
reduction in fruit loss

EXPECTED RESULTS

Holistic knowledge-based approaches, innovative tools & services

- Tools and databases to predict where and when invasive pests are likely to enter Europe
- Rapid detection and identification tools - electronic traps or noses
- Management toolkit to suppress any established fruit flies
- Novel approach for all pest organisms putting EU horticultural industry at risk

EU funded project

University of Thessaly
COORDINATOR

71 scientists

21 partners

17 countries

48 months

FF-IPM, In-silico boosted, pest prevention, and off-season focused IPM against new and emerging fruit flies ('OFF-Season' FF-IPM), is an EU funded project approved as a response to a call within the H2020 program. It takes one particular group of pest organisms as a test case, the tephritid fruit flies ***(Diptera: Tephritidae).*** Fruit flies have a long history as invasive pests. The presence in Europe of two of the world's most important pest species (the Mediterranean fruit fly Ceratitis capitata, and the olive fruit fly Bactrocera oleae) both have a foreign origin being introduced from Africa in pre-historical times.

Other invasive **fruit fly pests have spread from one continent to another and are considered as one of the major threats for the horticulture in both tropical and temperate regions**. As such fruit flies form an exemplary group to develop a comprehensive approach for the prevention and management of potential pest risks. FF-IPM focuses on three invasive fruit flies: the Oriental fruit fly ***(Bactrocera dorsalis)*** and the Peach fruit fly ***(Bactrocera zonata)*** both of Asian origin but already widely spread to other regions such as the Middle East and Africa. The third species, the Mediterranean fruit fly, is a well-established pest in the Mediterranean Basin but has been observed to spread further northwards in Europe because of changing climatic conditions. All three are polyphagous species, attacking a wide variety of host plants and they form a major threat to the European horticultural industry in both Mediterranean and temperate regions.

FF-IPM targets three levels of prevention and mitigation. Firstly, it aims at **developing tools and databases that can reliably predict where and when invasive pests are likely to enter Europe**. Trade and diverse horticultural activities are creating gates and pathways that are more vulnerable to the introduction of alien organisms. Seasonal differences create shifts in such gateway patterns. Once entered, the dispersal of any organism will vary according to the spatial composition at the point of entry but also according to several behavioral and biological variables of the organism itself, like tolerance to cold and drought, reproduction rate, flight dispersal capacity, etc.

FF-IPM, therefore, aims to obtain the necessary biological data, to feed these into spatial models both at the micro ('orchard') and the macro level, which would allow making predictions on likely points of entry and invasion routes of the target pest species. This is a computer-based ('in-silico') prediction that will then be tested in real-life situations.

Secondly, it aims at **developing rapid detection and identification tools**. Pest species can either disperse by themselves into new regions, or they can be transported over long distances by human activities such as transport of fresh food items. It is adamant to have a system in place that can detect any new incursions rapidly and efficiently. Novel technologies, such as electronic traps that allow automated recognition of a pest species, or electronic noses that can detect volatiles produced by infested fruits in cargo shipments for example are such methods that will be developed within the framework of the FF-IPM project. In addition to rapid detection, it also requires to be able to identify the organism correctly in a reliable, easy, fast, and relatively cheap way. FF-IPM aims to develop various tools (based on both morphological as well as genetic characteristics) that would make this possible. Rapid detection and correct identification would thus allow the authorities to take immediate action once a new pest has been observed. Only at this initial stage, it is possible to prevent further spread and aiming at eradication to safeguard the food production of a region.

Last, but not least, FF-IPM aims to **develop a management toolkit that would lead to suppression of any pest organism, should it become established, at acceptable levels**. Because of the increased awareness of the negative consequences of insecticide use both on human health and on the environment, the management tools are focusing on IPM (Integrated Pest Management) which comprises a diverse set of methodologies that are considered benign, such as natural predators and parasitoids. However, the novel approach of FF-IPM is that it will target the use of such IPM tools in the 'off-season'. Because of the seasonal variations in fruit production and climate conditions throughout the year, fruit flies demonstrate a decline in population levels during the winter periods. 'Off-season' IPM will target these low population levels, thereby reducing the economic costs because fly populations will not have attained the high number of flies which would necessitate much more intensive control.

As such FF-IPM aims to provide a comprehensive strategy targeting different stages of the invasion and establishment process. For this, it brings together research institutions from within and outside Europe, together with private enterprises, plant protection authorities, growers associations, and other stakeholders to tackle all different aspects of such strategy development. **While the project focuses on one particular pest group, it will allow us to design an approach that can be developed and implemented for other pest organisms that are putting EU horticultural industry at risk**.

