From Forest Nursery Notes, Summer 2007

15. © A method for breaking physical dormancy in seeds of the endemic Tibetan plateau shrub *Sophora moorcroftiana* var. *moorcroftiana* (Fabaceae) and implications for restoration. Baskin, C. C., Wurts, J., Liu, Z., and Baskin, J. M. Natural Areas Journal 27(2):118-123. 2007.

RESEARCH ARTICLE

•

A Method for Breaking Physical Dormancy in Seeds of the Endemic Tibetan Plateau Shrub *Sophora moorcroftiana* var. *moorcroftiana* (Fabaceae) and Implications for Restoration

Carol C. Baskin[1, 2, 4]
Jennifer Wurts[1]
Zhimin Liu[3]
Jerry M. Baskin[1]

[1] Department of Biology
University of Kentucky
Lexington, KY 40506-0225

[2] Department of Plant and Soil Science
University of Kentucky
Lexington, KY 40546-0312

[3] Institute of Applied Ecology
Chinese Academy of Sciences
Sheyang 110016, China

[4] Corresponding author:
ccbask0@uky.edu

Natural Areas Journal 27:118–123

ABSTRACT: Our purpose was to find a practical, easy, and economical method to break physical dormancy (PY) in seeds of *Sophora moorcroftiana* var. *moorcroftiana* from the Qinghai-Xizang (Tibet) Plateau of China and thus to facilitate use of this species in restoration. Mechanically-scarified seeds germinated to 100%, but neither dry heat, wet heat, chilling in ice water, nor freezing broke PY. However, 90-100% of the seeds were made water-permeable by subjecting them to wet heat (90 or 100 °C)/ice water (0 °C) cycles. Water uptake in wet heat/ice water-treated seeds was through the lens in 86% of the seeds that imbibed. Seeds made permeable by wet heat/ice water cycles and then stored dry at 22-24 °C for 69 wk germinated to 79%. Thus, seeds can be made water-permeable, stored dry, and then sown later at a restoration site. In trying to germinate seeds of other legumes with PY, wet heat/ice water cycles should be tried when neither wet nor dry heat treatments will make seeds water-permeable.

Index terms: legume seed, lens, physical dormancy, restoration, seed germination

INTRODUCTION

Sophora moorcroftiana (Benth.) Benth. ex Baker var. *moorcroftiana* (Fabaceae) (hereafter *S. moorcroftiana*) is a long-lived perennial shrub endemic to the Qinghai-Xizang (Tibet) Plateau, in western China, while variety *nepalensis* Kitam occurs in Bhutan, northern Burma, Nepal, and northern India (Flora Himalaya Database; TCSTQPCAS 1985; Liu et al. 2006). In China, *S. moorcroftiana* is distributed in the wide valleys of the middle reaches of Yarlung Zangbo River and several of its main tributaries (Nianchu and Lhasa Rivers), at elevations ranging from 2900 to 4100 m.a.s.l. (TCSTQPCAS 1988). *Sophora moorcroftiana* is one of the dominant species in the local xeric vegetation, and its optimal habitats are sand-covered terraces, semi-stable dunes, and initial stages of fixed sand dunes (Zhao 1998). Thus, it is an important species in regions of Tibet that are subject to desertification. According to Xue-Yong et al. (2002), 20.47 million ha are desertified in Tibet, and another 1.37 million ha are vulnerable. One of the many causes for increased desertification in Tibet is collection of *S. moorcroftiana* for firewood, which leads to activation of sand dunes (Liu and Zhao 2001). These authors estimate that 40-60 km^2 of natural vegetation, mostly *S. moorcroftiana*, are cut for fuel each year.

Sophora moorcroftiana is not a pioneer species, and plants grow too slowly to be a good sand-fixing species (Liu and Zhao 2001); however, it may be a good successor of pioneer, sand-binding plants (Liu et al. 2003). Consequently, this economically valuable species needs to be established after the moving sand has been stabilized, and the most cost-effective way to establish plants of *S. moorcroftiana* would be to sow seeds and have them germinate in situ. However, this species is not extensively used for revegetation because there is no reliable method for germinating the seeds. Thus, the purposes of our research were to find an effective, easy, and inexpensive method to germinate seeds of *S. moorcroftiana* and to determine if seeds made nondormant retained the ability to germinate after dry storage.

Seeds of *Sophora* species have water-impermeable seeds coats (Baskin and Baskin 1998), or physical dormancy (PY), and thus mechanical and acid scarification are effective methods to break dormancy. However, since mechanical scarification is tedious and time-consuming and acid scarification relatively expensive and potentially dangerous, the focus of our research was to find an easy way to make seeds permeable by causing the lens to open. The lens is an anatomical feature (sometimes a small protuberance) in the seed coat of many legumes (Werker 1997), including *Sophora* (Van Staden et al. 1989). In response to appropriate environmental signals, cells in the lens pull apart, resulting in creation of a natural water gap in the seed coat (Baskin et al. 2000; Baskin 2003).

Depending on the species, dry heat (Narang and Bhardwaja 1974; Martin et al. 1975; Teketay 1996), wet heat (Iwata 1966; Brant et al. 1971; Silva and Felippe 1986), and below-freezing temperatures (Martin 1945; Baskin et al. 2005) have been shown to make seeds of some legumes water-permeable. Thus, we tested the effects of these