Population genetic analysis of disjunct Ozark and Appalachian populations of tall larkspur (Delphinium exaltatum)

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Abstract

Delphinium exaltatum is one of many species that exhibits a disjunct distribution between the Ozarks in southern Missouri and the Appalachians, which is over 400 miles away. *D. exaltatum* is insect pollinated and its seeds are gravity and water dispersed. Globally considered vulnerable (G3), *D. exaltatum* is most threatened by encroachment of woody species due to suppression of the natural fire regime. In this study, we used microsatellites to understand levels of genetic diversity and patterns of genetic structure in *D. exaltatum*, with the goal of understanding the biogeographical forces that have affected patterns of genetic structure in the species, and in particular, the effects of the disjunction between the Appalachians and Ozarks on genetic diversity. Eleven populations (five from the Missouri Ozarks and six from the Appalachians and Eastern United States) totaling of 221 samples were analyzed at ten microsatellite loci. Contrary to expectations, analyses of genetic structure split four populations in the Northern Appalachians (i.e. those in PA, WV, VA, and western NC) from those in the southern Appalachians and Ozarks (i.e., TN, eastern NC, and MO populations), instead of along the Ozark and Appalachian disjunction as hypothesized. Although genetic analyses did not support the hypothesis that the MO populations are distinct from the remainder of the populations, the genetic divergence that separates the Northern Appalachians populations from those in the southern Appalachians and Ozarks may be significant enough to warrant being taxonomically distinguished as a separate species; further morphological studies are necessary to further test this hypothesis. The patterns of genetic structure in *D. exaltatum* may have arisen by populations occupying separate refugia during the colder climate associated with glaciation, with one refugia in the north that harbored more cold-tolerant individuals of *D. exaltatum*, and an additional refugia further south. The ranges may have then come together by recolonization from refugia after glaciation. The disjunction between the Ozarks and the Appalachians may have resulted from a subsequent hot, dry period.