Marc De Meyer is an entomologist at the Royal Museum for Central Africa (RMCA, Tervuren, Belgium). He is the Technical Manager of the FF-IPM project, as well as Work Package leader for tasks related to the development and enhancement of tools and methods for fruit fly prevention (WP3).

Françoise Petter

Assistant Director of EPPO

Interview conducted by
Ana Larcher Carvalho (AL)
and Ulrich Schiefer (US)
16.6.2020 via ZOOM

Françoise Petter studied agronomy in France and first worked for the French National Plant Protection Organisation. She began her career as the head of Paris airports inspection teams. She then joined the national level of the French NPPO in 1994 where she was mainly responsible of nursery surveillance programmes.

She was also involved in the negotiations of the EU legislation as well as in bilateral negotiations with third countries for French export programmes. In 2003, she joined the European and Mediterranean Plant Protection Organization as a deputy director, her current position. She is in charge, in particular, of the coordination of the diagnostic and pest risk analysis programme.

AL: Could you tell us bit about the work of EPPO? What are your key areas of concern?

The European and Mediterranean Plant Protection Organization (EPPO) is one of the 10 Regional Plant Protection Organisations. It was established in 1951 by 15 countries at the same time as the International Plant Protection Convention (IPPC) came into force. Now we have 52 countries and we cover Europe, Central Asia, as well as Mediterranean countries (including North African countries). We have two main areas of activities, one is Plant Protection, but we are also active in the area of Plant Protection Products (PPP) where we promote the safety and efficacy of plant protection products.

In Plant Protection our focus is the prevention of introduction and spread of pests in our member countries. We are providing guidelines and standards and information for our member countries. We also support our members for international activities in the framework of the IPPC. We prepare our own standards, but we also participate in the global standard setting process.

We have networks of experts and a permanent pool of experts in our panels. We organise panels, conferences and workshops and bring experts together, from our member countries but also from around the world.

It is also important to know that EPPO is funded by the member governments: our main budget comes from the contributions of our member countries. The Council is where the member countries decide about the budget and approve the standards. Regarding relations with the EU, all founding members are EU countries, but EPPO was founded before the EU.

All EU countries are members with full voting rights whereas the EU Commission has permanent observer status but without the right to vote. The Commission can also nominate members of our panels.

AL: One of your main work areas is to set standards to prevent the introduction and spread of pests. But are these standards binding for the member countries?

EPPO has developed more than 300 standards in PPP (mainly on efficacy evaluation of plant protection products), in plant quarantine we have more than 250 standards (including more than 140 in diagnostics). In some areas of work the number of Standards are more limited as we don't need many standards. In Pest Risk Analysis, we have developed guidelines on how to perform the pest risk analysis. We have developed eight standards.

EPPO standards are recommendations to the members, but it is up to the member to translate them into their regulatory frameworks. Of course, if countries approve the standards, they are expected to implement them and to base the regulation on them.

EPPO standards are prepared at regional level, and the region is very big. So the countries have to decide if the recommendations are applicable to them. Sometimes there are differences between recommendations of EPPO and of its members (including EU countries). When recommending measures EPPO does not do a cost benefit analysis for all, this has to be done at country level. The cost for inspections at the border, for instance, might not be the same in different countries, and this will have to be weighed against the cost of the pest introduction. Some countries might not take measures because they think that the pest is unlikely to establish.

AL: How do they relate to the IPPC standards?

Our standards are aligned with International Standards. In some cases, for instance, in Pest Risk Analysis, our standard was developed before the IPPC standard; it was a parallel process, but it was easier to get our standards approved by our members. At the time we asked our members if we should revoke our own standards as there were international standards. But they considered that our standards were more practical as they are organised in questions and answers in a structured sequential way, not as an open text as the international standards. We made a comparison and improved our standard on risk analysis, for example on the environmental impact. So, the members decided we should keep our own standards, but they are aligned with the international standards.

AL: The work of EPPO involves a lot of consultation and negotiation with different stakeholders. How do you do this in practice?

We have a formal standard setting process. The standards are prepared in the panels, then they are sent to all members for formal consultation. The comments are collected by the secretariat and then go back to the panels. If it becomes complicated to deal with the comments, we will organise follow up meetings with the panel. We only consult our member countries. The countries can consult different groups in the country. For example, if we develop standards for the testing of seeds, they can consult with their seed industries, but, in general. EPPO will only consult with the countries, not the industries. So the countries are the only stakeholders in our consultations.

However, for the standard setting process, we have different levels of meetings, with participation from different stakeholders: Panels and Working Parties. The panel is where we conduct the technical work. We want people with technical knowledge in the panels. They don't have to be from the National Plant Protection Organisation, they can also be from universities. The members of the panels are nominated by the countries but the countries have to cover the cost of participation and, for some, this is a big burden. So, some countries are better represented than others.

