ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA
DIPARTIMENTO DI
SCIENZE E TECNOLOGIE AGRO-ALIMENTARI

Distal international

Newsletter
n° 2 - 2021

CONTENTS

Previous issues of the newsletter

Seguici su facebook

https://www.facebook.com/distal.unibo

SEGUICI SU YouTube

https://www.youtube.com/c/distalunibo

DISTAL 2018-2022 — DIPARTIMENTO DI ECCELLENZA — MIUR

Dipartimento
di Scienze e Tecnologie Agro-Alimentari
ALMA MATER STUDIORUM
Università di Bologna

DISTAL INTERNATIONAL COMES OF AGE!

Author: Luca Fontanesi

This is the second issue of DISTAL International – the English newsletter of the Department of Agricultural and Food Sciences, which pairs the Italian version. DISTAL is the acronym of the department – the top department of the University of Bologna for number of international and national competitive research grants and industrial research contracts. DISTAL is a multidisciplinary department. It includes more than 160 scientists that work in all the fields of the agri-food sector as well as in several other basic and applied disciplines.

DISTAL scientists are organized in ten main research areas:
1) Agricultural and food economics;
2) Agricultural chemistry, pedology and agricultural genetics;
3) Agricultural engineering;
4) Agronomy and field, vegetable, ornamental crops;
5) Agro-environmental and food microbiology;
6) Animal Sciences;
7) Chemistry, biochemistry and botany;
8) Food science and technology;
9) Fruit tree and woody plant sciences;
10) Plant pathology and entomology.

This issue of DISTAL International opens new windows on the international positioning of our department. Hot topics and effective international collaborations in different research fields are presented in four thematic articles by specialists of the department. The articles are focused on healthy soil and its living, dynamic and complex ecosystems, on the recent identification of the ENHANCED GRAVITROPISM2 (EGT2) gene in barley and its relevance in plant breeding for drought tolerance, on the new frontiers opened by small peptides and double-stranded RNA applied as alternative pesticides and on the usefulness of essential oils, derived from aromatic and ornamental plant species, as novel antimicrobials.

Then, the latest six Horizon 2020 projects granted to scientists of the department are briefly presented. They span topics related to the bioeconomy (BIODEC, COOPID and Transition2BIO), the fork-to-farm avenues to boost biodiversity (BioValue), food consumer science (COMFOCUS) and the authentication of animal-derived products (INTAQ). These projects could potentially inspire new collaborations in Horizon Europe. The aim of this information and communication channel (DISTAL International) is to further expand the research cooperation of the department. If you are interested in our research programs and achievements, please do not hesitate to contact us.

Cooperation and networking are the treasures!

HEALTHY SOILS AS A STARTING POINT FOR A SUSTAINABLE AGRICULTURE

Author: *Livia Vittori Antisari*

Soils are one of our most valuable resources and are **fundamental natural capitals** at the base of all trophic chains. In a view of sustainable agriculture, the occurrence of healthy soils is necessary. In fact, soil is explicitly mentioned in the new growth EU strategy linked to European Green Deal (European Commission, 2019) and it is recognized as directly or indirectly relevant for achieving 9 of the 17 Sustainable Development Goals formulated by the UN for the period 2015-2030 (United Nations, 2015).
In three of the main EU policies (Biodiversity Strategy, Farm to Fork and Climate law), soil health is clearly strategic, and it will benefit from important goals to be reached by 2030 (Montanarella and Panagos, 2021).

Soil health has been defined by Doran and Zeiss (2000) as "*the capacity of a soil to function as a vital living system within ecosystem and land use boundaries to sustain plant and animal production, maintain or enhance water and air quality, and promote plant and animal health*." Therefore, a healthy soil is a **living, dynamic and complex ecosystem**, teeming with microscopic and larger organisms that perform many vital functions, including converting dead and decaying matter in both complex humic substances for soil resilience, providing elements for plant nutrition (nutrient cycling), improving soil structure with positive effects for soil water and nutrient holding capacity, and ultimately improving crop production.

