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ORIGINAL ARTICLE

## Robust and smart: Inference on phenotypic plasticity of *Coffea canephora* reveals adaptation to alternative environments

Maria Amélia G. Ferrão, Elaine M. Riva-Souza, Camila Azevedo, Paulo S. Volpi, Aymbiré F. A. Fonseca, Romario G. Ferrão, Christopher Montagnon, Luis Felipe V. Ferrão 

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### Abstract

Coffee is an important crop with economic and social importance in several countries. With a daily consumption estimated at 2.2 billion cups, its sustainability is facing critical challenges given the projected climate changes. *Coffea arabica*, which represents ~60% of the global market coffee is a delicate crop, quite susceptible to diseases and biotic stresses. Developing climate-resilience cultivars is necessary, and it includes coffee plants adapted to new farming conditions that can meet the demand for biotic and abiotic tolerance and quality. In this context, *Coffea canephora* emerges as a potential candidate if the crop combines plasticity and cupping quality. Plant plasticity refers to adjusted phenotypic performance when grown in different environments, a fact that may help mitigate the detrimental effect of climate changes. In this study, using a multiple environment trial, we combined genomic and genotype-by-environment analyses to answer the following main question: How the climate effects may affect the phenotypic plasticity in *C. canephora*? Our contributions in this paper are fourfold: (i) we draw attention to the cupping quality and yield performance of *C. canephora* cultivars when evaluated in high-altitude and cold weather, (ii) we compared *C. arabica* and *C. canephora* phenotypic plasticity and highlight genotypes with broad and specific adaptation to certain environmental conditions, and finally, (iii) using stochastic simulation, we emphasize the potential of molecular breeding in the long term in coffee. Altogether, we

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## CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

### Open Research

#### DATA AVAILABILITY STATEMENT

Data are available as supplemental material.

### Supporting Information

Filename	Description
<a href="#">csc221298-sup-0001-SuppMat.xlsx</a> 55.4 KB	Table S1: cultivar names used for <i>Coffea canephora</i> and <i>Coffea arabica</i> . Table S2: temperature values collected across the different environments. Table S3: rainfall values collected across the different environments. Table S4: Genetic parameters computed per environment for yield data collected in the <i>Coffea canephora</i> population. Table S5: Genetic parameters computed per environment for yield data collected in the <i>Coffea arabica</i> population. Table S6: Genetic parameters computed per environment for final score collected in the <i>Coffea canephora</i> population. Table S7: Genetic parameters computed per environment for final score collected in the <i>Coffea arabica</i> populations. Table S8: Genetic parameters computed for the sensory traits for <i>Coffea arabica</i> and <i>Coffea canephora</i> populations.

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