In the working parties we have more policy people. But we have also risk managers in the panels, people who are managing risk on a daily basis. We have one working party for Plant Protection Products and one on Phytosanitary Regulation.

Private sector stakeholders are not usually involved in Panels. Historically, ECPA (European Crop Protection) has been involved in EPPO's work on plant protection products and members of ECPA are members of Panels in this area. However, they only have an observer status in the working party on plant protection products (the body that recommends the adoption of standard to the EPPO Council). Expertise is present in the industry which is valuable for the activities of the organization on, e.g., efficacy evaluation of plant protection products.

In the Plant Quarantine area stakeholders are generally not members of panels nor present as observers at the Working Party on phytosanitary regulations. We consult them from time to time, we gather information, but that is only additional. In diagnostics we once prepared a diagnostic protocol with a contribution of the seed industry.

AL: What are the major challenges that phytosanitary authorities and Plant Protection Organisations are facing in Europe and the EPPO area?

It is not a really original story. But our reality is that international movement has increased a lot. When I started my career as the head of an inspection team in Paris, most of the imports of planting material were coming from Europe. There were hardly any imports of e.g. nursery plants from China or from the Americas. And that was about 30 years ago. And then trade increased, companies started to produce counter season in the southern hemisphere and then bring the product back. And so we saw an increase in the number of pests that were introduced over the past 30 years.

One of the biggest challenges we have at the moment is to try to prevent the entry of new pests into the region. New threats are emerging, and we are really struggling with this. How can we have a good prediction of what could be the risk for tomorrow? And how can we be prepared for that? In many cases we have to deal with unknowns. Some of the pests that are popping up in some areas of the world have never been known as pests before. It is only when these are introduced into new areas where they don't have a co-evolution that they become more damaging than they were in their areas of origin where antagonist organisms are present. Or, simply when they arrive, they find a new host which was never identified before. This is really a tricky part of the prediction, called early warning.

Let us go back to the history of how plant health has been dealt with in Europe for many years in the past. We have been working under the assumptions that we identify risks and we design measures to prevent that risk to happen. This means

that in European regulation, if a risk was not identified, the product could be imported. Many countries in other parts of the world work on the reverse strategy. For example, many Anglo-Saxon countries work under the principle that what is not known should be evaluated before it is allowed. If you don't know, you do not allow import before the risk is evaluated. There was a real difference between Europe and other countries. This has now changed in EU countries with new legislation and the concept of high-risk plants. In many countries you need an import permit before you can export to this country. In many European countries what was not covered in the regulation could be imported.

In our member countries we have different strategies. In Israel, they operate what is often called a closed system. Now the EU legislation is getting closer to a closed system. EPPO has contributed to the evaluation of the efficacy of plant health strategies. In 2009, an EPPO Council Colloquium considered whether the plant health systems that are in place in the EPPO region are able to deal with the challenges of increasing trade and climate change. The outcome of the colloquium, in particular regarding the risks posed by the imports of plants for planting, was further discussed in different EPPO meetings and the EPPO Council decided to allocate funds for a study on past experiences with new trade (new origins, new commodities) of plants for planting and the associated risks. The study and recommended a more protective approach and a commodity assessment before allowing import. This has subsequently led to a change in strategy.

FF-IPM will be very interesting to fit into the EU reduction of plant protection products and the in new models for IPM, in particular the off-season concept

AL: The establishment of EPPO was already an answer to the increase in introductions?

Definitely. Historically, there have been dramatic crises, like the potato famine in Ireland that was linked to the introduction of the potato blight, or the introduction of the grapevine phylloxera. So there were some introductions of plant diseases clearly linked to trade that triggered the International Plant Protection Convention.

AL: What about WTO rules and the problems regarding import and export, and what some see as mounting barriers to trade for countries that want to export to Europe?

The phytosanitary measures should not be technical barriers to trade. They should always be justified, and that is why we have pest risk analysis. The debate should be on the technical arguments. We are protecting ourselves from pests we don't have. So, it is always hard for countries that are exporting to another region. For the exporting country, a pest against which the importing country has measures, might be a common pest with which they can live. If you have a pest in a country, the perception of risk is always lower than in the country that does not have the pest and does not want it. So, from the perspective of exporting countries, it may seem that we are generating requirements that are over the top. However, importing countries need to protect growers from additional control costs, and the loss of access to trade markets, amongst others.

AL: What is the importance of fruit flies for the work of EPPO and for Plant Protection in Europe and the world?

Fruit flies are quarantine pests; they are very important at the international level. We don't want to have them introduced into the region because we have fruit producers in the south of Europe and they may also be important for production under greenhouse conditions. Some are important in terms of global trade, that if you get them introduced then you will lose a lot of market access.

