



Genetic structure of the threatened *Dipterocarpus costatus* populations in lowland tropical rainforests of southern Vietnam

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ABSTRACT. *Dipterocarpus costatus* is an endangered species restricted to the lowland forests of southern Vietnam. Habitat loss and over-exploitation of *D. costatus* wood are the major threats to this species. We investigated the level of genetic variability within and among populations of *D. costatus* in order to provide guidelines for the conservation, management, and restoration of this species to the Forest Protection Department, Vietnam. Nine microsatellite markers were used to analyze 114 samples from four populations representing the natural range of *D. costatus* in southeast Vietnam. We indicated the low allelic diversity ($N_A = 2.3$) and low genetic diversities with an average observed and expected heterozygosity of 0.130 and 0.151,

respectively, in the lowland forests of southeast Vietnam. The low genetic diversity might be a consequence of inbreeding within the small and isolated populations of *D. costatus* owing to its habitat loss and over-exploitation. All populations deviated from Hardy-Weinberg equilibrium showing reduced heterozygosity. Alleles were lost from the populations by genetic drift. Genetic differentiation among populations was high (average pairwise $F_{ST} = 0.405$), indicating low gene flow (<1) and isolated populations due to its destructed habitat and large geographical distances ($P < 0.05$) among populations. Heterozygosity excess tests (except of Bu Gia Map only under infinite allele model) were negative. The high genetic variation (62.7%) was found within populations. The STRUCTURE and neighbor joining tree results suggest strong differentiation among *D. costatus* populations, with the three genetic clusters, Phu Quoc, Tan Phu and Bu Gia Map, and Lo Go-Xa Mat due to habitat fragmentation and isolation. The threatened status of *D. costatus* was related to a lack of genetic diversity, with all its populations isolated in small forest patches. We recommend the establishment of an *ex situ* conservation site for *D. costatus* with a new big population comprising all genetic groups in order to enhance its survival under different environmental stresses.

Key words: Dipterocarps; *Dipterocarpus costatus*; Genetic conservation; Genetic variability; Simple sequence repeats