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THE NEWSLETTER

EXCALIBUR

The official newsletter of Excalibur Project

IN THIS ISSUE

EXCALIBUR PROJECT PLANS TO ENHANCE THE KNOWLEDGE ON SOIL BIODIVERSITY DYNAMICS AND ITS SYNERGISTIC EFFECTS WITH PREBIOTIC AND PROBIOTIC APPROACHES IN HORTICULTURE. THE PROJECT IS RUN BY 16 PARTNERS FROM 11 EUROPEAN COUNTRIES.

Excalibur General Assembly 1 - 3 September 2021, hybrid

The second General Assembly of the Excalibur Partners took place at the beginning of September. The 3-day meeting was organised in a hybrid mode which included a face-to-face meeting in Munich, Germany while some of the partners dailed in remotely. Everyone was very excited to get together after almost two years.

Excalibur Round Table on “Perspectives of multifunctional microbial-based products in agriculture”

One of the most important activities during the General Assembly was the ***Round Table entitled “Perspectives of multifunctional microbial-based products in agriculture”***, moderated by Prof. Eligio Malusà. About 60 relevant external stakeholders and advisors joined the event, including Dr. Jeremy Pinte as a representative of the European DG-GROW and DG-SANTE and Dr. Manuele Ricci as a representative of the European European Biostimulants Industry Council (EBIC) as invited speakers.
The main topic started from the assumption that the current EU legislative framework on fertilizers, the “Fertilising Products Regulation (FPR)” (EU Reg. n.1009/2019) is not exhaustive in terms of allowed groups of microorganisms, having only four included in the regulation list (Azotobacter spp., Mycorrhizal fungi, Rhizobium spp. and Azospirillum spp.). The main topics of the debate focused on:

- How can new organisms be added to the FPR list?
- The “multiple-use” concept for microbial biostimulants

FPR includes the legal provisions to extend the list of microorganisms (“positive list”) allowed as biofertilizers and EBIC proposed a possible procedure to do that, including the human and environmental safety evaluation. If a company wants to place a new product on the EU market, it is its own responsibility to demonstrate that the product is safe, in accordance with the criteria provided by the FPR. Regarding microbial multifunctionality, it is not possible to put on the market a biostimulant as EC fertilizer product with both fertilizer and PPP functions. However, in case a biostimulant shows both functions, there are 2 ways to reach the market: i) Register the product as PPP; ii) Register the product for the national market, according to national regulations.

In this framework, the Excalibur project can provide technical support to the EC by raising issues, developing tools or testing products in the field, in order *to better achieve the targets established by the Green Deal and Farm to Fork strategies*.

Excalibur in the spotlight!