For some of them you may look at the risk and consider if they really have the potential for establishing in the region. But if you have an incursion, there might be a lot of consequences. So, the fruit flies have always been a problem worldwide.

The risk of fruit flies is increasing. Now Austria has provided information that they have seen pests in areas where they were not considered to be able to survive. This shows that pests are now, because of some elements of climate change, moving further to the north than they were expected to a few years back.

AL: Why did you decide to support and to be involved in the FF-IPM project and become a member of the advisory board?

We are in the Advisory Board of FF-IPM and are trying to support the project there. It is because of the topics that are covered in the project, like the surveillance activities, linked to the trapping, and the diagnostics. These were the main reasons for us to consider that the project was worth supporting. And also because fruit flies are important quarantine pests. Some fruit flies are knocking on our door, there have been some findings recently and so the topics were of interest for the organisation.

I think the best way to ensure that the project produces impacts is to keep in touch. So, although it is difficult now to get into contact, our offer is still there. If you need contact with risk managers, we are happy to facilitate that. And I think there will be other project meetings where deliverables will be presented and that will give us opportunity to see what has been done and what could be included in our work.

AL: What, from your perspective, are the most important contributions of the FF-IPM project for EPPO and for Plant Protection and Agriculture in Europe and beyond?

Some members of the project are involved directly in the revision of diagnostic protocols and colleagues are contributing with sequences data which could be directly relevant to the work of EPPO. The activities on diagnostics are going to feed directly into our standards because of the keys that are being developed, etc. That would be very valuable for us, for the EPPO standards for fruit flies. In addition, experts of our panels are members of the FF-IPM project, so we hope there will be more direct links. Even if we are not a partner in the project, we have active members.

I should also tell you some words about Integrated Pest Management (IPM). One of the objectives of IPM is really to look how we can have an integrated management. EPPO had in the past activities called Good Plant Protection Practices which you could link now to IPM. These are standards have been adopted many years back and have not been updated recently. Our members,

because of their regulation and the need to decrease the use of plant protection products, want to move towards a combination of production practices, plant protection products and biological control. We have been asked by our members to work on IPM but we want to see where we can be useful. We want to understand better what our members would like us to do. In addition to the investigations that are already going on, we want to see what we do to complement what other bodies are doing: we can't afford to duplicate the work on IPM.

So, I think the results of FF-IPM will contribute to the EU reduction of pesticide products and to the models for IPM, in particular the off-season concept, the concept that is promoted by the FF IPM project to fight the pest all year round and not just during the high-season. The work on modelling in the FF IPM project is another contribution that will help us predict the possiblitiy of invasions..

AL: And now about the COVID19 crisis... What do you think are the negative impacts of the current health crisis for agriculture in Europe and the world and for plant protection?

This is a global crisis; it is an unavoidable question.

There were activities in Plant Protection that were kept going. The inspections were going on, there were less imports, but the inspectors were still on duty. In the National Plant Protection Organisations people continue to work, they have maintained their activities in order not to jeopardise the situation in the countries.

In the research projects, however, we know that some experiments have been stopped. So, there will be some impacts on the research by slowing or delaying results.

For the moment, in many countries, governments have decided to protect human health, whatever the costs to the economy. The importance of health has been clearly highlighted. I hope, however, that agricultural research will not have to suffer too much from the diverting of funds, even though this is understandable in the light of this crisis.

US: This COVID19 crisis is all about epidemics, so this is exactly your area. What strikes me most is that everything happened very, very fast. So, organisations had to work together in ways they had never done before. Do you think there might be something we could learn in terms of the way we work?

In terms of organising work, we have learned a lot. We are talking about how to maintain activities in the absence of physical meetings. We had to adjust very quickly. We saw the lockdown coming, so we prepared for it a little bit in advance and took measure to find other ways of working. We might have a different world of work after the crisis.

This epidemic shows clearly the importance to have contingency plans. To have also clearly defined, step by step action plans, that tell you clearly what you have to do and in what sequence. We were not prepared for this kind of event. But what we can learn from this crisis for plant health, as well is to have more contingency plans. Because the quicker you are, the better you can manage: if there is a new cluster, for example, there is a clear action protocol of contacting people, assessing risks, testing, and quarantining, all in ordered ways. We need to translate that also more systematically into our way of working.

The difference we have in plant health is the multiplicity of risks. So, it is more complicated to be well prepared. Testing humans or animals is, in a way, easier, because in humans and animals many diseases (or signs of them) can be detected through blood tests, in plants we don't have blood, so it is a little bit trickier. In plant health testing also depends on the season, there is a different approach on the testing of roots or twigs depending on the season.

US: What other learnings can we take from this crisis?

