Seed Germination of *Scutellaria* Species

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Seed capsules of *Scutellaria floridana*

Scutellaria incana in bloom

Abstract

Florida Skullcap, *Scutellaria floridana* (Lamiaceae), is a federally threatened species in the Florida Panhandle. Its habitat is a fire-prone, longleaf pine forest. Other *Scutellaria* species used in the study are found in southeastern U.S. The objective of this study was to compare several techniques to germinate seeds of *S. incana*, *S. lateriflora*, *S. ovata versicolor*, and *S. floridana*. *Scutellaria lateriflora* and *S. ovata versicolor* were stratified for one and two months at 4°C, whereas *S. floridana* was stratified for 1.5 months. All four species were scarified with concentrated sulfuric acid for various times (15 to 60 minutes). Smoke treatments were: Wrights® Hickory Smoke Seasoning (1:100 to 1:1000) for all species, and also plant debris smoke (half and full strength) for *S. floridana*. All seeds were placed in petri dishes moistened with appropriate solutions on filter paper with 3 replications. Dishes were placed in a chamber with 16 hours light at 25°C for 30 days. The best treatment was 15 minutes acid scarification for *S. lateriflora* with all other treatments yielding 13% germination or less for the 3 species, excluding *S. floridana*. Control seeds of *S. floridana* germinated significantly higher than stratification, scarification, and plant debris solutions, but were similar to Hickory Smoke Seasoning. Overall, seeds of *S. floridana* responded differently than the other three species.

Introduction

Florida skullcap, *Scutellaria floridana* Chapm. (Lamiaceae), is a federally threatened perennial forb found in four counties in the Florida Panhandle: Bay, Gulf, Franklin, and Liberty (U.S. Fish and Wildlife Service 2009). This species blooms in the spring and summer having blue/purple flowers with a white middle lower lip. *Scutellaria floridana* can be found in grassy, longleaf pine forests and savannas, once frequented by fires. Studies show that native plants can benefit from fires because of disturbance and reduced competition, and may trigger an increase in flowering (U.S. Fish and Wildlife Service 2009; Glitzenstein *et al.* 1995; Hessl and Spackman 1995). In addition, seeds of species found in fire-prone habitats respond to smoke solutions containing compounds created by burning plant debris. *Scutellaria* species also have germinated after stratification (Karlsson *et al.* 2006). For members of Lamiaceae, scarification of seeds increased germination by damaging the seed coat (Contreras and Ruter 2009). In this study, we seek to understand some of the seed germination requirements of *Scutellaria floridana*, our focal species, and three other *Scutellaria* species found throughout the southeastern U.S. (USDA, NRCS 2013): Hoary skullcap (*Scutellaria incana*), Blue skullcap (*Scutellaria lateriflora*), and Heartleaf skullcap (*Scutellaria ovata versicolor*).

Objective

To compare several techniques to germinate seeds of *Scutellaria incana*, *Scutellaria lateriflora*, *Scutellaria ovata versicolor*, and *Scutellaria floridana*

Materials and Methods

Seed Source

Scutellaria incana seeds were purchased from Missouri Wildflowers Nursery (Jefferson City, MO), *Scutellaria lateriflora* and *Scutellaria ovata versicolor* seeds were purchased from Prairie Moon Nursery (Winona, MN), and *Scutellaria floridana* seeds were collected in Florida in May 2007 and were donated from Bok Tower Gardens (Lake Wales, FL).

Stratification

• Seeds placed in moistened mixture of sphagnum peat moss and sand for 1, 1.5 or 2 months at 4°C.

Scarification

• Seeds submerged in sulfuric acid (95-98%) for 15, 30 or 60 minutes then rinsed in water for 5 minutes.

Hickory Smoke Seasoning

• Wright's® Natural Hickory Seasoning was diluted to concentrations of 1:100, 1:500 or 1:1000.

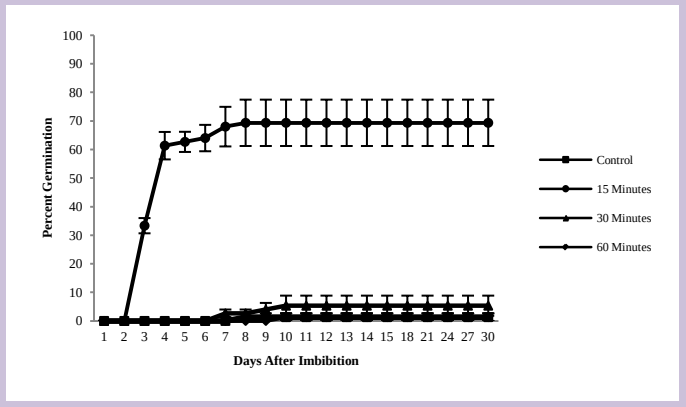
Plant Debris Smoke

• Plant debris from *S. floridana*'s habitat was air dried and burned in a bee smoker.
• Smoke was flushed through distilled water to collect water soluble smoke compounds.
• Plant debris smoke solutions were used in full and half strengths.

