PALMER AMARANTH POLLEN VIABILITY

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Introduction

The probability of a successful germination event occurring at any given distance from a pollen source is dependant upon the performance of pollen grains post-anthesis. Although many authors have shown that the functional life of pollen decreases at higher temperatures, lower relative humidities (RH), and with increased exposure to ultra-violet (UV) radiation and atmospheric pollutants, there have been no comprehensive studies performed to describe how pollen of a weedy species, such as Palmer amaranth, is affected by a range of environmental conditions. Our objective was to describe how Palmer amaranth pollen viability changes over time.

Materials and Methods

Because members of the family Amaranthaceae produce tri-nucleate pollen (tri-nucleate pollen produced by dicot species tend to have limited germinability *in vitro*), enzymatic assays, as opposed to an artificial germination media, were used to evaluate pollen longevity. In particular we employed 3-(4,5-dimethyl-2-thiazolyl)-2,5-diphenyl-2H-tetrazolium bromide (MTT). MTT is enzymatically converted (via dehydrogenase) from a yellow, soluble liquid to a reddish-purple, insoluble crystal in living cells.

Freshly harvest pollen grains were dusted onto microscope slides using a painter's brush and exposed to local atmospheric conditions for up to four hours for five days in July and August of 2007. Pollen grain sub-samples were brought into the lab at regular intervals and stained with MTT to monitor the change in dehydrogenase activity over time. Because the evaluation of color intensity is highly subjective (i.e. the concepts of dark, medium and light may differ among observers), we used a Diagnostic Instruments® SPOT™ Insight camera attached to an Olympus® BH-2 research microscope (400x magnification) to capture digital images of the pollen grains and then evaluated the degree of color development using RGB Color Analysis Software ©. The RGB software describes the color of any object, numerically, with respect to the amounts of red (R), green (G) and blue (B) present. Color values can range from 0 (very dark) to 255 (very light). Therefore, a combination of 255-R:255-G:255-B describes an object that is pure white, whereas 0-R:0-G:0-B describes an object that is pure black. Freshly harvested and enzymatically active pollen grains will stain darkly and have RGB values that are lower than more aged grains. No less than 300 pollen grains were scored for each time period each day.

Results and Discussion

Results show that the degree of color intensity, and therefore enzymatic activity, decreased with increased time post-harvest (Figure 1). When the RGB values were transformed to express color intensity as a percent of the freshly-harvested pollen (0 minutes) and statistically analyzed, it was determined that enzymatic activity was significantly reduced after 30 minutes. These results suggest that Palmer amaranth pollen viability may decrease rapidly, post-anthesis. Pollen grains that travel long-distances before contacting a receptive ovule may be less able to germinate and initialize a fertilization event than pollen grains with a shorter flight-time.

Figure 1. Change in color intensity of Palmer amaranth pollen grains over time.