We should take the opportunity provided by the crisis with the public. People have seen what an epidemic is. Everybody has understood the importance of testing for early detection, of rapid action, of establishing a lock down. Communication is not always easy, and scientist disagree. You have one scientist saying this, the other is saying something different with different hypotheses. Some people say they have miracle solutions. We have seen this during epidemics in plant health as well.

So, the general public will be better prepared to understand why you have to take some action such as limiting the movements of plants from farms to other parts of a country. People will understand this better and relate it to what happened in the COVID crisis. If we restrict the movement of people in the COVID crisis to avoid the virus circulating, we restrict the movement of plants for the very same reasons. I hope there will be better understanding of these concepts by the public.

The crisis also shows the importance of research to find solutions. I hope it is something that will help us.

And so what I hope we will gain from this crisis is a better understanding from the general public about epidemics in general. So, for me, we should build on that.

AL: We want to thank you very much!

INTERNATIONAL YEAR OF PLANT HEALTH 2020

The United Nations have proclaimed 2020 as the International Year of Plant Health (IYPH). In January 2020, the EPPO Secretariat launched the Beastie the Bug communication campaign.

Beastie the Bug is an invasive pest which seriously damages wild and cultivated plants. Several specimens have started to spread from the EPPO headquarters where the first outbreak was detected at the end of 2019.

Retrospective of the status and implementation of IPM in Europe – a few grumpy remarks

Slawomir A. Lux

Progress and development follow non-linear trajectories whose waves, ups and downs, and sudden turns are equally driven by discoveries, as well as the divergent needs and interests of different social sectors. The development of IPM is no exception. The basic framework for the use of natural agents and biological processes to mitigate the impact of pests on agricultural production was developed centuries ago. The benefits of crop rotation and diversification, mixed- and inter-cropping, and the role of predators were known a long time ago. The nineteenth-century witnessed rapid development and successful applications of classical and augmentative biological control. In the early twentieth century, several inorganic pesticides were tried, but not routinely used on a large scale. It was only in the post-war period in the mid-twentieth century that sudden availability and rapid development of highly effective synthetic pesticides (and fertilizers) caused radical changes in the approach to agriculture. Rapidly, traditional farming, organic by today's standards, has been supplanted by intensive and pesticide-reliant agriculture. This enabled efficient industrial food production and weakened the momentum, progress, and public interest in biology-based agriculture.

For decades, further development of alternative approaches was largely confined to academia, where over eighty years ago the IPM principles were formulated and then promoted by intergovernmental organizations such as FAO.[1] Farsighted vision, the development of new methods, and relentless efforts were necessary to build momentum and public awareness of the adverse effects of pesticide abuse, and formally recognize and strengthen IPM approaches through the adoption of Directive 2009/128/EC. Since then, the implementation of IPM became mandatory in Europe.

The Member States quickly developed legally binding National Action Plans and soon declared compliance with the new regulations. The value of the IPM directive has never been called into question and many brilliant and effective IPM schemes have been implemented, which is why many success stories can be cited. They have been publicized, appreciated by producers and consumers, and are well known to IPM community. Consumers assured that European food is now produced in line with IPM principles, have largely redirected their attention to new challenges such as climate change.

However, the widespread administrative reliance on formal IPM compliance declarations has created the illusion of achieving goals and complete success. In such context, the outcome of ex-post implementation assessment made 10 years after the adoption of the Directive, conducted by the European Parliamentary Research Service (EPRS 2008) and the European Environment Agency (2008) - is sobering and even worrying. It reveals that despite many success stories, the headline targets of the Directive: (1) reducing pesticide use in Europe, (2) eliminating (or at least severely reducing) pesticide residues in agricultural products (especially fresh fruit and vegetables) and (3) widespread implementation of low-pesticide IPM, have not been achieved.

1 Food and Agriculture Organization

Table 1. Sales (in tonnes) of insecticides and acaricides

Country	2011	2018	Change [%]
Italy	2494	1653	-34%
Belgium	695	476	-32%
Portugal	878	675	-23%
Spain	8062	6488	-20%
Cyprus	179	151	-16%
Netherlands	260	243	-7%
Chechia	291	292	0%
Switzerland	262	273	4%
Romania	808	1012	25%
Germany	11832	16237	37%
Hungary	522	787	51%
Poland	991	1770	79%
France	2190	5728	162%
Austria	248	1569	533%
Greece	109	1009	826%
Total	29821	38363	29%