Setup and Analysis

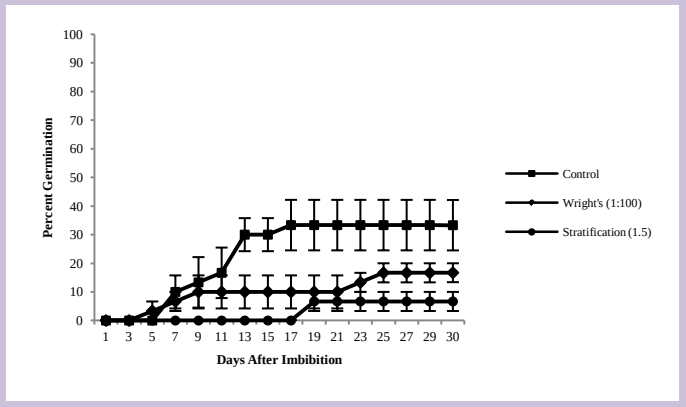
• *Scutellaria incana*, *S. ovata versicolor*, and *S. floridana* had 10 seeds per replication. *Scutellaria lateriflora* had 50 seeds for all replications except for stratification, which had 25 seeds per replication.
• For *S. floridana*, a tetrazolium test was performed and revealed 40% of seeds were viable.
• For all treatments, seeds were placed on filter paper within plastic petri dishes moistened with appropriate solutions.
• Petri dishes were placed in colorless plastic tubs in a Percival Scientific germinator with 16 hours light and 8 hours dark at 9 1 $\mu mol \cdot m^{-2} \cdot s^{-1}$ and 25.0 0.0 C.
• Germination was recorded over 30 days as indicated by radicle emergence.
• Data were analyzed in SPSS by ANOVA followed by Duncan's multiple range test at 5% level.

Germination Rates – *S. lateriflora* Scarification



Means standard errors

Germination Rates – *S. floridana* Hickory Smoke Seasoning and Stratification



Means standard errors

Seed Germination with Various Treatments

Treatments		*S. incana*[z]	*S. lateriflora*	*S. ovata versicolor*	*S. floridana*
Stratification	1 month	x	2.0 1.2	0.0 0.0	x
	1.5 months	x	x	x	6.7 3.3**
	2 months	x	1.3 0.7	0.0 0.0	x
Scarification	15 mins	x	69.3 8.1*	0.0 0.0	x
	30 mins	10.0 5.8	5.3 3.5	0.0 0.0	0.0 0.0**
	60 mins	3.3 3.3	1.3 1.3	13.3 8.8	x
Hickory Smoke Seasoning	1:100	0.0 0.0	0.7 0.7	0.0 0.0	16.7 3.3
	1:500	0.0 0.0	0.7 0.7	0.0 0.0	x
	1:1000	3.3 3.3	0.0 0.0	0.0 0.0	x
Plant Debris Smoke	half strength	x	x	x	0.0 0.0**
	full strength	x	x	x	0.0 0.0**
Control		0.0 0.0	0.7 0.7	0.0 0.0	33.3 8.8

[z]Means standard errors
* Germination percentages significantly higher than the control
** Germination percentages significantly lower than the control

Summary

• Scarification significantly increased germination in *S. lateriflora* after 15 minutes in acid.
• For *S. floridana*, stratification, scarification, and plant debris smoke significantly decreased germination.
• Hickory Smoke Seasoning did not significantly change germination in any species.

Significance

• For *Scutellaria floridana*, 3 of the 4 treatments decreased germination, which differed from the other three *Scutellaria* species.
• The control for *Scutellaria floridana* had significantly higher or equal germination compared to other treatments, suggesting no seed dormancy.
• Of the viable seeds (40%) of *S. floridana*, 83% germinated for the control.
• This information is useful for propagation of plants for restoration purposes.

Acknowledgements

• Bok Tower Gardens – *S. floridana* seeds
• U.S. Dept. of the Interior, Fish and Wildlife Service - Grant
• Biological Sciences Dept. Undergraduate Research Grant, Eastern Illinois University (Falls 2011/2012)
• Illinois State Academy of Science – Botany Division, Travel Grant (Spring 2012)
• Botanical Society of America Undergraduate Student Research Awards (Spring 2012)
• Undergraduate Research, Scholarship, and Creative Activities, EIU Honors College (Spring 2012)

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