JOURNAL OF THE TENNESSEE ACADEMY OF SCIENCE
Volume 44, Number 3, July, 1969

GERMINATION AND DORMANCY IN CEDAR GLADE PLANTS. IV. *ISANTHUS BRACHIATUS, PANICUM CAPILLARE, CYPERUS INFLEXUS, ERAGROSTIS SPECTABILIS AND RUELLIA HUMILIS*

CAROL C. BASKIN[1] AND JERRY M. BASKIN[2]
Vanderbilt University, Nashville, Tennessee 37203

ABSTRACT

At maturity seeds of *Eragrostis spectabilis* (Pursh) Steud., *Panicum capillare* L., *Ruellia humilis* Nutt., *Isanthus brachiatus* (L.) BSP., and *Cyperus inflexus* Muhl. were dormant. Germination in seeds of all five species was increased by stratification. Seeds of *E. spectabilis, P. capillare,* and *R. humilis* gave 96.9%, 92.0%, and 85.3% germination after 10, 28, and 14 weeks of stratification, respectively. Stratification was much less effective in promoting germination of seeds of *I. brachiatus* and *C. inflexus.* The highest percentage of germination in seeds of *I. brachiatus* and *C. inflexus* was 42.7 and 38.7 after 14 and 18 weeks of stratification, respectively. Germination of seeds of two of the species, *P. capillare* and *C. inflexus,* was increased by dry storage in the laboratory. The highest percentage of germination obtained for laboratory-stored seeds of *P. capillare* was 34.0 (after 24 weeks of storage), and the highest percentage germination in laboratory-stored seeds of *C. inflexus* was 20.7 (after 14 weeks of storage).

INTRODUCTION

The purpose of the present study was to investigate seed dormancy and germination of seeds of five species that grow in the middle Tennessee cedar glades. This study is a continuation of an investigation of seed dormancy and germination requirements of seeds of species growing in the open cedar glades. Species used in this study included three annuals, *Isanthus brachiatus* (L.) BSP. (Labiatae); *Panicum capillare* L. (Gramineae); and *Cyperus inflexus* Muhl. (Cyperaceae), and two perennials, *Eragrostis spectabilis* (Pursh) Steud. (Gramineae) and *Ruellia humilis* Nutt. (Acanthaceae). In all five species flowering occurs in the summer, the fruits mature in the fall, and the seeds are shed usually by late fall. Germination occurs the following spring after seeds have over-wintered in the field.

GENERAL METHODS

Seeds of all five species were collected at natural maturity from a cedar glade near Nashville, Tennessee. After collections were made, seeds were cleaned and stored in plastic containers in an air-conditioned laboratory until used. "Seeds" of *Panicum capillare* used in this study consisted of the caryopsis enclosed by the palea and lemma; whereas, "seeds" of *Eragrostis spectabilis* consisted of the naked caryopsis, the palea and lemma having fallen off during collection. "Seeds" of *Cyperus inflexus* consisted of naked achenes.

Germination tests were performed in petri dishes on two sheets of Whatman No. 1 filter paper moistened with distilled water. Three replications of 50 seeds each were used for each treatment, except for *Ruellia humilis* where three replications of 25 seeds were used because of a limited seed supply. All germination tests were carried out in incubators at a 12-hour photoperiod and at temperatures stated in the procedures and results. Final germination counts were made after two weeks. Seeds were considered to be germinated when the radicle emerged from the seed coat or, in the case of the grasses and the sedge, when it emerged from the pericarp.

PROCEDURES AND RESULTS

Germination Tests in Freshly-Harvested Seeds. To test for germination in freshly-harvested seeds, seeds of all five species were placed at 10, 20, and 30C at a 12-hour photoperiod and in constant darkness. After two weeks no germination had occurred in any of the five species; therefore, it was concluded that freshly-harvested seeds of all the species were dormant.

Stratification and Dry Storage. To study the effects of stratification and after-ripening in dry storage on subsequent germination, seeds of all five species were stored both on moist filter paper in a refrigerator at 3 to 5C (stratification) and in dry plastic containers in an air conditioned laboratory (dry storage). At regular intervals germination tests were performed on both stratified and laboratory-stored seeds. All germination tests on *Panicum capillare, Ruellia humilis, Isanthus brachiatus,* and *Cyperus inflexus* were carried out at 25C, while those on *Eragrostis spectabilis* were carried out at 30C. Germination thus was compared in stratified and laboratory-stored seeds.

Eragrostis spectabilis. Stratification was quite effective in overcoming dormancy in seeds of *E. spectabilis* (Fig. IA). Germination increased from 18.0% in seeds stratified for 2 weeks to 96.9% in seeds stratified for 10 weeks. Stratification was discontinued after 10 weeks due to contamination from fungi. Percentage of germination in the laboratory-stored seeds did not increase with time. After 30 weeks of dry laboratory storage only 1.3% of the seeds germinated.

Panicum capillare. Stratification was also quite effective in promoting germination in seeds of *P. capillare* (Fig. 1B). Germination increased from 12.0% in seeds stratified for 12 weeks to 92.0% in seeds stratified for 28 weeks. Germination was increased to some extent by dry laboratory storage. The highest percentage of

Present addresses:
1. Thomas Hunt Morgan School of Biological Sciences, University of Kentucky, Lexington, Ky. 40506
2. Department of Botany, University of Kentucky, Lexington, Ky. 40506

germination in dry laboratory-stored seeds was 34.0, after 24 weeks of storage.

