Biodiversity at gene level in Mediterranean conifers

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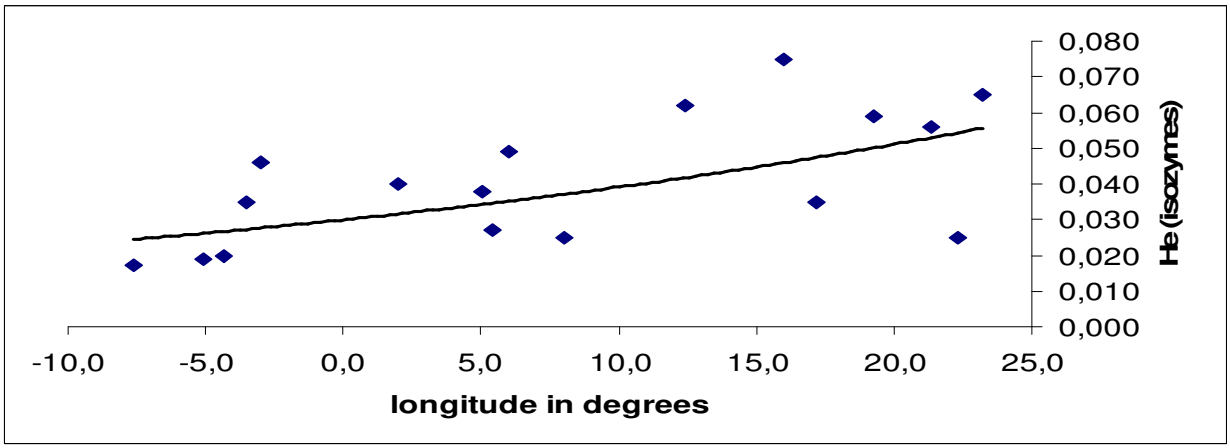
Biodiversity is commonly assessed at species level to monitor the spatial structure of richness and endemism, both worldwide and in specific biomes, and to understand how particularly rich regions came to emerge as the result of macro-evolutionary processes. The same type of investigations can be done using genetic diversity, where patterns of within and among population gene diversity can be plotted against past and current environmental variables to assess how past ecological processes have shaped the evolutionary structure of populations.
In this talk, I will present how gene diversity at neutral markers is structured in the Mediterranean, using published data on four conifer genera commonly found in the northern hemisphere, *Abies*, *Cedrus*, *Cupressus* and *Pinus*. Species from these four genera had higher genetic diversity than non-Mediterranean conifer species worldwide, indicating that the Mediterranean is not only a hotspot of species biodiversity, but also a hotspot of genetic biodiversity.
Genetic diversity in the Mediterranean was spatially structured, higher in the Eastern than in the Western Mediterranean (Figure 1), suggesting different micro-evolutionary patterns at the two ends of the Mediterranean.

Figure 1. West-east spatial distribution of within population gene diversity in *Pinus halepensis* in the Mediterranean.



A possible cause for this pattern is the last Quaternary ice age, drastically harsher in the western than in the eastern Mediterranean. Such conditions are likely to modify available ecological niches, with the advent of small-sized refugia in the western Mediterranean, and demographic bottlenecks leading to genetic drift and loss of genetic diversity within populations.

Genetic diversity was also found to be bioclimatically structured, with low elevation thermophilous conifers displaying less genetic diversity than mesophilous or mountain conifers. Again, this pattern could be explained by a more severely shrinking ecological niche during the ice ages for thermophilous than for mesophilous and mountain conifers.

These results show that Quaternary refugial zones were probably very different in size and shape across the Mediterranean, depending on species ecological requirements and spatial distribution. Additional examples taken from other genera and kingdoms are also considered in this talk. Finally, the extent to which long term evolutionary processes and human activities may have obscured these natural micro-evolutionary processes is discussed.