The REACT Newsletter

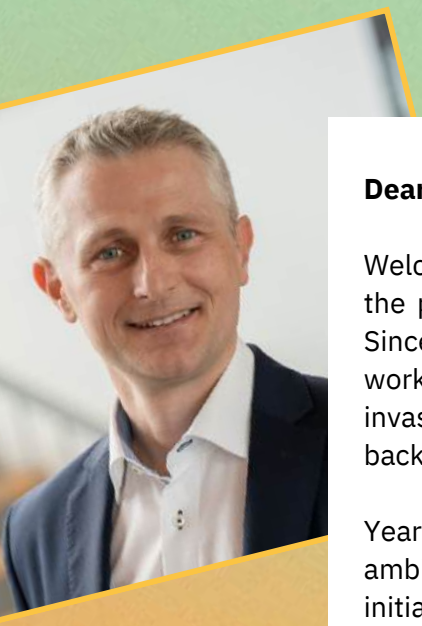
ISSUE #02

November 2024

Funded by the European Union

REACT

Editorial



Dear Readers,

Welcome to the second issue of our REACT newsletter. I am proud to reflect on the progress made as we approach the halfway mark of our four-year journey. Since the project's inception in November 2022, the REACT consortium has worked tirelessly to develop innovative and sustainable methods for controlling invasive fruit fly species across Europe. As we enter this crucial third year, we look back at the milestones achieved and anticipate the path ahead.

Year One was characterized by foundational work establishing the project's ambitious goals. From understanding the ecological drivers of fruit fly invasions to initiating genetic research, our consortium made significant progress in laying the groundwork for the Sterile Insect Technique (SIT) applications tailored to European agriculture. We completed essential preliminary studies on the behavior and dispersal patterns of the two main fruit fly species we target*: Bactrocera dorsalis* and *Bactrocera zonata*. By the end of Year One, we also established the necessary laboratory protocols and infrastructure to begin field work testing.

In Year Two, the project transitioned from planning to action. This phase saw the first field trials and the development of key technologies that will drive the project forward. One of the standout achievements was the launch of the REACT Citizen Science app, which allows individuals across Europe to report sightings of invasive fruit flies. Additionally, our work on developing genetic sexing strains reached a major milestone with the creation of bioinformatics pipelines that will be used for male-specific targeting needed for genetic sexing.

Year Three began with great momentum. In late October, the REACT consortium met in Mauritius for a stakeholder event that included farmers impacted by *Bactrocera* species and key participants actively involved in the ongoing SIT approaches in Mauritius. This event did not only showcase the progress made so far but also offered an opportunity for meaningful discussions with experts and local stakeholders. Our work and the interest of all stakeholders in Mauritius, reflects the global relevance of our project.

In this issue of the newsletter, we offer you a glimpse into our latest achievements, upcoming events, and future plans. From advances in genetic research to real-world field trials, the REACT project continues to pave the way toward sustainable pest control and reduced pesticide use in European agriculture.

We are excited to share these developments with you and look forward to your continued support as we progress towards a more resilient future in fruiticulture.

Kind regards,

Marc F. Schetelig
Coordinator of REACT | Giessen, November 2024

Introduction

As REACT enters its second half, the project has made significant strides in advancing **Sterile Insect Technique (SIT)** applications tailored to European agriculture. Our focus remains on controlling the oriental fruit fly (*Bactrocera dorsalis*) and the peach fruit fly (*Bactrocera zonata*) — **two highly invasive species that threaten crop health and economic stability across Europe.**

REACT's team has **achieved critical milestones** that enhance our understanding of these pests, refine our SIT methodologies, and develop effective, sustainable pest management solutions suited for Europe's diverse agricultural landscapes.

