Rules of thumbs are sometimes valid: very low genetic diversity in two ENEs from Majorca Island (W Mediterranean)

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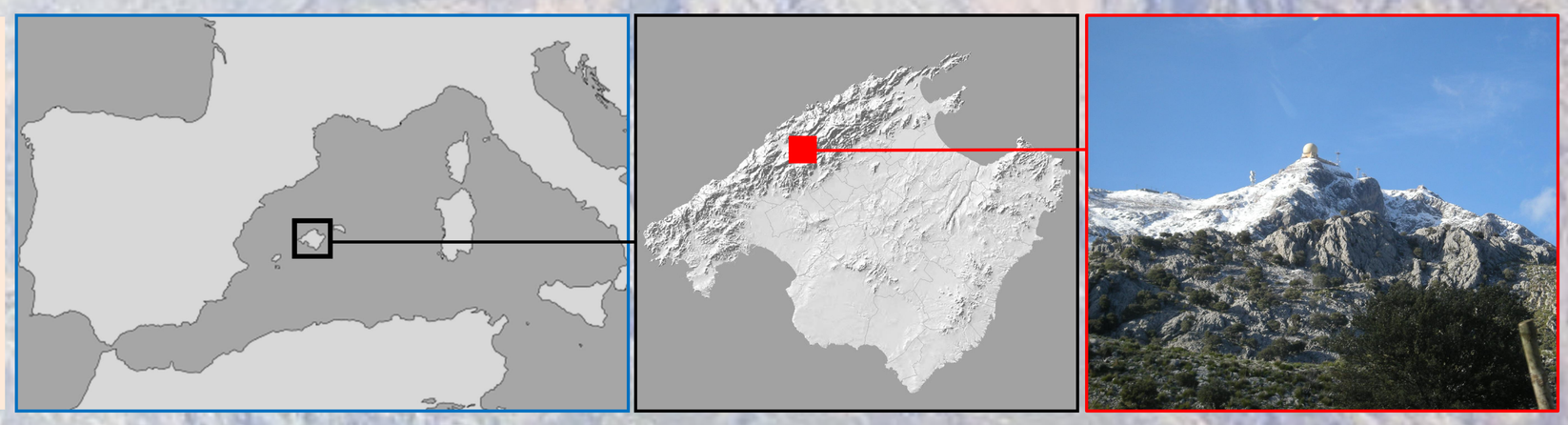
EXTREMELY NARROW ENDEMICS, WHAT'S THIS?

According to López-Pujol *et al.* (2013) Extremely Narrow Endemics (ENEs) are defined as those taxa that occur in one or very few populations (≤5) and that exhibit very small census sizes (≤500 individuals). ENEs, and particularly those from islands, usually display low levels of genetic diversity which is driven by several factors including: (1) bottlenecks associated with the founder effect, (2) the small size of island populations favoring genetic drift and inbreeding, and (3) genetic adaptation to island ecosystems.

THE PUIG MAJOR PEAK

The Puig Major Peak, in the Tramuntana mountain range, is the highest point on the Mediterranean island of Majorca with 1,436 m a.s.l. Despite its small extent, the Puig Major Mountain is an area with an extraordinary concentration of endemic plant species. This mountain occupies less than a single UTM 10x10 km square but has the highest concentration of endemic plant species of the Balearic Islands. In fact, four ENEs are restricted to the mountain area included in this UTM square: *Agrostis barceloi*, *Arenaria bolosii*, *Coristospermum huteri*, and *Euphorbia fontqueriana*).



CORISTOSPERMUM HUTERI

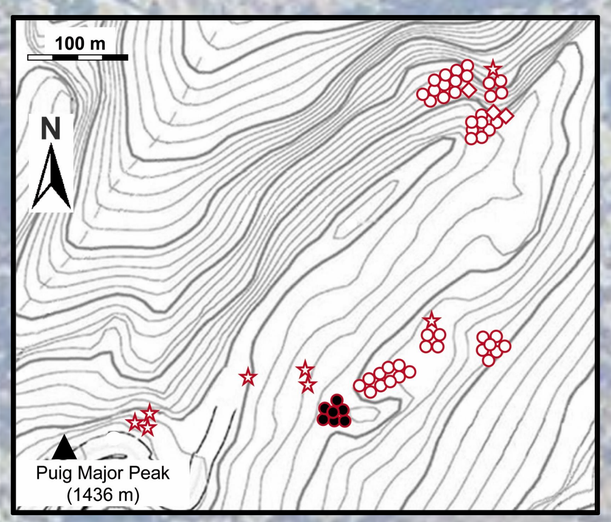
Coristospermum huteri (Umbelliferae) is a hemicryptophyte which grows in crevices of karstic cliffs in shaded, moist places and restricted in a single natural population of *ca.* 100 individuals. Allozyme electrophoresis was used to survey genetic variation in 63 individuals and 12 different loci were solved. All loci were monomorphic, with the sole exception of *6Pgd-2.* This locus exhibited two different alleles, which are responsible for the three alternative multilocus genotypes observed within the population: eight individuals were homozygotes for the slow-migrating allele (*6Pgd-2b*), three were heterozygotes, and the remainder (including the seven reintroduced individuals) were homozygotes for the fast-migrating allele (*6Pgd-2a*). Genetic variability was virtually nil for this species (P = 8.3%, A = 1.08, H_e = 0.022). A founder effect associated with a dispersal event from the continent is probably behind the lack of genetic diversity.

