KEYNOTE PRESENTATIONS

THE STATUS AND PROSPECTS FOR BIOTECHNOLOGICAL APPROACHES TO ATTAINING SUSTAINABLE DISEASE RESISTANCE

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The combination of predicted world population growth to 7 billion people in 20 years, and the results of increased economic growth resulting in a higher proportion of affluent meat-eaters in the population place increased challenges on the biosphere. These are already apparent in terms of reduced biodiversity and the continued existence of pristine environments.

A major constraint for food production is plant disease, so, if we can "solve" specific disease problems, we can feed more people with fewer resources, and, if the will is there, reduce the increased pressure on the environment. The challenge is obvious today in the way in which the fragmentation of habitat in intense agricultural systems, such as those common in North West Europe, have had major and well-documented impacts on, *e.g.*, butterfly and bird populations.

In my talk, I will describe the biological challenges posed by taxonomically diverse pathogens, pathogen lifestyles (*e.g.*, biotrophy versus necrotrophy) and challenges posed by abiotic stress. I will give an overview of promising strategies which may lead to durable resistance against specific important diseases. I will also impinge on the societal and market constraints, which are acting against the implementation of transgenic strategies for specific crops and especially in large parts of Europe, where we, so far, have the luxury of being able to choose alternatives. Finally, I will provide examples of how the knowledge provided using transgenic experimental approaches is leading to the development of rational and novel non-transgenic approaches for disease control.

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BIOLOGICAL CONTROL OF PLANT DISEASES: STATUS AND PERSPECTIVES FOR THE FUTURE

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Intensive research in biological control of plant diseases was initiated in the 70ties and since then a high amount of information has been gathered on how to isolate and select the right biocontrol organisms (BCAs), their biological function and, further, how to produce and formulate BCAs for use in crop production. Although several cases of successful development and commercial exploitation have been reported, today's status is that this control measure is not yet widely in use. Within the last few years, however, there are clear signs indicating that this will be rapidly changing.

There is now a growing demand for increasing food production to meet the needs of an increasing world population in a sustainable way. There is also an awareness of unintended environmental side effects due to a high input of chemical pesticides and, fungicide resistance is seen as an important problem. A demand from consumers for food and feed of high quality without pesticide residues is also becoming evident.

All this has led to legislative adjustments, which will be favoring future development of biocontrol measures. A clear indication of such a development is also the big change from the agroindustry in that they now invest in biocontrol companies for developing biocontrol solutions - in most cases as part of an integrated pest management strategy.

THE ROLE OF RESEARCH FOR OPTIMIZING BIOCONTROL

The last point to make for what can be considered crucial for this change in perspectives for biocontrol, is the new research methods, which have emerged over the last decade – including genomics and various sequencing techniques, the related bioinformatics and the possibilities of relating gene family expansions or contractions to biological function. These are now leading to a much deeper understanding of the biology of biocontrol interactions and how to optimise biocontrol implementation in crop production. Recent research has for example revealed that endophytism and induction of plant defence responses in many cases play much more important roles in biocontrol than considered earlier. Also how mycoparasitic fungal BCAs can tolerate toxins from their fungal prey through detoxification and membrane transporter activity have now been better elucidated. Similar research has also led to better understanding of how different BCAs can be formulated together in consortia or be used together with full or low doses of pesticides, when incorporated with existing technology following an IPM strategy.

Focus in the present talk will be on some examples of such research based developments.

SCIENCE AND SOCIAL MEDIA: A GUIDE FOR SCIENTISTS IN THE HYPER-CONNECTED ERA

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Social media as like as Facebook, Twitter and GooglePlus gather hundreds of millions of users worldwide, including scientists and science students. Moreover, social media have turned into a thriving environment suitable for scientist-to-scientist and scientist-to-public communication.

Some scientific Journals have already decided to track social media engagement around published research articles through online services (e.g. Altmetric), even though metrics analysis alone cannot evaluate the real impact of scientific papers on the broader audience yet.

Public discussion on social media is not a "one-way" interaction anymore. A social media user can freely interact with public profiles of research institutions and scientists, which leads them towards the urgent need of building solid social media presences.

