

A Chloroplast Genealogy Reveals the Impossibility of Obtaining Correct Phylogenetic Inference from Chloroplast Data in *Hordeum* L. (*Poaceae*)

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Abstract: To analyze reasons for inconclusive results of earlier chloroplast phylogenies in the grass genus *Hordeum* we established a genealogy of chloroplast haplotypes by sequencing the trnL–trnF region in 801 individuals, covering all 31 species of the genus. While the outcome of phenetic and parsimony analyses of 88 haplotypes were ambiguous, the network approach showed that in *Hordeum* ancient chloroplast types co-occur with their descendants. Moreover, we found up to 17 chloroplast haplotypes within single species and up to seven species sharing single haplotypes. Ancient polymorphisms together with incomplete lineage sorting occurred preferentially in the rapidly speciating New World taxa of the genus, where shared chloroplast types have persisted for at least four million years. Far reaching extinction of chloroplast lineages in Europe and the Mediterranean and their survival in Asia and North America resulted in a phylogenetic tree that differed significantly from nuclear estimates of species relationships. Thus, even for the deepest splits in the genus, reaching back more than nine million years, no safe phylogenetic inference from chloroplast data is possible in *Hordeum*. The chloroplast genealogy, however, revealed intercontinental dispersals and indicated processes involved in speciation in *Hordeum*.