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SENSITIVITY CYCLING AND MECHANISM OF PHYSICAL DORMANCY BREAK IN SEEDS OF *IPOMOEA HEDERACEA* (CONVOLVULACEAE)

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Sensitivity cycling to physical dormancy (PY) break in seeds is known to occur in some Fabaceae and Convolvulaceae species. PY in seeds of species of Convolvulaceae and of some other angiosperm plant families can be broken by storing them dry. However, the mechanism of opening the water gap in the seed coat (dormancy break) during dry storage has not been investigated. In research reported here, we determined whether sensitivity cycling occurs in seeds of *Ipomoea hederacea* (Convolvulaceae) and investigated the effect of dry storage on opening of the water gap. Seeds can cycle between insensitive and sensitive states to dormancy break, and dormancy can be broken in sensitive seeds by storing them dry at high to moderate temperatures. Seeds with the lower part of the hilum blocked lost a minimal amount of water during storage. Percentage water loss was significantly correlated with percentage dormancy break. Desorption of water through the hilar fissure during dry storage reduced the vapor pressure below the bulges (water gap), which caused slits to form around the bulges (opening of water gap). The amount of water desorption was low in insensitive seeds because the hilar fissure remained closed and thus the water gap did not open.

Keywords: bulges, hilar pad, physical dormancy, sensitivity cycling, water gap.

Introduction

Sensitivity cycling (insensitive ↔ sensitive) of physically dormant (PY) seeds to dormancy break is known to occur in seeds of species of Fabaceae (*Trifolium subterraneum* [Taylor 1981, 2005], *Ornithopus compressus* [Taylor and Revell 1999], and some other papilionoid legume species [Van Assche et al. 2003]) and of Convolvulaceae (*Ipomoea lacunosa* [Jayasuriya et al. 2008*a*], *Cuscuta australis* [Jayasuriya et al. 2008*c*], and *Jacquemontia ovalifolia* [Jayasuriya et al. 2008*b*]). Sensitivity cycling allows seeds to fine-tune the germination event to the environmental conditions favorable for germination and plant establishment (Jayasuriya et al. 2008*a*). Sensitivity cycling in seeds with physical dormancy (also PY) is ecologically equivalent to dormancy cycling in physiologically dormant seeds (Jayasuriya et al. 2008*a*), and thus it is important in the timing of germination of PY seeds in the field.

The close relationship between sensitivity cycling and breaking of PY has been used in modeling the maintenance of the Mediterranean-climate pasture species *T. subterraneum* and *O. compressus* (Fabaceae; Taylor 2005) and of the dynamics of seed dormancy and germination in the crop weed species *I. lacunosa* (Convolvulaceae; Jayasuriya et al. 2008*a*). Thus, knowledge of sensitivity cycling in seeds with PY, such as that in some species of Convolvulaceae and Fabaceae, is essential in understanding the timing of seed dormancy break and of plant and stand establishment in the field. This is particularly true for annual species.

Ipomoea hederacea Jacq. var. *hederacea* (Convolvulaceae) is a summer annual vine native to the eastern United States (Abel and Austin 1981; Gleason and Cronquist 1991). It is a common weed in corn (Webster et al. 2000), cotton, soybeans, and tobacco (Dowler et al. 1995). Stoller and Wax (1974) reported that intact seeds of this species stored dry at ambient laboratory temperature for 3 mo germinated to high percentage without further pretreatment, and Gomes et al. (1978) reported that dry storage of seeds at 22°C increased germinability of nonscarified seeds. Acid-scarified *I. hederacea* seeds germinated over a wide range of temperatures (16°–32°C) and osmotic potentials (0–10 bars [0–1.0 MPa]), whereas nonscarified intact seeds germinated to <20% in all temperatures tested (Crowley and Buchanan 1980). Gomes et al. (1978) reported that <20% of the scarified seeds of this species germinated at 40°C, whereas none of the nonscarified seeds germinated at this temperature.

A slit, or opening, is formed in the water-impermeable seed or fruit coat during alleviation of PY and allows seeds to take up water (Baskin et al. 2000). In most Convolvulaceae species, the slits that form around the bulges adjacent to the micropyle during dormancy break allow the seed to take up water (Jayasuriya et al. 2007). A hypothesis for the mechanism of PY break has been proposed for *Acacia kempeana*, in which dormancy is broken by dipping seeds in boiling water for 30 s (Hanna 1984), and for *I. lacunosa*, in which dormancy is alleviated by wet storage (Jayasuriya et al. 2009*b*). According to the speculation of Hanna (1984), heating increases pressure in the vascular bundle below the lens, which causes uplift and cracking (opening) of the lens, thus allowing water to enter

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