Furthermore, healthy soil is involved in the control of plant disease, insect and weed pests. A healthy soil also contributes to mitigate climate change by maintaining or increasing its carbon content. According to the abovementioned features, healthy soil allows to reduce fertilizers, water, pesticides, and energy consumption in agricultural lands which is the base for a **sustainable agriculture**.
The central soil property that influences soil health is organic matter. The organic matter component of the soil system is only a small fraction of soil but is essential for the soil physical, biological, and chemical functions and, in general, soil ecosystem services.
Soil organic matter is a commonly recognized **indicator of soil health**, responding to change through the implementation of sustainable management and enable the resilience of life on Earth (FAO-ITPS, 2020).
Several projects (SaveSOC2, Castani-CO, Fruttifi-CO, SUOBO , Castagni Parlanti, BosChiAMo, Agri-forestER) that involved the group of Pedology of DISTAL (*Livia Vittori Antisari*, *Mauro De Feudis*, *Gloria Falsone*, *Marcello Di Bonito*) have demonstrated how the soil management affects organic matter and soil functionality, and how soil makes agro-ecosystems more climate-resilient and sustainable in view of the new growth EU strategy.

UNDERSTANDING THE GENETIC CONTROL OF ROOT RESPONSE TO GRAVITY FOR DEVELOPING MORE STRESS-RESILIENT CROPS

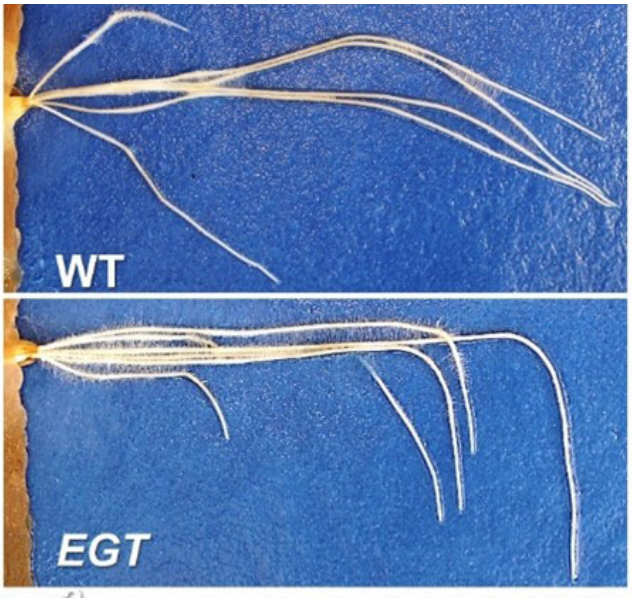
Author: Silvio Salvi

Future crop cultivars should be characterized by improved **resilience to climate-change effect**s (e.g.: higher tolerance to water stress) and adaptation to low-input, highly sustainable cropping systems (e.g.: greater absorption- and use-efficiency of fertilizers). Optimizing **root system architecture** is recognized as one of the strategies that breeders should adopt to genetically improve cultivars.

