

Genetic Diversity of Wild *Coffea arabica* in Ethiopia: Analyses Based on Plastid, ISSR and Microsatellite Markers

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SUMMARY

Based on a sampling of about 300 individuals from well documented forest populations, genetic diversity of *Coffea arabica* in Ethiopia was assessed. Chloroplast (cp) and ISSR (Inter Simple Sequence Repeat) fingerprint data provide strong evidence that *C. arabica*, the only tetraploid *Coffea* species, evolved through a single allopolyploidization event. Phylogenetic analyses of chloroplast sequence data depict *C. eugenoides* as sister to *C. arabica* with high statistical support. Both species have their characteristic autapomorphies, suggesting that an ancestor of *C. eugenoides* was the maternal parent of *C. arabica*, but not extant *C. eugenoides*. Although > 7.5 kb of rapidly evolving cp spacers and introns were sequenced, and seven microsatellites were characterized, no deviating cp haplotypes were encountered among individuals of *C. arabica*. This points to a recent origin of the species followed by rapid spreading or to severe bottlenecks in the evolutionary history of the species. Populations of *C. arabica* were compared throughout forests of Ethiopia using ISSRs. This interregional analysis reveals complex geographical patterns of genetic diversity, with most regions possessing their own genotypes. Adding Ethiopian landraces (farmer's varieties) showed that wild populations of *C. arabica* are genetically different and can be distinguished from semi-domesticated plants. In previous studies, different Ethiopian individuals of *C. arabica* were subsumed under "spontaneous material". Interregional patterns of genetic diversity in wild *C. arabica* indicate that a hierarchical-geographical structure is obscured by naturally occurring gene flow. Dense sampling of *C. arabica* with ISSRs in forests of Berhane Kontir and Yaya (Geba Dogi) shows a fine-scale spatial patterning of genotypes in wild populations. Work on nuclear microsatellites with the aim to establish a co-dominant marker system that allows to assess heterozygosity and gene flow in wild *Coffea* is in progress. Results of the first phase of the CoCE project provide a first assessment of genetic diversity throughout wild populations of *C. arabica* in Ethiopia. Molecular data support the existence of truly wild populations that differ from semi-domesticated plants, and underscore the need of conserving forest coffee. Effective strategies that well represent *C. arabica* genotypes require multiple sites for *in situ* conservation complemented with *ex situ* measures.