Throughout the second year of the project, our efforts have concentrated on **scaling up SIT applications** for pilot testing, **analyzing the ecological impacts** of invasive fruit flies, and **engaging stakeholders** to evaluate the economic implications of pest outbreaks. With ongoing research across the project's work packages, REACT is paving the way for precise, area-specific SIT deployments and **fostering collaboration to ensure these methods are both scientifically sound and economically viable.**

This newsletter captures the achievements of **REACT's second year** and offers a closer look at how our work is transforming pest control in European agriculture, creating a pathway toward a more resilient, sustainable future.

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Imprint: The REACT Newsletter is produced by Oikoplus GmbH, Vienna, as part of the communication and dissemination activities of the project.

It's about the Fitness

In its first two years, the REACT project has made substantial progress in developing its sustainable and ecological method to control invasive fruit fly species in Europe.

Since its inception, REACT has focused on advancing several key areas. Significant progress has been made in establishing surveillance protocols and genetic sexing strains (GSS). These strains are essential for the Sterile Insect Technique (SIT), which relies on the release of sterile males to suppress pest populations. While the potential of SIT is promising, further work is required to optimize the GSS and ensure their practical application meets the project's ambitious goals.

Another major accomplishment is the establishment of a model facility capable of mass-rearing sterile males in Greece. Initial field tests in Greece included the release of Mediterranean fruit flies (*Ceratitis capitata*, or Medfly) under controlled conditions. A critical component of these tests is the evaluation of different diets for the flies, as SIT's success hinges on the fitness of the released insects. By experimenting with enhanced diets, the project aims to improve the quality and competitiveness of the sterile males, ensuring they perform effectively in natural settings.

In parallel, the project has conducted extensive socio-economic analyses and engaged with stakeholders in Portugal, Germany, Greece, Mauritius, and South Africa in order to understand the broader impacts of invasive fruit fly species. Surveys and workshops have helped refine a cost-benefit model that integrates environmental, economic, and social dimensions, providing a comprehensive framework for evaluating REACT's interventions.

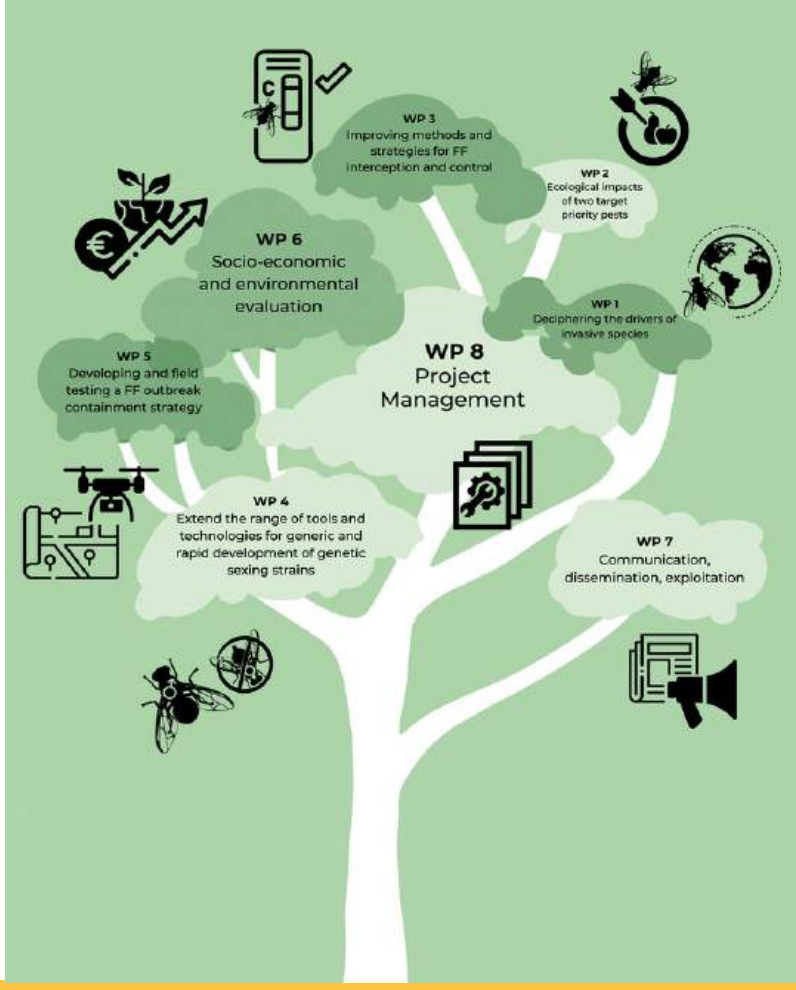
Despite these advances, progress in the development and deployment of genetic sexing strains has not met expectations, creating a bottleneck for the SIT strategy. Overcoming this challenge remains a key focus as the project moves forward.