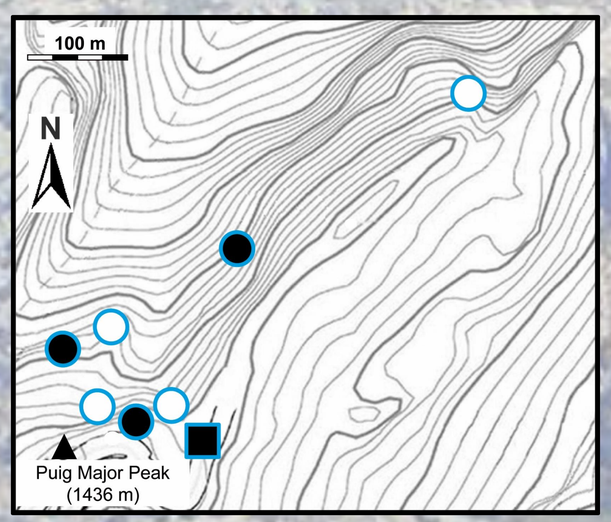
AGROSTIS BARCELOI

Agrostis barceloi (Gramineae) is a tetraploid shortly rhizomatous perennial grass with a single natural population of 70-80 individuals. It grows on shady slopes and vertical limestone cliffs and in small patches of shady meadows. All 40 analyzed samples showed the same genotype using allozyme electrophoresis. Four out of 18 interpretable loci (*Idh-2, Mdh-2, Pgi-2* and *Prx-3*) showed fixed heterozygosity (thus supporting an allopolyploid origin) and moderate levels of genetic diversity were obtained (P = 22%, A = 1.22, H_e = 0.113).

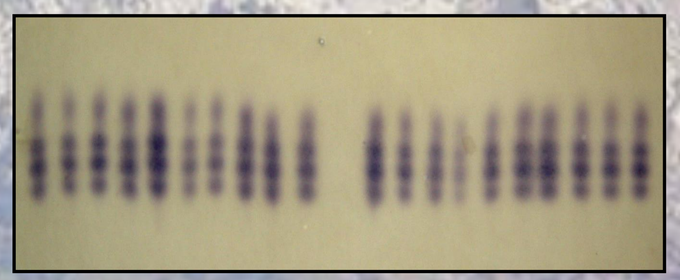
The genotypic uniformity of this species may be attributed to a founder effect associated with a dispersal event of its ancestor from the continent, a very small current effective population size, and a series of natural or anthropogenic threats affecting the population.

On the right: the precise location of the *Coristospermum huteri* genotyped individuals studied: *circles,* homozygotes for the fast-migrating allele (*6Pgd-2a*); *stars,* homozygotes for the slow-migrating allele (*6Pgd-2b*); *diamonds,* heterozygotes. In *black*, the seven introduced individuals (transplanted from Sóller Botanical Garden).





On the left: precise location of the all existing subpopulations of *Agrostis barceloi*: open *circles*, natural subpopulations; *black circles*, reinforced subpopulations; *black square*, ex novo subpopulation.



Coristospermum huteri

COMPARISON WITH OTHER ENEs

When populations are small, like in these cases, the deleterious effects of genetic drift and inbreeding are more likely to appear, which may lead to the fixation of alleles. Thus, it is not surprising to find very low levels of genetic diversity in ENEs (for diploid species, mean P = 16.1 and mean H_e = 0.057; see Table 1 in López-Pujol *et al.* 2013), as revealed in *Coristospermum huteri*. Due to its genotypic uniformity, *Agrostis barceloi* should be regarded as a functionally genetically impoverished species, comparable with other island ENEs.

CONCLUSIONS

Within the context of the conservation plan for the Puig Major flora approved by the regional government (BOIB, 2008), some conservation measures are proposed: (1) control of herbivory by fencing, (2) control of competitor species, (3) demographic monitoring, (4) maintenance of ex-situ collections, (5) population reinforcement, (6) environmental awareness campaigns and (7) the preservation of the mountain summit where the species are found which would also positively influence the conservation of other co-occurring rare and threatened species.

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