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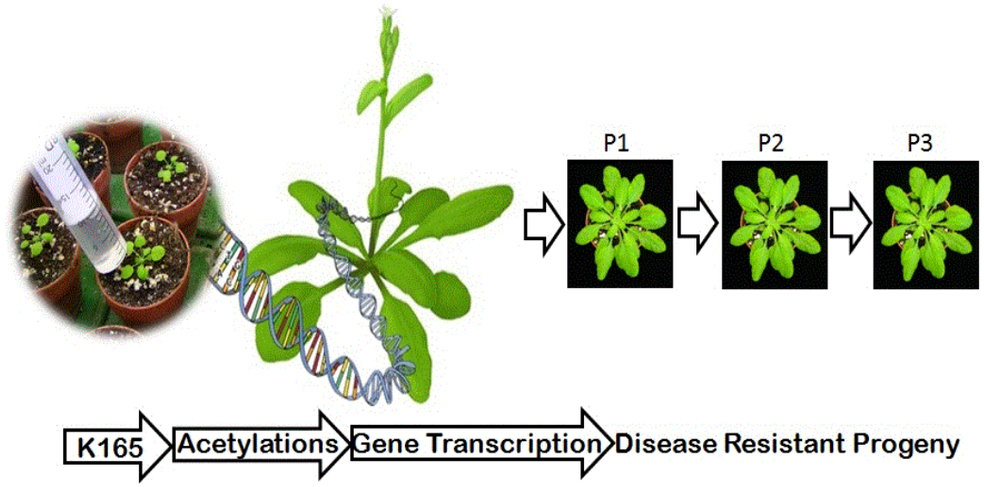
Description of the funded research project

1st Call for H.F.R.I. Research Projects to Support Faculty Members & Researchers and Procure High-Value Research Equipment

Title of the research project:
Epigenetics: creating novelty in plant disease protection



Principal Investigator: Dr. Sotiris Tjamos, Associate Professor

Reader-friendly title: BIOPLANT

Scientific Area: Agricultural Sciences

Institution and Country: Agricultural University of Athens / Greece

Host Institution: Phytopathology Lab, Agricultural University of Athens

Collaborating Institution(s): School of Life Sciences, University of Warrick, U.K.

Project webpage:
- ✓ www.facebook.com/pages/category/Science--Technology---Engineering/BioPlant-101713081435938/
- ✓ twitter.com/bepigenetics
- ✓ https://www.researchgate.net/project/Epigenetics-creating-novelty-in-plant-disease-protection

Budget: 170.000 euro

Duration: 36 months

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Research Project Synopsis

- The exploitation of epigenetic inheritance in plants is one of the most dynamic and innovative research fields in nowadays, which can offer new strategies in disease control lowering the pesticide environmental inputs. Recent studies have shown that the application of certain chemical compounds and plant pathogens on plants result to disease resistant offsprings. Despite its tremendous significance, the influence of biocontrol agents on epigenetic inheritance in plants has not been yet investigated at the molecular level.
- This research proposal aims to elucidate the plant epigenetic effect of the biocontrol agent *Paenibacillus alvei* K165.
- Our results show that the offsprings of K165 treated plants have increased resistance against the agricultural important fungal pathogen *Verticillium dahliae*.
- This proposal will exploit this knowledge in order to pave the way for the use of plant beneficial microorganisms as biofortifing agents against aggressive plant pathogens.
- The specific aim of this study is to understand the epigenetic influence of a plant beneficial microorganism that contributes to disease resistance.
- To achieve this aim, we will investigate (i) the epigenetic effects of K165 in plant resistance against bacterial (*Pseudomonas syringae* pv *tomato*), fungal *(Botrytis cinerea*, *Verticillium dahliae*) and ooomycete (*Hyaloperonospora parasitica*) pathogens and (ii) the K165 induced epigenetic mechanism that triggers the plant defense mechanisms.

Project originality

The following novel concepts are integrated in BIOPLANT:

- Production of plants resistant to diseases due to epigenetic modifications induced by a biocontrol agent
- Comparative studies of the epigenome and transcriptome of the progeny of a biocontrol agent treated plant
- Targeted comparative studies of the epigenome and transcriptome of the progeny of a biocontrol agent treated plant in relation to disease resistance
- Use of HAC and HAG Arabidopsis mutants to study their role in the K165 epigenetically induced disease resistance
- Yeast to hybrid experiments will reveal the interaction of HAC and/or HAG participating in the K165 epigeneticaly induced disease resistance with Arabidopsis transcription factors

Expected results & Research Project Impact

Expected results

- Screening for epigenetic effects of K165 on plant disease resistance against leaf and root pathogens
- Evaluation of the transgenerational K165 epigenetic effect on plant disease resistance
- Identify the K165 induced acetylation levels of histone 3 (H3) and 4 (H4) in the directly K165 treated plants and the progenies P1, P2 and P3
- Determine the K165 induced acetylation levels in defence related genes of the directly K165 treated plants and the progenies P1, P2 and P3
- Determine Arabidopsis genes epigenetically induced by K165
- Monitor the acetylation and expression levels of Arabidopsis genes epigenetically induced by K165, upon pathogen infection
- Elucidate the role of HAGs & HACs in the K165 epigenetically triggered disease resistance
- Identify Arabidopsis transcription factors (TFs) interacting with the HAGs and HACs participating in the K165 epigenetically triggered disease resistance

Research Project Impact

Scientific

- The research study offers new knowledge on the subject of the plant epigenetic effects induced by plant beneficial microorganisms
- Elucidates the epigenetically influenced defense responses that lead to disease resistance
- Due to the high levels of novelty and innovation, the research data will be published in high impact factor peer review journals with a significant impact for the participating institutions.

Social

- Two new positions for young scientists will open due to the project and a number of postgraduate and undergraduate students will have the opportunity to become familiar with state-of-the-art lab methodologies and new research concepts
- The implementation of the research data and methodologies by seed/plant producing companies may strength their market position
- The exploitation of the epigenetically induced disease resistance will lead to the development of new environmentally friendly disease control strategies, with low pesticide inputs.

The importance of this funding

This funding offers:

- the opportunity to perform innovative research by using cutting edge technology giving high throughput data
- transfer of knowhow from the School of Life Sciences, University of Warrick, U.K.
- 2 new research positions for 36 months
- participation in international congresses and publications in open access peer review journals
- development of international research cooperations

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