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Germination behaviour of 14 Mediterranean species in relation to fire factors: smoke and heat

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Abstract Fire is an ecological factor that has been present in the ecosystems of the Mediterranean region for thousands of years. Our study was undertaken to acquire knowledge of the effect of fire on the germination of Mediterranean species. We used high temperatures (up to 60°C) and smoke to determine the effect of these factors on the germination of species from the Mediterranean region. The species selected are characteristic of the central Mediterranean basin and are representative of both woody and herbaceous species: *Rhamnus alaternus* L., *Cistus albidus* L., *Cistus monspeliensis* L., *Fumana ericoides* (Cav.) Gand., *Rosmarinus officinalis* L., *Melica ciliata* L., *Avena sterilis* L., *Bituminaria bituminosa* (L.) C.H. Stirt., *Anthyllis vulneraria* L., *Coronilla glauca* L., *Argyrolobium zanonii* (Turra) P.W. Baland, *Emerus major* Mill., *Genista scorpius* (L.) D.C. and *Spartium junceum* L. The seeds were collected in

Mediterranean shrubland (8) and woodland (6) ecosystems, around Montpellier, France (24°45'N and 3°50'E). Ten treatments were tested: a control, three smoke treatments and six heat treatments. The average germination level (germination percentage) and the average T₅₀ rates (time taken to reach 50% of germination) were calculated. The smoke and heat act in a different way on each of the species. The smoke enhanced the germination of two species, whilst moderate heat increased germination in all of the species excepting *R. officinalis*, *F. ericoides*, *A. sterilis*, *A. vulneraria*, and *G. scorpius*. Germination was fastest in *M. ciliata* and *S. junceum* and slowest in *A. sterilis*, *E. major* and *C. albidus*. The cues did not significantly affect the rate of germination. Fire modified the germination response of 12 of the 14 species studied.

Keywords Fire · Mediterranean plant species · Germination · High temperatures · Plant-derived smoke

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Introduction

Germination behaviour after fire has been studied in many species from different families in Europe (Trabaud and Casal 1989; González-Rabanal et al. 1994; Reyes and Casal 1995; Reyes et al. 1997; Ferrandis et al. 1998), North America (Keeley 1987,