SURVIVING GLACIATION AT THE EDGES OF EMPIRE

CASAZZA G.[*], CONTI E.[**], GRASSI F.[***], GUERRINA M.[****], THEODORIDIS S.[*****], ZECCA G.[******], MINUTO L.[*]

*) IMBE, Aix Marseille Université, Avignon Université, CNRS, IRD, IMBE. Technopôle de l'Arbois-Méditerranée, Aix-en-Provence, France
**) Department of Systematic and Evolutionary Botany, University of Zurich, Switzerland
***) Department of Biology, University of Bari, Italy
****) Department of Earth, Environment and Life Sciences, University of Genoa, Italy
*****) Center for Macroecology, Evolution & Climate, Natural History Museum of Denmark, University of Copenhagen, Denmark
******) Department of Biosciences, University of Milan, Italy

late quaternary glaciations; phylogeography; species distribution models; endemisms.

Three main hypotheses may explain the distribution of alpine and arctic endemic plants: i) endemics with preference for more temperate climatic conditions had narrower distributions during glacial maxima and, when the glaciers retreated, moderately expanded their distributional range; ii) cold-adapted endemics had larger distributions during glacial maxima and, when the temperatures raised, contracted their distributional range; and iii) in areas less affected by the Late Quaternary glaciations, the distribution of endemics results by local buffering from extreme environmental effects. The hypothesis of post-glacial expansion has been supported by studies on several endemic species in the Eastern Alps, while the other two hypotheses have rarely been supported for endemic species and never in the European Alps. This is likely due to the massive ice-sheet in large part of European Alps, which eliminated suitable habitats and restricted the possibility of glacial expansion and/or in situ survival for many mountain plants during the glacial period. Recent studies on several plants (i.e. *Primula allionii*, *Silene cordifolia*, *Viola argenteria* and *Berardia subacaulis*) endemic to the South-Western Alps (SW Alps) combined the results of species distribution models and genetic analysis to reconstruct potential contractions and expansions of species through the Late Quaternary. In these species both populations and genotypes extinction was minimal during the Last Glacial Maximum, and they largely survived in situ without range contraction, resulting in complex phylogeographical pattern. In general, the phylogeographical patterns detected in SW Alps differ from the pattern usually observed in the Alps, where endemic species primarily retreated into refugia during cold periods and expanded during warm periods. In fact, in most of the Alps, the massive ice covers prevented also cold-adapted endemics to reach or to survive in most of the potentially suitable areas. On the contrary, in the SW Alps, the ice cover was less extended than in the rest of the Alps and this may have not prevented species to persist or to expand in most of the climatically suitable areas even at high altitude during the glaciations. Taken together, our findings support to the idea that in area less affected by glaciations, the genetic pattern of endemic species may not result only from the effect last glacial period but from cumulative effect of Tertiary paleoenvironmental changes and also by more recent changes.