Adaptive and neutral differentiation in the Mediterranean grass species Brachypodium retusum populations: consequences for ecological restoration.

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Abstract

The ecological restoration of Mediterranean *Thero-Brachypodietea* steppes is a slow process because dominant perennial grass species are poor colonizers. In Spanish and Southern French steppes, *Brachypodium retusum* (Pers.) P.Beauv. is a key species but its seedling recruitment is often very low. To evaluate the importance of plant origin in reintroduction approaches and the mechanisms driving genetic structuring, neutral and adaptive differentiation were tested using AFLP markers and morphological traits. Plant material from seventeen populations was collected in France (14 populations), Spain (2 populations) and Italy (1 population) for a total of 322 individuals genotyped with 330 AFLP markers. A subset of thirteen French populations was grown for two years in a common garden experiment to measure vegetative growth and reproduction. Based on AFLP marker analysis, diversity indices and their relations to climate and soil conditions were calculated. Population differentiation in neutral AFLP markers was estimated using pairwise
*theta*ST. First axis PCA scores of quantitative traits were fitted to determine PST values (adaptive differentiation), and PST were compared to
*theta*ST. Populations collected from habitats with high grazing pressure showed higher clonal reproduction. Clonality was negatively correlated with average annual precipitation and temperature. Global dataset
*theta*ST (0.102 ± 0.02) indicates significant differentiation between populations. PST (0.66 ±0.12) was higher than

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*theta*ST suggesting that phenotypic population differentiation is driven by directional selection leading to adaptive differentiation. This adaptive differentiation at a regional scale (Southern France) advocates a careful choice of plant origin in ecological restoration.