

# Genotyping of the First Yellow Arabica Coffee Variety 'AHERNT' Selected Through Participatory Breeding in West Java, Indonesia

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## Introduction

Farmer participatory breeding has been commonly adopted in Indonesia as an effective coffee breeding method in the last 20 years, resulting the release of numerous new varieties. However, so far none of those released varieties have been comprehensively assessed in terms of genetic identity using molecular markers. Due to high demand of new varieties from local producers, molecular identification of varietal identity is needed to ensure that the candidate variety is new and is genetically different from the previously released varieties. Here we report our first application of SNP genotyping on a new Arabica variety 'AHERNT', a variety with a unique yellow cherry, selected through Farmer participatory breeding method. We demonstrated that SNP markers can assess participatory selection of Arabica coffee in terms of assessing cultivar identity and homogeneity, which ensure the quality of new cultivar propagation and distribution. The new genotyping tool will play important role to support participatory research in coffee breeding.

## Materials/Methods

This AHERNT variety is developed locally by farmers in West Java province with introduced germplasm, but the source of origin is unknown. Leave samples were taken from several farms where the variety was originally developed. The sampled trees have similar morphological characteristics of AHERNT morphologies, such as dwarf type, green flush, rounded and dark green leaves, elliptical immature green cherry and rounded mature yellow cherry. The low-density SNP panel selected by Zhang et al. (2021) was used to genotype the AHERNT variety, together with 210 reference germplasm accessions from CATIE International Coffee Collections.

SNP genotyping : 96 SNP markers in 96.96 assay; Fluidigm EP1™ genotyping system (Fluidigm Co, CA).

Data analysis: Summary statistics and Principal Coordinates Analysis (GenAlEx 6.5); Bayesian Clustering Analysis (STRUCTURE 2.3.4)

## Conclusion/Perspectives

The present result has broad implication in downstream application of SNP genotyping in coffee research and development, including farmer participatory breeding, nursery and seeds verification, as well as assess authenticity and traceability of coffee beans in the value chain in Indonesia.

## References:

Zhang, D., Vega, F.E., Solano, W., Su, F., Infante, F. and Meinhardt, L.W. 2021. *Conservation Genetics Resources*, 13:329-335.

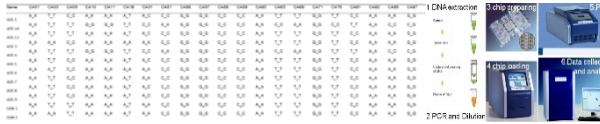


Figure 1: Examples of SNP fingerprints of AHERNT coffee variety generated by Nano-Fluidic genotyping system (showing truncated profiles).

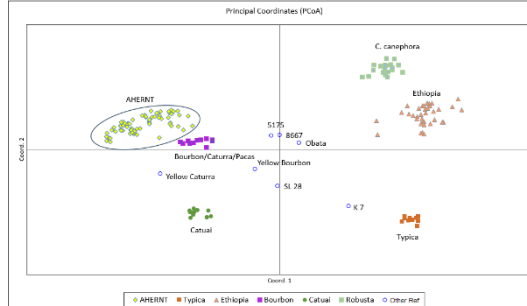
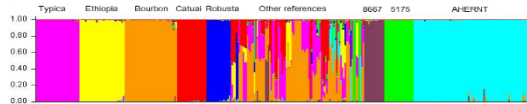


Figure 2: Bayesian clustering and Principal Coordinate Analysis (PCoA) of 77 AHERNT trees, together with 210 reference accessions representing different germplasm groups of Arabica coffee and one group of Robusta coffee. The PCoA graph only included a selected subset of reference accessions.

## Results/Discussion

Based on the genotyping result of 96 SNP markers, we compared the SNP profiles of AHERNT with 210 reference arabica germplasm accessions, representing various major varietal groups of Arabica coffee. The result of direct multi-locus comparison found no matching varieties.

Principle Coordination showed that samples of AHERNT formed an independent cluster, demonstrating the unique genetic background of AHERNT. The result of multivariate analysis was further supported by STRUCTURE analysis using admixture model. Genetic profiles of sampled trees from different farms are generally consistent and comparable in AHERNT. However, intra-varietal variation was also detected in AHERNT, showing a substantial level of segregation in this variety. The AHERNT trees showed a similarity to the Bourbon/Caturra group, relative to other major varieties. Indeed, the morphological characteristics of AHERNT have good similarity to Yellow Caturra as well. However, the SNP based result showed that AHERNT is clearly different from Yellow Caturra.

Our result confirmed that AHERNT has a unique genetic profile that differs from the reference varieties. Its genetic profile is consistent across different farms. However, the observed intra-varietal variation suggests that AHERNT is an introgressed variety with substantial residue segregation. It can be said that AHERNT is a type of composite variety. This kind of variety is expected to have more resilience to the impact of climate change for production, as well as resistance to pests and disease since the variety comprised of many genotypes with a mixed genetic background. The present study also detected a few 'off type trees' in the sampled trees of AHERNT, majority of which were collected from two farms. Therefore, measures of quality control for seeds propagation need to be developed. Close monitoring on intra-varietal segregation and possible pollen contamination (using molecular markers) is necessary to ensure that seeds from the authenticate 'AHERNT' variety were delivered to coffee farmers.