DOTTORATO DI RICERCA IN BIOLOGIA CELLULARE E DELLO SVILUPPO

Proposta di progetto per una borsa Dottorato Sapienza

Research title: Molecular mechanisms responsible in plants for elicitor-induced resistance to pathogens

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Summary

Plant organisms have evolved an innate immune system, based on the ability of each cell to recognize elicitors present in all strains of a given taxonomic group of microorganisms. Treatments with elicitors often lead to an increase in resistance against phytopathogenic microorganisms, which is maintained even for days after treatment. This induced resistance might be dependent on the phenomenon of priming, which leads to a faster and stronger response against subsequent attacks by herbivores or pathogens, though other mechanisms can be envisioned. We currently have a detailed view of the molecular mechanisms linking elicitor perception to short-term downstream responses, whereas an in-depth knowledge on the long-term response that are responsible for the establishment of an enhanced resistance to infection is still lacking. Moreover, the impact of elicitation on growth, and developmental processes is not fully elucidated. In this project we will investigate the molecular and biochemical mechanisms linking elicitor treatments to the induction of a durable resistance to pathogen infection, using the pathosystem Arabidopsis thaliana-Botrytis cinerea. Data obtained in transcriptomics experiments will be used to evaluate the duration of transcriptional changes induced by elicitation and its impact on the induction of defense responses during subsequent infection. Genes encoding key effectors and regulators of defense-related pathways important for elicitor-induced resistance will be identified, and their function established by reverse genetics. Metabolomics approaches will be employed to verify if constitutive accumulation or primed induction of specific compounds (antimicrobial compounds, phytohormones) correlates with changes in the expression of genes involved in their metabolism. Transgenerational changes caused by elicitation on basal resistance and on the ability to respond to elicitors will be studied, and epigenetic changes in genes showing primed expression will be investigated. Moreover, the effect of elicitation on growth and reproduction will be analyzed in WT plants and in mutants impaired in known regulators of defense pathways or with mutations that affect basal and/or induced resistance.

**Pertinent Publications of the proponent (last 5 years)**

1. Lorrai R, Ferrari S (2021) "Host Cell Wall Damage during Pathogen Infection: Mechanisms of Perception and Role in Plant-Pathogen Interactions" Plants, 10: 399
2. Wang P, Zhou L, Jamieson P, Zhang L, Zhao Z, Babilonia K, Shao W, Wu L, Mustafa R, Amin I, Diomaiuti A, Pontiggia D, Ferrari S, Hou Y, He P, Shan L (2020) "Cotton wall-associated kinase GhWAK7A mediates responses to fungal wilt pathogens by complexing with the chitin sensory receptors" Plant Cell 32: 3978-4001
3. Jemmata AM, Ranocha P, Le Rub A, Neela M, Jauneaub A, Raggi S, Ferrari S, Burlata V, Dunand C (2020) "Coordination of five class III peroxidase-encoding genes for early germination events of Arabidopsis thaliana" Plant Sci 298:110565.
4. Wu J., Reca IB, Spinelli F, Lironi L, De Lorenzo G, Poltronieri P, Cervone F, Joosten MHAJ, Ferrari S, Brutus A (2019) "An EFR-Cf-9 chimera confers enhanced resistance to bacterial pathogens by SOBIR1- and BAK1-dependent recognition of elf18" Mol Plant Pathol.

20:751-764.

5. De Lorenzo G, Ferrari S, Giovannoni M, Mattei B, Cervone F (2019) "Cell wall traits that influence plant development, immunity and bioconversion" Plant J, 97:134-147
6. De Lorenzo G, Ferrari S, Cervone F, Okun E (2018) "Extracellular DAMPs in Plants and Mammals: Immunity, Tissue Damage and Repair". Trends Immunol. 39(11):937-950.
7. Benedetti M, Mattei B, Pontiggia D, Salvi G, Savatin DV, Ferrari S (2017) "Methods of Isolation and Characterization of Oligogalacturonide Elicitors". Methods Mol Biol. 1578:25-38.

**References (other citations, if appropriate)**

Conrath, U., G. J. Beckers, C. J. Langenbach & M. R. Jaskiewicz (2015) "Priming for enhanced defense" Annu Rev Phytopathol, 53, 97-119.

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Mauch-Mani B, Baccelli I, Luna E, Flors V (2017) "Defense priming: an adaptive part of

induced resistance" Annu Rev Plant Biol.68:485-512

van Hulten M, Pelser M, van Loon LC, Pieterse CMJ, Ton J 2006 "Costs and benefits of priming for defense in Arabidopsis" Proc Natl Acad Sci U S A 103:5602-7

Zipfel, C. (2014) "Plant pattern-recognition receptors" Trends Immunol, 35, 345-51.