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Mechanical Scarification of Dodder Seeds with a Handheld Rotary Tool

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Dodder seeds are physically dormant because of hard seed coats and do not readily germinate without scarification. Reliable methods of scarification for small lots of dodder seed are needed to facilitate laboratory, greenhouse, and field research projects. Dodder seed was scarified for varying times using a handheld rotary tool at the 10,000 rpm setting with a conical grindingstone bit attached. Percentage of germination and weight change of seeds were assessed using scarification times between 0 and 4 min at 0.5-min increments. Mean seed weight loss and mean number of germinated seeds increased quadratically as scarification time increased. Scarifying for 2.5 min was judged the shortest time with maximal germination. Another study evaluated the effect of seed number (100 to 400 seeds sample^{-1}) on the efficacy of rotary tool scarification when scarification time was held constant at 2.5 min. Percentage of germination decreased linearly as seed batch size increased. The handheld rotary tool provides consistent and repeatable scarification of dodder seed with germination rates greater than 80%.

Nomenclature: Dodder, *Cuscuta* spp.; cranberry, *Vaccinium macrocarpon* Ait.

Key words: Electric scarifier, impermeable seed coat, parasitic weed, persistent seeds, physical dormancy, presowing treatment, seed germination.

Las semillas de *Cuscuta spp.* tienen latencia física debido a que sus testas son duras y no germinan fácilmente sin escarificación. Se necesitan métodos confiables de escarificación para lotes pequeños de semillas de *Cuscuta* para facilitar los proyectos de investigación de laboratorio, invernadero y campo. La semilla de *Cuscuta* fue escarificada por períodos diferentes usando una herramienta de rotación manual a 10,000 RPM a la cual se le colocó una piedra cónica de esmeril. El porcentaje de germinación y el cambio en el peso de las semillas fueron evaluados usando tiempos de escarificación entre 0 y 4 min, con incrementos de 0.5 min. La pérdida promedio en el peso de la semilla y el número promedio de semillas germinadas se incrementó cuadráticamente conforme aumentó el tiempo de escarificación. La escarificación por 2.5 min fue considerada como el tiempo más corto con máxima germinación. Otro estudio evaluó el efecto del número de semillas (de 100 a 400 semillas por muestra) en la eficacia de la herramienta rotativa cuando el tiempo de escarificación se mantuvo constante a 2.5 min. El porcentaje de germinación disminuyó linealmente conforme se incrementó la cantidad de semillas en la muestra. La herramienta rotativa manual proporciona escarificación consistente y repetible de las semillas de *Cuscuta* con índices de germinación superiores al 80%.

Reliable methods to promote seed germination are needed in many areas of weed science research. The seeds of dodder do not readily germinate without scarification (Meulebrouck et al. 2010), especially after field collection and storage in the laboratory or other facilities. The physical dormancy of dodder seeds is attributed to hard seed coats, preventing water from being imbibed, and is believed to be associated with the drying out of the seed coat (Dawson et al. 1994; Gaertner 1950; Jayasuriya et al. 2009). It has been suggested that when dormancy is broken under natural conditions, water enters dodder seeds exclusively via the hilum (Jayasuriya et al. 2009). However, laboratory studies that used concentrated sulfuric acid to break physical dormancy by causing damage to the seed coat have demonstrated that water can be absorbed though the entire dodder seed coat (Hutchison and Ashton 1979; Jayasuriya et al. 2009).

The search to find adequate germination methods for dodder extends back many decades, often with minimal success. The acid scarification method developed in the 1950s to enhance dodder seed germination has retained favorable prominence for seed germination work. The conventional approach is to soak the seeds in concentrated (96 to 98%) sulfuric acid (Buhler and Hoffman 1999; Gaertner 1950). In our experience, treatment with concentrated sulfuric acid has generated germination rates less than 50% (H. Sandler, unpublished data). In addition, potential injury to laboratory personnel from the use of a strong acid and base (needed to neutralize the pH after acid treatment) reduces the utility of this approach. The use of acid to scarify seeds requires the use of proper ventilation, protective clothing for the body and face, and appropriate disposal of hazardous chemicals after the scarification process is complete.

Mechanical scarification has been used with varying degrees of success with many other types of seeds. Methods have included scarifying annual wildrice (*Zizania aquatica* L.) seeds with granite (Oelke and Albrecht 1978), puncturing ornamental cycad (*Zamia* L. spp.) seeds (Smith 1978), piercing trailing crownvetch (*Coronilla varia* L.) seed (McKee et al. 1979), and rubbing seeds with sandpaper (acacia [*Acacia* Mill. spp.] and chinaberry [*Melia azedarach* L.])(Azad et al. 2010; Padma et al. 1993). High-capacity (high-volume) commercial mechanical seed scarifiers are available, such as the Forsberg Huller/Scarifier (Forsberg, Inc., Thief River Falls, MN), but

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