SUMMARY BOOK

IOBC-WPRS
International Organisation for Biological and Integrated Control
West Palaearctic Regional Section

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PRESENTATION

Dear colleagues and members of IOBC-WPRS

On behalf of the Organising Committee, I very cordially welcome you to the 10th edition of the IOBC-WPRS meeting on Integrated Protection of Olive Crops held from 11 – 14 November 2024 in Baeza, Andalucía, Spain.

Three years after the 9th IOB-WPRS "Integrated Protection of Olive Crops" meeting group at Lisbon, we now have the chance and the great honor to host the 10th edition. The meeting serves as a podium for knowledge exchange of scientific findings on a wide range of topics, related to integrated protection of olive crops such as innovative insect pest management or studies about the impact of global warming on olive crops.

The main aim of this meeting is to set up a forum enabling the exchange of information, strengthening the collaboration among people from academia, industry and farming with common interests in biological and integrated control of pests, diseases and weeds in olive crop.

The symposium will focus on new developments and technologies in all aspects of IPM and biological control of olive crops. Our goal is to gather scientists and stakeholders from around the globe and provide a unique opportunity to exchange information and to communicate research results.

Over the three-day meeting, there will be 5 sessions. These sessions are distributed across four plenary sessions dedicated to conference topics, such as emerging pests and deseases or olive grove soil health. Additionally, the meeting will feature more than 25 posters displayed throughout two days, with two poster sessions programmed to facilitate peer-to-peer communication.

Taking advantage of Baeza's amazing historical and monumental heritage, along with neighbouring Úbeda (both cities were added to UNESCO's list of World Heritage Sites in 2003), the social programme includes a touristic visit of both cities and a tasting of different olive oils, the symbolic ingredient of Mediterranean cuisine.

On behalf of the Organising Committee, I would like to thank all authors and plenary speakers for their talks, posters, and discussion sessions. We are very thankful to the 11 international Scientific Committee members for their time reviewing abstracts, selecting oral and poster presentations. Of course, we would like to thank the chairpersons who moderated the sessions during meeting, and helping to shape the complete meeting. We are also deeply grateful to our sponsors for collaborating with us, helping to make the most of our meeting in Baeza.

Photo: https://www.baeza.net/

International University of Andalusia (UNIA), Antonio Machado Campus

The International University of Andalusia (UNIA), at its Baeza campus, is a renowned center for postgraduate studies and continuing education in Andalusia. Located in the historic building of the **Old Seminary of San Felipe Neri**, built in the 17th century, this campus sits at the heart of a UNESCO World Heritage city, making it a unique space with significant architectural and cultural value.

Since its founding in 1994, the UNIA campus in Baeza offers a diverse academic program that includes official master's degrees, doctoral programs, and specialized courses in areas such as social sciences, technology, environmental studies, and humanities, among others. This historic building not only welcomes both national and international students but is also dedicated to innovation and internationalization, fostering collaboration with universities worldwide.

Moreover, the Baeza campus has become a hub for research and cultural exchange, known for its peaceful, focused atmosphere, further enhanced by the monumental surroundings that envelop it.

Photo: https://www.unia.es

IOBC-WPRS Meetings

Every three years, the IOBC-WPRS organizes the meeting on Integrated Protection of Olive Crops, with the aim of presenting the latest research and advances in the sustainable management of olive pests and diseases.

The first meeting was held in May 2003 in Chania, Greece. It was followed by meetings in Florence, Italy (2005), Bragança, Portugal (2007), Córdoba, Spain (2009), Jerusalem, Israel (2011), Budva, Montenegro (2013), Kalamata, Greece (2015), again in Florence (2018), and most recently in Lisbon, Portugal (2021).

With the participation of scientists, advisors, industry representatives, and other key stakeholders from the Mediterranean region and beyond, these meetings have fostered cooperation and the exchange of knowledge in the development of integrated management strategies for olive groves.

IOBC-WPRS

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In 1991, the Working Group on Integrated Protection of Olive Crops (WG-IPOC) was established within the IOBC-WPRS to promote the development of integrated pest management (IPM) in olive groves. The main goals of the Working Group are to encourage, facilitate, unify, and disseminate research and developments in all areas related to the integrated and biological control of pests, diseases, and weeds affecting olive crops.

To achieve these objectives, the WG-IPOC organizes scientific meetings and seeks other opportunities to connect olive crop protection professionals and researchers with those from related fields. The group promotes actions that enhance research and improve education in the field of Integrated Protection of Olive Crops, as well as the dissemination of key scientific aspects that are of societal and agricultural interest.

The WG places particular emphasis on fostering exchanges between olive crop protection experts from Spain and abroad, as well as establishing relationships with similar working groups and societies in other countries that focus on integrated pest management and related disciplines.

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Antonio Ortiz

Universidad de Jaén

I am professor of Inorganic and Organic Departament at the University of Jaén (UJA). My research interests lie in the fields of chemical ecology, natural products chemistry, semiochemical chemistry and Integrated pest Management (IPM). I have been a researcher at the National Demokritos Center (Athens, Greece) for two years and in 2019 at the University of Firenze (Italy). Over my carrer, I have participated in 12 competitive research projects; (co)authored more than 55 scientific papers and coordinator of more than 30 contracts University-Company. (Co)inventor of 2 UJA patents about IPM using pheromone techniques; one of these patents was licensed to a company for 20 years.

Lucía Ruiz

Universidad de Jaén

Ph.D. candidate in Chemistry. Lucía graduated with a degree in Chemistry from Jaén University. During this time, she completed an honor's Master degree in Chemistry conducting research on Natural Products chemistry. She then got a pre-doctoral contract at the University of Jaen, where she is working on semiochemical chemistry. Lucia's research interests include semiochemical identification, pheromone synthesis, plant-insect interactions and integrated pest management.

Jesús Mercado

EEZ-CSIC. Granada

Jesús Mercado-Blanco is Senior Researcher at CSIC (Consejo Superior deInvestigaciones Científicas, Spain), currently affiliated to the Estación Experimental del Zaidín (EEZ-CSIC). Previous scientific activities were performed at Utrecht University (The Netherlands) and Instituto de Agricultura Sostenible (IAS-CSIC). Head of the Crop Protection Department of IAS-CSIC (2020-2022). Current convenor of the Working Group "Integrated Protection of Olive Crops" of the IOBC-WPRS. His research isfocused on microbiology, agrobiotechnology, plant-microbiome interactions and integrated control of soil-borne pathogens. The identification and characterization ofvbiological control agents is one of his main research lines. He participated in more thanv20 research projects (11 as principal investigator) and (co)authored more than 100 book chapters and scientific/technical articles. (Co)inventor of 9 patents. He gave seminars and invited lectures at different academic institutions worldwide.

Ana V. Lasa

EEZ-CSIC. Granada

Is a postdoctoral researcher in the group *Microbiology of Agroforestry Ecosystems* at the Zaidín Experimental Station, a center of the Spanish Council for Scientific Research Agency (Granada, Spain). She received a PhD in Fundamental and Systems Biology in 2019 from the University of Granada. She specializes in microbiomes of forest and olive trees. Among her main findings, it stands out the isolation of five potential novel species belonging to genus *Pseudomonas* from the rhizosphere of *Quercus pyrenaica* (some of which showed plant growth promotion capabilities), the development of a novel technique for phytoplasmas detection and the description of the microbiota involved in pine decline and the seed microbiota of ten olive genotypes.

Antonio J. Fernández

EEZ-CSIC. Granada

Graduate in Biology (2008) and with a Master's degree in Research and Advances in Microbiology (2009) by the University of Granada. He got the PhD in Microbiology (University of Granada and Zaidín Experimental Station – CSIC) in 2014 with International Doctorate Accreditation due to his stay in the Joint Genome Institute (JGI), located by that time in Walnut Creek (now in Berkeley), California (USA). His postdoctoral stage was carried out in France. Currently, he is studying the belowground microbial communities (bacterial and fungal) of several cultivars of olive trees (*Olea europaea* L.)

Juan Moral

University of Córdoba

Ramón y Cajal Researcher, specialist in Epidemiology of woody species. Last Lee Hurchins Award of the American Phytopathological Society.

Antonia Rojano

University of Córdoba

Interests: herbicide cross-resistance; multiple herbicide resistance; herbicides; weeds; CytP450; GST; resistance mechanisms. 51 articles published in international journals, being more than 49 indexed in journals belonging to the first quartile of their area, and even some of them in the first decile. - 39 papers presented in national or international congresses -Participation in R+D+i projects financed in competitive calls of Administrations or public and private entities: AGL2010-16774 and AGL200760771. 5 non-competitive R&D&I contracts, agreements or projects with public or private administrations or entities. 1 patent: Patent no: ES1641.1249. h-index 19 -924 citations in 523 documents

SCIENTIFIC COMMITTEE

- Paula Baptista. Instituto Politécnico Bragança. Portugal
- Florent P. Trouillas. University of California, Davis. USA
- Patrizia Sacchetti. DAGRI. University of Florence. Italy
- Giovanni Benelli. Università di Pisa. Italy
- Sofiane Abdelhamid. Institution de la Recherche et de ESA. Tunisie
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- Argyro Kalaitzaki. Institute for Olive Tree, Subtropical Crops & Viticulture. Greece
- Robert Spooner-Hart. Western Sydney University. Australia
- Inmaculada Garrido. University of Córdoba. Spain
- Carolina Leoni. INIA Las Brujas. Uruguay
- Manuel Ruiz. AGAPA. Jaén. Junta de Andalucía

PLENARY LECTURES

Antonio J. Manzaneda

Universidad de Jaén

Soil Health, production and olive oil quality: The Soil Olive

I am a professor of Ecology at the Department of Animal Biology, Plant Biology, and Ecology at the University of Jaén. My research focuses on Agroecology, Evolutionary Ecology, and Interaction Ecology. I completed my doctorate at the Spanish National Center of Research (CSIC) and the University of Seville (PhD in Plant Biology). I have conducted post-doctorate studies at Duke University (2006-2010) as a Marie Curie Fellow (European Union). I have been a researcher at the University of Umea (Sweden) and a visiting professor in the Department of Horticulture at Virginia Tech University in 2017. I have published 57 research articles. I have led and participated in more than 20 competitive research projects (11 as PI or co-PI) in evolutionary ecology and agroecology for more than €9M. I act as PI and Project Coordinator in Horizon Europe Soil Mission programs, Marie Curie Actions, National Ministry Plan Projects, Ecological Transition Projects, Bayer AG, Junta de Andalucía Excellence Projects, etc.).

Antonio Trapero

Universidad de Córdoba

Emerging diseases of olive crops in the Mediterranean basin: causes and alternatives for their control

Professor Emeritus of Plant Pathology, Department of Agronomy, ETSIAM, Universityof Córdoba.
Professor of Plant Pathology at the University of Córdoba since 1978 and visitingprofessor at Washington State University (USA). He has been director of theDepartment of Agronomy and head of the “Agroforestry Pathology” research group and the “Plant Protection” teaching group. His research activity has been eminently applied and has focused on studies on the diagnosis, etiology, epidemiology and control of diseases of Mediterranean agricultural crops and forest systems, with special emphasis in recent decades on olive groves and nuts.
He is the author of more than 450 scientific and technical articles in national and international books and journals. He has directed 29 doctoral or masters theses, 92 final degree, bachelors or masters theses, and has been principal investigator of more than
150 research projects and contracts with public administrations and companies. In 2019, he was awarded the “Galileo Award for Knowledge Transfer” by the University of Córdoba, for his research career related to innovation and the transfer of knowledge to society.

Concepción Muñoz Diez

Universidad de Córdoba

Genetic diversity, the key to olive resilience

I am an associate professor in the Agronomy Department of the University of Cordoba, Spain. My career has been focused on genetic diversity studies and conservation programs of crops and their wild relatives, with emphasis in the olive tree (*Olea europaea* L*)*. I am also interested in plant developmental genetics, especially in the juvenile-to-adult transition in perennials. I worked during three years at the University of California – Irvine conducting evolutionary and population genomic analysis of maize (*Zea mays ssp. mays*). Currently, I participate in the identification and management of the World Olive Germplasm Bank of Cordoba, Spain, one of the four international collections of this species in the world. I am also involved in the olive breeding program of the University of Cordoba, being co-breeder of nine cultivars in the process of registration. Currently, I am coordinating the H2020 project Gen4Olive, focused on the agronomical evaluation of olive genetic resources, wild and cultivated, and the optimization of breeding techniques for this species.

Florent Trouillas

University of California

New and emerging diseases affecting olive trees in California

Florent (Flo) Trouillas is a Professor of Cooperative Extension with the Department of Plant Pathology at the University of California, Davis and the Kearney Agricultural Research and Extension Center in Parlier, CA. He received a PhD in Plant Pathology in 2009 from the University of California, Davis. Dr. Trouillas specializes in fruit and nut crop pathology.

Research topics in the Trouillas Lab include the taxonomy, biology and molecular detection of fungal, bacterial and oomycete pathogens, as well as the development of chemical and biological control strategies. He has established a broad research program that investigates fungal canker diseases, bacterial blast and bacterial canker, Phytophthora diseases as well as diverse fruit and foliar diseases in various fruit and nut crops. The Trouillas Lab provides disease diagnosis services (a Plant Disease Clinic) to the fruit and nut crop industries. His cooperative extension and education activities include the training of farmers and pest control advisers on disease diagnosis and management. He also serves as a lecturer for various specialized courses in Plant Pathology.