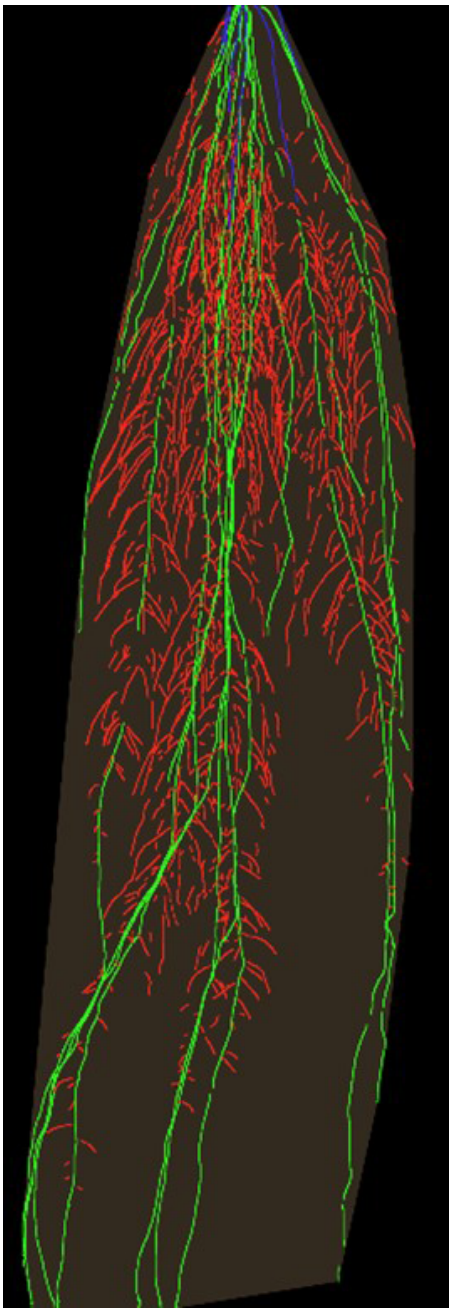
In the framework of the **project ROOTY** "*A root ideotype toolbox to support improved wheat yields*" funded by the IWYP Consortium, and in collaboration with the University of Bonn, our research group of Agricultural Genetics (Serena Rosignoli, Roberto Tuberosa, Cristian Forestan, and me) cloned a key regulator gene for the gravity response of the root. This gene has been called **ENHANCED GRAVITROPISM2** (**EGT2**). The protein encoded by EGT2 participates in **controlling the direction of growth of the root with respect to gravity**.

The presence of mutations in the EGT2 gene leads to an enhanced and faster gravitropic response, and thus to a very narrow (or steep) root growth angle. In this study, we identified this gene for the first time in plants and showed that it performs the same function in barley and wheat.

The use of this gene in breeding programs will potentially allow the controlled modification of the root growth angle in the newly released improved cultivars. For instance, a narrower root angle should result in a greater depth of the root system in the soil, resulting in a better **ability to draw water from deeper soil layers** and thus higher **drought tolerance**.



Gravity response test of root growth in barley wild type (WT) and *EGT2* mutant. After 5 d from germination and vertical growth on blue filter paper, seedlings growth plane was turned 90°. The photo was taken 48 h after changing the growth plane. *EGT2* seedling re-aligned its root growth to the gravity vector much faster than WT.



Additionally, less competition between plants for mineral nutritional resources is expected.

These aspects are now being tested in further studies where the mutated form (allele) of this gene is being transferred into elite cultivars which will be agronomically evaluated in multiple field sites. The study (Kirshner et al. 2021) has been recently published in the Proceedings of the National Academy of Sciences, U.S.A (PNAS).

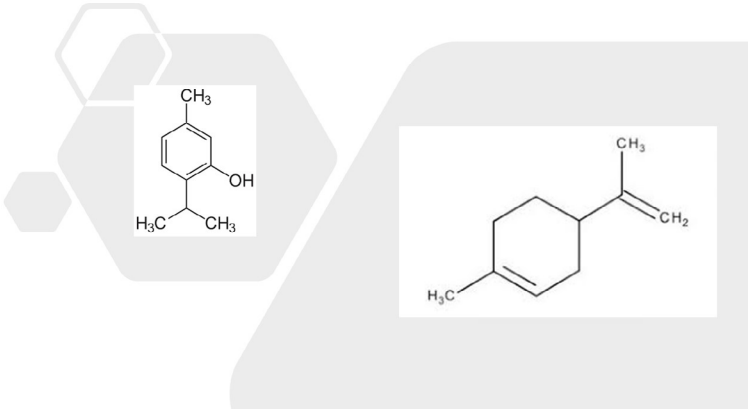
[segue a p. 5]

