28th Conference Asic 2021
From 28 June to 1 July 2021

# Enhanced air [$CO_2$] mitigates high temperature impact in elite *Coffea arabica* L. genotypes

S1-P-33

Ramalho José C.[1,2] (cochichor@isa.ulisboa.pt), Semedo José N. [2,3], Lidon Fernando C.[2], Rodrigues Ana P.[1], Pais Isabel P.[2,3], Silva Maria J.[1,2], Simões-Costa Maria C.[1], Moura Isabel[1], Scotti-Campos Paula[2,3], Partelli Fábio L.[4], Marques Isabel[1], Leitão António E.[1,2], Alves Paula[1], Reboredo Fernando H.[2], Silva Maria M.[2,5], Rodrigues Weverton P.[6], Campostrini Eliemar[6], DaMatta Fábio M.[7], Ribeiro-Barros Ana I. [1,2]

*[1] PlantStress&Biodiversity, CEF, ISA/Univ. Lisboa, Oeiras and Lisboa, Portugal; [2] GeoBioTec, FCT/UNL, Caparica, Portugal; [3] UIBRG, INIAV I.P., Oeiras, Portugal; [4] CEUNES, UFES, São Mateus, ES, Brazil; [5] ESEAG, Univ. Lusófona, Lisboa, Portugal; [6] Setor Fisiologia Vegetal, CCTA, UENF, Campos dos Goytacazes, RJ, Brazil; [7] Dept. Biologia Vegetal, UFV, Viçosa, MG, Brazil.*

BREEDCAFS

## Introduction

Climate changes have been pointed to threat coffee crop sustainability, but relevant coffee heat tolerance has been reported (1), further promoted by elevated air [$CO_2$] ($eCO_2$) (2,3) namely at C-assimilation level.

## Materials and Methods

Two-year-old plants of *C. arabica cvs*. Geisha 3 (G3), Marsellesa (Mar) and their Hybrid (Hy), grown under air [$CO_2$] of 400 or 700 µL $L^{-1}$, were exposed to a temperature rise from 25/20 ºC (day/night) up to 42/30 ºC (0.5 ºC $day^{-1}$), and a two week recovery (Rec14). Photosynthetic impacts were assessed through leaf gas exchanges (net and maximal photosynthesis, $P_n$ and $A_{max}$), photosystems (PS) electron transport rates, and RuBisCO activity (2).

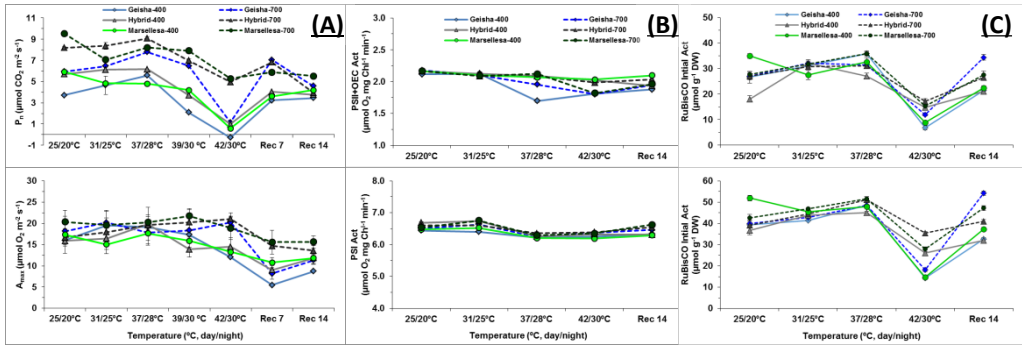


**Figure:** **(A)** net photosynthesis ($P_n$) and photosynthetic capacity ($A_{max}$); **(B)** Photosystem I and II activities; **(C)** Initial and Total RuBisCO activity.

## Results Highlights and Conclusions

- Net photosynthesis ($P_n$) was only moderately affected at 39 ºC, but strongly declined by 42 ºC. $eCO_2$ kept greater $P_n$ (and $A_{max}$) values at all temperatures, with a clear heat impact mitigation (Marsellesa and Hybrid). Minor non-stomatal impact ($A_{max}$) was found under $eCO_2$ at 42 ºC, but with relevant aftereffects up to two weeks.
- Intrinsic heat (42 ºC) tolerance of both photosystems (PSs) I and II, irrespective of genotype or [$CO_2$].
- Despite $A_{max}$ maintenance at 42 ºC, RuBisCO showed pronounced thermal sensitivity (although with a somewhat lower impact and better recovery under $eCO_2$ in all genotypes), deserving special breeders attention.

**References:**
1-Dubberstein et al. 2020. Front. Plant Sci. 11:1049, doi: 10.3389/fpls.2020.01049
2-Rodrigues et al. Global Ch. Biol. 2016, 22, 415-31. doi:10.1111/gcb.13088
3-Martins et al. 2016. *Front. Plant Sci. 7:947 , doi: 10.3389/fpls.2016.00947*

**Acknowledgements:**
Funding support by European Union's Horizon 2020 research and innovation program (grant agreement No 727934, project BreedCAFS), and by Fundação para a Ciência e a Tecnologia (project PTDC/ASP-AGR/31257/2017; units UIDB/00239/2020; UIDP/04035/2020).