TOPICS

1. Development of new methodologies for monitoring pests and diseases, and the crop itself.
2. Biodiversity, conservation and sustainability of olive crops: effects on pest/diseases and conservation biological control strategies.
3. Pest bio-ecology, biological control, biopesticides and bio stimulants.
4. Challenges and opportunities of novel technological tools: nanotechnology, biotechnology, bioinformatics, remote sensing, big data and artificial intelligence in IPM.
5. New advances in intensive and high-density olive plantations pest/disease management.
6. Semiochemicals in the olive crop protection
7. Emerging pests and diseases
8. Effect of climate change on olive pests and diseases
9. Advances in breeding for resistance/tolerance to (a) biotic stresses affecting olive
10. The olive microbiome: challenges and opportunities
11. Improving soil health to enhance fitness, production and food quality of the olive holobiont
12. Natural enemies and biocontrol agents
13. Combined use of biological and chemical control in olive pest and disease management
14. Other topics related with integrated protection of olive crops

PROGRAMME

Monday, November 11	
From 15:00	**Wellcome and registration** UNIA Hall
16:30 – 17:00	**Opening Ceremony** Aula 1
17:00 – 18:00	**Plenary Lecture** **Soil Health, production and olive oil quality: The Soil O-live approach.** Antonio Manzaneda. University of Jaén Chair: Jesús Mercado
	Session 1. Chair: Jesús Mercado
18:00 – 18:15	**The olive seed microbiome as source of plant beneficial microorganisms.** Ana V Lasa. CSIC.
18:15 – 18:30	**Correlating olive rhizosphere microbiome with the soil health.** Antonio José Fernández-González. Consejo Superior de Investigaciones Científicas (CSIC)
18:30 – 18:45	**Developing a New RT-qPCR Method to Quantify *Spilocaea oleagina* Spores: A Key Advancement in Scab Epidemiology Research.** Carmen Tercero-Alcázar. Universidad de Córdoba
18:45 – 19:00	**Rainfall Role in the Dispersal of Spilocaea oleagina. *Spilocaea oleagina* Spores.** Francisco Abel Guerrero Páez. Universidad de Córdoba
20:15	**Welcome cocktail.** Palacio de Gallego. Restaurante & Boutique

Tuesday, November 12	
9:00 – 10:00	**Plenary Lecture** **Emerging diseases of olive crops in the Mediterranean basin: causes and alternatives for their control.** Antonio Trapero. University of Córdoba Chair: Antonio J. Fernández
	Session 2. Chair: Antonio J. Fernández
10:00 – 10:15	**Olive lace bugs, an increasing problem in a number of regions.** Robert Spooner-Hart. University of Western Sydney. Australia (on-line)
10:15 – 10:30	**Olfactory response of *Philaenus spumarius* nymphs to plants usually found in field margin of olive groves in Trás-os-Montes, Portugal.** Isabel Rodrigues. CIMO-IPB. Portugal
10:30 – 10:45	**Endophytes induced changes on the volatile profile of olive tree with an impact on *Bactrocera oleae* behaviour.** Ana E. Cunha. CIMO-IPB
11:00 – 11:45	**Coffee break**

	Session 3. Chair: Andrés Porras
11:45 – 12:00	**Combination of new control strategies with entomopathogenic fungi and silicon within an integrated pest management for the olive fly *Bactrocera oleae* (Rossi**). Inmaculada Garrido-Jurado. University of Cordoba
12:00 – 12:15	**Microsclerotia of EAMa 01/58-Su strain *of Metarhizium brunneum:* an alternative for the biological control of Bactrocera oleae (Gmelin).** Antonia Romero-Conde. Universidad de Córdoba
12:15 – 12:30	**Effect of soil treatments with the entomopathogenic fungus *Metarhizium sp.* on the diversity of *Auchenorrhyncha* insects in olive groves.** Juan Carlos Conde Bravo. University of Cordoba
13:45 – 14:00	**Group photo**
14:00 – 16:00	**Lunch.** Puerta de La Luna
16:00 – 17:00	**Plenary lecture** **New and emerging diseases affecting olive trees in California.** Florent Trouillas. USA. Chair: Ana V. Lasa
17:00 – 18:00	**Panel and Coffee Session** Seminary inner courtyard
19:30 – 21:00	**A World Heritage journey I: Baeza**

Wednesday, November 13	
	Session 4. Chair: Ioannis Koufakis
9:15 – 9:30	**Role of rain in the dispersal of *Venturia oleaginea* fungus on olive leaves.** Zeinab Sweidan. Università Cattolica del Sacro Cuore di Piacenza**.** Italy
9:30 – 9:45	**Carob and pomegranate extracts act as resistance inducers against Verticillium wilt of olive.** Begoña I. Antón-Domínguez. Universidad de Córdoba
9:45 – 10:00	**Resistance as main tool for the integrated control of Verticillium Wilt of Olive.** Francisco Javier López-Escudero. University of Córdoba
10:15-10:30	**Leaf Spectroscopy and Machine Learning for Early Detection of Verticillium Wilt in Olive Trees.** M. Teresa Garcia-Lopez. Institute for Sustainable Agriculture – Spanish National Research Council (IAS-CSIC)
10:30-10:45	**A mechanistic, weather-driven model for anthracnose on olive: discussing current performance and unveiling future research needs.** Irene Salotti. Università Cattolica del Sacro Cuore di Piacenza. Italy
10:45:11:00	**Olive Scab caused by *Spilocaea oleagina*: phenotypic resistance and impact of the pathogen on physiological parameters.** Cristina Estudillo. University of Cordoba**.**
11:00 – 11:30	**Coffee break**

11:30 – 12:15	**Plenary Lecture** **Genetic diversity, the key to olive resilience.** Concepción Muñoz Diez. Universidad de Córdoba. Chair: Juan Moral
	Session 5. Chair: Juan Moral
12:15 – 12:30	**Multi-resolution and multi-temporal spectral analysis of crops using vegetation indices.** Alba Gómez Liébana. Universidad de Jaén
12:30 – 13:00	**Development, validation, and practical use of a decision support system for the sustainable management of olives.** Emiliana Carotenuto. Horta srl: Italy
13:00 – 13:15	**Mass trapping of the olive fruit fly *Bactrocera oleae* with a novel food-based attractant.** Ioannis Koufakis. Institute of Olive tree, Subtropical Crops and Viticulture. Greece
13:15 – 13:30	**Effectiveness of bait sprays and mass trapping systems using *Dacus* Bait for IPM of *Bactrocera oleae*: Field results from Crete, Greece.** Argyro Kalaitzaki. Institute of Olive tree, Subtropical Crops and Viticulture
13:30 – 13:45	**Mister P: A novel pheromone-based mating disruption system for Olive Moth (*Prays oleae*) control using aerosol dispensers.** Jordi Martí. Biogard – CBC Group
13:45-14:00	**Are low infestations of *Bactrocera oleae* in South African olive groves due to parasitoids? End of a legend.** Virgilio Caleca. University of Palermo
14:00 – 16:00	**Lunch.** Puerta de La Luna
16:00 – 17:00	**Round Table**
17:00 – 18:00	**Panel and Coffee Session** Seminary inner courtyard
18:00 – 18:15	**Closing ceremony**
18:15 – 19:15	**IOBC General Assembly**
21:00	**Gala dinner.** AOVEland Baeza

Thursday, November 14	
9:30 – 14:00	**A World Heritage journey II: Úbeda** **Visit to Museo del Olivo**

POSTER LIST

Nº	TITLE, AUTHOR and AFFILIATION
1	**Ecological infrastructures of olive groves and organic farming effects on the arthropod communities associated to *Bactrocera oleae* in Spain.** Imen Blibech. University of Madrid.
2	**Effect of carob and pomegranate extracts against olive anthracnose and characterisation of antioxidant activity and phenolic compound production.** Begoña I. Antón-Domínguez. Universidad de Córdoba.
3	**Selection of potential biological control agents against *Colletotrichum godetiae*, causal agent of olive anthracnose.** Luiza Sánchez-Pererira. Universidad de Córdoba.
4	**Fungicide sensitivity of *Colletotrichum acutatum* from Australian olives.** Robert Spooner-Hart. Western Sydney University. Australia.
5	**Flavonoids mediate *Bacillus amyloliquefaciens*-Induced Resistance against the olive knot disease in inoculated plants.** Ana E. Cunha. CIMO-IPB.
6	**Impact of Spontaneous Vegetation Management on the Epidemiology of Olive Anthracnose.** Paula Baptista. CIMO-IPB. Portugal.
7	**Dynamics and role of bacterial communities in *Philaenus spumarius* at different developmental stages.** José A. Pereira. CIMO-IPB. Portugal.
8	**Unlocking the cultivable microbiota of *Philaenus spumarius* and their implications for insect fitness.** José A. Pereira. CIMO-IPB. Portugal.
9	**Microbial dynamics and bacterial exchange in plant-*Philaenus spumarius* interactions.** Paula Baptista. CIMO-IPB. Portugal.
10	**The impact of olive tree age and tillage on soil microbial communities.** Paula Baptista. CIMO-IPB. Portugal.
11	**Preliminary study on the susceptibility of different olive cultivars to verticilliosis.** Veronica Vizzarri. CREA Research Centre for Olive, Fruit and Citrus Crops. Italy.
12	**Monitoring and management of *Xylella fastidiosa* spread in Apulia olive groves: a remote sensing and GEOBIA-based approach.** Stefania Gualano. International Centre for Advanced Mediterranean Agronomic Studies of Bari (CIHEAM Bari). Italy.
13	**Influence of Olive Fruit Biometric Traits on *Bactrocera oleae* Oviposition Preferences: Three Years of Field Data from 72 Cultivars in Southern Greece.** Ioannis Koufaki. Institute of Olive tree, Subtropical Crops and Viticulture. Greece.
14	**Adaptation of a physiologically based model for predicting the phenology of *Philaenus spumarius:* first validation in Italian olive groves.** Marta Corbetta. Università Cattolica del Sacro Cuore. Italy.
15	**Early detection of *Xylella fastidiosa* in olive trees: non-targeted spectranomics approch.** Franco Santoro. International Centre for Advanced Mediterranean Agronomic Studies of Bari (CIHEAM Bari). Italy.
16	**Wide application of geoinformatics technologies for the optimization of the National Olive Fruit Fly Control Program in Greece.** Argyro Kalaitzaki. Institute of Olive tree, Subtropical Crops and Viticulture. Greece.
17	**Spatial distribution of juveniles of *Philaenus spumarius* in olive groves from Trás-os-Monte's region (Portugal).** Isabel Rodrigues. CIMO-IPB. Portugal.

18	**Response of spittlebug vectors of *Xylella fastidiosa*, to different wavelengths of light.** Patrizia Sacchetti. University of Florence. USA.
19	**Assessment of Cold Tolerance in Olive Cultivars (*Olea europaea* L.): Integrating Acclimation Processes through Visual and Fluorometric Analyses.** M. Teresa Garcia-Lopez. Institute for Sustainable Agriculture, Spanish National Research Council (IAS-CSIC).
20	**Evaluation of the presence of viruses in the Repository of Commercial Olive Variety of the University of Cordoba and Closterovirus in orchards of this crop.** Rocio Estévez (Nutesca).
21	**In vitro screening of biological control agents and antimicrobial potential of plant extracts against *Xylella fastidiosa* subsp. pauca.** Marwa Mourou. University of Bari Aldo Moro. Italy.
22	**Are *Bactrocera oleae* adult traps really useful? Are captures correlated with infestation? Which captures are intervention or alarm thresholds?** Virgilio Caleca. University of Palermo. Italy.
23	**Seed-eating insects of wild and cultivated olive trees exclusive to South Africa, harmfulness and identification from early instar larvae.** Virgilio Caleca. University of Palermo. Italy.
24	**The role of rhizobacteria of the genus *Bacillus*in the control of diseases of olive *(Olea europaea).*** Salvador Salvatierra. Corteva Agriscience.
25	**Evaluation of a qPCR methodology for the detection of *Venturia oleaginea* latent infections.** Elisa González-Domínguez. Horta srl: Italy

ABSTRACTS OF THE PRENARY LECTURES

Soil Health, production and olive oil quality: The Soil O-live approach

Antonio Manzaneda

Universidad de Jaén, Email: amavila@ujaen.es

The shift from natural ecosystems to agricultural systems focused on productivity can cause environmental imbalances, reliance on external resources, and increased costs for maintaining soil health. This poses a threat to the current and future viability of crops. In the case of olive cultivation, intense agricultural practices over the past fifty years have had a dramatic impact on olive groves in the Mediterranean region. This has resulted in land degradation, loss of biodiversity, and reduced functionality, potentially affecting the quality and safety of olive oil. Soil O-live is undertaking a comprehensive assessment of the environmental status of olive grove soils on a large scale using multidisciplinary approaches. This includes studying key olive oil production areas in the Mediterranean region and their connection to olive oil quality. In this presentation, I will discuss the effects of pollution and land degradation on olive grove soils, including the impact on biodiversity and ecological function at various levels and scales. I will also explore the relationship between soil health and the quality and safety of olive oil.

Key words: Soil functionality, pollution, olive oil quality, soil respiration.

Emerging diseases of olive crops in the mediterranean basin: Causes and alternatives for their control.

Antonio Trapero

Professor Emeritus, Department of Agronomy, ETSIAM, University of Cordoba. Email: trapero@uco.es

In recent decades, olive groves in Spain and throughout the Mediterranean basin have been affected by new diseases, or some of the existing ones have markedly increased in severity, and have therefore been considered as emerging or re-emerging diseases. Among them, the serious situation caused to Verticillium wilt (*Verticillium dahliae*) and the risk posed by the presence of the *Xylella fastidiosa* bacteria in Europe should be highlighted. Other emerging diseases include cankers and desiccation of branches associated with various fungi, especially *Neofusicoccum mediterraneum,* leprosy (*Phlyctema vagabunda*), olive knot or tuberculosis (*Pseudomonas savastanoi* pv. *savastanoi*) and, to a lesser extent, anthracnose (*Colletotrichum* spp.). Furthermore, some diseases that cannot be considered globally as emerging, such as olive scab (*Venturia oleaginea*) or root rots caused by *Phytophthora* spp., have also caused serious outbreaks in some places and special situations. The determining factors of this emergence are mainly related to the intensification of olive cultivation, especially the mechanization of harvesting and pruning, which has increased the wounds on branches and leaves, the poor protection of the wounds, the wide diffusion of cultivars susceptible to these diseases and their expansion to more favorable areas, and the genetic variability of the pathogens. Controlling these emerging diseases requires new strategies that include the use of more tolerant olive cultivars, adequate protection of wounds, the development of more effective biological or chemical products, and epidemiological studies that deepen knowledge of the life cycle and the factors that determine the epidemics of these diseases.