As REACT enters its third year, it is well-positioned to build on these achievements. Continued refinement of its techniques, expanded field trials, and strengthened stakeholder collaboration will ensure that its innovative pest management solutions contribute to sustainable agriculture in Europe.

Photo: REACT

Work Program

The **work program of REACT** compiled of eight work packages takes this into account. Alongside the **deciphering of the drivers** of invasive species (WP1), the **ecological impacts** of the two target priority pests will be analyzed (WP2) in order to inform the **improvement of methods** and strategies for their interception and control (WP3). The project aims at **extending the range of tools and technologies** for generic and rapid development of genetic sexing strains (WP4) and **developing and field testing** a fruit fly outbreak containment strategy (WP5). A **socio-economic and environmental evaluation** of SIT-based tools and strategies for eradication of invasive fruitflies (WP6) as well as ongoing project **communication, dissemination and exploitation** of the project results (WP7) and a project management work package (WP8) complete REACT's work program.



Project Milestones

MARCH 2023
Milestone 0.1: Consortium Agreement
Milestone 0.2: Kick-off meeting (KOM)

JUNE 2023
Milestone 6.1: Relevance of selected list of parameters for socio-economic analysis for the project development tools and strategies validated.
Milestone 7.1: Plan for dissemination and explotation including communication developed.

October 2023
Milestone 4.1: Initial bioinformatic pipeline for Work Package 4 generation of Genetic Sexing Strains in *Ceratitis capitata* developed.

FEBRUARY 2024
Milestone 2.1: Amplicon sequencing pipeline developed and microbial profiles determined.

APRIL 2024
Milestone 1.1: Sequencing for population diversity and microbiome studies completed.
Milestone 2.2: Acquisition of data for meta analysis on ecological impacts of *Bactrocera dorsalis* and *Bactrocera zonata* conducted.
Milestone 3.1: Metabolomics pipeline and male quality markers in *Ceratitis capitata* developed.

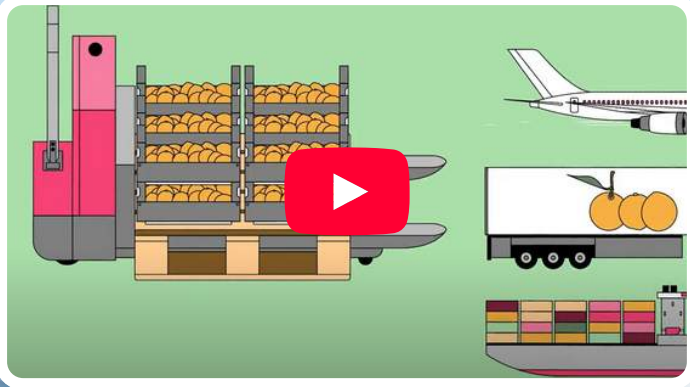
APRIL 2024
Milestone 4.2: Y chromosome targeting developed and evaluated as proof-of-principle in *Ceratitis capitata.*
Milestone 5.1: Emergency-response rearing facility established and productivity assured.

SEPTEMBER 2024
Milestone 1.2: Parameters for population dispersal studies collected.

OCTOBER 2024
Milestone 1.3: Parameters for developing simulation models for *Bactrocera dorsalis* and *Bactrocera zonata* collected.
Milestone 3.2: Fruitfly interception protocol developed and evaluated.