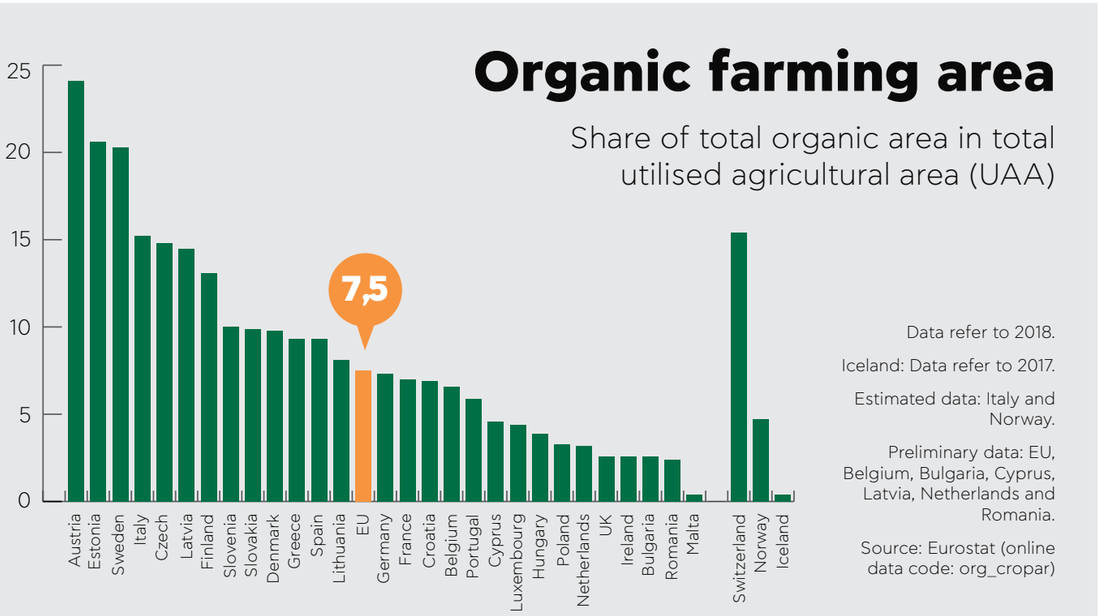
Source: https://ec.europa.eu/eurostat/statistics-explained/pdfscache/14964.pdf

1. The change in pesticide use in Europe: After a temporary drop in 2011–2013, the sales and use of pesticides have returned to, and in many cases exceeded the status before the Directive. According to Eurostat, over the period 2011-2018, the combined sales of all categories of pesticides remained more or less stable in Europe at around 360 000 tonnes per year. But the records of insecticide sales are less optimistic. Although their use has been reduced in some countries, such as Italy, Belgium, Portugal, Spain, in many others a very substantial increase was recorded (Table 1). Overall, after the Directive, the use of insecticides and acaricides has increased in Europe by 29%.

2. The change in pesticide MRLs and residues: Although adherence to the Maximum Residue Levels (MRL) in fresh products has generally been improved, this has not always resulted in the actual reduction of pesticide residues in fruit. The case of acetamiprid, a systemic pesticide commonly used in fruit protection, illustrates the case well. It is highly preferred because it rapidly penetrates the fruit tissue and kills the fruit fly larvae living inside. Before the Directive, the MRL for cherries was set at a fairly rigorous level - 0.25 ppm (mg/kg).

However, after the Directive was adopted, the threshold was increased six-fold (doubled to 0.5 ppm in 2011 and tripled to 1.5 ppm in 2015). The MRLs for other fruits, such as apricot, blueberries, and olives, show similar or even more pronounced trends.

The increase above the 0.5ppm threshold has important implications for IPM practice. In 2014, Luzic et al reported that, with the recommended spray of ca. 125 g of active ingredient per ha, only 1-2 days post-application the concentration of acetamiprid in cherries already complies with 0.5ppm MRL. Indeed, very crude calculation explains it well. In Switzerland (Price et al. 2017), live tree biomass in orchards approximates 25-29 tons/ha + 10-30 tons of fruit, so assuming no drift and 100% absorption, the 0.5ppm MRL can be satisfied shortly after the spray. The current, 1.5ppm MRL de facto eliminates the need to respect all pre-harvest periods, and even to "worry" about any IPM.



3. The change in the implementation of low-pesticide IPM: Accurate data on low-pesticide farming is not readily available, but organic farming can be used as a proxy. Between 2012 and 2018, the share of land used for organic farming in Europe increased by around 25%. This is very positive, but it becomes less impressive when we realize that it means that by 2018 organic farming in Europe has reached an average of 7% of the total utilized agricultural area (Eurostat, 2018). The leaders include Austria (23.4%), Estonia (19.6%), Sweden (19.2%), Italy (14.9%), Switzerland (14.5%), the Czechia (14.1%) and Latvia (13.9%). However, for the main agriculture producers, such as Spain, Germany, and France, the share of organic farming does not exceed 10%. Ironically, in the countries considered to be bastions of IPM research and promotion, such as the Netherlands and the United Kingdom, the share of organic farming reached only 3.2% and 2.6%, respectively.

