

Assessing the success of scarification in promoting germination in *Cuscuta glomerata*, a hard-seeded parasite

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Background

- Rope dodder, *Cuscuta glomerata*, is one of few parasitic plants in tallgrass prairie that derives all fixed carbon from its host
- Parasites like dodder might mediate interspecies competition to maintain biodiversity in increasingly fragmented prairie
- Laboratory study of *C. glomerata* could yield information about its peculiar, rootless lifecycle and its interactions with hosts, but no one knows how to germinate *C. glomerata*
- Other species of dodder are hard-seeded and need scarification with acid, sanding, or boiling to break the seed coat

Question

Which scarification methods and climate incubation conditions most successfully promote germination in *Cuscuta glomerata*?

Methods

840 *C. glomerata* seeds from one individual were sorted into 7 scarification treatments groups, each with 4 climate conditions, with 3 replicates, $n=10$

Seeds were submerged in concentrated H_2SO_4 for 10, 20, or 30 minutes and rinsed 5 times with dH_2O

Seeds were boiled in dH_2O for 10, 20, or 30 seconds and rinsed 5 times with cool dH_2O

Seeds were rinsed 5 times with dH_2O

Seeds from all scarification treatments were randomly assigned to 84 4cm Petri dishes. A replicate contained 10 seeds from each scarification treatment in 7 dishes. 3 replicates were assigned to each of 4 climate conditions: 15/5°C, 20/10°C, 25/15°C, and 30/30°C

Seeds were checked for radicle protrusion every 24 hours for 6 days



Brian O'Brien, 2013

Results

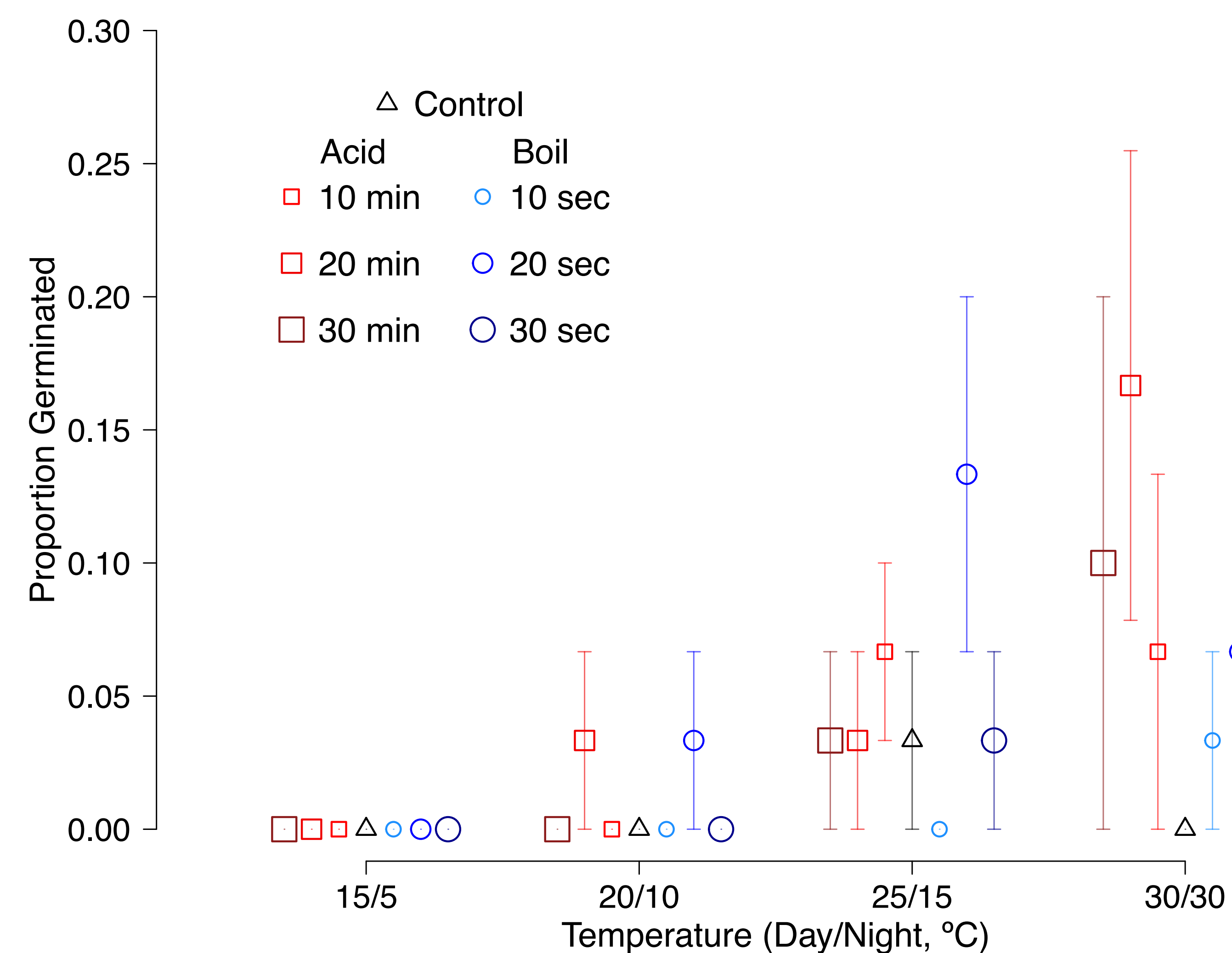


Figure 1. Proportion of *C. glomerata* seeds exposed to scarification treatments that successfully germinated after 6 days of incubation in one of four climate conditions

- A comparison of generalized linear models with a likelihood ratio test suggested that incubation temperature ($p=2.5 \times 10^{-9}$) and scarification treatment ($p=0.031$) additively influence germination success
- The highest average germination rates observed for each scarification treatment were generally among the replicates exposed to 30/30°C
- Acid submersion for 20 min produced the highest germination rate at optimal climate conditions (16.7%)
- Boiling for 20-30 seconds both offered similarly high germination rates (13.3%) at 25/15 and 30/30 incubation conditions respectively
- Untreated seeds and seeds boiled for 10 seconds rarely germinated (at most 3.3%) even in warm conditions

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Discussion & Conclusion

- *C. glomerata*, like other dodder species, is hard-seeded, and requires scarification of the outer seed coat before it can germinate
- Incubation temperature and scarification treatment both influence germination success in *C. glomerata*, with effects combine additively
- Given the high germination rate of scarified seeds incubated in warm conditions (30/30°C), *C. glomerata* seeds favor balmy conditions
- Acid scarification and scalding treatments were able to produce similarly high germination rates. Both could be viable scarification methods for artificial germination in the laboratory
- Acid scarification longer than 20 minutes reduced germination rates. H_2SO_4 dissolves the outermost seed coat layers and damage the embryo faster in *C. glomerata* than some dodder species but slower than others, implying interspecific variation in seed coat thickness
- The success of scalding in increasing germination may relate to the influence of burning on rope dodder proliferation observed in Ohio populations after statewide extirpation