From Forest Nursery Notes, Summer 2011

162. © Seed reserve composition in 19 tree species of a tropical deciduous forest in Mexico and its relationship to seed germination and seedling growth. Soriano, D., Orozco-Segovia, A., Marquez-Guzman, J., and Kitajima, K. Annals of Botany 107:939-951. 2011.

Annals of Botany **107**: 939–951, 2011
doi:10.1093/aob/mcr041, available online at www.aob.oxfordjournals.org

ANNALS OF BOTANY
Founded 1887

Seed reserve composition in 19 tree species of a tropical deciduous forest in Mexico and its relationship to seed germination and seedling growth

Diana Soriano[1], Alma Orozco-Segovia[1], Judith Márquez-Guzmán[2], Kaoru Kitajima[3], Alicia Gamboa-de Buen[1] and Pilar Huante[1,*]

[1]*Instituto de Ecología, Universidad Nacional Autónoma de México, Apartado Postal 70-275, Ciudad Universitaria, 04510 México, DF México,* [2]*Departamento de Biología, Facultad de Ciencias, Universidad Nacional Autónoma de México, Ciudad Universitaria, 04510 México, DF México and* [3]*Department of Biology, University of Florida, Gainesville, FL 32611, USA*
** For correspondence. E-mail phuante@cableonline.com.mx*

Received: 9 November 2010 Returned for revision: 20 December 2010 Accepted: 21 January 2011 Published electronically: 7 March 2011

• *Background and Aims* The size and composition of seed reserves may reflect the ecological strategy and evolutionary history of a species and also temporal variation in resource availability. The seed mass and composition of seed reserves of 19 co-existing tree species were studied, and we examined how they varied among species in relation to germination and seedling growth rates, as well as between two years with contrasting precipitation (652 and 384 mm).
• *Methods* Seeds were collected from a tropical deciduous forest in the northwest of Mexico (Chamela Biological Station). The seed dry mass, with and without the seed coat, and the concentrations of lipids, nitrogen and non-structural carbohydrates for the seed minus seed coat were determined. The anatomical localization of these reserves was examined using histochemical analysis. The germination capacity, rate and lag time were determined. The correlations among these variables, and their relationship to previously reported seedling relative growth rates, were evaluated with and without phylogenetic consideration.
• *Key Results* There were interannual differences in seed mass and reserve composition. Seed was significantly heavier after the drier year in five species. Nitrogen concentration was positively correlated with seed coat fraction, and was significantly higher after the drier year in 12 species. The rate and lag time of germination were negatively correlated with each other. These trait correlations were also supported for phylogenetic independent contrasts. Principal component analysis supported these correlations, and indicated a negative association of seedling relative growth rate with seed size, and a positive association of germination rate with nitrogen and lipid concentrations.
• *Conclusions* Nitrogen concentration tended to be higher after the drier year and, while interannual variations in seed size and reserve composition were not sufficient to affect interspecific correlations among seed and seedling traits, some of the reserves were related to germination variables and seedling relative growth rate.

Key words: Germination, seed reserves, seedling growth, tropical deciduous forest.

INTRODUCTION

The size and composition of seed reserves are expected to vary among species in relation to their ecological strategies for seed dispersal and seedling establishment (Fenner and Thompson, 2006). Seed reserves may also play a role in the seed's permanence in soil banks and its susceptibility to predation (Hoshizaki and Miguchi, 2005; Rajjou and Debeaujon, 2008). Young seedlings depend on the availability of stored reserves in seeds, such as carbohydrate, lipids, storage protein and other mineral nutrients, until seedlings become established (Fenner, 1983; Kitajima, 2002; Hanley *et al.*, 2004; Kitajima and Myers, 2008). While many workers have explored the relationships of seed size to seed dispersal and seedling recruitment strategies (e.g. Moles and Westoby, 2006), seed reserve composition has been quantified for only a small number of species in relation to ecological characteristics (Levin, 1974; Ichie *et al.*, 2001; Finkelstein and Grubb, 2002). The composition of these maternally endowed resources may vary in relation to the environmental conditions experienced by the mother plant (Gutterman, 1980); little is known about how environmental conditions can affect multiple co-existing species (Violle *et al.*, 2009). Furthermore, little is known about how seed reserves are distributed within seeds, even though such information could be useful in taxonomical identification and help to understand water imbibition characteristics of the embryo (Shepherd *et al.*, 2005).

Seed size may reflect various aspects of plant life histories and reproductive ecology (Marañon and Grubb, 1993; Fenner and Thompson, 2006; Moles and Leishman, 2008). Seed size is considered to be traded-off with seed number in relation to the relative importance of seedling establishment vs. dispersal (Ezoe, 1998; Muller-Landau, 2010). The advantage of seed size for seedling establishment has been shown repeatedly in shaded environments (Poorter and Rose, 2005), but seed size advantage for survival in a dry environment is equivocal (Leishman and Westoby, 1994). Seed size is often negatively correlated with seedling relative growth rate (RGR) across species (e.g. Fenner, 1983; Huante *et al.*,