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Short Communication

Sand verbenas (*Abronia* spp., Nyctaginaceae) germinate in response to ethylene

P.M. Drennan*

Department of Biology, Loyola Marymount University, 1 LMU Drive, MS-8220, Los Angeles, CA 90045-2659, USA

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Abstract

Sand verbenas (*Abronia* spp., Nyctaginaceae) are difficult to germinate in the laboratory. This hinders conservation and restoration efforts for *Abronia* spp. some of which are rare and others of which have been displaced from dune environments by invasive species and human activities. The possibility that ethylene (supplied as the liquid ethephon) could promote germination was investigated for *Abronia fragrans*, *Abronia maritima*, *Abronia umbellata*, and *Abronia villosa*. Germination of achenes from which the anthocarp had been removed ranged from 0% to 15% in deionized water and at alternating temperatures of 27/20 °C associated with a 12-h light/12-h dark cycle. For *A. maritima* and *A. umbellata* under similar conditions of temperature and light, germination exceeded 90% for all concentrations of ethephon tested (10, 100, and 500 $\mu mol\,l^{-1}$). The rate of germination was highest at 500 $\mu mol\,l^{-1}$; however, the radicles were stunted at this concentration. Germination was also promoted by imbibition of the achenes with ripe apple tissue providing evidence that the ethephon effects are due to ethylene. Ethephon treatment (100 $\mu mol\,l^{-1}$) also significantly increased germination for *A. fragrans* and *A. villosa* suggesting that the different species of sand verbena may have similar dormancy mechanisms.

Keywords: Alternating temperatures; Ethephon; Restoration; Scarification; Stratification

1. Introduction

Sand verbenas (*Abronia* spp., Nyctaginaceae) are psammophilous species occurring in open and often disturbed habitats in western North America, especially coastal dune communities along the Pacific coast and sandy desert habitats (Galloway, 1975). Some *Abronia* species are rare or endangered, e.g., *Abronia ammophila*, a highly restricted endemic of Yellowstone National Park (Saunders and Sipes, 2006); *Abronia macrocarpa*, a federally endangered species of east-central Texas (Williamson and Werth, 1999); and *Abronia umbellata* subsp. *breviflora*, a state-listed endangered species of the Oregon coast (McGlaughlin et al., 2002), which is also considered a species of concern by the US Fish and Wildlife Service (Kaye, 1999). Rarity of some species is possibly the result of their very specific habitat requirements. Additionally, habitat fragmentation and loss due to human activities such as off-road vehicle use and the development of coastal

*Tel.: +1 310 338 1983; fax: +1 310 338 4479.
E-mail address: pdrennan@lmu.edu

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