OCTOBER 2024
Milestone 7.2: Reaching sufficient response and interest for the project (indicator values in Dissemination, Exploitation and Communication Plan).

Milestone 5.2: Area tailored *Ceratitis capitata* containment strategy developed and validated.
POSTPONED TO SPRING 2025



Oriental Fruit Fly Detected in Belgium

Multiple detections of *Bactrocera dorsalis* in Belgium highlight the risk of exotic fruit fly invasions in Europe.

The REACT Methodology Explained

This video shows an in-depth introduction to the REACT project, including some of the activities undertaken by the researchers, and shares the knowledge of the fundamental methodologies used in the project. If you want to learn more about REACT, keep on watching!

The Royal Museum for Central Africa in REACT

The Royal Museum for Central Africa in Tervuren, a suburb of the Belgian capital Brussels, plays an important role in the REACT project. Through genetic analyses and comparisons with the museum's historical collection, the museum's entymologists are tracking the spread of insect species around the globe.

Photos: REACT

The Ecological Impacts of Invasive Pests

This video explains how fruit flies can impact our ecosystems and affect agriculture and trade. Keep watching and sign up for our channel if you want to learn more about how scientists collaborate in REACT.

REACT Field Trials in Northern Greece

The REACT work meeting in Naoussa, held from September 29 to October 4, 2024, focused on evaluating strategies for controlling invasive fruit fly species, particularly through a pilot release and recapture study targeting the Mediterranean fruit fly (Medfly).

REACT General Assembly in Mauritius

During the annual meeting in Mauritius, the REACT team could witness a release of sterilized flies and exchange with farmers about their experiences with SIT-based insect pest control.

Photos: REACT

Aruna Manrakhan

“If SIT is Affordable, Stakeholders Will Embrace It.”

In a conversation at the REACT annual meeting in Mauritius, Aruna Manrakhan, a research entomologist at Citrus Research International in South Africa, explained her role in evaluating the socio-economic and environmental impacts of invasive fruit flies within the REACT project. Focusing on stakeholder acceptance, challenges of pest-specific strategies, and the potential benefits of the Sterile Insect Technique (SIT), Manrakhan shares key findings from South Africa's citrus industry and reflects on her hopes for the project's upcoming results.

What is your role in the REACT project?

In REACT, I'm involved in Work Package 6, which is the evaluation of socio-economic and environmental impact of invasive fruit flies, and the benefits in managing them with a sterile insect technique - SIT. We aim to determine whether SIT would be beneficial in the containment and management of invasive fruit flies.

How do you approach the work in WP6? What's the methodology you apply?

We have two tasks. The first one consists of the evaluation of the socio-economic and environmental impact of invasive fruit flies through stakeholder consultations. The second one consists at conducting analyses of costs and benefits of different fruit fly management strategies including SIT. REACT is a project funded by the European Union, and it eventually aims to develop the SIT technology to protect Europe from invasive fruit fly species.

Dr Aruna Manrakhan

is a research entomologist and co-ordinates the fruit fly research programme at Citrus Research International since 2008.

The focus of her research is on ecology and management of fruit fly pests. Dr Manrakhan has also been involved in research projects relating to the monitoring and control of citrus psyllids. She has done some ecological studies on Australian Bug and also recently embarked on a project exploring post-harvest treatments for mealybug.

Why is it important to include the South African perspective?

We have interesting scenarios in South Africa with regard to one of the target pests of REACT- *Bactrocera dorsalis.*
Bactrocera dorsalis reached our northern borders in 2010. We conducted eradication programmes for the initial outbreaks and were successful. With increased and recurrent detections in the same areas, the pest could not be eradicated. *Bactrocera dorsalis* became established in the northern parts of the country. It is still restricted in its distribution in the country. *Bactrocera dorsalis* is therefore present in parts of the country and absent in other parts.
We also have SIT operations in South Africa targeting local pests, and REACT eventually wants to develop a strategy involving an enhanced SIT to combat invasive fruit flies including *Bactrocera dorsalis*. In South Africa there are stakeholders that are already using SIT technique on other pests and they are located in areas where *Bactrocera dorsalis* is absent.

