

# Haitian Coffee agroforestry systems harbor considerable and dynamic genetic diversity



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Figure 1. Examples of *Coffea arabica* field samples

## Introduction

*Coffea arabica* L. (Rubiaceae): amphidiploid, allotetraploid, facult. autogamous species from Ethiopia

- Bourbon and Typica lines spread worldwide (XVIIth century onwards)
- Typica introduced on Hispaniola (Haiti in XVIth century). Other varieties introduced over time, full extent unknown
- Multiple varieties grown in same fields in low-input agroforestry systems; recruitment from seed bank common

## Materials and Methods

- Sampling:** 14 agroforestry fields in the North and Grande-Anse departments respectively (28 total). 20 representative plants plus 1-6 « atypical » plants sampled to capture field diversity (n=610)
- Markers:** Targeted KASP genotyping of 89 core SNPs known to differentiate different varieties (Mérot-Anthoëne et al. 2019, Zhang et al. 2021)
- Genetic diversity** was compared with local vernacular perceptions of diversity

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**References** Mérot-L'Anthoëne, V., Tourmeize, R., Darraçq, O., Rattina, V., Lepellet, M., Bellanger, L., Tranchant-Dubreuil, C., Coulée, M., Pégard, M., Metailon, S., Fournier, C., Stoffelen, P., Janssens, S.B., Kivuka, C., Musoli, P., Sumirat, U., Legnaté, H., Kambale, J.-L., Ferreira da Costa Neto, J., Revel, C., de Kochko, A., Descombes, P., Crouzillat, D., Poncet, V., 2019. Development and evaluation of a genome-wide Coffee 8.5K SNP array and its application for high-density genetic mapping and for investigating the origin of *Coffea arabica* L. Plant Biotechnology Journal 17, 1418-1430

Zhang, D., Vega, F.E., Solano, W., Su, F., Infante, F., Meinhardt, L.W., 2021. Selecting a core set of nuclear SNP markers for molecular characterization of Arabica coffee (*Coffea arabica* L.) genetic resources. Conservation Genetics Resources 13, 329-335.

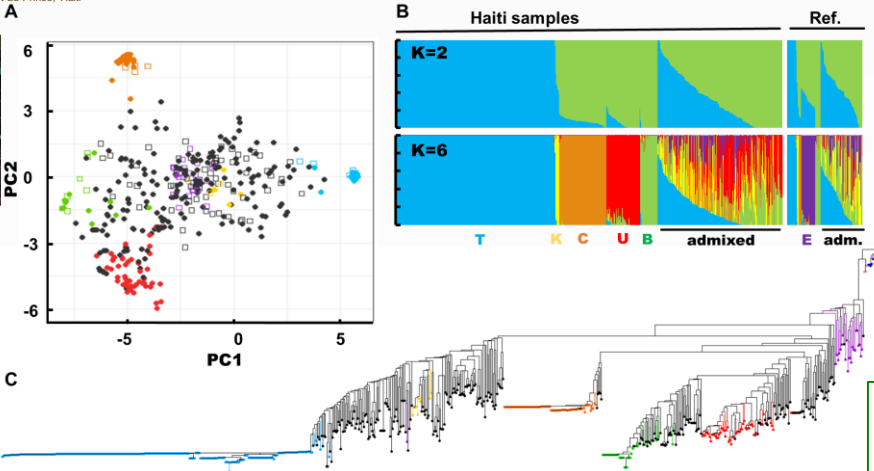


Figure 2  
 A. PCA of Haitian (●) and reference (□) *C. arabica* samples.  
 B. Unweighted neighbor-joining dendrogram of ref. and Ht. Coffee.  
 C. *C. arabica* population structure (sNMF) at K=2 and d) K=6. Samples colored according to a 80% threshold of membership to ancestral population

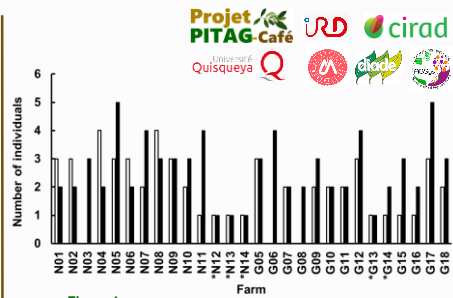


Figure 4  
 Number of vernacular varieties reported by farmers at time of sampling (□) and genetic groups identified by genotyping (■). All farms except (\*) also contained admixed individuals

## Results

- 6 main groups identified with SNMF: **Typica-**, **Bourbon-**, **Kent-** (Indian variety from the XXth century), **CR95-** (Catimor group) and **Ethiopian-**like accessions, and a group of **Unlabeled Haitian** samples (no close reference)
- Low diversity farms are mainly Typica, and in many farms admixture is common
- Population structure significant at farm level, not municipalities or departments
- Local knowledge is attuned to diversity but tends to underestimate it

## Discussion

- Varietal compositions reflect patterns of historical introductions: Typica in colonial era, Kent-like spread in early XXth century, Catimors introduced following leaf rust arrival
- Set of SNPs used proved appropriate and useful for differentiating main lines of cultivated arabica, Typica and Bourbon
- Haitian diversity cover the range of cultivated accession
- Some farms are repositories of old historical varieties while others are generators of cultivated coffee diversity

## Conclusion

Unexpected, underestimated diversity and high rates of dynamic genetic exchange in Haitian coffee farms. Haitian genetic diversity may suggest local adaptation and yield germplasm of special interest for revitalization of agroforestry systems. The social, agronomic and ecological factors explaining this diversity need to be investigated

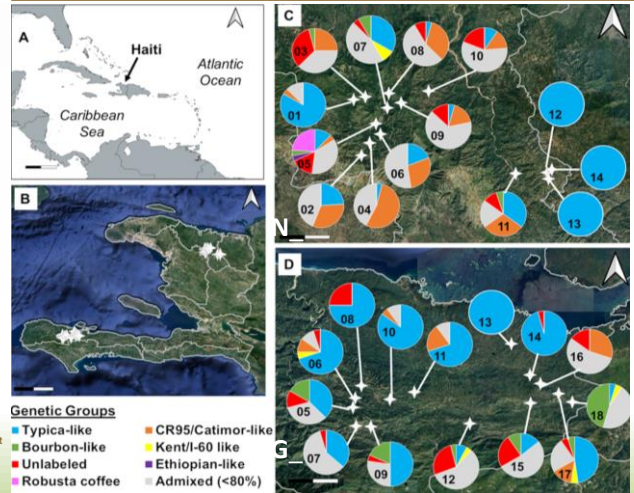


Figure 3  
 A. Geographic location of Haiti (Scale bar ticks = 250 km).  
 B. Study area in the Nord (north) and Grande-Anse (south) departments. Scale bar ticks = 25 km.  
 C. Farm varietal group composition in the Nord department and D. in the Grande-Anse department. Scale bar ticks = 2.5 km.