ESSENTIAL OILS FROM MONARDA spp. AS ANTIMICROBIALS

Authors: *Maria Grazia Bellardi* & *Paola Mattarelli*

Everything on our planet is subject to microbial attacks: living (humans, animals, plants, etc.) and non-living organisms (architectural works, public buildings, artworks).
Because of the pressing need for new therapies to treat the bacteria and fungi infections, scientists have directed their studies toward the discovery of natural substances with greater efficacy and lower toxicity, in particular **Essential Oils**.
Essential oils are complex mixtures of volatile compounds, produced naturally in different plant organs during secondary metabolism. Essential oils have great potential as antimicrobial agents due to the presence of various aldehydes, phenolic compounds and terpenes that are active towards a wide range of pathogens. Since 2012, several Italian research projects have been carrying out to better know the antimicrobial activity of essential oils of two aromatic and ornamental species belonging to Monarda genus (Lamiaceae family): *Monarda didyma* and *Monarda fistulosa.*

To investigate their biological properties, the two species were grown for consecutive years in Imola (Bologna) for essential oils distillation, composition analysis, and antimicrobial activity.
*A*ntimicrobial activity was tested on pathogenic and non-pathogenic strains of fungi and bacteria such as *Erwinia amylovora*, *Pseudomonas syringae* pv. *actinidiae*, *Staphylococcus aureus*, *Enterococcus faecalis* and *Escherichia coli.*
Major essential oil compounds varied from 11 for *Monarda fistulosa* to 12 for *Monarda didyma*.
As a general results, a certain increase of thymol, the main component, can be obtained from the second year of cultivation with yield in *Monarda didyma* twice as high as in *Monarda fistulosa*. Limonene was only detected in *Monarda didyma.* Human, animal, and phytopathogenic microorganisms were more sensitive to the antimicrobial properties than the non-pathogenic ones.
From the microbiological viewpoint, the study demonstrates that the essential oils from *Monarda didyma* and *Monarda fistulosa*, despite compositional differences, share a good potential as antimicrobial agents to be used in the development of biofungicides and biobactericides.
Thymol is the most important compound, but not the only one. In fact, the overall antimicrobial activity of essential oils cannot be associated with a single component.



RNA AND PEPTIDES AS ALTERNATIVE PESTICIDES: PERSPECTIVES AND GAPS ON THE WAY FROM THE LAB TO THE FIELD

Author: *Elena Baraldi*

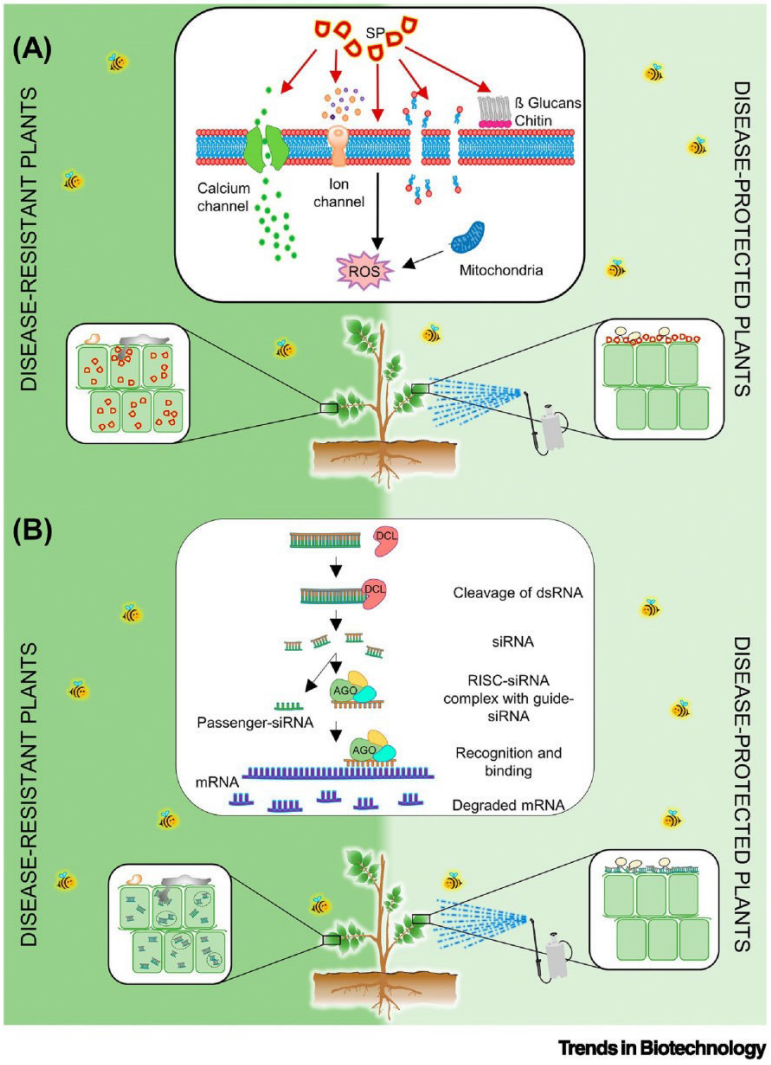
Modern intensive agriculture requires the use of large quantities of pesticides to ensure high yields, but their use causes environmental pollution and toxicity for both humans and animals (for example bees). Small organic molecules (small peptides and double-stranded RNA) can represent a valid alternative to the use of fungicides conventionally used in agriculture.