And how do you approach these scenarios in your research?

We start by consulting stakeholders in the two types of regions: one where *Bactrocera dorsalis* is present and SIT operations are absent and one where *Bactrocera dorsalis* is absent and SIT operations are in use for other pests. During consultations, we assessed the impact of fruit flies including *Bactrocera dorsalis*, the acceptance of SIT technology, the effectiveness of current pest control methods. We gather insights on stakeholders' pest control costs, crop losses, and general experiences to understand the economic burden and challenges they face. Additionally, we consult relevant databases to identify affected production areas, evaluate production values and quantify losses due to fruit flies. This combined stakeholder feedback and data-driven approach enables a comprehensive understanding of the situation and the impact of fruit fly including *Bactrocera dorsalis*.

Photo: REACT

Who do you have in mind, when you say stakeholders?

Fruit industries involve different role players. The role players are the producers and those in the fruit supply and export chain such as packhouse managers, quality control officers and exporters. Additionally, there are crop protection agents who are directly involved in the provision of control products and services for fruit flies and other pests. All these role players are impacted by fruit flies and are impacted by development of a new strategy.

How do you engage with these stakeholders?

We began by designing an anonymous questionnaire survey targeting a wide range of stakeholders, which we launched on our website and received an unexpectedly high response rate. The survey reached the intended variety of stakeholders. We then selected key role players affected by fruit flies and who could provide valuable feedback for participation in workshops.

Did you make interesting findings?

Yes. We managed to rank fruit flies in terms of pest status. We could get an estimation of damage levels due to fruit flies. We got feedback of what the growers are currently using to control fruit fly pests and whether they would accept SIT technology. It costs a lot to control fruit flies. There are benefits in fruit fly control since this would enable export of fruit fly free fruit. Regarding the acceptance of the SIT technology, stakeholders expressed that they are willing to consider the SIT technology but only if it is cheaper or the same as the current control method. If SIT is affordable, stakeholders will embrace it.

It seems the challenge that has to be overcome is actually an economical one?

Very much so. In any industry, you have to be economically viable to continue your business.

Do you foresee this challenge to be manageable or are there constraints?

It is manageable. We will have to determine the value of using SIT. Already we found that there would be more opportunities for fruit export if we have no fruit flies in the fruit. So that already brings an added revenue. There will be added costs if SIT is included in the management strategy. But if it's still profitable to include SIT and still export more, the technology can be accepted. This technology must must be affordable for it to be acceptable. One of the virtues of SIT is that it is species specific, while pesticides often affect a variety of potential pests, but also other insects. However, in a given region you may have multiple pests, and it might be less costly to use a management approach that tackles several pests at once.

Is that a challenge that you came across in your stakeholder consultation as well?

Yes, very much so. Fruit flies are top ranking pests, but there are also other important pests which have to be controlled. And even among fruit flies, there are maybe two or three species affecting one commodity. If you implement SIT for one fruit fly species, then ideally you would require SIT for the other fruit fly species as well.

We're now in the second half of the REACT project. What project results are you looking forward to with great anticipation over the next two years?

Several project outcomes will benefit everyone, including the fruit fly detection kits, the mass-rearing facility, and the technology itself. I'm excited to see these developments progressing well, with some, like the detection kits, nearing completion. These tools will be valuable for fruit fly management overall.

Thank you.

Photo: REACT

Kandas Cloete

Paper Farming Against Pests: How Economic Modeling is Shaping Fruit Fly Control in REACT

In the REACT project, agricultural economist Kandas Cloete from South Africa's Bureau for Food and Agricultural Policy (BFAP) dives deep into the numbers behind pest control. Working with Citrus Research International, Cloete uses cost-benefit analysis to assess the potential of Sterile Insect Technique (SIT) to tackle invasive fruit flies in South Africa and Europe. In this interview, she explains why analyzing both direct and opportunity costs is crucial to understanding SIT's economic impact—and how a moderate investment in control could yield major savings for farmers.

