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Morphological Characteristics of Seeds With Physical Dormancy©

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INTRODUCTION

Seed dormancy is a condition where seeds will not germinate even when the environmental conditions (water, temperature, light, and aeration) are permissive for germination (Hartmann et al., 2011). Not only does seed dormancy prevents immediate germination, it also regulates the time, conditions, and location where germination will occur. In nature, different kinds of dormancy have evolved to aid the survival of a species by programming germination for particularly favorable times in the annual seasonal cycles (Baskin et al., 1998).

The major seed dormancy categories include:

- Primary dormancy
  - exogenous dormancy (physical)
  - endogenous dormancy (physiological and morphological)
  - combination dormancy (physical plus physiological)
- Secondary dormancy

The focus of this paper will be to describe the morphological characteristics associated with physical dormancy and indicate how specialized structures on the seed called water gaps function to coordinate dormancy release.

PHYSICAL DORMANCY

Exogenous physical dormancy is imposed upon the seed from factors external to the embryo including the outer seed coat or parts of the fruit coverings (Hartmann et al., 2011). Seeds with physical dormancy fail to germinate because the seed is impermeable to water. Physical dormancy is found in at least 15 plant families, including horticulturally important families like the Fabaceae, Malvaceae, Cannaceae, Geraniaceae, and Convolvulaceae (Baskin et al., 2000). For horticultural crop production, seeds are scarified to mechanically abrade the seed coverings or seeds are treated with concentrated sulfuric acid to alleviate physical dormancy. In nature, exposure to high temperature or fluctuating temperatures is the most likely cause of dormancy release (Geneve, 2003).

Two features characterize seeds with physical dormancy. Physically dormant seeds have an outer seed or fruit cell layer comprised of macrosclereid cells and there is also a surface feature within the outer seed layers that functions as a water gap to allow water imbibition.

MACROSCLEREID CELL LAYER

Macrosclereid cells form the outer cell layer in the seed coat or fruit wall in physically dormant seeds and are responsible for preventing water uptake (Fig. 1). These cells belong to a plant cell type called sclereids. Sclereids are characterized by extensive secondary wall formation and are usually non-living at maturity. This cell layer is also referred to as the Malpighian or palisade cell layer. Malpighian cells