Key words: Emerging diseases, Integrated Disease Management, *Olea europaea*.

New and emerging diseases affecting olive trees in California

Florent Trouillas; Alejandro Hernandez-Rosas

University of California, Davis, Department of Plant Pathology, Email: flotrouillas@ucanr.edu

California produces more than 95 percent of the olives grown in the United States with 14,700 bearing hectares and a total of 164,650 tons of olives produced in 2019. Modern California olive oil production is characterized by super-high-density (SHD) farming systems (>1,500 plants/ha), a cultural practice that allows for mechanized harvest and pruning of olive trees to reduce production costs. SDH orchards have seen increased infections and disease outbreaks caused by bacterial and fungal pathogens due to the resulting large numbers of injuries on olive trees. *Neofabraea* leaf and twig lesions has recently emerged as a new, widespread disease of SHD oil olive orchards in California. Affected trees show leaf and shoot lesions, and cankers in branches, that developed at wounds caused by mechanical harvesters. Two species, namely *Phlyctema vagabunda* and *Neofabraea kienholzii*, were found to be consistently associated with the disease. Disease control was achieved using chemical fungicides to reduce disease incidence and management strategy guidelines were implemented to limit further spread of this disease in California. *Pleurostoma* decline of olive trees caused by the fungal pathogen *Pleurostoma richardsiae* occurs sporadically in olive orchards. Symptoms of *Pleurostoma* decline include collar rot, leaf yellowing and browning, leaf drop, branch dieback, as well as brown to dark discoloration of the wood. More recently we detected *Pseudophaeomoniella oleicola* causing vascular browning and branch dieback in olive trees in Sonoma County. New canker and branch dieback diseases included *Cytospora* cankers caused by *Cytospora oleicola* and *C. olivarum*. Olive anthracnose was not detected from commercial olive orchards in California. However, the disease was found in one experimental olive orchard near Fresno. Fungal isolates associated with olive anthracnose were identified as *Colletotrichum fioriniae* in the *C. acutatum* species complex based on DNA phylogenetic analyses. Finally, we detected *Phytophthora kelmanii* causing root rot in olive trees.

Key words: *Phlyctema*; *Neofabraea*; *Pleurostoma*; *Phytophthora*; *Pseudophaeomoniella*.

Genetic diversity, the key to olive resilience

Concepción Muñoz Díez

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Olive growing has undergone drastic changes in recent decades, mainly due to mechanization, intensification, and the introduction of irrigation. These changes pose new challenges and threats, in some cases exacerbated by the effects of climate change. The genetic diversity of olive traditional varieties and wild relatives is the most valuable resource to guarantee the resilience of the crop in these new scenarios.

ABSTRACTS OF THE ORAL PRESENTATIONS

The olive seed microbiome as source of plant beneficial microorganisms

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The microbiota inhabiting plant seeds is crucial for the health and fitness of the plant holobiont. Some members dwelling in this plant compartment, play essential roles as, for instance, their involvement in the germination process. Notwithstanding, the microbiota of the seeds is still relatively unexplored and no studies have been conducted on olive trees so far. In this study, we aimed to characterize the bacterial, fungal and archaeal communities present in seeds of ten olive genotypes growing in the same orchard through amplicon sequencing.

A diverse microbiota was uncovered in olive seeds, the plant genotype being an important factor shaping the structure and composition of the microbial communities. The most abundant bacterial phylum was *Actinobacteria*, accounting for 41% of the total bacterial sequences. *Streptomyces*, *Stenotrophomonas* and *Promicromonospora* were the most abundant genera, although their abundance depended on the considered genotype. Within the fungal community, the genera *Malassezia*, *Cladosporium*, and *Mycosphaerella* were the most abundant. Furthermore, a comparison between findings obtained here and earlier results from the root endosphere of the same trees indicated that genera such as *Streptomyces* and *Malassezia* were present in both olive compartments, suggesting a translocation from the roots to the seeds. This study provides the first insights into the composition of olive seed microbiota and shows that seeds could be a novel source of plant growth promoting microorganisms, such as *Streptomyces* and *Promicromonospora*, among others. These and other genera could be used both for agrobiotechnological purposes and as biomarkers in olive breeding programs.

Key words: seed; olive genotype; *Streptomyces*; *Malassezia*; PGPR

Acknowledgemts: This work was funded by the European Union, HE Soil Health mission, HE/MISS-SOIL/0199, Project 101091255 Soil O-live; and by Ministerio de Ciencia e Innovación, proyect BIOLIMITS PID2019-106283RB-I00

Correlating olive rhizosphere microbiome with the soil health

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The plant microbiome is crucial for the health and fitness of the host holobiont, but it is also influenced by the soil properties, agricultural managements of the crops and climatic conditions. The cultivation of the olive tree is one of the most important crops in the Mediterranean basin, with historical records dating back 5,000 years BC. In this work, we have analyzed 52 olive orchards from 15 provinces in 5 countries of the Mediterranean Basin: Portugal, Spain, Morocco, Italy and Greece. The olive orchards were subjected to either traditional, organic or hedgerow cultivation systems, under different climatic and pedological conditions. A total of 472 DNA samples from olive root rhizosphere were subjected to high-throughput sequencing for ITS2 and 16S rRNA gene amplicons in MiSeq platform. We obtained more than 40 million raw reads for both bacteria and fungi which yielded more than 10 and 5 thousand ASVs for bacterial and fungal communities, respectively. The preliminary analysis of the beta diversity established two clearly distinctive groups: one with samples from Spain and Morocco (A), and another with samples from Italy, Portugal and Greece (B). Regarding the taxonomic analyses, was shown a dominance of *Proteobacteria* in the rhizosphere of olive trees from group B while *Actinobacteria* was the predominant bacterial phylum in group A. Similarly, for the fungal communities, although *Ascomycota* was the most abundant phylum in all countries, it was highly depleted in group A respect to group A. For instance, an enrichment was observed in the phylum *Mortierellomycota* in Morocco and *Glomeromycota* in Spanish soils. Next step is to check whether these differences are mainly due to the physicochemical properties of each country.

Key words: rhizosphere; microbiome; soil health; abiotic stress.

Acknowledgment: This work was funded by the European Union's Horizon Europe research and innovation programme under grant agreement No 101091255 (project Soil O-live), HE Soil Health mission, HE/MISS-SOIL/0199.

Developing a New RT-qPCR Method to Quantify *Spilocaea oleagina* Spores: A Key Advancement in Scab Epidemiology Research

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Olive trees, the dominant perennial crop in the Mediterranean Basin, suffer from scab, a common and extended disease caused by the fungus *Spilocaea oleagina* (syn. *Venturia oleaginea*). The pathogen evokes an intense leaf fall, which decreases the vegetative growth and tree fruit setting, causing substantial economic losses. Since olive scab is a mono(oligo)-cycle disease, control is highly dependent on primary infection periods, which can be identified according to spores' picks. We are currently monitoring spores' picks using adhesive slides mounted in passive traps in commercial olive orchards. However, spore visual quantification by optical microscopy is time-consuming. Therefore, we have developed a real-time quantitative PCR (RT-qPCR) using a target sequence in the *S. oleagina* genome. Amplicon sequencing using different *Venturia* species confirmed that the in-house primers were species-specific. In another set of experiments, symptomatic leaves with different severity grades (0-8 scale) were collected, and the amount of inoculum was quantified by RT-qPCR. Furthermore, spore DNA detection of serial dilutions was evaluated by comparing two methods, conventional (RT-qPCR only) or nested RT-qPCR (with initial amplification before RT-qPCR). Nested RT-qPCR resulted in 10-fold higher sensitivity (100 spores/mL) than RT-qPCR only (1000 spores/mL). In sum, the developed RT-qPCR offers a novel system for quantifying the inoculum load, which is a key factor in the epidemiology of this olive pathology. This essential advancement may be helpful in improving our knowledge about the ecology of *S. oleagina.*

Key words: Olive tree; Scab; *S. oleagina*; RT-qPCR; Nested RT-qPCR

Rainfall Role in the Dispersal of *Spilocea oleagina* Spores

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The olive tree, a crucial perennial crop in The Mediterranean Basin, with 98% of the world's surface area concentrated, is severely affected by Olive Scab, a leaf disease caused by the obligate hemibiotrophic fungus *Spilocaea oleagina*. The fungus leads to extensive defoliation, reducing the tree's photosynthetic capacity and productivity. The pathogen spreads through asexual spores (conidia) dispersed by raindrops. Understanding the influence of rainfall and its characteristics (e.g., duration, intensity, etc.) on the dispersal of the pathogen is crucial for identifying optimal disease control timing. Two experiments were conducted using a rain simulator (a Cornell infiltration gauge, 2 m height) to characterize the horizontal dispersal of pathogen conidia and study also its vertical dispersal inside the tree canopy. The experiments used highly susceptible olive plants cv. Meski with pathogen sporulating lesions. In the first experiment, the plants were moistened, and various slides with Melinex tape (spore traps) were placed radially around the plant at 0.40, 0.60, 0.80, and 1 m. Under these conditions, four olive plants were subjected to a 12,5 mm/h rainfall for 1 or 2 min. To study vertical dispersion inside the plant canopy, nine plants were subjected to the described rainfall for 0, 2, or 6 min; four spore traps were then placed under each plant canopy. This experiment was performed twice, with 18 plants assayed. The density of conidia captured decreased exponentially with distance from the inoculum source from 1,6 to 0,2 conidia/cm2 at 0,40 to 1 m, respectively. In the second experiment, conidia were captured after 2 and 6 min of rainfall, demonstrating that the pathogen can disperse vertically once rainfall finishes. These experiments show that rainfall disperses pathogen spores over short distances and that spore movement processes within the tree canopy can occur post-rainfall.

Key words: Rainfall; dispersal; slides; *Spilocea oleagina*; olive groves

Olive lace bugs, an increasing problem in a number of regions

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Lace bugs, or tingids (Hemiptera:Tingidae) are sap-sucking insects causing increased problems in some olive producing countries. They have been reported attacking cultivated olives in Australia, South Africa, Ethiopia, and northern India and Pakistan, where they have moved from their native *Oleaceae* hosts. In Australia, the native olive lace bug *Froggattia olivinia* was first described feeding on the native olive *Notelaea longifolia* but by the early 1900s was reported damaging European olives. It has spread from its original distribution in eastern Australia to all olive-growing states and has become a serious pest. All life stages cause chlorotic spotting and yellowing of leaves, and in heavy infestations leaf drop and dieback. There are commonly three generations per season. Limited information is available on its natural enemies, although there appears to be tolerance in some olive cultivars. Hot, dry conditions cause high mortality in young nymphal instars especially in the crawlers-conversely, mild and humid conditions result in high survival rates to adulthood. Stressed trees, especially non-irrigated crops, are less able to tolerate lace bug damage. Two years of La Niña during the 2021-22 and 2022-23 crop years in eastern Australia, followed by an unusual El Niño which behaved like La Niña, resulted in extremely high lace bug populations and severe crop damage and losses in many districts in 2023-24. Lace bug integrated management strategies heavily rely on monitoring particularly for emergence of the first-generation nymphs in spring, pruning trees to open the canopy and stimulate tree vigour, as well as appropriately timed and targeted insecticides to particularly treat hot spots. Some growers have released green lacewings for biological control, but with limited success. The industry has developed educational outputs and activities to provide growers with information and tools to further improve sustainable pest and disease management practices in Australian olive production.

Key words: Tingidae; Australia; South Africa; India; IPM; climate change

Olfactory response of *Philaenus spumarius* nymphs to plants usually found in field margin of olive groves in Trás-os-Montes, Portugal

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The olive tree is currently threatened by Olive Quick Decline Syndrome, caused by the phytopathogenic bacterium *Xylella fastidiosa.* This bacterium is transmitted and spread by insect vectors that feed exclusively on the xylem, that belong to the infraorder Cicadomorpha, subfamily Cicadellinae (Cicadellidae), and the families Aphrophoridae and Cercopidae. Among these vectors, the meadow spittlebug, *Philaenus spumarius* (Hemiptera: Aphrophoridae), is the only one of epidemiological importance in European outbreaks. Field margin plants have important agroecological functions and act as shelters and dispersal corridors for biodiversity, playing a critical role in maintaining ecosystem services. However, their role in the attraction or repulsion of insect vectors remains poorly understood. To address this gap, the objective of this study was to evaluate the olfactory response of *P. spumarius* nymphs to five plants typically abundant in the field margins of olive groves in Trás-os-Montes, Portugal: *Cistus ladanifer, Foeniculum vulgare, Lavandula stoechas*, *Rosmarinus officinalis*, and *Thymus mastichina*. The olfactory response of nymphs at different stages (N1, N2-N3, and N4-N5) to the different field margin plants was individually assessed using a Y-shaped olfactometer. For each nymphal stage and plant 25 repetitions were performed. Additionally, the volatile profile of each plant was characterized through headspace solid-phase microextraction and gas chromatography with a mass spectrometry detector. Nymphs in the stages N1 and N2-N3 were repelled by *C. ladanifer* and attracted to *L. stoechas* and *T. mastichina.* However, nymphs in N4-N5 stage were attracted to *F. vulgare* and *T. mastichina* but repelled by *C. ladanifer* and *R. officinalis.* In total, 105 volatile organic compounds were identified, with each plant presenting distinct volatile profiles. These results provide valuable insights into the interactions between *P. spumarius* nymphs and field margin plants, potentially contributing to the development of sustainable strategies to control *X. fastidiosa* vectors by either repelling or attracting them.