How would you describe your job? What do you do in the REACT project?

I'm an agricultural economist, so I do what I would call paper farming. In REACT, I'm involved in work package six, where I work on the cost-benefit analysis component. There's a European component, and there's a South African component. Within the South African component, my responsibility is to conduct the cost-benefit analysis, and to make sure that we get all the economics and socioeconomic components and environmental aspects into the model to actually quantify the cost and benefit of SIT on *Bactrocera dorsalis* in South African context. And then we'll use that information at the end of the day and contribute to the European side of the project as well.

REACT seeks to develop an SIT application to fight two fruit fly pests. Why is a cost benefit analysis needed in the project?

A cost-benefit analysis essentially structures real-life decision-making factors into a model, helping to assess both the costs and benefits of a choice. Just like choosing shoes based on weather or location, it considers multiple influences, often subconsciously. For our analysis, we include not only direct costs but also opportunity costs—the potential loss of not taking an action. On the benefit side, we evaluate both quantifiable and qualitative advantages, such as the non-cash benefit of SIT reducing pesticide residues on fruit, which enhances quality without directly increasing revenue.

Photo: REACT

Kandas Cloete

is an analyst & researcher at the Bureau for Food and Agricultural Policy (BFAP) and Citrus Research International (CRI).

Kandas is a senior analyst at BFAP and works primarily on export orientated, perennial horticultural crops. Her focus includes farm level modelling, impact quantification at farm and industry level and trend analysis throughout the value chain. Since joining BFAP in 2018, her focus is on informing strategic decision making in the fruit, nut and wine industries

You said you do paper farming. But how does your work in the REACT project look? Do we have to imagine endless Excel sheets and numbers, or is it more you talking to people?

In fact, it involves extensive consultation with all parties. First, we aim to clarify the project's scope, including EU objectives for the REACT project. We then gather key information from producers and stakeholders, ensuring accuracy. Finally, we analyze and organize the data to present the results in an accessible format.

To me it sounds quite straight foward. You apply SIT, it helps you get rid of flies. Sounds like a good deal, right?

Yes, agreed. But then you have different countries, different rules, so different people pay for it at the end of the day. For example, in South Africa, subsidies are minimal or nonexistent, placing the full cost of new technology on producers. In the EU, the situation may differ, with adoption potentially conditional on specific circumstances. Therefore, we can explore scenarios where if governments, policymakers, or industry bodies share some costs, it could benefit the collective.

In the parameters of your cost-benefit analysis, is there one that seems to be very crucial, that seems to work or isn't there one that has shown up yet?

Our current findings, focused initially on the citrus industry reveal that direct control costs at the farm level, in storage facilities, and along the value chain are significantly lower than opportunity costs. Losses due to partial control of fruit flies—where some produce is inevitably wasted or unsellable—surpass our direct spending on control measures. The key question, then, is whether investing slightly more in control efforts at the farm level could substantially reduce these opportunity costs. If a moderate increase in direct costs leads to a greater reduction in opportunity costs, this would result in a net benefit overall.

What does this effectively mean for the citrus industry?

