Autopolyploid origin of the octoploid Turkish parsley fern (Cryptogramma bithynica) Jessen, Lehmann, and Bujnoch

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INTRODUCTION

The parsley ferns (Cryptogramma) are small ferns in the family Pteridaceae. Nine species are recognized worldwide (Fig. 1). These ferns are characterized by dimorphic leaves and false indusia. They grow almost exclusively on rocky surfaces. The diploid chromosome counts (2n) known within the genus were 60 and 120 until recently. The newly discovered Turkish parsley fern Cryptogramma bithynica is an octoploid with a 2n = 240 chromosome count (Jessen, Lehmann and Bujnoch 2012). This is an exciting new addition to our current knowledge of the genus Cryptogramma. We analyzed plastid and nuclear markers to determine this species progenitors and if it resulted from autopolyploidy or allopolyploidy.

MATERIALS AND METHODS

Samples: 39 accessions representing 8 species

Matrix:
Six maternally inherited plastid loci = 6272bp
rbcl, rbcL-accD, atpB-rbcL, rps4, trnP-petG, trnGR
One biparentally inherited nuclear locus = 500 bp
gapCp

Phylogenetic Analysis:
Maximum Parsimony with 1000 replicates; 500 BS reps with 10 searches each (PAUP*)
Maximum likelihood with 100 reps, GTR (GTRli); 1000 BS reps, GTR GAMMA (RaxML v.7.2.1)
Bayesian inference ran for 10m generations, 25% burn-in (MrBayes v.3.1.2)

RESULTS/DISCUSSION

Our analysis of maternally inherited plastid data confirmed that Cryptogramma crispa is the maternal parent of C. bithynica (Fig. 4). The biparentally inherited nuclear gapCp recovered all C. bithynica alleles in a single clade (Fig. 5), meaning that it was formed as an autopolyploid. Thus, C. bithynica is an autopolyploid with C. crispa being the sole parent. Our plastid analysis also revealed a genetic division within C. crispa. The Caucasus Mountains populations of C. crispa and C. bithynica form a separate clade from other C. crispa samples (Fig. 3). This indicates that the Caucasus Mountains were a barrier during the Last Glacial Maximum, isolating these populations from the rest of C. crispa and creating genetic divergence.

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