Concluding remarks

Undoubtedly, the mere fact that the Directive was formally adopted was in itself a great success. However, the overall increase in pesticide use recorded within 10 years after its adoption proves that its all-European impact does not seem to match the initial enthusiasm and hope.

Several factors have contributed to this, and the IPM community is also not without fault. IPM became compulsory for all farmers in Europe at a time when for many crops and pests the methods available in the IPM 'toolkit' were not yet robust enough or in many cases did not exist at all. Several ingenious IPM methods worked well, but only in the hands of the researcher. Very few were ready to pass them on to farmers, being able to compete fully with pesticide-based plant protection in terms of simplicity, efficiency, and labor costs.

Despite significant progress and many excellent examples of IPM implementation, these remarks remain largely valid even today. Perhaps the time has come to admit that the promises enthusiastically made by the IPM community at that time were overstated, at least to a large extent.

Despite the increase in pesticide use, all food produced in Europe became nominally IPM compliant. The Member States, after the approval of national action plans and formal declarations of compliance, have largely not established formal criteria for assessing the implementation of IPM, nor have they adopted any measures applicable in cases of infringement (EPRS 2008). To ensure the abundant and inexpensive agricultural production, possible with the intensive use of pesticides, the formal definitions of IPM have been creatively extended to cover most of the 'business as usual', which has since become 'IPM compliant'. The European administration was satisfied with the nominal declarations of the Member States. Although many harmful pesticides have been removed from the market, several MRLs have been significantly liberalized at the same time. It seems clear that, overall, national and pan-European institutions have shown an insufficient capacity to lead this change and resist pressure from large agricultural and pesticidal lobbies.

Over the past 50-70 years, fierce competition between fruit producers jointly with aggressive marketing campaigns have bred entire generations of consumers accustomed to absurd and unsustainable fruit standards. It has never been quite publicly accepted that with real IPM and low pesticide use, not all fruit can be inexpensive, abundantly available, uniformly large, colorful, impeccably flawless.

Before the adoption of the Directive, no effort has been made to make consumers

fully aware of this obvious truth and to stimulate the evolution of their preferences and expectations towards a more sustainable and conducive to adopting IPM with low-pesticide content. Undoubtedly, the original concepts and goals of IPM remain valid, but all of the above-mentioned events have seriously blurred the clarity of the IPM concept in its common perception, and significantly eroded public confidence and the impetus for its implementation.

The unexpected pandemic of Covid-19 is spreading major shockwaves globally, which will certainly affect the priorities and attitudes of human societies in the future. For many, the pre-pandemic global liberal order loses part of its appeal. We are brutally reminded that social progress, health security, and prosperity cannot be measured solely by gross domestic product per capita (GDP). Although the forces to restore pre-pandemic order will likely prevail, the resurgence of public demand for change in progress paradigms can be acknowledged. Once again, more human-oriented concepts may gain popularity, as measured by public health, consumer safety, and sustainable development of local food production systems. This 'shift in public mood' may be temporary only, but it may provide a transient "window of opportunity" for improving the status and practice of IPM in Europe.

Still, the choice of fruit production methods remains determined by highly distorted and exaggerated consumer preferences, cultivated by global competition on the market. To broadly introduce more than just nominal but true IPM with low pesticide content in Europe, a social consensus needs to be re-developed and sustainable trends in consumer priorities and attitudes cherished. It would not hurt to recognize that the IPM community, in addition to publicized success stories, also needs a solid dose of sober pragmatism to rebuild social respect and the demand for authentic IPM approaches.

FF-IPM, being aware of these needs and trends, has the ambition to make a positive contribution to these developments.

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Need to broadly introduce more than just nominal but true IPM with low pesticide content in Europe

The FF-IPM Kick-off Meeting

21 project partners,
9 work packages with the associated WP leaders,
more than 40 participants

The FF-IPM Kick-off Meeting opened with an International Workshop in Portaria, Volos, Greece. The day-long event, titled "A stakeholders perspective on the fruit fly problem" attracted over 100 participants, featured numerous speakers from the global scientific, research, commercial and the policy-making experts (including interventions via Skype), and left everyone certain that a great Project is underway.

WORKSHOPS

Six distinct series of workshops were organized to increase stakeholders' involvement, facilitate consultations, and perform training workshops. These meetings took place in Croatia, Greece, Israel, Italy, Spain and S. Africa to ensure genuine stakeholder involvement in all aspects and stages of knowledge development.