Ruellia humilis. Dormancy in seeds of *R. humilis* was almost completely overcome by stratification (Fig. 1C). The highest percentage of germination (85.3) was obtained after seeds had been stratified for 14 weeks. Dry laboratory storage did not overcome dormancy in this species.

Isanthus brachiatus. Stratification was moderately effective in overcoming dormancy in seeds of *I. brachiatus* (Fig. 1D). The highest percentage of germination (42.7) was obtained after seeds had been stratified for 14 weeks. Percentage of germination decreased in seeds stratified for 16 weeks or longer, and seeds stratified for 22 weeks germinated at only 22.7%. Dry laboratory storage did not overcome dormancy.

Cyperus inflexus. Both stratification and dry laboratory storage promoted some germination in seeds of *C. inflexus;* however, neither of the two treatments were very effective in overcoming dormancy in seeds of this species (Fig. 1E). The highest percentage of germination for stratified seeds was 38.7, after 18 weeks of cold, moist storage, while the highest percentage of germination for laboratory-stored seeds was 20.7, after 14 weeks of storage.

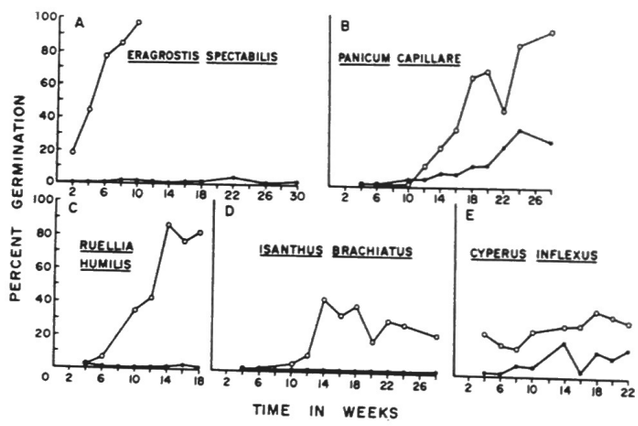

FIGURE I. Germination in stratified (open circles) and laboratory-stored (solid circles) seeds of *Eragrostis spectabilis, Panicum capillare, Ruellia humilis, Isanthus brachiatus,* and *Cyperus inflexus.*

Discussion

The short period of stratification necessary to break dormancy in seeds of *Eragrostis spectabilis* is probably satisfied in nature before winter is over. This means that the seeds are ready to germinate before spring. However, seeds of this species do not germinate well at low temperatures, and the optimal temperature for germination is about 30C (Baskin and Baskin, unpublished data). Thus, germination is delayed until the arrival of favorable spring temperatures. A high temperature requirement also prevents germination until spring of seeds of *Aristida longespica* Poir. another cedar glade grass requiring a short stratification period (Baskin and Caudle, 1967).

In contrast to seeds of *Eragrostis spectabilis,* seeds of *Panicum capillare, Ruellia humilis, Isanthus brachiatus,* and *Cyperus inflexus* require a rather long stratification period before near-maximum germination will occur. In nature this requirement is satisfied during the winter, and by the following spring the seeds germinate. It is possible that some seeds of *R. humilis, I. brachiatus,* and *C. inflexus* are ready to germinate before spring, since a short stratification period caused a small percentage of seeds to germinate. However, the high temperature requirements for germination of these species (Baskin and Baskin, unpublished data) would in such cases delay germination until spring when conditions favor seedling establishment.

Although seeds of *Panicum capillare* and *Cyperus inflexus* gave a low percentage of germination after a period of dry laboratory storage, this is probably of no significance in overcoming dormancy in nature, since the seeds are never exposed to such conditions.

Since we were unsuccessful in getting good germination of seeds of *Isanthus brachiatus* and *Cyperus inflexus,* we are continuing investigations of these two species.

The authors' thanks are extended to Dr. Elsie Quarterman, Professor of Biology, Vanderbilt University, for providing necessary equipment.

Literature Cited

Baskin, J. M. and Carol Caudle. 1967. Germination and dormancy in cedar glade plants. I. *Aristida longespica* and *Sporobolus vaginiflorus.* Jour. Tenn. Acad. Sci. 42:132-133.

NEWS OF TENNESSEE SCIENCE

The University of Tennessee at Knoxville in consortium arrangement with East Tennessee State University has received a Department of Defense THEMIS contract to conduct work entitled, "Remote Sensor Utilization for Environmental System Studies." Geology, geography, botany, agriculture, forestry, civil engeering, physics, urban and regional planning, and the Water Resources Research Center are directly involved. The current equipment inventory includes Hasselblad and TV cameras, darkroom, a DC-3 aircraft and related remote sensing instrumentation, and an infrared scanner. Program Manager is Dr. Bruce Tschantz, of Civil Engineering. Activities carried on by Botany Department personnel are directed by Drs. H. R. DeSelm and Clifford Amundsen. Two graduate students are fully or in part supported. Field parties in the Cumberland and Great Smoky Mountains, beginning Spring, 1969, will obtain vegetation, soil and site "ground truth" for comparison with multi-spectral imagery to be used for landscape interpretation and factor prediction.