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Phylogeography of a species complex of lowland Neotropical rain forest trees (*Carapa*, Meliaceae)

Caroline Scotti-Saintagne , Christopher W. Dick, Henri Caron, Giovanni G. Vendramin, Erwan Guichoux, Anna Buonamici, Caroline Duret, Pierre Sire, Renato Valencia, Maristerra R. Lemes, Rogério Gribel, Ivan Scotti

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*Correspondence: Caroline Scotti-Saintagne, INRA UMR 0745 EcoFoG ('Ecologie des forêts de Guyane'), Campus Agronomique, BP709 – 97387 Kourou, French Guiana, France.
E-mail: caroline.scotti@ecofog.gf

Abstract

Aim Many tropical tree species have poorly delimited taxonomic boundaries and contain undescribed or cryptic species. We examined the genetic structure of a species complex in the tree genus *Carapa* in the Neotropics in order to evaluate age, geographic patterns of diversity and evolutionary relationships, and to quantify levels of introgression among currently recognized species.

Location Lowland moist forests in the Guiana Shield, the Central and Western Amazon Basin, Chocó and Central America.

Methods Genetic structure was analysed using seven nuclear simple sequence repeats (nuSSR), five chloroplast SSRs (cpSSR), and two chloroplast DNA (cpDNA) intergenic sequences (*trn*H–*psb*A and

trnC–ycf6). Bayesian clustering analysis of the SSR data was used to infer population genetic structure and to assign 324 samples to their most likely genetic cluster. Bayesian coalescence analyses were performed on the two cpDNA markers to estimate evolutionary relationships and divergence times.

Results Two genetic clusters (*nu_guianensis* and *nu_surinamensis*) were detected, which correspond to the Neotropical species *C. guianensis* (*sensu latu*) and *C. surinamensis*. Fourteen cpDNA haplotypes clustered into six haplogroups distributed between the two nuclear genetic clusters. Divergence between the haplogroups was initiated in the Miocene, with some haplotype structure evolving as recently as the Pleistocene. The absence of complete lineage sorting between the nuclear and chloroplast genomes and the presence of hybrid individuals suggest that interspecific reproductive barriers are incomplete. NuSSR diversity was highest in *C. guianensis* and, within *C. guianensis*, cpDNA diversity was highest in the Central and Western Amazon Basin. Regional genetic differentiation was strong but did not conform to an isolation-by-distance process or exhibit a phylogeographical signal.

Main conclusions The biogeographical history of Neotropical *Carapa* appears to have been influenced by events that took place during the Neogene. Our results point to an Amazonian centre of origin and diversification of Neotropical *Carapa*, with subsequent migration to the Pacific coast of South America and Central America. Gene flow apparently occurs among species, and introgression events are supported by inconsistencies between chloroplast and nuclear lineage sorting. The absence of phylogeographical structure may be a result of the ineffectiveness of geographical barriers among populations and of reproductive isolation mechanisms among incipient and cryptic species in this species complex.

Article Information

Supporting Information