Understanding foredune communities from the seed traits perspective

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Traditionally, the processes that rule species assemblage have been investigated on adult plants, while early phases of plants life cycle have been often neglected. However, early phases such as seed germination and seedling growth represent the first step that allows plant establishment thereby governing the composition of plant communities. The aim of this work was to investigate the role of seed traits in community assemblage. Specifically, we analyzed to what extent germination responses to temperature and photoperiod constrain species composition in a foredune community.

We performed a cluster analysis on a database of 504 plots x 155 species of coastal dune vegetation carried out in NE Mediterranean coast (Veneto, Italy). Accordingly, we identified the group of plots representative of the foredune community and selected all the species listed, including aliens, for a total of 19. We distinguished typical foredune species from those that thrive in other communities (e.g. semi-fixed ones), but can be accidentally found in the foredune, by using fidelity (Phi coefficient) and frequency values. For each species, we analyzed the germination response to constant temperature (5, 10, 15, 20, 25°C) and photoperiod (12/12 light/darkness, and 24h darkness), through GLMM. Species were then grouped according to their germination response through cluster analysis and NMS ordination.

We identified four groups of seed germination responses, with increasing complexity of germination requirements: high germination at all tested conditions ("high-germinating" group), high germination only at warm temperatures either in the dark ("dark warm-cued") or in the light ("light warm-cued"), and low germination regardless of conditions ("non-germinating" group). Typical foredune species showed a narrow regeneration niche, being "non germinating" (e.g. *Ammophila arenaria* and *Cakile maritima*) and dark warm-cued (*Salsola kali* and *Elymus farctus*). On the contrary, annual species of semi-fixed dunes were "high-germinating" (*Hypochoeris radicata*, *Medicago littoralis*, *Vulpia fasciculata*). Alien species (*Erigeron canadensis*, *Oenothera stucchii*, *Xanthium orientale*) occupied an own regeneration niche ("light warm-cued"). Rising temperatures forecasted with climate change could favoring the regeneration by seed of species with a wide regeneration niche (e.g. grassland species) or those requiring high temperature (e.g. alien species). Our results contribute to bridge the gap between germination ecology and community ecology and to improve the prediction of plant assemblages under changing environmental conditions.