Time and Temperature Requirements for Thermal Death of Seeds of Yellow Starthistle (*Centaurea Solstistealis* L.) and Black Mustard (*Brassica Nigra* L.)

Carrie C. Tuell-Todd, Ruth M. Dahlquist, and Michael Kunz, Fresno Pacific University, 1717 S. Chestnut Ave., Fresno, CA 93702-4709, ruth.dahlquist@fresno.edu;
James J. Stapleton, Statewide Integrated Pest Management Program, Kearney Agricultural Center, University of California, 9240 S. Riverbend Ave., Parlier, CA 93648, jim@uckac.edu

Solarization is a method of soil disinfestation that relies upon high temperatures to reduce populations of pest organisms in the soil (Stapleton and De Vay 1986). Soil temperatures above 45 C have been found to reduce emergence of seeds of annual weed species (Horowitz et al. 1983, Peachey et al. 2001). While solarization has promise as a potential alternative to soil fumigation, specific guidelines for treatment are lacking (Stapleton et al. 2000). Time and temperature requirements for thermal death have already been determined for seeds of six weed species (annual sowthistle, barnyardgrass, black nightshade, common purslane, London rocket, and tumble pigweed) at temperatures reached during solarization (Dahlquist et al. 2007).

We determined the time required for thermal death for seeds of two additional weed species, yellow starthistle (*Centaurea solstitialis* L.) and black mustard (*Brassica nigra* L.), at 50 C. Seeds were placed in organdy bags and allowed to imbibe water at room temperature for 2 hours before heat treatment. Seed bags were placed in 0.47-L mason-type canning jars filled with 30-grit silica sand wetted to field capacity (10.4% moisture) with deionized water and maintained at 50 C in a water bath. Six jars per species were maintained at 50 C, and three jars were kept at room temperature as controls. In each experiment, three to four bags of seeds were placed in each jar. Seed bags were removed at intervals from 2 to 19 hours. After removal from the jars, seeds were taken out of the packets and placed in 100 by 15-mm petri dishes on 7-cm-diam Whatman #1 filter paper moistened with 1.4 ml of deionized water. Petri dishes were incubated in a growth chamber on a cycle of 8 h at 20 C in darkness and 16 h at 30 C. Germination percentages were determined for each dish after 14 days. The percentage germination from each bag of seeds was divided by the average percentage germination of the three controls to correct for any variables besides temperature. A tetrazolium test was performed on black mustard seeds with intact seed coats that had not germinated to determine viability. Seeds were incubated for 24 hours in 1% (wt/vol) triphenyl tetrazolium chloride and then examined for staining patterns.

Seeds of both weed species were dead within 16 hours at 50 C. This combination of time and temperature falls within the range of values for the weed species previously studied. Annual sowthistle required 4 hours at 50 C for complete mortality, while more heat-tolerant species such as black nightshade and tumble pigweed required 71 and 113 hours, respectively. This indicates that yellow starthistle and black mustard seeds are relatively susceptible to high temperatures. In tetrazolium tests, 96% of black mustard seeds were determined to be non-germinable, indicating

that the lack of germination was due to mortality at high temperatures rather than heat-induced dormancy.

References:

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