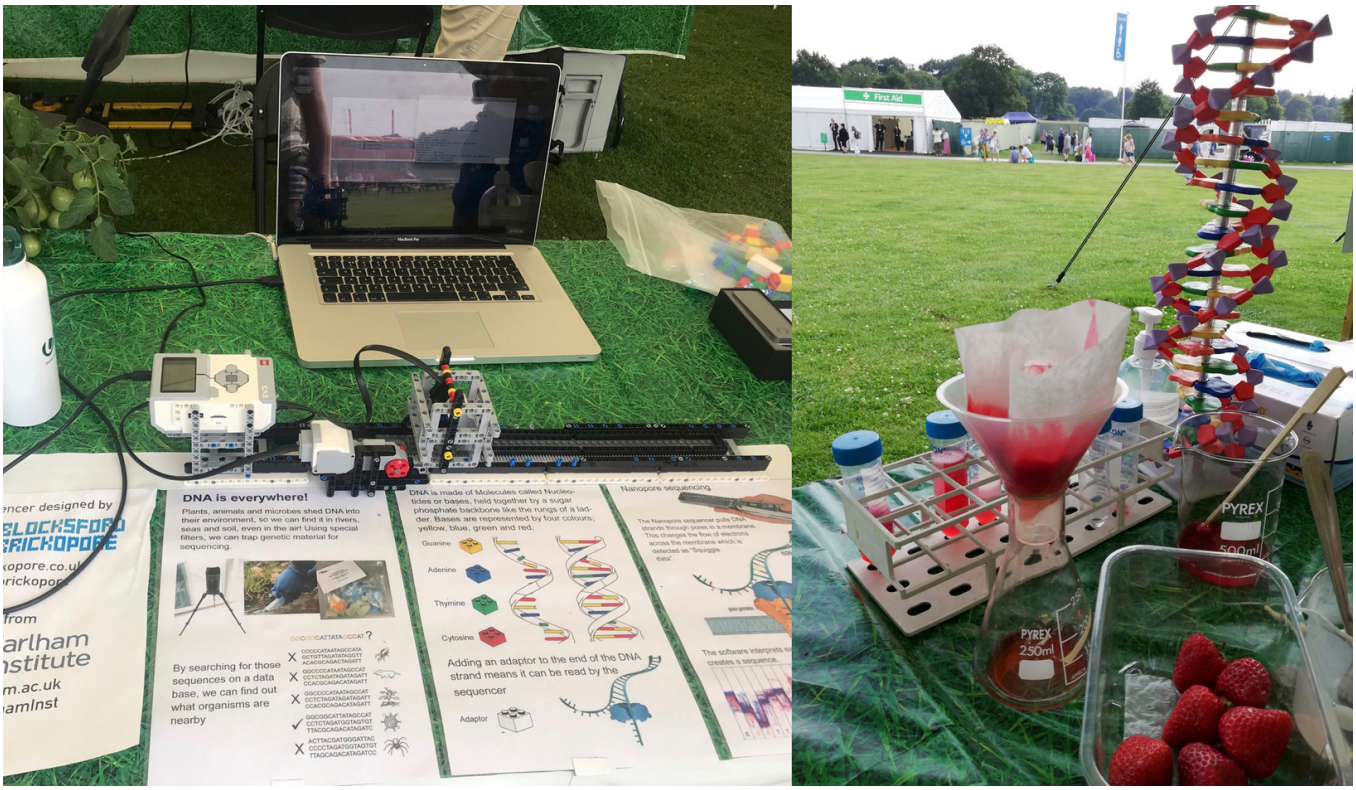
Excalibur at RHS Flower Show Tatton Park

The RHS Flower Show Tatton Park is held every summer at Tatton Park in Cheshire, United Kingdom by the Royal Horticultural Society. It has been running since 1999 and attracts 80,000 visitors on the 28 acres show grounds over 5 days. The show houses the RHS National Flower Bed Competition, Young Designer of the Year Award and a wide range of inspirational show gardens, marquees displaying prize plants and flora exhibits. Another key feature of the show is the Greenfields zones that is dedicated to activities for families and children.

This year, the National History Museum and NIAB-EMR represented the Excalibur with a stand called “The Soil is Alive” in July 2021. The Excalibur team had fungi and soil invertebrates on display and visitors were able to have a closer look at these organisms under microscope.

DNA extractions from fresh strawberries were carried out using a simple protocol based on salt and dish washing liquid. Visitors were also able to see demonstrations of DNA sequencing using Lego DNA strands and Blocksford Brickopore sequencer. The Brickopore mimics a Nanopore sequencer and allows to do a real-time NCBI database of the sequences. The Excalibur had an amazing week talking with hundreds of visitors and share our enthusiasm for soil biodiversity and horticulture.

Picture 1: Excalibur team carried out a range of science outreach activities at the stand at RHS Flower Show Tatton Park.



Picture 2: Visitors were able to see demonstrations of DNA extractions from strawberries and Lego DNA using the Blocksford Brickopore sequencer.

Picture 3: Excalibur team at the RHS display closing the exciting week

Excalibur in the spotlight!

Excalibur at “Landesgartenschau Überlingen 2021”

The "Landesgartenschau Überlingen 2021" or the State Horticultural Show in Überlingen is a "summer-long garden party" that takes place between May and October at the shore of Lake Constance in Germany.
Excalibur was presented by the partner **Kompetenzzentrum Obstbau Bodensee** (KOB) who enjoyed the ability to finally meet people in person and tell them more about Excalibur.

