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Temperature requirements for dormancy break and seed germination vary greatly among 14 wetland *Carex* species

Karin M. Kettenring *, Susan M. Galatowitsch

Department of Horticultural Science, University of Minnesota, 305 Alderman Hall, 1970 Folwell Ave., St. Paul, MN 55108, USA

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Abstract

We evaluated dormancy loss in seeds of 14 Carex species (C. atherodes, C. brevior, C. comosa, C. cristatella, C. cryptolepis, C. granularis, C. hystericina, C. lacustris, C. pellita, C. scoparia, C. stipata, C. stricta, C. utriculata, C. vulpinoidea) under growing season and stratification conditions and determined the temperature requirements for germination. Seeds were germinated for 1 year at a diel temperature regime (5/1 °C, 14/1 °C, 22/8 °C, or 27/15 °C) or a seasonal regime (seeds moved among the four diel regimes to mimic seasonal temperatures). All species had conditionally dormant seeds at maturity. The optimal temperature for germination of most species was 27/15 °C. The 14 species were grouped by their seed viability, dormancy, and germination with a Seed Regeneration Index (SRI; range 0–1) using the results of this study and a previously published paper on stratification effects on Carex seed dormancy and germination. The eight species that had an SRI value >0.5 (C. brevior, C. comosa, C. cristatella, C. cryptolepis, C. hystericina, C. scoparia, C. stipata, C. vulpinoidea) had high seed viability (>60%) and required little to no stratification to germinate readily over a broad range of temperatures. The six species with an SRI value <0.5 (C. atherodes, C. granularis, C. lacustris, C. pellita, C. stricta, C. utriculata) generally had low seed viability (<50% and often <1%) and required stratification or particular temperatures (35/30 °C or 5/1 °C for C. stricta; 35/30 °C for C. utriculata; 27/15 °C for C. atherodes, C. lacustris, C. pellita; 5/1 °C for C. granularis) for germination >50%. These six species will require more attention from restoration practitioners to ensure that there are sufficient viable seeds to meet revegetation goals, that dormancy break is achieved, and that seeds are sown when temperatures are optimal for germination. The different seed germination syndromes that we found for these Carex species likely contribute to variable seed bank formation and emergence patterns, and species coexistence.

Keywords: Cold stratification; Germination temperature; Glacial wetland; Prairie pothole region; Sedge; Seed dormancy; Seed germination ecology

1. Introduction

As humans attempt to reverse trends of environmental degradation, ecosystem restoration is becoming increasingly important. Restoration efforts are often hampered by a lack of basic ecological information of the processes and species involved. For instance, attempts to restore plant communities are often limited by a dearth of knowledge of the life history of native species (Clewell and Rieger, 1997). Revegetation efforts focus on seeding target species directly into restoration sites or propagating plants for transplantation to restorations (Galatowitsch and van der Valk, 1994; Guerrant, 1996; Middleton, 1999). Understanding the requirements for dormancy break and germination of desired species is necessary to maximize the often limited native seed supply in many restoration efforts (Lippitt et al., 1994; Urbanska, 1997; Middleton, 1999). In nature, the requirements for seed dormancy break and germination may vary greatly within and among species (Baskin and Baskin, 1998). From a restoration perspective, breaking seed dormancy and providing suitable germination microsites can be relatively straightforward or very complicated depending on the species and its class of seed dormancy (i.e., physiological, morphological, morphophysiological, physical, or combinational) (Lippitt et al., 1994; Diboll, 1997; Baskin and Baskin, 1998; Cochrane et al., 2002). Seed dormancy and germination ecology can be quite different even for congeneric species (Grime et al., 1981; Shipley and Parent, 1991; Meyer et al., 1995; Schütz and Rave, 1999; Brändel,

* Corresponding author. Present address: Smithsonian Environmental Research Center, 647 Contees Wharf Road, Edgewater, MD 21037, USA. Tel.: +1 443 482 2265; fax: +1 443 482 2380.
E-mail address: KettenringK@si.edu (K.M. Kettenring).

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