Effects of Seed Size and Temperature on Seed Dormancy in an Alpine Meadow on the Eastern Tsinghai-Tibet Plateau

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Key words: seed dormancy, alpine meadow, temperature treatment, seed size, Tsinghai-Tibet plateau

Introduction As a complex phenomenon, dormancy is an important persistence mechanism for many weeds in temperate regions (Baskin and Baskin 1998). Although germination could be influenced by lots of factors, temperature is one of the most important environmental factors influencing the induction of seed dormancy (Strand, 1980). Meanwhile most studies have concentrated on demonstrating intraspecific variation in seed size with respect to their fitness. However, studies dealing with variation in seed size among species are few (Foster 1985; Murali KS 1997). In this research, we aimed to assess correlations between seed size and proportion dormancy of 534 plants in a whole community and whether these correlations change depending on temperature treatments.

Material and method In this experiment, 5/15℃, 5/20℃, 10/25℃ were chosen. Seeds were sorted by weight into 92, 21 and 11 size classes, on the basis of 0.05mg, 0.5mg and 1mg intervals respectively (because some mass classes were missing or had only fewer species when seed mass > 3.0mg, not all size classes were sorted by fixed interval). Data from this study were analyzed using SPSS 13.0 software. After conducting an analysis of variance (General Linear Model), the LSD was used to detect significant differences among the treatments with a probability of 95% ($\alpha = 0.05$).

Results Both seed size and temperature had strong influences on the proportion dormancy, but no interaction was found between temperature and seed size (Table 1). High proportion dormancy occurred at 5/20℃, compared with 5/15℃ and 10/25℃ (Figure 1). We also found a significant positive relationship between seed mass and dormancy percentage. With the decline of the classification number, the correlation between seed mass and proportion increased (Figure 2).

Table1 *Results of GLM for the effects of temperature and seed size on the proportion dormancy.*

Source	df	F	p
Correct model	247	1.50	<0.001
Seed size	91	1.66	<0.001
Temperature	2	7.24	0.001
Seed size × Temperature	154	0.78	0.98

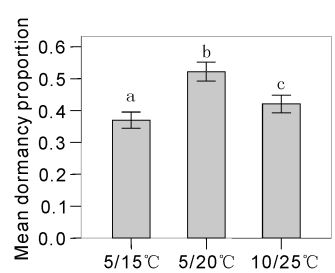

Figure 1 *The mean (± SE) proportion dormancy at 5/15℃, 5/20℃ and 10/25℃.*

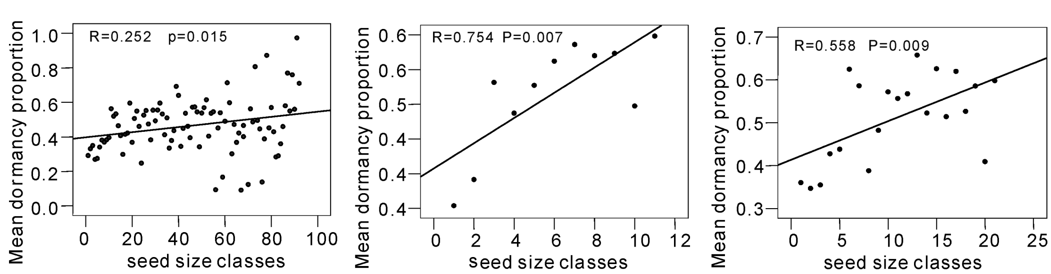

Figure 2 *Simple linear regressions of mean proportion dormancy against seed mass*

Discussion Seed dormancy pattern and germination preferences help to explain and predict the spatial and temporal distribution of a species. According to our results, relatively larger seeds showed higher proportion dormancy. Similar to our study, many researches have found significant correlations between seed mass and dormancy (Thompson and Grime 1979). Rees and Jurado found a negative relationship between seed mass and dormancy in 1996 and 2005 respectively. This different result may stem from the fact that important factors co-varying with seed size and/or seed dormancy may have been left out of consideration (Jurado and Flores 2005). Furthermore, percentage germination of larger seeds would lower because of their usual opacity of thick and hard seed coats (Pearson et al. 2002). In addition, the seed sizes are various at different flora. In the Tsinghai-Tibet alpine meadow, small-seeded species had a numerical advantage, so the decision of seed size has the quality of relativity. The interesting pattern observed in this study is the higher proportion dormancy occurred at 5/20℃, neither the high temperature 10/25℃, nor the low one 5/15℃.