Key words: Olive Quick Decline Syndrome; *Salvia Rosmarinus; Foeniculum vulgare; Thymus mastichina; Lavandula stoechas; Cistus ladanifer.*

Endophytes induced changes on the volatile profile of olive tree with an impact on *Bactrocera oleae* behaviour

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The olive fruit fly, *Bactrocera oleae* (Rossi), is a key pest of the olive tree worldwide. Its control relies primarily on the application of hazardous insecticides, demanding the need for alternative methods. In this work, the potential of the endophytes *Bacillus amyloliquefaciens*, *Alcaligenes faecalis*, *Aureobasidium pullulans* and *Penicillium commune*, previously isolated from olive tree, to control *B. oleae* was studied by affecting the emission of plant volatile compounds (VOCs). Accordingly, in an olive orchard located in Mirandela (Northeast of Portugal), five olive trees were inoculated with the endophyte or with buffer (control). After 2 months, the percentage of infested fruits was estimated, and healthy fruits and leaves were collected to perform olfactometer assays and to evaluate VOCs by HS-SPME and GC-MS. *B. amyloliquefaciens*, *A. faecalis* and *A. pullulans* significantly reduced the number of ovipositions, from 31% to 43%, in the field, and repelled *B. oleae* females compared to control. The analysis of the volatile compounds allowed the identification of a total of 59 VOCs belonging to eight chemical classes. Alkenes and alcohols were the most abundant, accounting for 31% and 17% of the total VOCs abundance, respectively. The principal component analysis performed with VOCs analyzed reveals that the alkenes o-cymene, D-limonene, gamma-terpinene, beta-myrcene and the alcohols 1-dodecanol were characteristic and positively associated with plants inoculated with the endophytes tested. Thus, it is likely that these compounds play a crucial role in olive tree protection against *B. oleae*, by acting as deterrents. This assumption needs to be confirmed in future work.

Key words: *Olea europaea*; olive fruit fly; biocontrol; Alkenes

Combination of new control strategies with entomopathogenic fungi and silicon within an integrated pest management for the olive fly *Bactrocera oleae* (Rossi)

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The olive fly *Bactrocera oleae* (Rossi) (Diptera: Tephritidae) is responsible for 60% of the economic losses caused by insects in olive groves due to both direct and indirect damage. Its populations have shown resistance to insecticides, and fewer of them are authorized for use. For over 20 years, the AGR 163 Agricultural Entomology research group has developed a control method based on soil applications of the EAMa 01/58-Su strain of the entomopathogenic fungus *Metarhizium brunneum* Petch. (Ascomycota: Hypocreales). These applications have reduced the spring adult population emerging from overwintering pupae in the soil up to 70%. In Nutrisan project, the application of this strain to the soil has been included within an integrated pest management (IPM) strategy and compared with the current system used by farmers to control the olive fly. Additionally, the incidence of foliar silicon (Si) treatments for controlling the olive fly has also been investigated. The fly population was monitored using sticky and McPhail traps, and the persistence of the fungus in soil was also tracked throughout the project. Results from two years show that plots with the IPM-UCO and Si-UCO strategies have fewer adult captures and lower strung olives rates than those managed by farmers, both in Antequera (Málaga) and Rabanales (Córdoba), and in both McPhail and chromotropic traps. These results indicate how the combinations of new control strategies with entomopathogenic fungi and Si can be deployed in IPM programs of olive fly.

Key words: Biological control, *Metarhizium brunneum*, persistence, population.

Microsclerotia of EAMa 01/58-Su strain of *Metarhizium brunneum*: an alternative for the biological control of *Bactrocera oleae* (Gmelin)

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The genus *Metarhizium* (Ascomycota: Hypocreales) principally produces aerial conidia, but it can also produce a resistant propagule known as microsclerotia (MS) that remains latent under adverse environmental conditions. This tolerance to unfavourable conditions makes the MS candidates for use as active ingredients in mycoinsecticides for field treatments. The Research Group AGR163 "Agricultural Entomology" of the University of Córdoba has successfully developed a strategy to control edaphic stages of the olive fly *Bactrocera oleae* Rossi (Diptera: Tephritidae) through soil treatments with the strain EAMa 01/58-Su of the entomopathogenic fungus *M. brunneum*. However, to date, it has not been proven whether MS is a valid propagule for use against preimaginal stages of the olive fly. In the present study, laboratory and field experiments were conducted to determine the differences in viability and virulence between both propagules. In laboratory, physiologycal (mycelial growth), biochemical (API ZYM and Subtilisin Pr1) and insecticidal activity were evaluated in culture-dependent medium and in vivo experiments against prepupariating larvae of *Ceratitis capitata* Wied. (Diptera: Tephritidae). Fungal growth varied for each propagule but not for their optimal temperature. Additionally, no differences were found in the enzymes produced by each, although there were differences in the intensity of some of them. In vivo experiment was conducted with both propagules against *C. capitata* puparia treated as late third instars in sterilized soil at four concentrations (1 x 107, 5 x 106, 1 x 106 and 5 x 105 conidia/mL), showing an increasing mortality rate with the dose. On the other hand, conidia and MS were applied in an olive orchard. No differences were found in olive fly captures or in the arthropodfauna of the plots treated with the different propagules.

Key words: microsclerotia; biological control; *Bactrocera oleae*; virulence

Effect of soil treatments with the entomopathogenic fungus *Metarhizium* sp. on the diversity of Auchenorrhyncha insects in olive groves

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The new strategy to control the olive fly *Bactrocera oleae* Rossi (Diptera: Tephritidae) through soil treatments with a strain of the entomopathogenic fungus *Metarhizium brunneum Petch.* (Ascomycota: Hypocreales) is nearing commercialization. These applications have been shown not to negatively affect the arthropodfauna of the olive grove, an indispensable requirement for their approval. However, these studies have not been specifically evaluated insects of the suborder Auchenorrhyncha, which are of particular interest due to their role as actual and potential vectors of the bacterium *Xylella fastidiosa*. In this study, carried out in different locations of Andalusia (Córdoba, Castro del Río, Mogón, Cambil and Antequera), the impact of soil treatments with *Metarhizium* strains on the seasonal presence of *Cicadomorpha* and *Fulgoromorpha* insects was assessed. Samples were taken every two weeks using an entomological sleeve from the cover and the canopy of the olive tree. Subsequently, collected samples were taxonomically clustered using morphological and molecular techniques to determine the insect species in treated and control plots. Results indicated that the most frequently encountered species belonged to the Issidae and Cicadellidae families, with their abundance varying across sampled areas but not significantly influenced by fungal treatment. Additionally, the vector *Philaenus spumarius* Linnaeus (Hemiptera: Aphrophoridae) was found in low numbers in some locations. In general, the fungal application reduced the Auchenorrhyncha population, with the maximum reduction of 91% with EAMa 01/58-Su strain in Mogón (Jaén). Thus, this study shows that the fungal treatment for *B. oleae* control, may also reduce populations of *X. fastidiosa* vectors, providing a side benefit in the integrated pest management program.

Key words: *Philaenus spumarius*; *Cicadomorpha*; Integrated pest management; Biological diversity; *Xylella fastidiosa*

Role of rain in the dispersal of *Venturia oleaginea* fungus on olive leaves.

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Olive leaf spot is a major disease caused by the fungus *Venturia oleaginea* affecting olive trees worldwide, leading to considerable yield losses. The fungus causes lesions, which produce new conidia under favorable environmental conditions. These conidia can be occasionally dispersed by wind and insect, but rain plays a major role, with rain splashes detaching conidia and splashing them away. Studies on the relationship between conidial and rain intensity are not available so far. We exposed olive leaves with sporulating lesions of *V. oleaginea* in Beckers under a rain simulator providing rainfall at a rate of 3 mm per minute, with drops variable in size and speed velocity; leaves were exposed from 1 to 20 minutes, for a total of 8 exposure periods. We conducted four experiments (two in spring and two in autumn, i.e., the risk periods for *V. oleagina* infection under Mediterranean climate); there were 20 repetitions (each of them composed by four sporulating lesions) for each exposure period. After each exposure, water in the Beckers was collected to count detached conidia with the help of a Burcker chamber, which were finally expressed as numbers per cm2 of lesion. At the end of each experiment, the conidia still on the lesions were also enumerated. Relation between cumulative numbers of detached conidia and mm of rain were then fit to monomolecular equations, which made it possible to accurately estimate the rain needed to detach different proportions of conidia. For instance, an average of 5.2 mm of rain were needed to detach 50% of the conidia. These equations could be integrated into mathematical models for predicting the risk of olive leaf spot infection, so that to develop more effective disease control strategies.

Key words: Olive leaf spot, conidial dispersal, *Spiloceae oleaginea,* rain

Carob and pomegranate extracts act as resistance inducers against Verticillium wilt of olive

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Verticillium wilt of olive (Olea europaea; VWO), caused by the fungus *Verticillium dahliae*, is one of the most important diseases of this crop. The low effectiveness of fungicides besides their negative environmental impact have led searching for alternative control strategies such as bioprotection through plant extracts. The aim of this work was to evaluate the effectiveness of carob and pomegranate extracts against VWO, determining their mechanism of action. Carob (*Ceratonia siliqua*) pods and leaves or pomegranate (*Punica granatum*) peels extracts were obtained using methanol, ethanol or ethyl acetate. Their effect was evaluated on mycelial growth, conidial germination and microsclerotia viability of *V. dahliae* as well as on disease progression in olive plants inoculated with *V. dahliae*. Quantification of fungal genomic DNA abundance was determined by qPCR at the end of the experiment in root samples. Pomegranate and carob leaf extracts obtained with methanol or ethanol significantly reduced the viability of pathogen structures and reduced disease progression in olive plants by more than 72.4% when applied by irrigation at 3 mg/l compared to the control. Their ability as host resistance inducers was determined by relative expression quantification analysis of the salicylic, jasmonic or abscisic acids-mediated response marker genes by RT-qPCR in root and stem samples from untreated and noninoculated, treated and noninoculated, untreated and inoculated, and treated and inoculated plants, collected at different times. Throughout the sampling times, an antagonistic expression pattern of the salicylic acid and abscisic acid marker genes was noticed in inoculated plants treated with both extracts. Plants inoculated and treated with both extracts presented significantly lower levels of *V. dahliae* DNA compared to untreated controls. The findings of this study indicate that the utilisation of carob and pomegranate extracts may serve as resistance inducers against VWO, potentially enhancing the response to the pathogen mediated by salicylic acid.

Key words: Bioprotection; *Ceratonia siliqua*; Induced resistance; *Olea europaea*; *Punica granatum*; *Verticillium dahliae*

Resistance as main tool for the integrated control of Verticillium Wilt of Olive

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That is a review summarizing the works on the line research of resistance for controlling Verticillium Wilt of Olive (VWO), the most destructive disease of this strategic crop in Spain.

Resistance is the main tool for controlling plant vascular diseases, particularly aimed to diminish the impact of these diseases. Nevertheless, the path to correctly and efficiently identification of resistant genotypes and offering them as commercial varieties is a long and toilsome research work.

The main research is related to the Breeding Program released in the Agronomy Department of the Engineer School of the University of Cordoba, Unidad de Excelencia de María de Maeztu. In the last years, it has generated a huge amount of information about VWO, that has been reviewed in several different journals. That also reveals the importance of this disease. Indeed, the rest of the topics boarded are connected to agronomic parameters that definitively have an important influence on plant resistance, and therefore, on the onset and development of the disease in olive orchards. Watering, fertilization, soil types, management, inoculum potential in soil, the virulence of isolates of the pathogen, the long-term capability of grafting over resistant cultivars, and other bad management agricultural practices.

We will try to send you what that this disease means.

Key words: *Verticillium dahliae*, control, breeding, resistance.

Leaf Spectroscopy and Machine Learning for Early Detection of Verticillium Wilt in Olive Trees

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Verticillium Wilt of Olive (VWO), caused by the fungus *Verticillium dahliae* (Vd) Kleb, threatens global olive cultivation. Most olive cultivars are susceptible, while resistant ones are often unsuitable for the modern intensified systems. Timely detection of VWO guarantees its effective control. Here, a non-invasive method was used to detect VWO early using leaf spectroscopy and machine learning (ML) models. Based on that, a set of Vegetation Indices (VIs) was calculated and ranked based on their discriminant performance. Forty-five 7-year-old 'Picual' trees were monitored one year after the half was drip-inoculated with the Vd-defoliating pathotype and irrigated to satisfy full demand. Control trees were subjected to three water regimes (rainfed, 50%, and 100% crop evapotranspiration) to contrast biotic and abiotic stress. Pre-inoculated trees were categorized based on VWO symptoms and leaf spectral data were collected using a full range (350-2500 nm) portable field spectroradiometer every 22 days from 5th July to 10th October 2022. Six inoculated olive trees remained asymptomatic, while the rest ranged from incipient to moderate symptoms. The non-inoculated control group showed no VWO symptoms. The ML models accurately differentiated between inoculated and non-inoculated trees, achieving an overall accuracy (OA) of 70-95% with a Kappa coefficient (κ) of 0.43-0.85 in the training dataset, highlighting the performance of the GP and NN models. When validated, an OA of 65% and 71% with an F1-score of 63-67% and 69-73% was obtained for GP and NN respectively. The models' performance improved with VIs. Furthermore, the best classification was achieved with the VIS/NIR spectral range, ensuring cost-effectiveness and practicality for developing tools for field applications. This novel method enables the early detection of VWO even in asymptomatic cases and its differentiation from drought stress symptoms.

Key words: Verticillium Wilt of Olive detection, Hyperspectral data, Machine Learning, Vegetation Indices, classifiers.

