**DOTTORATO DI RICERCA IN BIOLOGIA CELLULARE E DELLO SVILUPPO**

**XXXIX CYCLE**

**Project proposal for a Sapienza PhD scholarship**

**Other research line**

**Title: Microalgae biomass valorization in agriculture as biostimulant, bioprotector and biofertilizer**

**Supervisor:** Prof. Simone Ferrari(simone.ferrari@uniroma1.it)

**Scopus Author ID:** 7201818434

**Summary (max 500 words)**

Microalgae are a promising resource for the sustainable production of proteins, biofuels and high-value chemicals. Extraction of products of interest results in large amounts of waste residual biomass, enriched in cell wall components, that could be valorized to develop cheap and environmentally friendly products for crop fertilization and protection, in a circular economy perspective. This project aims at valorizing algal waste biomass from well-established industrial strains belonging to different taxonomic groups (*Chlorophytae*, diatoms, cyanobacteria) and from novel strains, identified through the screening of available collections. High throughput bioassays for growth-promoting activity and for the ability to elicit plant immune responses will be developed using *Arabidopsis thaliana* as model system. Model (Arabidopsis) and crop (tomato) plants will be treated with crude residual algal biomass and different fractions, obtained after extraction of products of interest, to determine their ability to increase biomass production, productivity, and resistance to microbial pathogens and to abiotic stresses. We will analyze the impact of these treatments on plant molecular and physiological responses, as well as on the ability to interact with beneficial soil microorganisms. Bioactive fractions of selected algal residual biomasses will be isolated and characterized, and identification of molecules with potential use as “green” products for agriculture will be pursued. This project will contribute to the valorization of waste by-product from industrial cultivation of microalgae, facilitating the transition to a sustainable, circular, environmentally friendly, energy-efficient, and climate-resilient economy.

**References (other than publications of the proponent, if appropriate)**

1. Chiaiese et al 2018 Front Plant Science 9
2. Leu et al 2018 Industrial Biotech 10:169-183
3. Ruiz et al 2016 Energy Environ Sci 9:3036
4. Spain et al 2022 J Agric Food Chem 70:9711-9721
5. Stephens et al 2010 Trends Plant Sci 15:554-564

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

1. Giovannoni M, Lironi D, Marti L, Paparella C, Vecchi V, Gust AA, De Lorenzo G, Nürnberger T, **Ferrari S.** (2021) “The Arabidopsis thaliana LysM-containing Receptor-Like Kinase 2 is required for elicitor-induced resistance to pathogens”. *Plant Cell & Environment* 44(12):3545-3562. doi: 10.1111/pce.14192.
2. Lorrai R, Francocci F, Gully K, Martens HJ, De Lorenzo G, Nawrath C, **Ferrari S§** (2021) “Impaired cuticle functionality and robust resistance to *Botrytis cinerea* in *Arabidopsis thaliana* plants with altered homogalacturonan integrity are dependent on the class III peroxidase AtPRX71” *Frontiers in Plant Science* 12:696955.https://doi.org/10.3389/fpls.2021.704958 IF 5.753
3. Giovannoni M., Marti L., **Ferrari S**, Tanaka-Takada N. Maeshima M., Ott T., De Lorenzo G., Mattei MB, (2021) “The plasma membrane-associated Ca2+- binding protein PCaP1 is required for oligogalacturonide and flagellin-induced priming and immunity” *Plant Cell & Environment*44(9):3078-3093. doi: 10.1111/pce.14118. IF 6.362
4. Lorrai R, **Ferrari S§** (2021) “Host Cell Wall Damage during Pathogen Infection: Mechanisms of Perception and Role in Plant-Pathogen Interactions” *Plants* 2021, 10(2), 399;https://doi.org/10.3390/plants10020399 IF 2.762
5. 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(12): 3978–4001 DOI: https://doi.org/10.1105/tpc.19.00950. IF 9.848
6. 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. doi: 10.1016/j.plantsi.2020.110565 IF 3.591
7. 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(6):751-764. doi: 10.1111/mpp.12789 IF 4.379
8. 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(1):134-147 doi: 10.1111/tpj.14196. IF 5.726