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Germination responses of three congeneric cactus species (*Neobuxbaumia*) with differing degrees of rarity

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Abstract

Seed germination patterns may have a direct impact on the level of rarity of a species. We analysed the germination behaviour of three cactus species differing in their degree of rarity: *Neobuxbaumia macrocephala*, *N. tetetzo*, and *N. mezcalaensis*. Germination treatments included different temperatures, immersion in HCl, darkness, and different water potentials. The rarest species, *N. macrocephala*, showed the lowest germinability compared to the other two species; *N. mezcalaensis* (the most common) showed a photoblastic response and was considerably affected by water potential. These results are discussed in terms of the differences in the level of rarity between the three species.

Keywords: Ecophisiology; Germination; Seed ecology; Arid environments; Early establishment; Plant conservation; Rarity

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1. Introduction

The analysis of the species' features that determine their distribution, abundance and habitat specificity has long been in the core of ecological research (Gaston, 1994; Krebs, 1994). These three features determine a species' level and type of rarity (Rawinowitz, 1981). This subject is considered of great relevance in the context of conservation biology, since a large number of endangered species are naturally rare and therefore more prone to decline and extinction than relatively more common ones (Gaston, 1994). A species is considered rare when its populations are biologically viable but naturally sparse, frequently limited in its distribution range and/or occupying specific habitats.

To date, there is no sound ecological theory addressing the causes of rarity. Yet, aspects such as the reproductive biology and the requirements for seed germination may play an important role as causal factors for limited abundance or restricted distribution ranges (Fiedler, 1986). Seed germination responses have a direct impact on a species' distribution and abundance, since it is a key element affecting population dynamics, especially in semi-arid environments (Godínez et al., 1999; Valverde et al., 2004). In this study we analyse the germination response of three cacti species which belong to the same genus (*Neobuxbaumia*) and differ in their degree of rarity: *Neobuxbaumia macrocephala* (Weber) Dawson, which shows low population numbers and a highly restricted distribution range is the rarest of the three; *N. tetetzo* (Weber) Backeb. shows a relatively wider distribution range and is usually present in high densities; finally, the most common of the three, *N. mezcalaensis* (Bravo) Backeb., shows the widest geographical distribution range and high population numbers (Table 1). We studied the germination responses to different factors of these three species under controlled

Table 1
Ecological features of the three *Neobuxbaumia* species studied

Species	Average seed weight (mg)	Vegetation type	Geographic distribution	Population density (plants/ha)
N. mezcalaensis	6.0	Thorny forest Dry tropical forest	Balsas River Basin (Mexican states of Colima, Guerrero, Jalisco and Michoacán) Tehuacán-Cuicatlán Region (Mexican states of Puebla and Oaxaca)	1000–1680
N. tetetzo	1.2	Dry tropical forest Xerophytic shrubland	Tehuacán-Cuicatlán Region (Mexican states of Puebla and Oaxaca)	1200–1800
N. macrocephala	0.9	Dry tropical forest Xerophytic shrubland	Valley of Tehuacán, within the Tehuacán-Cuicatlán Region (Mexican states of Puebla and Oaxaca)	130–200