In recent years, small peptides and double-strand RNAs have emerged as promising alternatives to conventional fungicides due to their specificity for the target organism (the fungus), short persistence in the environment and ability to act at low concentrations, favoring the transition to a more sustainable agri-food system and greater safety for farmers and consumers.

Small molecules based on dsRNA or small peptides are good candidates to substitute contentious pesticides in the near future, in line with the Green Deal policy. However some gaps need to be filled first, such as risk assessment, consumer acceptance and specific regulation from Eu policy agencies.

In a recent study that was published in Trends in Biotechnology with the title "***Game-changing alternatives to conventional fungicides: small RNAs and short peptides***" a broad overview of the molecules recently identified by different research groups around the world, their antimicrobial properties, their mechanisms of action and the strategies used for their identification are reported.

The study describes further experimental phases to be carried out before their commercialization and the possible strategies to be adopted for their use in the field.



The work was conducted by the research groups of the botanist Simona Masiero, the geneticist Paolo Pesaresi, both of the Department of Biosciences of the University of Milan (Italy), Bruno Mezzetti of the Polytechnic University of Marche (Italy), Vincent Bulone of the University of Adelaide (Australia), the KTH Royal Institute of Technology (Sweden), and by me, pathologist at the Department of Agricultural and Food Sciences of the University of Bologna (Italy).

Horizon 2020
European Union Funding
for Research & Innovation

H2020 PROJECTS FINANCED IN 2021

BIOBEC (2021-2024) ***Preparing the creation of Bio-Based Education Centres to meet industry needs and boost the contribution of the bioeconomy to societal challenges***
Coordinated by the University of Bologna (Davide Viaggi)

Unlocking the full potential of the bioeconomy and its value chains requires a systematic and collaborative perspective for the development of new skills, educational approaches, and organizational solutions to provide education and training services. The aim of **BIOBEC** project is to develop a holistic framework for multi-level Bio-Based Education Centres (BBEC) flexible enough to answer the present and future needs of the industry and of the surrounding ecosystem at local, regional, national and/or international levels. The project will design 6 BBEC pilots assuring a wide geographical coverage in Europe and addressing different topics linked to the variety of value chains and institutional contexts (vocational to university level, primary producers, processors, SMEs to MNCs). BIObec will clarify the needs of the different regional ecosystems and will provide detailed design, economic and financial assessment, governance plans for the educational training centres, as well as plans for life-long-learning programmes. It will also develop collaborative tools to maximize the synergies between them at the European and international level. The project will mobilise a network of 19 partners, which are leaders in Bioeconomy Education from different perspectives (ranging from academia to industry) together with a wide network of Implementation and Replication Working Groups and local stakeholders based in the EU. This network will pave the way for implementation and replication of the BBEC, to boost the contribution of the education sector for the development of the bioeconomy.