A mechanistic, weather-driven model for anthracnose on olive: discussing current performance and unveiling future research needs

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Fungi of the genus *Colletotrichum* poses a threat for olive growth worldwide. Timing fungicide application to prevent the occurrence of infection is fundamental for the successful control of anthracnose. A systematic literature review was conducted to retrieve relevant information on *Colletotrichum* spp. biology, ecology, and epidemiology to develop a mechanistic, weather-driven model able to predict infection risk and disease progress over time. The model incorporates main aspects of *Colletotrichum* spp. life cycle, which include i) a reproductive (asexual) stage on olive mummies; ii) infection caused by conidia; iii) an asymptomatic stage after infection; iv) a necrotrophic stage with the appearance of symptoms; and v) the production of secondary inoculum on lesions. Based on recent studies that provided a picture of the diversity of *Colletotrichum* species complexes (clades) associated with olive, the model was parametrized with a clade-based approach, with particular attention to the acutatum clade. The model was then validated against independent data collected from epidemics occurred in Italy between 2017 and 2019; results showed good concordance between model predictions and field data, with concordance correlation coefficients -0.79. Although the fair performances provided by the current model structure and mathematical framework, several key aspects are still missing. The model merely accounts for olive growth stage, which however covers a determinant role for both infection and symptoms onset. Furthermore, clade-based calibration provides a generalized response to environmental factors that might cause over- or underestimation of the epidemics caused by singleton species. Developing species-specific equations (e.g., for dominant species of the acutatum clade like *C. godetiae*, *C. nymphaea*, and *C. fiorinie*) and modeling their responses to olive growth stage may overcome the current model's bottlenecks and improve its prediction accuracy.

Key words: Epidemiology; disease modeling; *Glomerella*; systematic literature review; integrated disease management

Olive Scab caused by *Spilocaea oleagina*: phenotypic resistance and impact of the pathogen on physiological parameters

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One of the most widespread olive diseases in the Mediterranean region is Scab, caused by the hemibiotrophic fungus *Spilocaea oleagina*. Olive Scab causes severe economic losses in the crop because of the impact on the photosynthetic activity of the leaf and plant defoliation. Management strategies have implemented the use of copper- based fungicides and cultivar resistance. The incidence of Olive Scab incidence varies with weather conditions, making it essential to conduct phenotypic stability studies to ensure that resistant cultivars maintain their response to the pathogen regardless of climatic variations. Here, we have assessed the resistance of the 25 cultivars located at the Germplasm Bank of the Cordoba for six seasons. Stability parameters (Wricke's ecovalence stability index, Shukla's stability variance, environmental coefficient of variance, or Thennarasu's non-parametric statistics) confirming resistance or susceptibility as stable reaction regardless the season weather. For example, cv. Frantoio was almost immune (< 0.1 % affected leaves) even the most humid season (499 mm), while cv. Mari was highly susceptible (> 97 % affected leaves) in dry season (170 mm). To evaluate the impact of the pathogen and fungicide treatments on photosynthetic activity of the plant, we measured physiological parameters of healthy and symptomatic leaves. In general, symptomatic leaves showed a significant reduction of the stomatal conductance (9.3 % mol/m2s) and quantum yield (4.6 % PhiPS II) regarding healthy one.

Likewise, the copper treated trees exhibited a significant reduction in stomatal conductance (1.2 %) and fluorescence (3.2 %) compared to those untreated, suggesting an effect on the overall health and productivity of the trees. These findings contribute to our understanding of the resistance mechanisms of different olive cultivars and provide valuable insights for managing Olive Scab disease.

Key words: Copper; Olive Scab; Physiological parameters; *Venturia oleaginea*.

Multi-resolution and multi-temporal spectral analysis of crops using vegetation indices.

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The aim of this paper is to present a detailed analysis of vegetation indices obtained from various sources, specifically drones and satellites, applied to olive farms. The study focuses on a farm located in Marmolejo, Jaén, using historical data from 2016 to 2023. Drone and satellite are multi-resolution and multi-scale data, and both are compared for NDMI, NDVI and SAVI indices, showing that drone data provide higher accuracy in the assessment of greenness and vegetation cover compared to satellite data.

The SAVI index shows less discrepancy between the two sources due to its ground adjustment factor. However, it is important to focus more on the olive grove, as soil indices can distort the olive grove survey. For this reason, pixels of a circle have to be chosen instead of the whole area, to ensure a more accurate and focused assessment of the olive trees. Additionally, graphs of precipitation and temperatures recorded at monthly level, which are crucial for agricultural planning, are analyzed.

The analysis is extended to a specific olive tree within the farm, where the benefits of monitoring individual tree health and performance are highlighted, enabling accurate agronomic decisions to be made.

Key words: UAVs; Sentinel 2; NDVI; SAVI; crop segmentation; multi-spectral

Development, validation, and practical use of a decision support system for the sustainable management of olives

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The transition from conventional to sustainable agriculture requires increased knowledge of the farming system so that farmers can take informed decisions. Decision support systems (DSS) are fundamental tools in the current agricultural context and their development and use is promoted by EU institutions in the framework of the Green Deal. Several DSSs have been developed in the scientific-technical field since the 1980s, but there is a large gap between the number of DSSs that have been developed and their practical use agriculture; this low adoption rate has been linked to both technological and socio-economic constraints. In this work we present a DSS developed for olives, powdered by Horta srl. The DSS is a web-based tool able to: i) collect multiple information/data in real-time about different olive components (air, soil, plants, pests, and diseases) by using IoT technologies; ii) analyze these data by advanced and validated process-based models; and iii) make up-to-date information, alerts and decision supports for olive management. The DSS considers olive development for the main varieties cultivated in the Mediterranean basin, risk for diseases (olive scab and Anthracnosis) and pests (olive fly, olive moths), protection dynamics of fungicide applications, water balance, and fertilization. The DSS was initially developed in 2016 in collaboration with UNAPROL, one of the main Italian olive producers' organizations; in 2023 it has been practically used on over 1000 olive commercial plots in Italy, Spain, Portugal, and Greece guiding the sustainable management of around 8,000 ha of olives. Optimization of crop management and saving of agricultural inputs (e.g., reduction by 50% of treatments against olive scab in two seasons) and better knowledge about farming system, as well as transparency and traceability of agricultural operations, were the main benefits of the use of the DSS as reported by farmers.

Key words: integrated pest management; supporting tools; sustainable agricultura.

Mass trapping of the olive fruit fly *Bactrocera oleae* with a novel food-based attractant

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The management of *Bactrocera oleae* (Rossi) (Diptera: Tephritidae), the most damaging pest of olives worldwide, has been based on the use of chemical insecticide treatments, applied either as bait or cover sprays. However, the side effects of extensive chemical use, along with the increasing resistance of *B. oleae* to pesticides, and the European Union's Green Deal which aims to drastically reduce pesticide usage with numerous active substances already withdrawn from the market or planned for future withdrawal, have driven the search for more effective and eco-friendly alternative strategies. Among alternative tools, mass trapping with powerful attractants, are crucial for controlling *B. oleae*. The aim of the study was to assess the attractiveness of a novel food-based attractant 'Attravol' to *B. oleae* in comparison to the most widely used commercial lures, either in plastic McPhail trap or in commercial trap - lure combinations, during trials conducted in olive groves in Crete, Greece. 'Attravol' attracted significantly more olive fly adults compared to the other tested food-based attractants used for monitoring. Moreover, whether placed in McPhail plastic trap (Anel) or container trap, it demonstrated significantly higher attractiveness compared to all other tested commercial traps and lures. Additionally, the efficacy of mass trapping using 'Attravol' was evaluated in field trials. With low pest pressure, mass trapping was sufficient to keeping damage below the economic threshold. Under high pest pressure, mass trapping, complemented by only one bait spray, resulted in significantly lower number of captured olive flies in the monitoring traps and reduced fruit infestation below the economic threshold, compared to control, where four bait sprays were applied. These findings demonstrate that the novel attractant is a powerful tool for both monitoring and controlling *B. oleae* populations, offering a promising alternative in olive pest management strategies that significantly reduces the reliance on insecticides.

Key words: novel attractant, monitoring, control, olive fruit fly, *Bactrocera oleae*.

Effectiveness of bait sprays and mass trapping systems using Dacus Bait for IPM of *Bactrocera oleae*: Field results from Crete, Greece

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Bactrocera oleae (Rossi) (Diptera: Tephritidae), is the most important pest of olive cultivation in Greece, affecting the quality and quantity of both oil and table olives. The management of *B. oleae* populations has been based on the use of chemical insecticide treatments applied either as bait or cover sprays. However, the ecological and toxicological side effects of extensive chemical use, coupled with the increasing resistance of *B. oleae* to pesticides, have driven the search for more effective and eco-friendly alternatives within the framework of Integrated Pest Management. Among alternative strategies, mass trapping, either alone or in combination with bait sprays, has shown to be an effective tool for controlling *B. oleae*. The aim of the study was to assess the attractiveness of Dacus Bait to *B. oleae* compared to the most widely used commercial lures in Greece. The results of the study revealed that the Dacus Bait attracted significantly more olive fly adults compared to other lures tested. Additionally, the efficacy of mass trapping using Dacus Bait in plastic McPhail traps supplemented with bait spray applications if needed, was assessed through field trials. The results revealed that using Dacus Bait with mass trapping, along with bait sprays in period with high pest pressure, significantly reduced the number of captured olive fruit fly adults in monitoring traps and decreased fruit infestation throughout the growing season, compared to the conventional control method, where only bait sprays were applied. This study demonstrates that combining efficient mass trapping systems with complementary bait sprays provides a highly effective alternative for managing olive fruit fly populations during periods of high pest pressure.

Key words: food-based attractant, bait spray, mass trapping, olive fruit fly, IPM.

Mister P: A novel pheromone-based mating disruption system for Olive Moth (*Prays oleae*) control using aerosol dispensers

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Olive trees cover *c*. 4.6 million hectares in the EU. In the Iberian Peninsula, the area dedicated to olive cultivation has seen rapid growth in recent years, with more than 2.6 million hectares in Spain and approximately 400,000 hectares in Portugal. One of the primary pests threatening these crops is the olive moth (*Prays oleae* Bern.), capable of causing significant damage along the Mediterranean Basin—often underestimated—however, capable of reducing harvests by 50-60%, leading to major losses in olive oil production.

Mating disruption strategies using pheromones offer a sustainable, environmentally friendly alternative for integrated pest management. This approach has the added benefit of reducing or even eliminating the need for chemical pesticides. In this study, an active mating disruption system was developed, utilizing the controlled release of sex pheromones through aerosols equipped with programmed heads, Mister P, in olive groves infested by *P. oleae*. Since 2019, efficacy trials have been conducted across a wide range of environmental conditions; across Spain —from Andalusia to Catalonia—, Portugal, and Italy, covering various olive grove types (super-intensive, intensive, and traditional) and production systems (integrated, organic, and conventional). In all cases, the mating disruption system demonstrated greater efficacy compared to the standard insecticides strategies, showing a notable reduction in male moth captures and important decreases in both, inflorescence infestation and fruit damage.

This approach not only promotes a more sustainable olive production by minimizing or eliminating chemical inputs but also fosters a healthier environmental balance, supporting organic farming and the integrated pest management. Moreover, it helps safeguard the profitability of olive oil producers by reducing pest-related losses without resorting to potentially environmentally harmful conventional methods.

Key words: *Olea europaea*; *Prays oleae*; mating disruption, aerosols

Are low infestations of *Bactrocera oleae* in South African olive groves due to parasitoids? End of a legend

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In 1913, Silvestri collected wild olives in Wellington (Western Cape, South Africa) from which more parasitoids than olive fruit flies emerged. He hypothesized that the low infestations of *Bactrocera oleae* observed on cultivated olives in the region were also due to parasitoid activity. Since then, the assumption that South African *B. oleae* parasitoids are more abundant and effective than Mediterranean ones has persisted. However, adequate studies on infestations and their causes in South African cultivated olives are nearly absent.

We compared *B. oleae* infestations and its parasitization in cultivated and wild olives from Wellington, Somerset West, and Franshhoek (Western Cape, South Africa) and from Trapani province (Sicily, Italy) during growing seasons, with a typical climate for those areas, harvesting in the second month of fall (April for the Western Cape, October for Sicily).

Parasitism rates for *B. oleae* in cultivated olives were low and insufficient both in the Western Cape (6%) and Sicily (17%), as it has been widely recorded in Tephritidae of economic interest. Higher parasitization (27% in the Western Cape, 48% in Sicily) was recorded in wild olives, where the thinner pulp favors specialized parasitoids with a short ovipositor (<2.6 mm). The significant difference in infestation levels observed between olives cultivated in South Africa (3.2% in 2009, 6.3% in 2010) and Sicily (79% in 2009, 82% in 2010) appears to be influenced by contrasting climatic conditions: specifically, the lower relative humidity and greater temperature range in the Western Cape during the last three months of olive production.