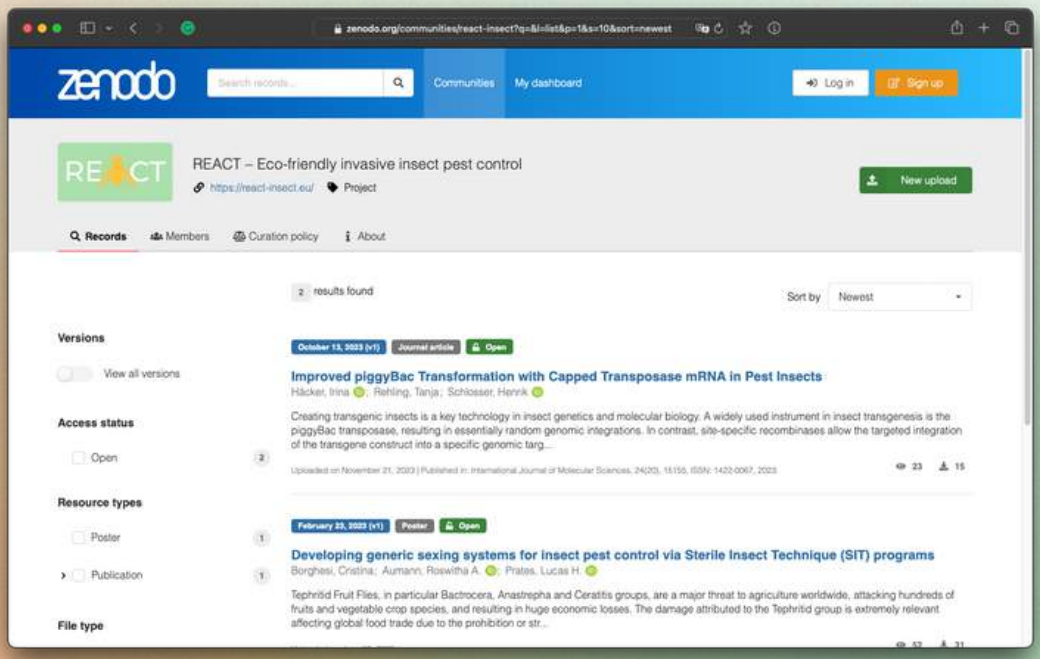
Each failure in controlling fruit flies leads to a ‘lost opportunity cost’ that is about three times the direct cost of control. In other words, when control measures aren’t fully effective, we don’t just lose the money spent on control itself; we also face greater financial losses from produce that becomes unsellable or wasted. For example, if a control method effectively prevents fruit damage, the cost is justified. However, any inefficiency in these methods results in much higher total costs. Therefore, investing in more effective control could significantly reduce these larger, indirect losses.

Thank you!

Photo: REACT

News and Events

Find all scientific publications of REACT on **Zenodo**:
https://zenodo.org/communities/react-insect

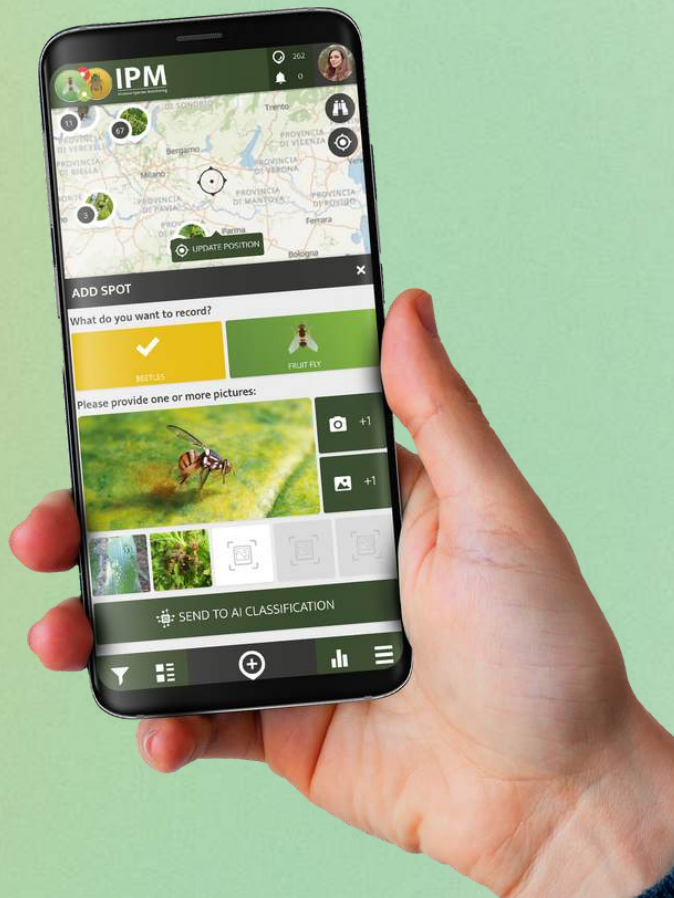


IPM citizen science app

Join and help prevent the spread of invasive fruit flies in your region.

