## PROJECT TITLE

How primary metabolism modulates Coffea arabica-Hemileia vastatrix interactions?

## CONSORTIUM

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# SUMMARY OF THE REPORT

With over 2.25 billion cups consumed per day, coffee is one of the most important beverage crops in the world. Arabica coffee has the best quality/aroma, but most of its commercial varieties are highly susceptible to *Hemileia vastatrix*, the causal agent of coffee leaf rust (CLR). This devastating disease is spread to all coffee growing countries (CGCs) threading coffee production with yield losses up to 50% if no chemical control is undertaken (Várzea & Marques 2005, Talhinhas et al. 2017, Maghuly et al. 2020). Since 1955, Centro de Investigação das Ferrugens do Cafeeiro (CIFC/ISA/University of Lisbon) has centralized the research on CLR at international level, assisting the CGCs in the development of coffee resistant cultivars (Silva et al. 2006; Avelino et al. 2015). However, the adaptive capacity of *H. vastatrix* and the unforeseen effects of climatic changes have resulted in the gradual loss of resistance in some commercial cultivars in Brazil, Central America, East Africa, India, Indonesia, etc (Avelino et al. 2015). Moreover, societal expectations of a more sustainable coffee production are increasingly imposing the replacement of fungicide treatments by alternative solutions (Várzea & Marques 2005, Avelino et al. 2015, Maghuly et al. 2020). The identification of components of the plant primary metabolism, essential for plant growth and development that, simultaneously, participate in the plant defense responses can open new perspectives for plant breeding programs (Possa et al. 2020). Primary metabolism provides energy and structural material for defense responses in plants. On the other hand, sugars and amino acids are important nutrient sources for fungal development. The up-regulation of *H. vastatrix* genes involved in sugar transport and metabolism was reported in susceptible coffee plants (Vieira et al. 2012). Additionally, the decrease in the abundance of hydrolases (of carbohydrates and peptides), PR-proteins and oxidases in the apoplastic fluid of susceptible leaves, was also described (Guerra-Guimarães et al. 2009, Guerra-Guimarães et al. 2015). On the other hand, coffee plants treated with resistance inducers and challenged by *H. vastatrix* showed a reduced incidence of CLR which was related with primary metabolic adjustments (Possa et al. 2020). Carbohydrates are at the core of primary metabolism in plants such that all the carbon fixed during photosynthesis passes through soluble sugars. Plants have evolved sophisticated mechanisms to sense, translocate, metabolize and store carbon; and coordinate their availability with the many processes for consumption during plant development and stress (Buchanan et al. 2015). Therefore, in plant-pathogen interactions, plants try to limit pathogen access to nutrients and initiate immune responses, whereas the pathogen evolves adaptive strategies to suppress host immunity. This project aims to identify components of the plant primary metabolism, essential for plant growth and development that are simultaneously involved in the plant defense responses.

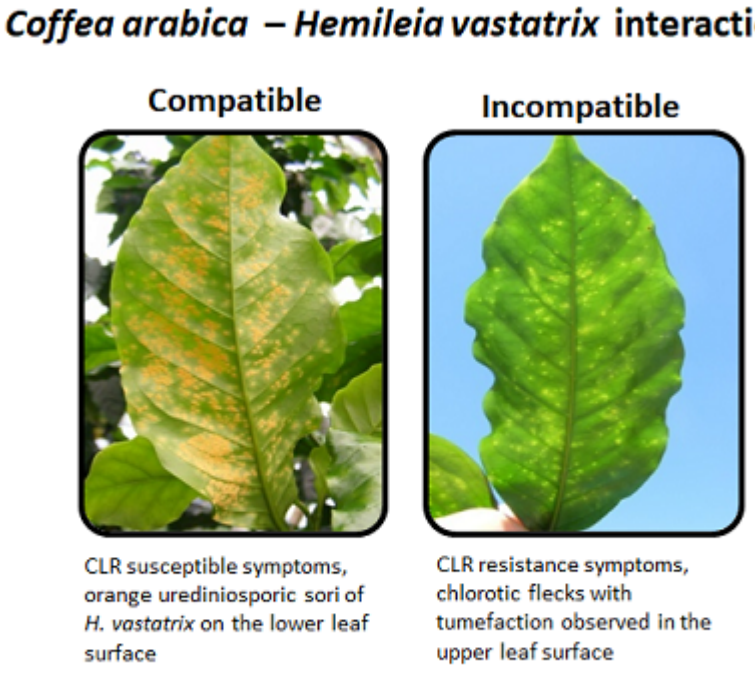


Fig. 1 – CLR symptoms