In fact, years with lower relative humidity and reduced rainfall in final three months of the season, as observed in Sicilian sites, corresponded to halved infestation levels. These findings suggest that climate, rather than braconid parasitism, is the primary environmental factor limiting olive fruit fly infestations

Key words: biological control, Braconidae, relative humidity, daily temperature range, cultivated and wild olives

ABSTRACTS OF THE POSTER PRESENTATIONS

Ecological infrastructures of olive groves and organic farming effects on the arthropod communities associated to *Bactrocera oleae* in Spain

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The maintenance of ecological habitats under different management systems drives the status of biodiversity of the arthropods community across olive orchards. In our research we examined habitat characteristics and management system on richness and abundance of species associated to *Bactrocera oleae* (Diptera, Tephritidae). The study was carried out at four regions of Spain: Valencia (Moixent), Granada (Orgiva), Jaen (Menghibar) and Malaga (Alorà). McPhail and pheromone traps were used for the survey of *B. oleae* from June 2022 to November 2023. Two management systems were considered 1) The conventional CF and 2) the organic farming OF. Each experimental plot covered 1 to 5 ha and five traps per ha. Infested fruits were collected at the harvesting. A rearing protocol of larva was set up in order to recuperate the emergencies. Data were subject to analysis of Variance (ANOVA). Diversity indices were calculated using: Shannon diversity index (H), Simpson's Dominance (D), Margalef's Species Richness (d) and the Effective Number of Species (ENS). Results showed that the most important group was Diptera: Tephritidae was the most abundant family, followed by Agromyzydae. The rest were: Drosophilidae, Anisopodidae, Cecidomyiidae, Syrphidae, Tabanidae, Pallopteridae, Tachinidae and Mydidae. Ten hymenopteran were determined: Apidae, Megachillidae, Vespidae, Formicidae, Sphegidae, Ichneumonidae, Siricidae, Braconidae, Eulophidae and Eurytomidae. Most hymenopteran were found in Orgiva OF. Siricidae was perceived in Moixent OF. *Camponotus* sp. (Formicidae) was found in all parcels. Orgiva had the highest H in both management systems OF and CF respectively: (1, 42 and 1, 15). Alternatively, Mengibar had a low H in CF but a high D in both systems. Alora and Moixent CFs showed a low diversity and high D but a higher ENS in Moixent. Our research shows that the ecological infrastructures and the organic inputs contribute heavily to define the status of biodiversity and enhance the beneficial arthropod's community.

Key words: biodiversity, arthropods community, olive farms, management system, ecological infrastructure

Effect of carob and pomegranate extracts against olive anthracnose and characterisation of antioxidant activity and phenolic compound production

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Olive (*Olea europaea*) anthracnose, caused by *Colletotrichum* species, is one of the most economically damaging diseases of this crop. Control is mainly based on copper fungicides applications, but their environmental impact and the expected reduction in their use, requires searching for sustainable alternatives such as bioprotection. This work evaluated the effect of carob (CE) and pomegranate (PE) extracts against olive anthracnose and determine their mechanisms of action. Copper (Cu) was used as a comparative treatment. Their inhibitory effect on mycelial growth, conidial production and germination, and appressoria formation of *C. godetiae* and *C. nymphaeae* was evaluated in vitro at 30, 300 or 3000 mg/L. Bioassays on detached olives and olive plants were performed using the highest dose. Both extracts and Cu inhibited *C. godetiae* conidial production by more than 90% compared to the control at a high dose. PE and Cu reduced *C. nymphaeae* conidial production by more than 90%. Both extracts and Cu completely inhibited appressoria formation in both pathogens. PE inhibited *C. nymphaeae* conidial germination by over 89% compared to the control, showing no significant difference from the Cu treatment. Both botanical extracts reduced the disease progression in olives by more than 33% when a curative treatment was applied and CE reduced disease incidence in plants by 35% compared to the positive control. Their resistance-inducing effect was evaluated by quantifying H_2O_2 and phenolic production in olive leaves collected at 0, 3, 7 and 24 h after plant inoculation with *C. godetiae*. A significant increase in H_2O2 was observed in CE-treated plants at 0 h compared to the control. In turn, plants treated with PE showed a higher accumulation of H_2O_2 at 3 and 7 h. An increase in the production of gallic acid and other phenolic compounds was observed in the treated and inoculated plants compared to controls.

Key words: Bioprotection; *Colletotrichum* spp.; *Olea europaea*; Plant extract; Resistance induction

Selection of potential biological control agents against *Colletotrichum godetiae*, causal agent of olive anthracnose

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The use of beneficial microorganisms as biological control agents (BCAs) is proposed as an alternative to control olive anthracnose, caused by *Colletotrichum* species, with *C. godetiae* being the main causal agent in Spain. The antagonistic effect of 22 BCAs against *C. godetiae* were evaluated through in vitro dual culture assays and bioassays on detached olives ('Arbequina'). Copper sulfate (2 g/L) and Serenade® (*Bacillus subtilis*, 8 ml/L) were included for comparison. Mycelium agar plugs with *C. godetiae* were placed on PDA inoculated with each BCA or adjusted to the indicated product dose. PDA with only the pathogen was used as positive control. Mycelial growth inhibition (MGI; %) of *C. godetiae* colonies and conidial production inhibition (CPI; %) were estimated with respect to control. For bioassays, surface-disinfected olives were treated with BCAs or products 4 days and 24 h before pathogen inoculation by spraying a conidial suspension (106 conidia/ml or 108 CFU/ml for fungal or bacterial BCAs) or product solution at indicated doses. The pathogen was inoculated on the 5th day by spraying a conidial suspension (105 conidia/ml). Inoculated olives were incubated at 22ºC and 100% humidity for 20 days. Symptom progression was periodically assessed using a severity scale, and final relative disease severity (DS) was estimated. Copper sulfate and Serenade® were the most effective in vitro, showing 100% MGI and CPI. Among the BCAs, *Bacillus* sp. PV-1361 (MGI = 45.4%) and *Neocosmospora rubicola* PV-826 (MGI = 40.0%) were most effective and 17 of the 22 BCAs showed CPI values above 50%. In bioassays, copper sulfate was the most effective (DS = 15.5%), followed by *Myrothecium inundatum* PV-329 (DS = 36.2%) and *Bacillus* sp. PV-1394 (DS = 66.0%), all significantly lower than the untreated control (DS = 100%). These results will allow us to select potential BCAs for plant evaluation and determining their mechanisms of action.

Key words: anthracnose; biocontrol; *Colletotrichum godetiae*; beneficial microorganisms; *Olea europaea*

Fungicide sensitivity of *Colletotrichum acutatum* from Australian olives

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Olive anthracnose is primarily caused by *Colletotrichum acutatum* to the major olive growing region along the Murray River valley of Australia. Significant crop losses occur in seasons with abnormally wet summer conditions with some disease carry-over into subsequent years. This was the case in 2010-11 and again in 2022-23. Field trials were conducted in 2011-12 along with detached fruit assays which determined that the QoI fungicides, azoxystrobin and pyraclostrobin had superior relative efficacy compared with several copper formulations. In 2023, 12 isolates from that earlier study along with 75 fungal isolates from the 2022-23 season were used in in-vitro assays to determine if there had been a shift in sensitivity to azoxystrobin. All isolates had an EC50 of less than 1 µg/mL suggesting that no significant resistance had developed, in contrast to reports of highly resistant populations of *C. acutatum* from strawberries in Florida where EC50 values exceed 100 µg/mL. Azoxystrobin formulations are currently registered for use on olives in Australia at an equivalent spraying concentration of 200 µg a.i./mL, so the current sensitivity of *C. acutatum* isolates demonstrated in this study is well within that limit. Unfortunately, there were no QoI naïve isolates available for this study, so it remains possible that some decreased sensitivity had developed prior to their first use in the mid-2000s.

Key words: Anthracnose; strobilurins; resistance.

Flavonoids mediate *Bacillus amyloliquefaciens*-Induced Resistance against the olive knot disease in inoculated plants

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The Olive knot (OK) is a disease caused by the bacterium *Pseudomonas savastanoi* pv. *savastanoi* (Pss) presenting significant challenges in control due to the absence of effective methods. The use of naturally microbial control agents, such as endophytic bacteria, could be a sustainable tool to manage this disease. Their protective effect often involves highly regulated cascades of metabolic events that can induce resistance or prime plant defenses. This work aimed to identify secondary metabolites that may act as potential mediators of induced resistance or priming in olive trees against Pss through the endophyte *Bacillus amyloliquefaciens*. This endophyte has previously shown the ability to reduce the incidence and severity of olive knot disease. Accordingly, olive plantlets were inoculated with this endophyte (E+) or buffer (E-). One week later, the E+ and E- plants were inoculated with Pss or buffer. A-non targeted metabolomic analysis (LC-Q-TOF-MS/MS) was performed in a time course experiment to identify compounds likely participating in the enhanced resistance of plants interacting with the endophyte. Principal component analysis of metabolites showed that the four treatments could be separated mostly at early time-points after pathogen inoculation. A significant increase of compounds from the group of flavonoids was observed in plants inoculated with *B. amyloliquefaciens* + Pss when compared to the other treatments indicating that early responses induced by the endophyte may be crucial for an effective defense response in olive trees. This accumulation of flavonoids indicates that the endophyte *B. amyloliquefaciens* may confer protection against the pathogen via the induction the sub-pathways of phenylpropanoid biosynthesis, with the significant presence of Kaempferitrin and Xanthohumol. Their significant role in host plant protection and mode of action needs to be further elucidated in future research.

Key words: Endophyte; *Pseudomonas savastanoi*; biocontrol; priming

Impact of Spontaneous Vegetation Management on the Epidemiology of Olive Anthracnose

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Kept natural or spontaneous vegetation cover in olive groves has become common in most olive-growing countries, including Portugal. Besides protecting soil from erosion, spontaneous vegetation cover provides various ecosystem services, such as supporting beneficial insects. Despite its benefits, vegetation cover's role in disease epidemiology remains largely unexplored. This study investigates the impact of spontaneous vegetation on the incidence and severity of anthracnose in three olive groves in Mirandela, Trás-os-Montes region (Northeast of Portugal). This fungal disease is airborne and caused by various *Colletotrichum* species. Certain plant species within the cover vegetation may act as reservoirs for *Colletotrichum*, enabling the pathogen to persist and spread within the olive grove environment. In contrast, other plant species may be disease-suppressive. A comprehensive floristic survey performed in the spring and autumn of 2023 allowed the detection of a great diversity of spontaneous plant species belonging to more than 10 families. Primers targeting the GAPDH gene were used to detect *Colletotrichum* spp. in the endosphere and episphere of leaves of the most abundant cover plant species. Among the 31 surveyed plant species, six tested positive for *Colletotrichum* spp., with a higher prevalence observed on leaf surfaces. Correlation analyses showed that some of these *Colletotrichum* -positive plant species were significantly associated with higher disease incidence and severity in olive orchards. These results highlight the potential for targeted management of spontaneous vegetation to reduce the inoculum sources of *Colletotrichum* and the likelihood of anthracnose outbreaks in olive groves.

Key words: *Colletotrichum*; cover crop; PCR detection; inoculum sources.

Dynamics and role of bacterial communities in *Philaenus spumarius* at different developmental stages

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Insect microbiomes have received increased attention over the years due to their critical roles in host functions. Several factors, such as environmental conditions or insect developmental stage, are known to influence the assembly of bacterial communities in the host. The microbiome of *Philaenus spumarius*, the European vector for the transmission of Xylella fastidiosa, remains poorly studied and understood. In this work, a metabarcoding approach was employed, and the functional prediction of detected bacterial communities was performed to investigate the changes in the bacterial communities from nymphs to adults, describing for the first time the core bacteriome of this insect across different life cycle stages. The bacteriome of nymphs revealed to be less diverse yet more abundant in functional pathways compared to adults. However, female adults show greater similarity to nymphs in terms of bacterial abundance and predicted functional pathways. A core bacteriome was identified, composed of 12 bacterial genera persistently present across all stages and samples of *P. spumarius*, with variations in abundance between life stages and sexes. Among these, *Candidatus Sulcia* and *Sodalis* were more abundant in nymphs, while *Candidatus Sulcia* and *Cutibacterium* were more prevalent in adults. These genera displayed distinct profiles of abundant pathways, providing essential functions to the host. Additionally, core bacteria such as *Curvibacter*, *Duganella*, *Methylobacterium* and *Pseudomonas* were found to offer similar functional profiles, enriched in functions related to host protection and response to environmental stresses. Our study highlights the importance and potential of bacteriome diversity and functions throughout the insect life stages, underscoring the dynamic nature of microbial communities in *P. spumarius*.

Key words: functional prediction, life stages, insect sex, microbial diversity, core bacteriome.

Unlocking the cultivable microbiota of *Philaenus spumarius* and their implications for insect fitness

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The microbial community of the *Philaenus spumarius*, an insect vector of the phytopathogenic bacteria *Xylella fastidiosa*, has been studied using non-cultivable methods and focusing on the bacterial community. However, the cultivation of microorganisms is crucial for developing microbiota-derived control strategies and understanding their significance in insect biology. This work used a simple culturomic approach to characterise the cultivable bacterial and fungal communities associated with *Philaenus spumarius* females and males. The effect of five isolated bacterial strains on insect progeny and morphology was then evaluated using *Drosophila melanogaster* as a model organism over three generations. Overall, a total of 91 operational taxonomic units were identified from six phyla and 38 genera, with three bacterial genera (*Aeromicrobium*, *Agrobacterium* and *Williamsia*) and all the nine fungal genera being described for the first time in *Philaenus spumarius*. *Pseudomonas* and *Cladosporium* were the most abundant genera identified within bacterial and fungal communities, respectively. Most strains isolated from *Philaenus spumarius* were described as plant endophytes and thus likely acquired through feeding. The bacterial strains provided in the fly food showed variable effects on *Drosophila melanogaster* progeny and morphology, depending on the strain type, the duration of strain exposure, and the insect sex. In general, all five strains increased progeny, particularly *Curtobacterium* B26, *Rhodococcus* B27, and *Microbacterium* B79, and affected the body and wing sizes of *D. melanogaster*. For some strains, notably *Agrobacterium* B34 and *Williamsia maris* B46, these effects seem to be transgenerational. Although preliminary, these findings suggest that cultivable microorganisms may play significant roles in insect fitness and highlight their potential use in managing *Philaenus spumarius* populations.

Key words: Meadow spittlebug; culturomics; fungi; bacteria; offspring performance.