On the other hand, social media represent valuable resources for science, too. Citizens network can help scientists in tracking the behavior of particular insects (e.g. Cicada Tracker), delocalising data elaboration from research centers to private home computers (e.g. LHC@home) and testing new stereochemical geometries for proteins by playing video games (e.g. Foldit).

Scientists have also access to professional social networks dedicated to knowledge transfer such as ResearchGate and Academia.edu. Besides sharing papers, resources, protocols and scientific information, scientists can also turn to new networks designed to share tools and laboratory equipment (e.g. Quartzy).

Moreover, companies running social media have moved to science as well. Data scientists at Facebook are conducting "emotion manipulation" studies on ~700,000 users, altering algorithms running the News Feed in order to evaluate reactions to prevalent positive/negative news updates.

Finally, open access to data from public funded research is often being granted as a consequence of new European policies. How will science evolve inside this unprecedented scenario? How will scientists and science students approach new communication technologies wisely?

MAPK CASCADES MEDIATING SIGNAL SENSING AND TRANSDUCTION DURING INFECTIOUS GROWTH OF *FUSARIUM OXYSPORUM*

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Root-colonizing fungi have a dramatic impact on plant health, acting either as beneficial symbionts or as devastating pathogens. It has long been known that these filamentous organisms can sense and grow towards signals released by plant roots. After entering the host, the pathogen colonizes the plant tissues through invasive hyphal growth. These processes are governed by a complex network of signal sensing and transduction modules, however, the underlying mechanisms remain poorly understood. We are studying chemotropism and invasive growth in *Fusarium oxysporum*, a soil-borne ascomycete that provokes vascular wilt disease in a wide range of plant species, causing devastating losses in field and greenhouse crops. We found that *F. oxysporum* germ tubes can sense and grow towards a variety of chemical stimuli, including nutrients, mating pheromones and tomato root exudates. Chemotropism towards different compounds is mediated by conserved elements of mitogen-activated protein kinase (MAPK) cascades. Intriguingly, the same MAPK pathways are also required for invasive hyphal growth within the plant tissue. Given the broadly conserved nature of fungal cell signalling cascades, the findings in *Fusarium* might be of general relevance to the interaction between root-colonizing fungi and their host plants.

EPIDEMIC OF *XYLELLA FASTIDIOSA* AND OLIVE QUICK DECLINE SYNDROME: A PROBLEM LIMITED TO THE SALENTO PENINSULA?

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An outbreak of a strain of *Xylella fastidiosa* subsp. *pauca* denoted CoDiRO (abbreviation from the Italian name "Complesso del Disseccamento Rapido dell'Olivo") has been found in Apulia (south-eastern Italy) in olive trees severely affected by a novel disease denoted "Olive Quick Decline Syndrome" (OQDS), which appeared suddenly in 2010. The disease may be the result of the combined action of *X. fastidiosa* with at least other two organisms, i.e. the lepidopteran leopard moth (*Zeuzera pyrina*) and several species of wood-inhabiting fungi (mainly *Phoeachremonium parasiticum*). Prior to the discovery of this outbreak (October, 2013) *X. fastidiosa* was known to be widely distributed in the Americas, where at least four different subspecies have been described and characterized. More recently it emerged in grapevines and pear trees in Taiwan. In these areas the bacterium is the causal agent of a number of economically important diseases, including Pierce's Disease (PD) of the grapevine, leaf scorch of almond and other stone fruits, pear, oleander and coffee, Citrus variegated chlorosis (CVC), and other diseases of perennial and landscape plants. Research activities have been promptly undertaken for the molecular and biological characterization of the pathogen, and for understanding its epidemiology. Acknowledge of the latter being essential for the design a rational plan of containment. Preliminary results brought to the identification of the range of susceptible hosts, other than olive, among which almond (*Prunus dulcis*), oleander (*Nerium oleander*), cherry (*Prunus avium*), myrtle-leaf milkwort (*Polygala myrtifolia*) and coastal rosemary (*Westringia fruticosa*), and to the identification of *Philaenus spumarius* as vector. Several new infection foci, promptly reported to the Regional Phytosanitary Service, were discovered within the whole province of Lecce besides the major one located around the district of Gallipoli. An effort of characterization of the epidemiology is now under way to try to understand if there is a significant risk of further spread out of the Salento peninsula.