The use of beneficial soil fungi in field production of strawberries

by Aleks Bordon, Nika Cvelbar Weber, Jaka Razinger, Agricultural Institute of Slovenia

At the beginning of the Excalibur project, the Agricultural Institute of Slovenia (KIS) has selected and characterized two fields to further establish the field experiments on strawberry. One field is under organic production and the other one under integrated production. The aim of the research is to monitor the influence of different beneficial soil fungi that had been selected and tested within EXCALIBUR under strawberry field production conditions. In 2020 both fields were sown with buckwheat in order to be prepared. In summer 2021, the field trial was established by first cultivating the soil and then making four ridges along each field. Once the ridges were made, they were covered with black foil and an irrigation tube was placed under the foil. The foil had pre-prepared holes for planting strawberries in which the selected fungal treatments were applied. The negative control planting holes were left untreated. At the end of July ’21 a total of 2000 plants were planted. Soil characteristics and plants growth, yield and responses to the inoculated microorganisms will be monitored during the next two production seasons.

Picture 1: Prepared ridges waiting for the plants

A few days after planting, 32 NIR-LitterBags, produced by CCS Aosta Company, were buried in the soil next to treated plants. LitterBags are small polyethylene bags containing ground mountain hay. They are used as a simple tool able to give an indication of the biological activity of the soil, i.e., the (microbial) biodegradation capacity.

The soil was treated with three different fungi: Metarhizium brunneum, Clonostachys rosea and a consortium of arbuscular mycorrhizal fungi (AMF). M. brunneum is an entomopathogenic fungus, which means that it parasitizes various insects. Observing its effect on the plants themselves as well as insect pests and beneficials aboveground is of great interrest. C. rosea is a mycoparasitic fungus, meaning it parasitizes other fungi; as such it has the potential to protect plants from phytopathogenic fungi. Mycoparasitic fungi usually parasitize other fungi by secreting various enzymes to degrade their cell walls or antibiotics which inhibit the cell growth. The mycorrhizal product AMF Asteria® is a biofertilizer. It is known that AMF contribute to better plant nutrition, better growth, increased flowering and yield, resistance to drought and root diseases, reduced water and nutrient consumption, and also reduced plant mortality.

Picture 2: LitterBag just got buried 15cm deep

Picture 3: Arbuscular mycorrhizal fungi in action on a fine root

After 60 days, in September, the Litterbags that were buried after planting, were excavated. The samples were dried overnight at 40 °C in the dark and then sent for further analysis.

Picture 4: Excavation of the LitterBag number 6378

Strawberry roots were also sampled in September, in order to assess the success of mycorrhizal colonization by the AMF from the product Asteria, in comparison to naturally occurring mycorrhizal fungi present in the field soil. An iron corer to dig a small hole right next to the plant was used. In this way, a direct access to the roots was granted and soil samples were collected along with the roots. Later, the soil was separated from the roots. The samples were sent for further analysis in falcon tubes.

Picture 5: Only two months old strawberry roots, hopefully full of mycorrhizae fungi

...So, the field experiments are well on their way, and we can't wait for first results in 2022!

Microbiome modulation and management for sustainable agriculture

by Peter Kusstatscher & Gabriele Berg - Graz University of Technology

Excalibur's goal is to promote the use of microbial inocula in agriculture, which interact with the indigenous community, and activate the soils hidden functional potential. This is not only beneficial for soil and plant health but eventually also planetary health. Probiotics, which have a similar concept for the gut microbiome, are well established in human medicine, however, in agriculture, we still rely on extensive application of synthetic chemicals. Numerous studies have shown that plant diseases are often caused by an imbalance of the microbial community (dysbiosis). This imbalance can lead to the prevalence of plant pathogens already present in the community or in the environment. With synthetic agrochemicals we are managing those plant pathogens but simultaneously disrupt the indigenous microbial community.

Traditionally, bioinocula are selected due to their plant beneficial traits or activity against plant pathogens. These are e.g. the release of plant growth hormones, defense against plant pathogens by released enzymes or compounds as well as competition for nutrients. Their effect on the indigenous microbiome was so far often neglected. We at Excalibur believe that this, however, is one of their key features and recently proposed it as a new mode of action (Berg et al., 2021). While agrochemicals disrupt the indigenous communities, bioinocula induce shifts in the community to stabilize it and make it more resistant for future pathogen attacks.