Download on the App Store

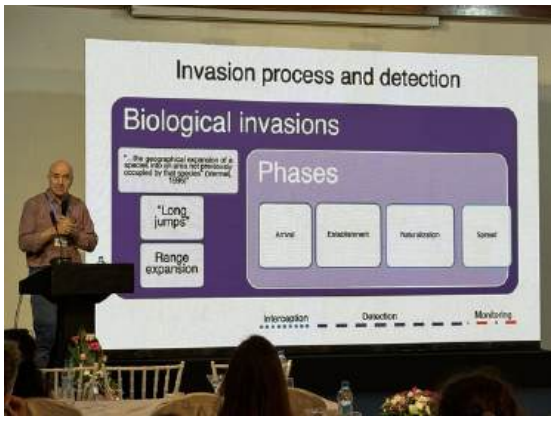
GET IT ON Google Play



TEAM Meeting in Mauritius (April 14-18, 2024)

REACT researchers participated in the 10th International Symposium of TEAM (Tephritid Workers of Europe, Africa, and the Middle East) held in Mauritius. This symposium provided a platform for researchers and practitioners to discuss advancements in the study and management of tephritid fruit flies, facilitating knowledge exchange and collaboration among experts in the field.

Read more online →



Photos: REACT

Stakeholder Workshops in South Africa (June, 2024)

In summer 2024, REACT conducted a series of stakeholder workshops across various regions in South Africa. These workshops aimed to engage local farmers, agricultural experts, and policymakers in discussions about sustainable pest management strategies, focusing on the challenges posed by invasive fruit fly species and the implementation of the Sterile Insect Technique (SIT).

Read more online →

Photos: REACT

Naoussa Fruit Fly Test Release (September, 2024)

In late September 2024, REACT initiated a test release of sterile male fruit flies (*Ceratitis capitata*) in Naoussa, Greece. This pilot project aimed to assess the effectiveness of SIT in controlling local populations of invasive fruit flies, providing valuable data to refine and optimize pest management strategies tailored to the region's specific agricultural conditions.

Read more online →

Photos: REACT

Naoussa Stakeholder Meeting (October 2, 2024)

Following the test release, a stakeholder meeting was held in Naoussa. This gathering brought together local farmers, agricultural advisors, and representatives from the REACT project to discuss preliminary results from the test release, share insights, and gather feedback to inform future pest control initiatives in the area.

Read more online →

Stakeholder Workshop in South Africa (October 19, 2024)

Citrus Research International hosted a Stakeholders' Workshop at the Ondini Venue, Champagne Sports Resort, Drakensberg, South Africa. This interactive session, part of the 12th Citrus Research International Symposium, brought together 21 key players from the citrus industry—including producers, consultants, researchers, and exporters—to tackle the pressing issue of invasive fruit fly pests. The key goal: Understanding challenges in managing fruit flies in northern citrus regions of the country, assessing the impact of invasive species like *Bactrocera dorsalis*, and evaluating current management strategies, and exploring innovative technologies like the Sterile Insect Technique (SIT).

Read more online →

Photos: REACT

REACT Annual Meeting Mauritius (October 28-31, 2024)

Read more online →

Coinciding with the TEAM symposium, the REACT project held its annual meeting in Mauritius in April 2024. This meeting provided an opportunity for consortium members to review progress, discuss ongoing research, and plan future activities, ensuring alignment with the project's objectives and fostering collaboration among international partners.

Contact and Links

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