

Effect of Light on Seed Germination of Eight Wetland *Carex* Species

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- **Background and Aims** In wetland plant communities, species-specific responses to pulses of white light and to red:far-red light ratios can vary widely and influence plant emergence from the seed bank. *Carex* species are the characteristic plants of sedge meadows of natural prairie wetlands in mid-continental USA but are not returning to restored wetlands. Little is known about how light affects seed germination in these species—information which is necessary to predict seed bank emergence and to develop optimal revegetation practices. The effects of light on germination in eight *Carex* species from prairie wetlands were investigated.
- **Methods** Non-dormant seeds of eight *Carex* species were used to determine the influence of light on germination by examining: (a) the ability of *Carex* seeds to germinate in the dark; (h) the effect of different lengths of exposures to white light on germination; (c) whether the effect of white light can be replaced by red light; and (d) whether the germination response of *Carex* seeds to white or red light is photoreversible by far-red light.
- **Key Results** Seeds of *C. brevior* and *C. stipata* germinated >25% in continuous darkness. Germination responses after exposure to different lengths of white light varied widely across the eight species. *Carex brevior* required <15 min of white light for > 50% germination while *C. hystericina*, *C. comosa* and *C. vulpinoidea* required > 8h. The effect of white light was replaced by red light in all species. The induction of germination after exposure to white or red light was reversed by far-red light in all species, except *C. stipata*.
- **Conclusions** The species-specific responses to simulated field light conditions suggest that (a) the light requirements for germination contribute to the formation of persistent seed banks in these species and (b) in revegetation efforts, timing seed sowing to plant community development and avoiding cover crops will improve *Carex* seed germination.

Key words: *Carex*, far-red light, seed germination ecology, photomorphogenesis, phytochrome, prairie wetland, red light, sedge, white light.

INTRODUCTION

Carex is a globally important genus with >2000 species worldwide (Bernard, 1990), and in many wetlands of the northern hemisphere, *Carex* species are the dominant vegetation. In the prairie pothole region of mid-continental North America, >60 species of *Carex* are found in wetland habitats (Barkley, 1986), especially sedge meadows, the seasonally flooded zone of prairie wetlands. Seed bank dynamics of prairie wetlands have been the focus of a number of studies (e.g. van der Valk and Davis, 1978; Welling *et al.*, 1988; Seabloom *et al.*, 1998). The specific factors that drive emergence from the seed bank and vegetation dynamics in sedge meadows, however, are not well understood in comparison to what is known about the dynamics of the emergent plant community (van der Valk and Davis, 1978; Kantrud *et al.*, 1989; Murkin *et al.*, 2000). In wetland plant communities, species-specific dormancy break and germination requirements influence emergence from the seed bank (van der Valk and Davis, 1978; Leek, 1989; Baskin and Baskin, 1998). Both the amount of light [length of exposure and photosynthetic photon flux density (PPFD)] and quality of light [especially the red: far-red light ratio (R : FR)] are environmental cues that signal conditions potentially suitable for seedling establishment and survival (Pons, 2000).

Many wetland species require light for germination compared with upland species (Grime, 1981). In wetland plant communities, emergence of light-requiring species from the seed bank is triggered by a disturbance when soil turnover, decline in water depth, or gaps in litter or the plant canopy (Leck, 1989) expose seeds to light or higher R: FR. Small-scale disturbances in sedge meadows include burrowing, trampling and grazing by mammals and waterfowl (Fritzell, 1989; Murkin, 1989; Swanson and Duebber, 1989). What is the predicted response of *Carex* seeds to these disturbances in sedge meadows? For many *Carex* species from prairie wetlands it is not known whether seeds germinate readily in the dark or if their

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