Genetic resources for a sustainable rosewood essential oil industry in South America: Insights from genetic, genomic, and chemical approaches

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Keywords: *Aniba rosodora*, linalool, forest genetics, conservation

Rosewood (*Aniba rosodora* Ducke.), an endangered Amazonian species (IUCN, 2014), has high economic value due to its linalool-rich essential oil (EO), which is used in the cosmetics industry. Overexploitation since the 19th century in French Guiana has drastically reduced natural populations, resulting in the inclusion of rosewood in CITES Appendix II (2010), which regulates its trade. Major knowledge gaps remain in the taxonomy, ecology, essential oil chemistry, and reproductive biology of the species, including the effects of origin on offspring fitness and the relationship between genetic diversity and essential oil chemotypes. These gaps still limit the development of sustainable production and breeding strategies.

This study aims to integrate molecular genetic characterization with phenotypic and phytochemical analyses to better understand the drivers of genetic and essential oil variability in *Aniba rosodora*, while also evaluating the influence of origin on reproductive performance and chemical composition. The study will assemble a South American collection of rosewood genetic material originating from Amazonian regions and characterize it using SSRseq. Phenotypic and environmental traits will be evaluated, and leaves will be collected from seedlings naturally regenerating in a commercial plantation in Risquetout (French Guiana) for chemical and genetic characterization. Finally, genomic data (SNP markers) will be integrated with gas chromatography (GC) analyses to investigate the association between genetic diversity and essential oil chemotypes, particularly linalool content. By bridging the gap between molecular genetics and forest management, this study aims to provide the scientific foundation to support a sustainable rosewood industry, balancing biodiversity conservation with the demands of the global cosmetics market.