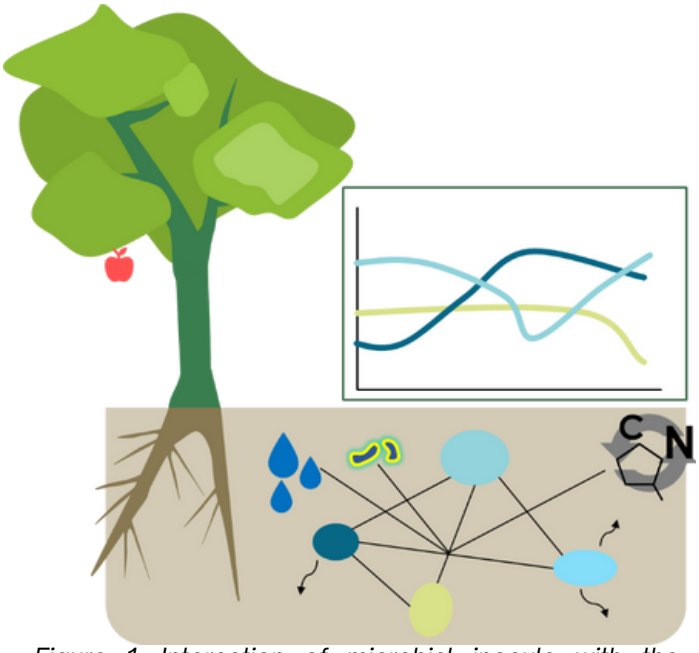


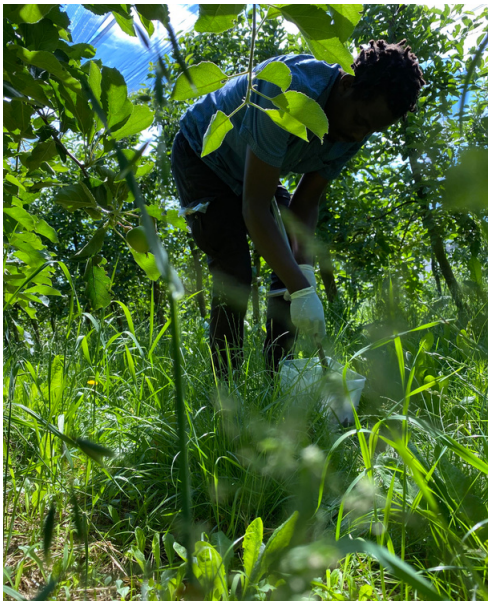
Figure 1: Interaction of microbial inocula with the indigenous microbial community to activate and enhance the tremendous functional potential in soil. In Excalibur these interactions are tracked over time.

Technical University Graz will, together with the partners in Italy and UK, track the changes in the microbial community over time, following different treatments in the field. By comparing with an untreated control, we identify the changes induced by our microbial products and exclude changes due to climatic or seasonal shifts. This will give us indications of shifts and beneficial effects the applied inocula induce in soil (Fig. 1).

Integrating data of the plant's health, yield as well as meso- and macrofauna, we further try to identify key microbial targets for increased plant performance and soil health.

Management of the indigenous microbial community using the newly developed products could not only lead to increased yield on the fields but also to a more balanced and healthy soil micro- meso- and macro-community. Moreover, a rich and stable community could decrease the need for fertilizer and agrochemical inputs. Overall, tools for a targeted microbiome alteration will play a key role for more sustainable management practices.

Berg, G., Kusstatscher, P., Abdelfattah, A., Cernava, T., & Smalla, K. (2021). Microbiome Modulation—Toward a Better Understanding of Plant Microbiome Response to Microbial Inoculants. Frontiers in Microbiology, 12, 803. For further information, you can read the following article.