BIOVALUE (2021-2025) ***Fork-to-farm agent-based simulation tool augmenting BIOdiversity in the agri-food VALUE chain***
Coordinated by the ARISTOTLE UNIVERSITY OF THESSALONIKI (Aristotelio P. Thessalonikis)
Partner: University of Bologna (Giulio Malorgio)

The approach of **BIOVALUE** project is to set-up a holistic perspective, under the "multi-actor" approach, to analyze the link between biodiversity, the agro-food value chain agents, the environment, consumer food preferences and health. By employing a bottom-up vertical approach to develop the BIOVALUE TOOL, a dynamic and customizable agri-food value chain vis-a-vis biodiversity analysis tool, the proposal tries to introduce, model, evaluate, breed, produce and spread specifically selected genetically diverse underutilized crops (cereals, legumes, leafy and fruity vegetables) and develop final marketable, certified and labelled culinary products incorporating them (dish recipes and processed foodstuff), that enhance agro-biodiversity to the applied agro-ecosystems and appeal to the consumers, securing their future market performance and concurrently, their cultivation viability. Moreover, in a modelled user-friendly ready-to-work framework, the project will produce a set of key performance indicators destined to measure policy quality and impact, environmental evolution, and compliance with regulations of introducing underutilized, genetically diverse crops to the value chain and are by design expandable to further enhance biodiversity in the value chain. Ultimately, this expanding nature, is highlighted by the complimentary effects of BIOVALUE processed and unprocessed final food products and dishes such as low energy consumption, environmental cultivation resiliency to marginal landscapes and future climate, as well as nutritional and health benefits. Incorporating the market power in the whole approach, the proposal can lead towards self-supported sustainability of biodiversity in the future.

COOPID (2021-2023) ***CooPeration of bioeconomy clusters for biobased knowledge transfer via Innovative Dissemination techniques in the primary production***
Coordinated by SPANISH CO-OPS - Cooperativas agro-alimentarias de espana u de coop sociedad cooperative (Juan Sagarna)
Partner: University of Bologna (Davide Viaggi)

Bioeconomy starts on the fields, yet meaningful participation of the primary sector in the bioeconomy is currently challenged, especially due to (i) poor cooperation and knowledge transfer between relevant stakeholders, (ii) limited support to invest in R&D of new value chains. To answer this challenge, **COOPID** project proposes an effective strategy to mobilize primary producers and stimulate the uptake of inclusive and sustainable bio-based business models in the European primary production sector, considering regional & sectorial conditions. To do so, a network of COOPID Bioeconomy Clusters from 10 European countries has been created ad-hoc, involving a range of stakeholders: (a) primary producers, in cooperatives or associations, within agriculture, forestry & aquaculture, (b) industry, (c) public sector, (d) research & academia.

COMFOCUS (2021-2026) ***Communities on Food Consumer Science***
Coordinated by Stichting Wageningen Research (Netherlands) (Hans van Trijp)
Partner: University of Bologna (Mario Mazzocchi)
Co-partnership UniBO: Department of Agricultural and Food Sciences (Matteo Vittuari)

COMFOCUS brings together, integrates on European scale, and opens key national and regional research infrastructures in the inherently interdisciplinary field of food consumer science to all European researchers, from both academia and industry, ensuring their optimal use and joint development. Its mission is to advance the food consumer science community beyond its current level of fragmentation that is preventing it from being the data-rich science area contributing to the societal problem of (un-)healthy food choices. As a library of meta data and digital service tools, the COMFOCUS Knowledge platform is developed as an easily accessible focal point for all European researchers to make this happen within the principles of FAIR and Responsible Research & Innovation (RRI) data use. COMFOCUS achieves this through a coordinated set of activities on networking, joint research, and transnational and virtual access to key research infrastructures. Networking activities foster the culture of co-operation between 10 key research infrastructures, and beyond in interaction with academic and industry research users and technology developers. Joint research activities develop the harmonization protocols for measurement and research procedures both in conventional self-reported data and more objective emerging food consumer science methodologies. The transnational and virtual access activities ensure that researchers from outside the consortium are supervised to become experienced with this new way of working, while also contributing to the data infrastructure from which the COMFOCUS Knowledge platform can further grow into the future. Promotion of transnational and virtual access and dissemination of COMFOCUS outcomes and innovations for maximum impact will be supported by a Stakeholder Forum from relevant bodies such as consumer organizations, food industry, retail, NGOs, and policy makers at national and EU levels.