Microbial dynamics and bacterial exchange in plant-*Philaenus spumarius* interactions

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Plants and insects engage in intricate interactions that significantly influence their microbiomes, yet the extent of bacterial exchange between them remains poorly understood. This study examines the bacterial communities associated with nymphs of *Philaenus spumarius* (Hemiptera: Aphrophoridae), the stems of *Coleostephus myconis* where the nymphs feed, and the foam produced by the nymphs. Using both culture-dependent and -independent approaches (metabarcoding), the findings revealed that foam surrounding the nymphs exhibits a significantly higher bacterial diversity compared to nymphs and stems, all of which harbored bacteria known to provide diverse benefits to their host. Bacterial compositions of foam and stems showed greater similarity to each other than to the nymphs. Stems were predominantly colonized by *Burkholderiaceae* and *Moraxellaceae*, whereas foam was dominated by *Rhizobiaceae* and *Sphingobacteriaceae*. The nymphs possess a distinct bacterial community enriched with endosymbiotic genera such as *Candidatus Sulcia* and *Sodalis*, absent in stems and foam. The bacterial community in the foam closely resembles that in the stems, suggesting an exchange facilitated by nymph feeding wounds on *C. myconis* stems. The genera *Methylobacterium*, *Curvibacter*, *Cutibacterium*, *Pseudomonas*, and *Rhizobium* are likely the most frequently exchanged between nymphs and stems. Nymphs also appear to transfer bacteria to the foam, including *Enhydrobacter* and *Roseomonas* genera, potential contributing to nymph development and health. Further research is needed to understand the functions on the shared bacteria between *P. spumarius* and *C. myconi*s, which could pave the way for innovative pest control methods through microbial manipulation.

Key words: Plant-insect interaction, microbiome exchange, symbiotic bacteria, foam microbiota.

The impact of olive tree age and tillage on soil microbial communities

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Soil is known to harbour a diverse microbial community that is important for maintaining soil processes and protecting plants against biotic and abiotic stresses. In this work, using a metabarcoding strategy targeting 16S and ITS2 barcodes, it was analysed the microbial communities (bacterial and fungal) in soil samples from olive orchards 10 and 100 years old, either tilled or not tilled and collected in the row middles and under the tree canopy. Overall, *Actinobacteria* and *Ascomycota* were the dominant phyla. Tillage management, followed by orchard age and the location of the soil samples, significantly contributed to the variation of microbial community composition. Nevertheless, tillage had a more significant impact on the overall assemblages of the soil microbial community (fungi and bacteria) in young olive orchards (10 years old) compared to old orchards (more than 100 years old). In young olive orchards, tillage reduced significantly the diversity of fungi and bacteria up to 1.3-fold compared to non-tillage soils. No significant differences were found in microbial diversity and composition between soils collected from row middles and under the tree canopy, either in tilled or non-tilled soils. Only in young olive orchards, bacterial diversity was significantly higher in soil samples taken from under-the-tree canopy than those from the row middle, regardless of whether the soils were tilled or non-tilled. Several fungi/bacteria genera showed a clear positive association with the older or young orchards, tilled or non-tilled soils, row middles and under-the-tree canopy soil. Overall, this study suggests that the impact of tillage on soil microbial communities is variable according to the age of the olive tree. Soil microbial communities appear to stabilise as the plants age and become more resilient to tillage, likely due to the long-term establishment of soil structure and nutrient cycles in older groves.

Key words: Microbial diversity; Bacterial; Fungal; Metabarcoding; Illumina MiSeq sequencing.

Preliminary study on the susceptibility of different olive cultivars to *Verticillium dahliae*

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Verticillium dahliae is an ascomycete fungus responsible for the most important soil-borne disease affecting olive trees. Its hyphae penetrates the olive roots, reaches the xylem vessels, and developsconidia. The occlusion of the extensively colonized xylem results in yield losses and plant mortality. The symptoms depend on the pathotype: defoliant (D) and non-defoliant (ND) The D pathotype can be lethal, while the ND pathotype is less aggressive and is associated with a slow decline syndrome.

In this work, 15 olive cultivars have been tested for their susceptibility/resistance to Verticillium wilt. The work was conducted in the laboratories of the CREA OFA of Rende, Italy, where the roots of 9-month-old potted olive plantlets were immersed in a fresh conidial suspension of 107 conidia/ml of the highly virulent infectious defoliant pathotype (D). The inoculated plants were placed in a climate chamber for symptom development. Three control treatments were also considered: i) uninoculated control plants of the tested genotypes, ii) inoculated olive plants of a resistant (Frantoio) and iii) of a susceptible (Picual) cultivar. Ten plantlets per cultivar and treatment were used. The severity of the disease was assessed according to a four-degree scale based on defoliation percentage (- 25, 26-50, 51-75, and 76-100%). The weekly monitoring lasted 10 weeks, starting 2 weeks after inoculation. The findings showed a great variability, whereas the cvs *Cellina di Nardò*, *Giogolino*, *Pampagliosa* and *Carbuncion* resulted highly susceptible, *Ghiacciolo*, *Verde Verdelho* and *Ciciarello* appeared decidedly resistant, and all the remaining cultivars showed intermediate levels of *V. dahliae* pathogenicity, with the control cvs *Frantoio* and *Picual* confirming their assumed behaviors.

The ongoing research activities involving screening a higher number of cultivars are part of the GEN4OLIVE European project. These activities are crucial to the project's aim of providing a comprehensive understanding of the susceptibility/resistance of different olive cultivars to Verticillium wilt, which could significantly contribute to managing this destructive disease.

Key words: verticilliosis; olive; defoliant; susceptible; resistant.

Monitoring and management of *Xylella fastidiosa* spread in Apulia olive groves: a remote sensing and GEOBIA-based approach

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Xylella fastidiosa has caused significant damage to olive cultivation in Puglia, with severe repercussions on both the olive oil supply chain and the entire local agricultural sector, as well as resulting in major alterations to its landscape. The urgent need for large-scale monitoring tools for the bacterium and effective strategies to combat it has spurred the development of new and advanced management approaches, including the use of remote sensing technologies, whose effectiveness is highly dependent on the availability of accurate and up-to-date data on the evolution of the bacterium.

This study provides a detailed analysis of the disease's progression in Puglia's olive groves from 2015 to the present, utilizing an algorithm developed with the GEOBIA (Geographic Object-Based Image Analysis) approach and Sentinel-2 satellite data. The algorithm specifically focuses on olive grove areas and integrates vector data from various regional sources, such as Land Use data, Technical Maps, and the Rural Cadastre. Furthermore, the algorithm estimates changes in the vegetative conditions of the plants and the severity of symptoms over time, considering the agronomic practices adopted during the observation period. This approach allows for the monitoring of the disease's evolution both spatially and temporally.

In addition to documenting the evolution of *Xylella fastidiosa* over the last decade, the system enables the immediate identification of potentially affected expansion areas, starting from the regions where the infection was first detected. This provides a valuable operational tool for the proper management of necessary interventions — including effective vector control measures — and for adequate planning of containment measures.

Looking ahead, the proposed approach can also be extended to other crops and phytopathologies, representing a valuable tool for the sustainable protection of economically and strategically important crops, both in Puglia and in other at-risk areas.

Ke words: Sentinel-2 satellite data; Vegetation health monitoring; Vector control; Disease progression; Containment measures.

Influence of Olive Fruit Biometric Traits on *Bactrocera oleae* Oviposition Preferences: Three Years of Field Data from 72 Cultivars in Southern Greece

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This study evaluated the susceptibility of 72 olive cultivars to *Bactrocera oleae* (Rossi) (Diptera: Tephritidae) under field conditions. Olives from each cultivar were collected every ten days, from June to October during 2021, 2022 and 2023, from the National Olive Germplasm Bank of Greece of the Institute of Olive Tree, Subtropical Crops & Viticulture, in Chania, Crete (Southern Greece). The percentage of infestation was assessed by dissection of all sampled olives under a binocular stereomicroscope to detect the alive and dead preimaginal stages, emergence holes and sterile oviposition punctures. The fruit weight, length, width and maturity index were also measured. Adults of *B. oleae* were monitored weekly using a network of McPhail traps. Flight curves showed that *B. oleae* had about four generations during each sampling period. During 2022, population size was significantly higher than in 2021 and 2023, likely due to unusually high temperatures during summer of 2021 and 2023. Oviposition signs were observed very early in the growing season (in June). The percentages of fruit infestation varied significantly among tested cultivars with average levels ranging between 0.9% and 85.6%. Our findings suggest that fruit weight and volume partially explain the susceptibility of olive varieties to *B. oleae*. Specifically, we observed that certain medium and small-sized varieties were significantly more susceptible to *B. oleae* than certain large-sized varieties. It appears that multiple factors may contribute to the susceptibility of different olive cultivars to *B. oleae* attack.

Key words: genotype, olive fruit fly, fruit biometric parameters, susceptibility, cultivar

Acknowledgment: This research is supported by the EU-HORIZON 2020 program GEN4OLIVE.

Adaptation of a physiologically based model for predicting the phenology of *Philaenus spumarius*: first validation in Italian olive groves.

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The significance of *Philaenus spumarius* (Hemiptera: Aphrophoridae) has grown considerably due to its high capacity to transmit *Xylella fastidiosa* (Xf), the bacterium responsible for olive quick decline syndrome (OQDS). Classified as a quarantine organism in 1981, Xf was first detected in 2013 in Apulia, a southern Italian region with a long olive-growing tradition, where it has caused significant damage to local production. Effective containment of Xf strongly relies on vector management through chemical insecticides and soil tillage to disrupt vector juvenile stages; treatments should be carried out before the adult spittlebugs acquire the bacterium from infected plants, to reduce the vector population that becomes potentially infectious.

In this study, we adapted a physiologically based model to *P. spumarius* in order to predict the phenology of the pest. Pest phenology prediction is important to guide the monitoring programs and optimise the use of insecticides. To adapt the model, new development rate functions were fitted and parametrized for each phenological stage, from egg to adult, by using field data from literature.

The model was validated in various areas of Apulia using two data sets. The first, collected in 2019, comes from a group of seven nearby fields along the Ionian coast of Taranto; the second, collected in 2024, includes several locations as part of the official monitoring program, with data available online through the regional cartographic service (“Emergenza Xylella”).

Overall, this first validation showed a good capacity to predict 3rd, 4th and 5th nymphal instars. Improvements are needed for earlier stages and for adults, which are discussed in this work.

Key words: Physiologically based model, *P. spumarius*, Integrated Pest Management, vector management, Apulia

Early detection of *Xylella fastidiosa* in olive trees: non-targeted spectranomics approch

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The spread of *Xylella fastidiosa* (Xf) subsp. pauca ST53, responsible for Olive Quick Decline Syndrome (OQDS), has devastated millions of olive trees in the Apulia region, causing severe damages on the agricultural economy of the Southern Italian region. One of the greatest challenges in managing the disease is early detection, as trees can remain asymptomatic for long periods, thus facilitating the spread of the pathogen to new plants.

Recent studies have explored the use of non-targeted spectranomics to detect latent infections by analyzing the relationship between the presence of specific water-soluble metabolites and the optical properties of olive seedlings' leaves inoculated under controlled conditions. By combining HyperSpectral Reflectance (HSR), Nuclear Magnetic Resonance (NMR), and Chemometrics, significant changes were identified in the relative content of specific metabolites associated with Xf infection, such as malic acid, fructose, sucrose, oleuropein derivatives, tyrosol derivatives, and formic acid. These metabolites were correlated with specific wavelengths in the visible, near-infrared, and SWIR electromagnetic spectrum, enabling the distinction between infected and healthy plants before the appearance of visible symptoms.

New scientific evidence on other susceptible varieties, discussed in this work, confirms the results obtained, paving the way for the development of HSR-based sensors capable of early detection of *Xylella* infection directly in the field. This allows for accurate and timely monitoring, improving the ability to contain the disease and providing farmers with a powerful tool in the fight against this devastating threat to olive trees.

Key words: Water-soluble metabolites; Hyperspectral reflectance; Olive Quick Decline Syndrome; Nuclear Magnetic Resonance; Early detection.

Wide application of geoinformatics technologies for the optimization of the National Olive Fruit Fly Control Program in Greece

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The *Bactrocera oleae* (Rossi) (Diptera, Tephritidae) is the most serious pest of olives in Greece. To address this, the National Olive Fruit Fly Control Program (NOFCP) has been established and implemented for over 70 years, coordinated by the Ministry of Rural Development and Food and regionally supervised by the Directorates of Agriculture and Veterinary. The NOFCP involves the application of collective bait sprays across all olive-growing regions of the country, protecting approximately 100,000,000 olive trees. While bait sprays are an effective, environmentally friendly method that is safe for both users and the quality of the final product, malfunctions during the spraying process can occasionally lead to reduced effectiveness, resulting to production losses. To optimize the effectiveness of bait sprays, ELGO-DIMITRA coordinates two national projects ("DACUSSOS", "DACUS4PEL"), aimed at modernizing and upgrading the NOFCP, while protecting the environment and conserving resources. Since 2020, these projects have widely applied advanced geoinformatics, automation technologies, and low-cost tools to monitor and ensure the proper application of bait sprays, to the major olive-growing regions of Greece, covering all olive cultivation areas of Crete, the Peloponnese and Halkidiki (two-thirds of the country's protected olive-growing area). A comprehensive monitoring and control information system has been developed, utilizing 2,047 smart mobile devices with GPS and the open-source software platform Traccar in combination with the MySQL database management system. This system enables real-time: a) recording and web-based display of data on the route of spraying tractor and the flow and consumption of the spraying solution per spraying machine, b) cartographic visualization of geospatial data, and c) creation of digital maps showing sprayed and unsprayed olive plots by area, using an automated model. The projects "DACUSSOS" and "DACUS4PEL" are funded by the Region of Crete and the Region of the Peloponnese, respectively.

Key words: GPS trackers, model QGIS, National Olive Fruit Fly Control Program, *Bactrocera oleae*.