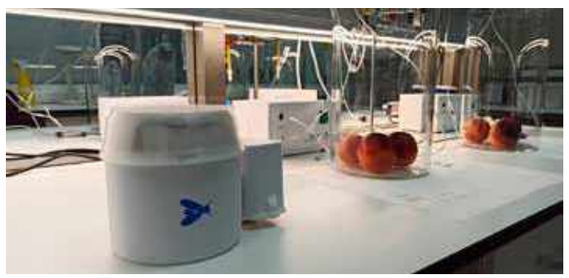
In addition, at the invitation of Ms F. Petter (EPPO Assistant Director), FF-IPM project Technical Manager Mr Marc De Meyer participated at the meeting of the EPPO Panel on Diagnostics in Entomology and presented the project to the members of the different National Plant Protection Organizations that were present.

Milestone Achieved

Electronic FF detection trap advanced and tested

David Nestel's group in the Agricultural Research Organization of Israel (ARO) has recently deployed an advanced e-trapping system. ARO was able to establish one out of ten e-traps in the suburbs of Tel Aviv to perform an initial evaluation of a completely redesigned system which also includes modification of the energy source. The e-trap, baited with methyl eugenol to attract adults peach fruit flies (Bactrocera zonata), has been installed on a citrus host tree. This trap has been transmitting daily frames of the target sticky yellow board, where fruit flies are immobilized and recorded.

The automated recording of captured flies is a breakthrough towards reducing surveillance cost, achieving real time information from the field, and avoiding halting of surveillance efforts. The images produced will be automatically analyzed by an image-analysis algorithm using machine-learning technology and the artificial creation of hundreds of images of FFs.



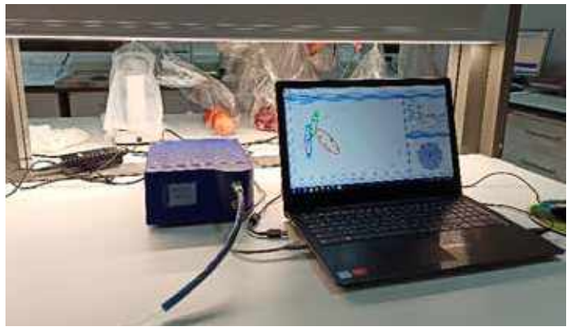
PROGRESS TIMELINE

SEPT 2019	NOV 2019	DEC 2019	JAN 2020
Kick-off Meeting + International Workshop (Greece) 100+ participants Trap installation in Greece	Deliverables 2.1, 9.1, 9.2, 9.3, 9.4 Data loggers' installation in Spain	4 stakeholders Workshops in Greece, Croatia & S. Africa	3 stakeholders Workshops in Spain, Italy & Israel Trap installation in Spain, Italy

e-Nose tool evaluation in laboratory

FF-IPM EU team is developing a novel, highly automated, non-destructive system that reliably identifies FF-infested from un-infested fruit. Benaki Phytopathological Institute (BPI) has started to characterise the volatile profile of fruits infested by FF and determine whether this is FF or host specific. The specific volatile profiles will be used for the "training" and validation of an e-Nose system that can be deployed as a useful FF detection tool in different conditions (fruit consignments, orchards, warehouses).

Controlled infestation trials using different host fruits (peaches in this case), post-harvest fruit storage periods (i.e. kept in storage for different time periods) and developmental stages of larval infestation will be conducted using alien FF within the bio-secure containment facility in BPI. Artificially infested fruits are placed within the facility and the ability of the e-Nose to detect them are evaluated.



Impact of the COVID-19 quarantine on FF-IPM research activities (WP4 & WP6)

Many activities of the FF-IPM project, especially field tasks, were suspended when the lockdown was imposed in many European countries in the spring. Therefore, ongoing project activities linked to "Development and enhancement of tools and methods for the management of FF" (WP4) and "Enhancement of methods and strategies for the management of FF" (WP6) were abruptly stopped and slowly recoup in late May. The overall effect of this long interval is a discrepancy in the baseline data that we were collecting during this first year of the FF-IPM project.

Due to the seasonality of data collection, it will not be possible to meet this goal until next year (2021) and this will no doubt impact additional activities relying on the results of these working packages. This should be an opportunity for the partners to get the best from the existing results and finally produce the high-quality results expected with the minimum of delay.

FEB 2020	MAR 2020	APR 2020	JUN 2020
Deliverables 6.1 & 7.1	Trap installation in Israel, Greece Data loggers' & trap installation in Croatia	**Milestone achieved** Electronic FF detection trap advanced & tested	Extensive testing of mass trapping devices at UTH

Fruit Flies In-silico
Prevention & Management
FF•IPM

Horizon 2020
European Union Funding
for Research & Innovation

www.fruitflies-ipm.eu fruitfliesipm H2020Ipm