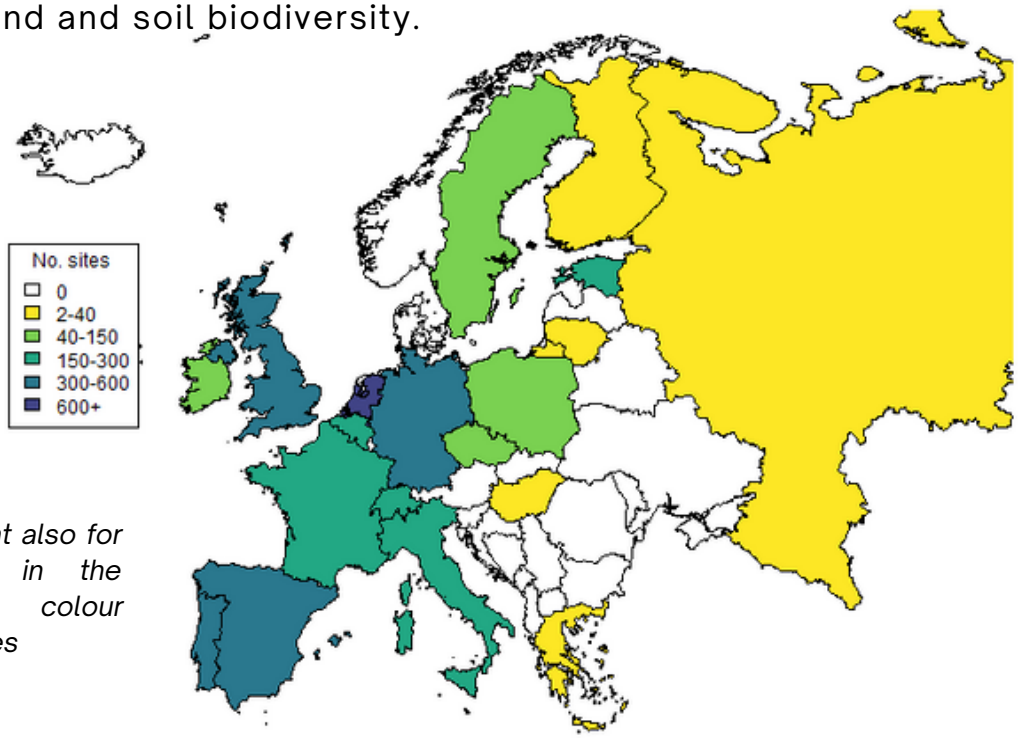


Statistical modelling of soil biodiversity in horticulture agriculture: call for data!

by Victoria Burton, National History Museum London

In Task 5.5 of Excalibur, the team of National History Museum (NHM) is synthesising data from previous studies of soil biodiversity in horticultural systems. This will be used to develop statistical models to estimate and predict how land management and bioinoculants affect biodiversity in agricultural systems, which will be tested with data from Excalibur field trials. Models will also go towards the development of a Decision Support System (DSS) for biodiversity-driven soil management. And NHM colleagues are looking for suitable data!

This component of Excalibur is based on the NHM's expertise from the PREDICTS database - a global compilation of biodiversity data from assemblages in different land uses (Hudson et al. 2016). The PREDICTS database comprises 552 data sources from 98 countries, comprising 3,857,790 samples and 52,195 taxa and is freely available for other researchers to use. Data has been collected through many sub-projects and used to investigate a variety of topics on how human activities, such as land use, affect local biodiversity. Questions have included how human pressures affect islands and mainland differently, the effects on land use on bees, the impact of biofuels on biodiversity, and how responses to land use differ between above-ground and soil biodiversity.



European countries relevant also for EXCALIBUR, with sites in the PREDICTS database, colour indicates the number of sites

To make the database more suitable for the DSS, more data from horticultural sites is needed! A “call” for collaboration is launched: **Do you have, or have colleagues with data they are willing to share?** This is an opportunity for you to benefit from the work performed in Excalibur! All contributions will be acknowledged appropriately and contributors will be offered co-authorship of the database.

STUDY CRITERIA:

=> BIODIVERSITY SAMPLES AT MULTIPLE SITES (NOT ALL NEED BE CROP SITES) WITH AT LEAST TWO LAND USES OR MANAGEMENT SYSTEMS.

=> AT LEAST ONE HORTICULTURAL CROP.

=> ANY TAXONOMIC GROUP(S), ANY PLACE, ANY TIME.

=> ANY SAMPLING METHOD, SO LONG AS IT WAS THE SAME FOR ALL SITES.

=> OPTIONAL: ANY DATA ON MANAGEMENT, E.G., CROP, CROPPING SYSTEM, FIELD SIZE, IRRIGATION, FERTILIZATION, YEARS UNDER THIS CROP, BIOEFFECTORS, BIOINOCULA.

=> OPTIONAL: ANY DATA ON ENVIRONMENTAL PROPERTIES: E.G., SOIL MOISTURE, TEXTURE, NUTRIENT CONTENT, PH

If you have data which meet the above criteria that you are willing to share, or wish to discuss further, please contact Dr. Victoria Burton at: v.burton@nhm.ac.uk.

Reference

Hudson, L. N. et al. (2016) The database of the PREDICTS (Projecting Responses of Ecological Diversity In Changing Terrestrial Systems) project. Ecol. Evol. 7, 145–188.

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