Spatial distribution of juveniles of *Philaenus spumarius* in olive groves from Trás-os-Monte's region (Portugal)

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The spatial patterns of arthropod species, particularly those regarded as insect vectors or pests, play a critical role in agriculture and pest management. Understanding these distribution patterns is essential for developing and implementing effective sampling, monitoring, and control strategies. Currently, the monitoring of juveniles of *Philaenus spumarius* L., occurs along a 100-meter transect in the ground cover vegetation of the groves. Within each transect, 30 random samples are carried out by counting the spittle masses and juveniles on host plants within a 0.25 m² area marked by a wooden frame. This process, while thorough, is both exhaustive and time-consuming. Therefore, the main objective of this study was to: (i) investigate population fluctuations of the juveniles in two olive groves in the Trás-os-Monte's region, Portugal; (ii) assess the spatial distribution of the population in the studied olive groves; (iii) estimate the minimum sampling effort. To this end, from March to May in both 2023 and 2024, the ground cover vegetation of two olive groves in Trás-os-Monte's region (Portugal) was weekly sampled. The sampling followed the standard methodology used for monitoring juveniles of *P. spumarius*. Additionally, several aggregation indexes were calculated. In both olive groves and years of study, the peak abundance of juveniles occurred in the third week of April. According to the results, juvenile *P. spumarius* generally exhibits an aggregated pattern. However, regarding the minimum sampling effort required to estimate population density, the data suggest that 15 samples per transect is sufficient and positively correlated with the observed population when high population densities are observed. Conversely, when population densities are low, the number of observed samples per transect should increase to 40 samples for a correct estimation of *P. spumarius* populations. The findings highlight the importance of adjusting sampling efforts based on population density to optimize monitoring protocols.

Key words: aggregation indexes; minimum sampling effort; population density; *Xylella fastidiosa*.

Response of spittlebug vectors of *Xylella fastidiosa*, to different wavelengths of light

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In IPM, monitoring pests is crucial to plan effective control programs. Monitoring procedures should be easy to carry out and reliable, to maximize application's benefits. In case of *Philaenus spumarius*, the main European vector of the plant pathogenic bacterium *Xylella fastidiosa*, commonly used yellow sticky traps were found to be attractive but not reliable to assess spittlebugs' population in agroecosystems. Nevertheless, in Auchenorrhyncha sight appears to be essential for orientation and host search. So, studying the response of spittlebugs to specific wavelengths could increase our knowledge of their ethology and highlight wavelength-specific behavior that might help in monitoring and trapping methods. In this work, the visual acuity of two European vectors of *X. fastidiosa*, *P. spumarius* and *Neophilaenus campestris*, was investigated in laboratory trials. Experiments were conducted using a round choice box divided into four isolated sectors. Each sector was equipped with a mini-LED (light-emitting diode) emitting at a specific wavelength: white (3300-5300 K), green (500-570 nm), blue (450-500 nm) and ultraviolet (300-395 nm). Three types of bioassays were conducted: 1) only one of the four sectors of the choice box was illuminated by a white light; 2) three sectors were illuminated by green blue and UV lights, respectively; 3) two sectors were illuminated by green and blue lights, respectively. Results showed the ability of P. spumarius and N. campestris to perceive and discriminate different wavelengths. Behavioral differences were pointed out for both species, either inter- and intra-specifically between males and females. Findings also suggest the importance of UV light, since spittlebugs changed their behavior depending on the presence/absence of UV stimuli. Our results seem to confirm the assumption of trichromatic vision in phytophagous insects and highlight wavelength-specific behaviors. However, further studies are needed to deepen these preliminary observations and clarify whether wavelength-specific behaviors occur in spittlebug adults.

Key words: *Philaenus spumarius*; *Neophilaenus campestris*; behavior; LED; visión.

Assessment of Cold Tolerance in Olive Cultivars (*Olea europaea* L.): Integrating Acclimation Processes through Visual and Fluorometric Analyses

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The olive (*Olea europaea* L.) is an evergreen woody crop with moderate and cultivar-dependent frost tolerance. However, the frost tolerace of olive cultivars has been poorly characterized. Prolonged exposure to sub-zero air temperatures can lead to damage, with acclimation status being crucial for plant hardiness. Factors such as age, health, and tissue condition modulate this tolerance, with olive leaves often more susceptible than shoots. We aimed to assess frost tolerance in 18 olive cultivars by integrating acclimation dynamics through visual and fluorometric analysis. In October 2023, a predefined acclimation protocol was implemented, subjecting 10 one-year-old olive plants per cultivar to six weeks at 8-10ºC. Visual evaluations followed a frost protocol, freezing 20 detached leaves per cultivar at -10 ºC for 30 minutes. Damage incidence (%) and leaf mortality (%) were calculated after 72 hours. Concurrently, the same experiment was conducted using non-acclimated plants in greenhouse conditions (Fig.1). In December 2023, plants were transferred to an olive orchad in the mountains prone to light frost events. On 6thFebruary 2024, chlorophyll fluorescence was measured in-field using PhotosynQ (MultispeQ V2.0) and LICOR LI-600 (LICOR, Lincoln, USA) equipment to detect freezing damage, what allowed the assessment of the differential effect of acclimation on frost tolerance in field conditions (Fig.2). Our current results, along with those of infield-freezing damage incidence and resprouting capacity in spring, will lead to strong insights into the accurate classification of the main olive cultivars to frost tolerance.

Key words: Olive; frost tolerance; acclimation; fluorometry; visual assessment.

Evaluation of the presence of viruses in the Repository of Commercial Olive Variety of the University of Cordoba and Closterovirus in orchards of this crop.

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Olive cultivation is a key agricultural activity in Andalusia, spanning 1.6 million hectares and comprising over 50 cultivars. Many Andalusian and international olive cultivars are preserved ex-situ in the Commercial Olive Variety Repository (RCOV-UCO) of the University of Cordoba. Maintaining virus-free stock in this repository is crucial to protecting the health and productivity of this vital crop. This study aimed to evaluate the presence of ArMV, CRLV, and SRLV viruses in RCOV-UCO by DAS-ELISA and to investigate Closterovirus spp. (specifically, Olive Leaf Yellowing-associated Virus, OLYaV) in commercial olive orchards through RT-PCR, nested PCR, and specific primers.

Our results confirmed that RCOV-UCO olive plants are free of ArMV, CRLV, and SLRSV. In commercial orchards, nested RT-PCR and specific primers initially detected OLYaV in two symptomatic olives, marking the first record of this virus in Spain. However, follow-up molecular analyses conducted in 2019 on previously positive trees yielded negative results, indicating possible temporal variation in viral presence. Additionally, no evidence of OLYaV was found in pollen samples, although further assessments are advised to confirm these findings. Notably, this study reports the first observed co-infection of *Verticillium dahliae* and OLYaV in olives. At the same time, CRLV was associated with severe chlorotic symptoms, reduced tree vigor, and internode shortening in young shoots in two trees. Finally, all molecular analyses for *Xylella fastidiosa* were negative.

Key words: Analysis, culture, DAS-ELISA, detection, nested RT-PCR, protection, symptomatology.

In vitro screening of biological control agents and antimicrobial potential of plant extracts against *Xylella fastidiosa* subsp. pauca

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Xylella fastidiosa is a devastating pathogen that threatens economically significant crops, such as olive trees. Currently, effective control methods for this bacterium remain elusive. In this context, screening for antimicrobial activity using various plant extracts and biological control agents may offer insights into novel plant protection products that could be integrated into control strategies for xylem-colonizing pathogens, such as *Xylella fastidiosa*. Antimicrobial metabolites produced by antagonistic microorganisms play a crucial role in managing plant diseases. While natural antagonists have traditionally been employed for disease control, the use of microbial metabolites offers several advantages over utilizing entire microorganisms. In this study, in vitro disc diffusion and broth dilution assays were performed to evaluate the antimicrobial activity of various plant extracts against *Xylella fastidiosa* subsp. pauca (Xfp). Additionally, the antagonistic activity of various *Bacillus* species was screened using a dual culture assay. Our results demonstrated significant antimicrobial effects of carob extract and different halophytes, such as *Suaeda maritima*. A clear inhibition zone of 5.7 mm was observed for the carob extract. Additionally, *Suaeda* extract effectively reduced *Xp* growth (OD600 = 0.45 after 192 hours), compared to the control (0D600 = 0.54 after 192 hours). Interestingly, the in vitro dual culture test showed that some *Bacillus* isolates inhibited *X. fastidiosa* growth, with a clear inhibition zone of 5.4 mm. Further investigation into the potential of these extracts and antagonistic bacteria to manage *X. fastidiosa* is warranted, as their secreted compounds could lead to the development of a sustainable control strategy.

Key words: Plant extract, antimicrobial activity, biocontrol

Are *Bactrocera oleae* adult traps really useful? Are captures correlated with infestation? Which captures are intervention or alarm thresholds

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In IPM of olive groves, setting traps to monitor adult populations of *Bactrocera oleae* (Rossi), olive fruit fly, either males by pheromones or both sexes by yellow and food attractants, is a practice still widely suggested, sometimes considered mandatory, by the phytosanitary services of many Mediterranean countries, Italy first. Despite this, rarely an intervention or alarm threshold based on adult catches is indicated and, when it occurs, the alarm threshold to start sampling drupes is rather low (1-3 adults/trap).

Thanks to our decades-long investigations on the efficacy of different methods of controlling *B. oleae* infestations, by analysing a large amount of data, we have sought a correlation between the average catches of three pheromone traps and the active infestation detected in the same untreated plot in the same week, and after one and two weeks. The correlation between the captures of males and the infestation levels of the three weeks considered, resulted very low, not allowing the definition of both alarm and intervention threshold.

Consequently, captures of adults of *B. oleae*, a monophagous insect that tends to remain in the olive groves even in unfavorable environmental conditions, suspending its oviposition, are useless in assessing the risk of attack. Therefore, attention should be addressed towards direct monitoring of the levels of infestation in the drupes, preferably with simplified methodologies (sequential sampling, external observation of the drupe) which can certainly provide more reliable and useful data than captures of adults.

Key words: Olive fruit fly, monitoring methodologies, pheromone, yellow and food attractant traps, integrated pest management

Seed-eating insects of wild and cultivated olive trees exclusive to South Africa, harmfulness and identification also from early instar larvae

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Some insects exclusive to South Africa and Eritrea collected on the sub-Saharan and Asian wild olive tree *Olea europaea* subsp. cuspidata develop on seeds: olive seed wasps and a seed olive weevil. Silvestri (1915) saw six Chalcidoidea wasps emerging from the wild olive kernel, attributing the role of seed eater to *Eurytoma oleae*, considering the other five as its parasitoids. In the absence of adequate studies, until a few years ago, *E. oleae* was still considered the only olive seed wasp, while in our recent studies in the Western Cape, *Eupelmus spermophilus* was found to be a spermophagous, the first truly phytophagous *Eupelmus*, and the most frequent seed wasp on both cultivated (99%) and wild olive trees (81%). Its oviposition occurs when the olive stone is still soft; the average infestation recorded on wild olive trees was 18%, while on cultivated olive ones it was 14%, reaching a maximum of 66% on Koroneiki cultivar, which has not a very thick pulp. In a subsequent three years study conducted on cultivated olives, the early fruit drop due to *E. spermophilus* ranged from 0% to 14% (average 4.9%) of the entire production, concluding that in the Western Cape economically significant yield losses occurred sporadically. DNA-based identification of larvae collected inside the olive kernel confirmed that *E. spermophilus* is the most abundant seed wasp, *E. oleae* is a seed wasp rarely present in cultivated olive trees, while *Sycophila aethiopica* and *Eurytoma varicolor* are parasitoids of *E. spermophilus*.

The African olive seed weevil *Anchonocranus oleae*, was recently found in several sites of the Western Cape also on cultivated olive fruit, even where wild olive trees were far from olive crops, suggesting a low but stable presence in cultivated olives in those sites. However, *A. oleae* does not yet represent a problem of significant economic importance.

Key words: olive seed wasps, olive seed weevil, *Eupelmus spermophilus*, *Eurytomidae*, early fruit drop, *Anchonocranus oleae*

The role of rhizobacteria of the genus *Bacillus*in the control of diseases of olive *(Olea europaea).*

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In olive (*Olea europaea*) cultivation, the use of plant growth promoting bacteria (PGPR) has been investigated as a strategy in the context of sustainable agriculture and the reduction of chemical use in the field. The action of these microorganisms is not only focused on growth promotion and resistance to abiotic stress factors, but also on defense against pathogens.

Key words: PGPR, pathogens defense

Evaluation of a qPCR methodology for the detection of *Venturia oleaginea* latent infections

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Olive scab caused by the fungus *Venturia oleaginea* is a widespread disease in olive-growing areas that can cause serious yield losses. In recent years, knowledge about the biology and epidemiology of the pathogen has increased, and various mathematical models have been developed to predict the risks of infection. However, the validation of these models is limited due to variable and long latency periods. The aim of this study was to develop a qPCR-based methodology for the detection of latent infections to improve the knowledge of the disease and validate a previously developed epidemiological model. First, the reaction conditions were optimized, the standard curve was obtained, and the protocol was evaluated in the laboratory using spore suspensions of *V. oleaginea* at different concentrations. A significant correlation was observed between the concentration of spores and the DNA concentration of the fungus. In addition, samples of olive leaves with and without symptoms of olive scab were taken once every two weeks (from March to July 2024) in plots located in Valencia (east Spain) and La Rioja (north Spain). Symptom severity was assessed before and after sodium hydroxide treatment to identify latent infections and sporulation was quantified. Once the leaves were washed DNA of V. oleaginea was extracted and quantified by qPCR. Both sodium hydroxide treatment and qPCR analysis allowed latent infections to be detected in asymptomatic leaf samples, even though higher sensitivity was observed with the qPCR. The methodology can be used to validate prediction models of scab infections in olive trees.

Key words: latent infections; qPCR; olive scab; *Venturia oleaginea*.


11-14 November 2024,
Baeza, Spain
10th Meeting of the IOBC-WPRS "Integrated Protection of Olive Crops"