

Influence of Underground Storage on Seed Weight of Perennial Plants in Mongolia

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Abstract

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There are a number of studies on relevance of photosynthetic contribution for seed weight. Here we demonstrate a contribution of plant underground storage on seed weight. We collected 348 seed samples of 230 species, in the forest-steppe, steppe, desert-steppe and desert zones in Mongolia, between 1981 and 2007. All species were categorized by growth form, flowering phenology and underground storage. Plant height was not different among categories of flowering phenology and underground storage. Seed weight was higher in large storage perennials than in small storage species. Correlation between seed weight and plant height was significantly positive in small storage perennials but it was insignificant in large storage perennials. For small storage perennials, correlation between seed weight and plant height was found in early and continuous flowering perennials while was absent in late flowering perennials. For large storage perennials, seed weight and plant height positively correlated in early flowering perennials, but those were not correlated and negatively correlated in continuous and late flowering perennials, respectively. The results suggest that early and continuous flowering perennials might use photosynthetic production for seed development, more intensive than late flowering perennials. Also, late flowering perennials more strongly use underground storage for seed development.

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Introduction

Seed weight at least partly reflects phylogenetic signals (Thompson, 1990; Grime *et al.*, 1997; Knight & Ackerly, 2002). Most studies agree that seed weight is associated to plant traits, such as growth form (Eriksson, 2016; Ackerly, 2009; Albach & Greilhuber, 2004), phenology (Zhang, 1998) and photosynthetic productivity (Liu *et al.*, 2012; Knight *et al.*, 2005). Annual plants produce smaller seeds than perennials (Sera & Sery, 2004), and herbs generally make smaller seeds than shrubs (Moles *et al.*, 2005). Leishman *et al.* (1995) reported that mean log seed weight of climbers is large, followed by woody plants, then forbs and graminoids, thus pointing to seed weight differences among growth forms. Among annual and perennial plants, onset

of flowering is positively and – respectively - negatively correlated with seed mass (Zhang, 1998; Bolmgren & Cowan, 2008). Seed size and seed mass are strongly associated to plant height (Leishman *et al.*, 1995; Moles *et al.*, 2004). Experimental results showed e.g. that seed weight is greatest for pruned *Ambrosia trifida* individuals with intact root systems (Bazzaz & Carlson, 1979), and seed weight and leaf area are positively correlated in soybean (Park *et al.*, 2013), indicating photosynthetic effect on seed weight in annuals.

A ¹³C tracing experiment revealed that young fruits are photosynthetically active, while photosynthetic products from leaves were mainly transferred to the below-ground parts