INTAQT (2021-2026) ***INnovative Tools for Assessment and Authentication of chicken meat, beef, and dairy products' QualiTies***
Coordinated by INRAE - Institut National De Recherche Pour L'Agriculture, L'Alimentation et L'Environnement (Bruno Martin)
Partner: University of Bologna (Massimiliano Petracci)

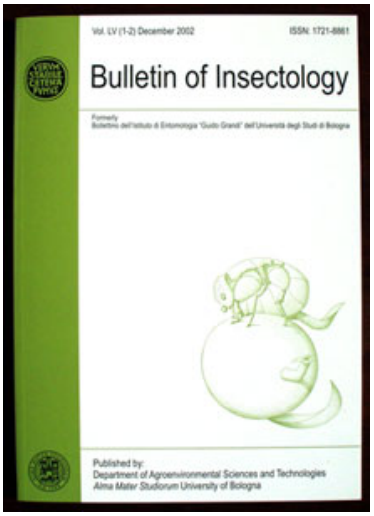
INTAQT project will perform an in-depth multi-criteria assessment of the relationship between husbandry systems and intrinsic quality traits of animal-sourced products. Researchers will develop quality assessment and authentication tools that provide science-based decision support for policy makers, industries, farmers, and consumers, in addition to improving husbandry practices. The initiative will focus on unprocessed and processed ready-to-eat chicken meat, beef and dairy products stemming from husbandry systems of different European countries. INTAQT will involve all actors of the agri-food chains, from farmers to consumers, scientists, certification bodies, policy makers and citizens to achieve consistent and verifiable high-quality animal-based products from both extensive and intensive husbandry systems.

Transition2BIO (2021-2022) *Support the TRANSITION towards the BIOeconomy for a more sustainable future through communication, education, and public engagement*
Coordinated by APRE - Agenzia per la Promozione della Ricerca in Europa (Chiara Pocaterra)
Partner: University of Bologna (Davide Viaggi)

Transition2BIO will built upon the most relevant communication and education EU funded projects and initiatives to contribute to the implementation of the updated 2018 EU Bioeconomy Strategy and promote the transition towards a more sustainable production, consumption, and lifestyle by implementing an integrated package of activities ad-dressing a wide range of target stakeholders, namely: DEMAND SIDE; SUPPLY SIDE; MULTIPLIERS and SUPPORTIVE ENVIRONMENT. The project will: • Valorize and exploit sectoral communication tools and activities developed at national, regional and local level by EU funded bioeconomy projects and other relevant initiatives • Raise awareness on bioeconomy at large and the related environmental and socio-economic impacts for Europe-an citizens through communication activities • Contribute to the transition towards a more sustainable production, consumption and lifestyles through engagement and education activities • Contribute to the deployment of the regional bioeconomy strategies by providing Member States and Regions with methodologies, mentoring, capacity building, tools and materials to raise awareness and communicate bioeconomy (contributing to action 2.3 of updated EU Bioeconomy Strategy) • Facilitate the identification of the educational and training needs towards the creation of an innovation ecosystem for bioeconomy (contributing to action 2.4 of updated EU Bioeconomy Strategy) • Strengthen the European Bioeconomy Network to maximize the collaboration among and impacts of EU-funded projects in bioeconomy (contributing to action 2.3 of updated EU Bioeconomy Strategy).

