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DNA barcodes for the identification of the heavily logged Amazonian timber species, *Manilkara huberi*, and related *Manilkara* species

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Earlier Amazonian studies have found that at least four species of *Manilkara* may be managed as “maçaranduba” timber, potentially causing severe population depletion in vulnerable species. Tools for accurate identification of both standing trees and logged timber are therefore urgently required. The accepted plant DNA barcode combination, *MatK*+ *RbcL* was evaluated for its ability to reliably differentiate the heavily logged species, *Manilkara huberi*, from some phylogeographically related *Manilkara* species, in comparison with some alternative DNA loci. *RbcL* was invariant among all *Manilkara* species tested, including the distantly-related African species *M. butugi*. *MatK* was also invariant among *Manilkara* species occupying overlapping ranges, including *M. paraensis*, *M. cavalcantei*, *M. bidentata* and its subspecies *M. bidentata* subsp. *surinamensis*; and provided just one differentiating character in the Atlantic rainforest species, *M. multifida*. The alternative chloroplast locus, the *psbA-trnH* intergenic spacer, which has been used in some plant DNA barcode studies, was somewhat more variable and provided some useful, but ultimately insufficient, autapomorphic characters, as well as some homoplastic characters. The locus was also found to be quite difficult to sequence, using standard methods, in *Manilkara*, often leading to poor data quality. In contrast to the chloroplast markers tested, the nuclear ribosomal internal transcribed spacers (nrITS), were found to possess good phylogenetic resolution in *Manilkara*, successfully separating all species examined. The locus was also easy to amplify by PCR and to sequence, which are characteristics of an effective plant barcode. We also evaluated the nuclear ribosomal external transcribed spacer (ETS) in *Manilkara*, and as a potential DNA barcode, found it to possess similar favourable characteristics to ITS. The ETS also possessed less intraspecific variation than the ITS in *Manilkara*. ITS and ETS are therefore good DNA barcodes for Amazonian *Manilkara* species either individually or in combination.