



Plastid DNA fingerprinting of the rare *Fritillaria moggridgei* (Liliaceae) reveals population differentiation and genetic isolation within the *Fritillaria tubiformis* complex

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Abstract

A phylogenetic analysis based on combined DNA sequences of the partial *matK* gene and the *rpl16* intron showed that the rare alpine endemic *Fritillaria tubiformis* subsp. *moggridgei* (Liliaceae) and the more widespread *F. tubiformis* var. *burnatii* are exclusively related. A genetic study used plastid DNA markers, due to limits imposed by nuclear DNA fingerprinting in species with large genomes, to study variation within and between populations. Five length-variable homopolymer repeats (polyA and polyT) and four regions with one or two insertion/deletions (indels) of different lengths were identified. Of the total of 56 plastid haplotypes obtained, 32 were fixed in the seven populations of subsp. *moggridgei* and the rest were variable in var. *burnatii*. Analysis of molecular variance (AMOVA) showed higher genetic variation among rather than within subsp. *moggridgei* populations. Indel mutations, on the other hand, were fundamental in distinguishing the two taxa.

Key words: endemism, genetic diversity, Ligurian Alps, population differentiation

Introduction

More than 11% of the world flora is endemic to the Alps, and 81% of the narrow endemics are restricted to the Maritime and Ligurian Alps in the Italian provinces of Cuneo, Imperia and Savona (Aeschimann *et al.* 2011). Owing to overall richness of the flora and incredibly high number of endemic species, this portion of the mountains has long been recognised as one of the biodiversity hotspots of the Mediterranean basin (Médail & Verlaque 1997, Casazza *et al.* 2005, 2008, Aeschimann *et al.* 2011).

The peculiar co-occurrence in this region of geological, edaphic and climatic discontinuities has largely contributed to the current high level of diversity (Minuto *et al.* 2006, Grassi *et al.* 2009, Szövényi *et al.* 2009). Geographical and climatic gradients acting as natural barriers among species and populations can eventually lead to differentiation of new endemic taxa (Thompson *et al.* 2005, Ægisdóttir *et al.* 2009, Schwienbacher *et al.* 2010 and references therein). Peripheral or locally rare populations can develop at boundaries of a species range and, in the presence of atypical habitats, diverge from central populations both morphologically and genetically (Jones *et al.* 2001, Hardie & Hutchings 2010).

Fritillaria tubiformis Grenier & Godron (1855: 13) subsp. *moggridgei* (Boissier & Reuter ex Planchon, 1873: 116) Rix in Heywood (1978: 356) (Liliaceae) provides a good example of a rare taxon sporadically distributed across the southwestern Alps at a few localities in Italian Piedmont and Liguria (Charpin & Salanon, 1985). In contrast, *Fritillaria tubiformis* subsp. *tubiformis* is not present in Liguria but has a much more widespread range in the Central Alps, from the Piedmont to Valle d'Aosta and provinces of Bergamo and Brescia (Conti *et al.* 2005). However, in a recent paper reporting typification of *Fritillaria tubiformis*, Bartolucci and Peruzzi (2012) questioned the above-mentioned distribution and stated that the species has