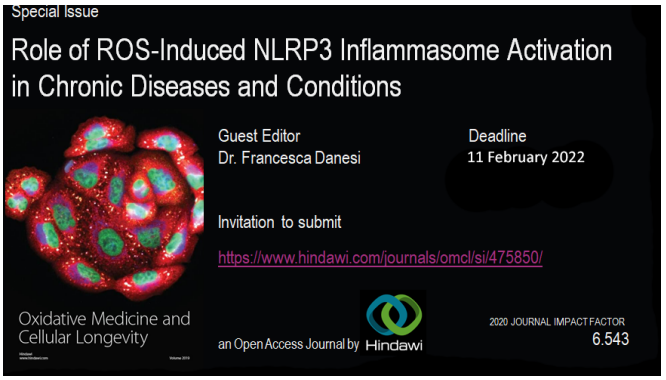
Transition2BIO is promoted by the founders of the European Bioeconomy Network, an alliance of 57 projects and initiatives promoting Bioeconomy. The project partners are involved in the most relevant communication and education EU funded projects (BIOVOICES, BLOOM, SHERPA, BE-Rural, Biobridges, LIFT, NEXTFOOD, BoostEdu, etc) and initiatives like the European Bioeconomy University.

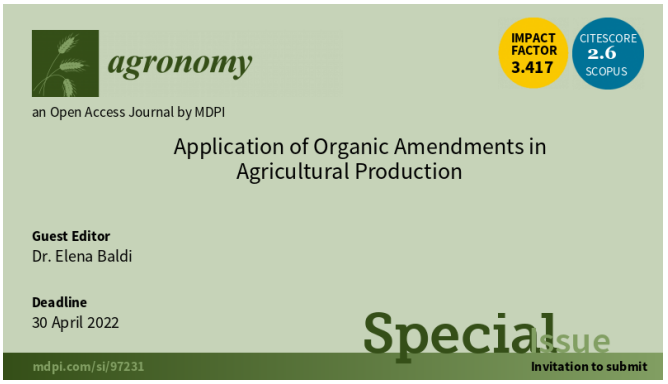
EDITORIAL ACTIVITIES



Bulletin of Insectology is an open access international scientific journal that publishes original articles mainly on morphology, biology, behaviour and physiology of insects and other arthropods, on control of insects, mites and other arthropod pests with particular reference to biocontrol and integrated pest management.
ISSN: 1721-8861 (Print)
ISSN: 2283-0332 (Online)
2020 Impact Factor: 1.711 / 5-Year Impact Factor: 1.756 / ISI Journal Citation Reports© Ranking 2020: Q2 - 45/102 (Entomology)
2020 CiteScore™: 2.4 / CiteScore Rank 2020: 54/153 (Insect Science) / SCImago Journal Rank 0.559
Bulletin of Insectology is linked to ISPI on-line abstract services
Managing Director: **Stefano Maini**

EQA – International Journal of Environmental Quality is an international, multidisciplinary, and peer-reviewed journal that encourages high-quality submissions of original research or brief reviews and analyses dealing with the aspects concerning soil, water and air quality and the sustainable use of these environmental resources.
Policy analyses, regional reports, conference reports and book reviews on the above-mentioned topic are also welcome.
Editors-in-Chief
G. Corti, C. Dazzi, G. Falsone, V. Radim, G. Vianello. L. Vittori Antisari, D.C. Weindorf





Publications

This newsletter and any file transmitted with it may contain material that is confidential, privileged and/or attorney work product for the sole use of the intended recipient. If you are not the intended recipient of this e-mail, please do not read it, notify us immediately by e-mail or by telephone and then delete this message and any file attached from your system. You should not copy or use it for any purpose, disclose the contents of the same to any other person or forward it without express permission. Considering the means of transmission, we do not undertake any liability with respect to the secrecy and confidentiality of the information contained in this e-mail and its attachments.

If you no longer wish to receive newsletters, please mail to distal.comunicazione@unibo.it.