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Influence of shrub cover on germination, dormancy and viability of buried and unburied seeds of *Piptochaetium napostaense* (Speg.) Hackel

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Abstract

In the semi-arid rangelands of central Argentina, heavy continuous grazing has produced shrub encroachment and a decrease in the abundance of valuable perennial grasses. The objective of this work was to study the effect of shrub cover on germination, dormancy and viability of buried and unburied seeds of *Piptochaetium napostaense*, a native perennial grass abundant in the pastures and highly preferred by grazing animals. Field germination of seeds was rare, especially on the soil surface, probably due to high temperatures and lack of humidity. At the end of the field experiment, seeds were collected, tested for viability and incubated in the lab under optimal conditions for germination. Viability was high for all treatments (93–98%) indicating that seeds were not affected by the very high temperatures (up to 55 °C) measured in the field. Seeds that had been buried between shrubs showed the highest rate of germination in the lab (56%); germination of seeds buried under shrub cover was relatively low (18%); and seeds that had remained in the litter layer showed poor germination (<3%). These results may be related to disruption of dormancy owing to different temperature regimes among treatments. Exogenous dormancy due to the presence of glumes seems to be the main dormancy mechanism in this species.

Keywords: Grass; Dormancy; Shrub effects; Caldenal; Semi-arid grassland

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1. Introduction

Grazing may facilitate the creation of microsites apt for seed germination (Hulme, 1996; Moretto and Distel, 1998). Availability of propagules and adequate microsites for germination are critical for the establishment of species that propagate by seed (Grubb, 1977; Harper, 1977). Changes occurring in the semi-arid rangelands of the Caldenal in central Argentina have been attributed to overgrazing, periodical droughts and alteration of the historical frequency of natural fires (Bóo et al., 1997). These changes have caused a decrease in the productivity of the region, where the main economic activity is cattle raising, in particular cow–calve operations (Llorens, 1995). The most evident changes produced by grazing are the replacement of good forage grasses by less valuable grasses and a sharp increase in the abundance of woody species (Cano, 1975; Bóo and Peláez, 1991; Busso, 1997).

Shrub species are reported to produce environmental modifications underneath their canopy in semi-arid ecosystems. As a result of shading and litter accumulation, soil temperatures generated under the protection of shrubs are less extreme than in open spaces (Belsky et al., 1989; Vetaas, 1992). Although sites underneath woody plants receive less precipitation because of foliar interception, this is partially compensated by reduced soil moisture evaporation as a consequence of shading. Temperature and humidity are among the most crucial factors governing germination in buried seed (Vegis, 1964; Forcella et al., 2000). The milder microclimate generated under shrub canopy, with less extreme temperatures and higher humidity than in open areas, is important for seed germination of herbaceous vegetation (Breshears et al., 1998). In addition, the patchiness created by woody plants influences the establishment and regeneration of herbaceous species: there is a higher level of seed deposition and accumulation, stronger soil aggregation and more water infiltration under shrub cover than in the adjacent open spaces (Aguiar et al., 1992; Villamil, 1999). Open spaces are usually subject to considerable trampling pressure by animals in search of food. Trampling, especially under continuous overgrazing, can affect species recruitment by affecting the number of seeds and the pattern of seed distribution (Grubb, 1977; Harper, 1977; Hulme, 1996).

Some species have dormancy mechanisms that distribute seed germination over time, enhancing species conservation (Bewley and Black, 1982; Vleeshouwers et al., 1995; Hilhorst, 1998); many species have seeds able to remain dormant in the soil for several years (Nikolaeva, 1969; Koller, 1972, pp. 2–93). This dormancy can be disrupted by various causes such as temperature variation, water availability and oxygen availability (Bewley and Black, 1982; Baker, 1989; Hilhorst, 1998). Several authors mentioned that disruption of dormancy is produced by high temperatures on the soil surface (Crocker and Barton, 1957; Mott, 1978; Baskin and Baskin, 1998). Moretto and Distel (1998), working with other grass species in the same area as this study, concluded that germination increases with daily temperature fluctuations. In summary, temperature may affect dormancy and germination in several ways: maximum and minimum temperatures reached, range of daily temperature variation, and duration of critical temperatures or heating rate (Roberts, 1981; Van Assche and Van Nerum, 1997).

The effects of high temperature and daily fluctuation on seed germination and dormancy breaking mechanisms have been extensively described in the literature (Hagon 1976; Lodge and Whalley, 1981; Groves et al., 1982; Van Auken, 1997). However, most of the studies refer to experiments performed under controlled lab conditions and information about the