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# Germination in five shrub species of Maritime Pine understory—does seed provenance matter?

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## Abstract

• **Context** Maritime Pine forests cover important mountain areas in Portugal and are known to be a particularly fire-prone forest type. Understory composition plays an important role in maintaining biodiversity and ecosystem services after recurrent wildfires.  
• **Aims** This study aims to improve the knowledge on the germination ecology of understory species of Maritime Pine forests, focusing on the importance of seed provenance, including in relation to germination enhancement by heating.  
• **Methods** The selected species were *Cistus ladanifer* L., *Erica australis* L., *Erica umbellata* L., *Pterospartum*

*tridentatum* L. (Willk), and *Genista triacanthos* Brot. Seeds were collected from two or three distant populations. Besides a control treatment, two heating regimes were applied, i.e., 100°C during 5 min and 80°C during 30 min.

• **Results** Heating treatments significantly enhanced germination in four out of the five species. Differences between provenances were most evident for *C. ladanifer* and *E. australis*, especially following the heating treatments. Overall, the seeds from the southern provenances germinated better and, at the same time, were smaller.

• **Conclusion** The present results confirmed that seed provenance should not be ignored as a key factor in germination ecology, so that further work is needed to untangle the roles of environmental and genetic factors in the observed differences between provenances.

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**Contribution of the co-authors** Ana Vasques: experimental design, data analysis, data collection, writing the paper.  
Paula Maia: collaboration in experimental design and species selection, data collection.  
Mariana Pedro: internal reviews and data analysis.  
Conceição Santos: experimental design, logistical support, supervision.  
Ramón Vallejo: experimental design, logistical support, supervision.  
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**Keywords** Germination · Seed provenance · Maritime Pine ecosystem · Fire-prone shrubs · *Cistus ladanifer* · *Erica australis* · *Erica umbellata* · *Genista triacanthos* · *Pterospartum tridentatum*

## 1 Introduction

Wildfires play an important role in the history of Mediterranean ecosystems and, as a consequence, Mediterranean plant communities have become fire resilient (Pausas and Vallejo 1999). The resilience of these communities is related to the ability of their principal species to resprout after fire and/or to attain elevated levels of recruitment by germination (Keeley 1986). Based on these traits, Mediterranean species can be divided into seeders and resprouters (Pausas 1999; Verdú 2000), presenting different levels of seedling density and survival following wildfires (Benwell 1998).

In Portugal, Maritime Pine (*Pinus pinaster* Ait.) plantations have been widely introduced and now are a predominant cover