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Analyzing Seed Production and Germination in Pityopsis ruthii

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Southern Scholars Senior Project

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INTRODUCTION

Pityopsis ruthii, commonly known as Ruth's golden aster, is a perennial plant belonging to the family Asteraceae. The plant has dissected, alternate leaves with composite inflorescence born terminally.

Since August 19, 1985, *Pityopsis ruthii* has been listed as an endangered species by the state of Tennessee and the U.S. Fish and Wildlife Service and is also listed under the provisions of "The Rare Plant Protection and Conservation Act."

The species is limited in its distribution to two sites in Polk county of East Tennessee: the Ocoee and Hiwassee Rivers and is not reported in any other part of the world. Moreover, *Pityopsis ruthii* is also quite specific in its habitat; it grows in the crevices of phyllite and graywacke boulders in the proximity of the rivers.

The present study on *Pityopsis ruthii* is an extension of research conducted last year. More specifically, the purpose of this study was to conduct a more in-depth examination of seed set and germination in *Pityopsis ruthii*.

Previous Study: Synopsis

METHODS AND MATERIALS

In a previous study, the primary goal was to identify some of the major factors involved in the decline of *Pityopsis ruthii*. During November of 1996, an average of 480 flowerheads were collected from the Hiwassee River site. These flowerheads were aired for a period of approximately two weeks and then analyzed. Each flowerhead was separated into its individual seeds, which were subsequently categorized as flat, eaten, and non-eaten. It should be noted that "flat" seeds were ones that were less filled and lacking in rotundity, while eaten seeds were those that were preyed upon.

RESULTS

The sample seed population was 990 seeds. Of this sample, 525, or 53.0% were flat, 205, or 20.7% were eaten, and 260, or 26.3% were non-eaten (Figure 1). More specifically, of the 26.3% of non-eaten seeds, only 13.7% of them actually germinated (Figure 2).

DISCUSSION

Because flat seeds comprised more than half of the sample population, it was hypothesized that a variety of factors were affecting the decline of *Pityopsis ruthii.* An earlier study conducted by Jody Allen suggested that this decline was due to either low pollination activity or ovule abortion. Results from the current study suggest that a low germination rate and predatory activity also play significant roles.

Further, a suggested culprit possibly responsible for the 20.7% of the seeds that were eaten was an opportunistic, seed-feeding moth of the order Lepidoptera, as suggested by Dr. John Haradee of UC Riveside. Evidence of this predatory activity is clearly seen as large, hollow holes in the seed.

Current Study

METHODS AND MATERIALS

From the time period of September 12, 1997, to November 7, 1997, a total of 190 flowerheads were randomly collected from the Hiwassee River site. The seeds contained in each flowerhead were characterized. Some of those seeds were germinated within a growth chamber for a period of two weeks at a constant temperature of 24^0C. Subsequent analysis of seed set followed to generate the five following categories of seeds: flat, round, immature, eaten, and non-categorized. It should be noted that "immature" seeds

were not fully developed, while "non-categorized" seeds were those that could not fall under any of the four other categories.

RESULTS

The 190 flowerheads created a sample population of 9273 seeds, and an average of 48.8 seeds were counted per flowerhead.

Among the 48.8 average number of seeds, the flat seeds made up 35.9 of them in a given flowerhead and comprised 6812 of the 9273 seeds (73.5%). The round seeds made up 2.2 seeds of the 48.8 and comprised 413 of the 9273 seeds (4.5%). Eaten seeds made up 7.7 seeds of the 48.8 and comprised 1456 of the 9273 seeds (15.7%). Immature seeds made up 2.2 seeds of the 48.8 and comprised 418 of the 9273 seeds (4.5%). The non-categorized seeds made up 0.86 of the 48.8 and comprised 164 of the 9273 seeds (1.8%) (Figure 3) and (Figure 4).

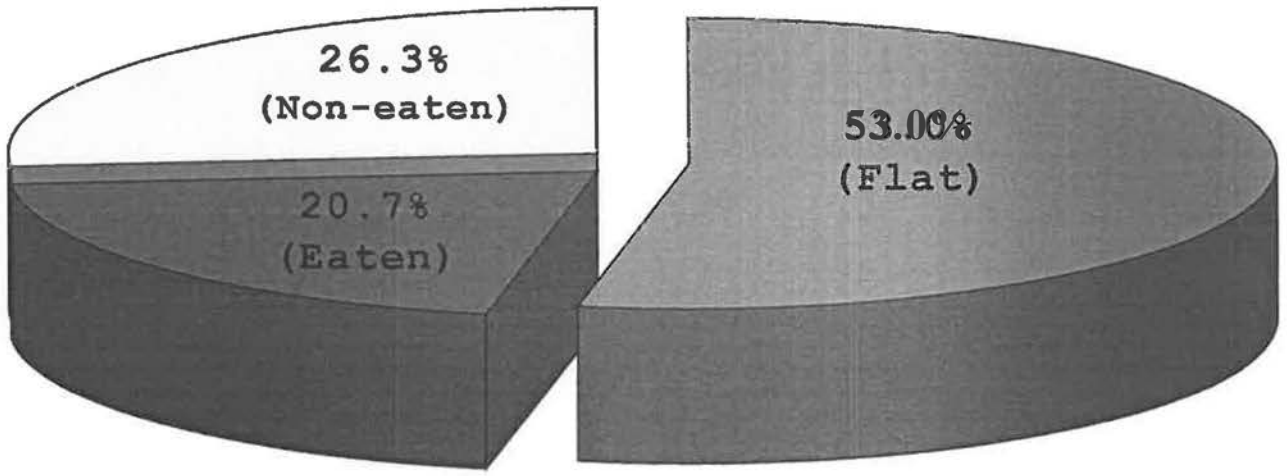
Of the 381 germination attempts, only 24 (6.3%) of them were successful (Figure 5). Moreover, an average of 2.2 seeds/flowerhead (4.2%) germinated.

DISCUSSION

As mentioned earlier, there was a high frequency of flat seeds. One suggested reason could be due to a low seed set. A colleague of mine, Helen Lee supports this in an earlier study which suggested that *Pityopsis ruthii* indeed does have a low seed set. Another reason may be due to predatory activity. In fact, this predatory activity has been positively affirmed. By breeding larvae found among the collected flowerheads, adult moths were available to study. With the assistance of expert entomologist Dr. John Brown of the Smithsonian Institute, the predator has been narrowed down to a possible member of the Tortricidae family of the order Lepidoptera.

CONCLUDING STATEMENTS

Although some exciting insights have been made regarding this endangered species, only the surface of the problem has been investigated. Because there are several factors cooperating to cause the decline of the species, the inclination to simply attribute one particular factor as the sole cause of its decline must be avoided. Instead, a holistic approach must be applied to save *Pityopsis ruthii* from extinction. This requires the will and dedication of people to take an *interest* in the species that are silently slipping away. Who knows what cures for disease, remedies for pain, and other life-changing substances have been lost because no one took an interest. After all, one day we may not only lose species but their whole ecosystems as well. And when we lose this, we lose a part of who we are.



Eaten, 205 Non-Eaten, 260 Flat, 525

Figure 1.—Results of previous study depicting composition of seed population.

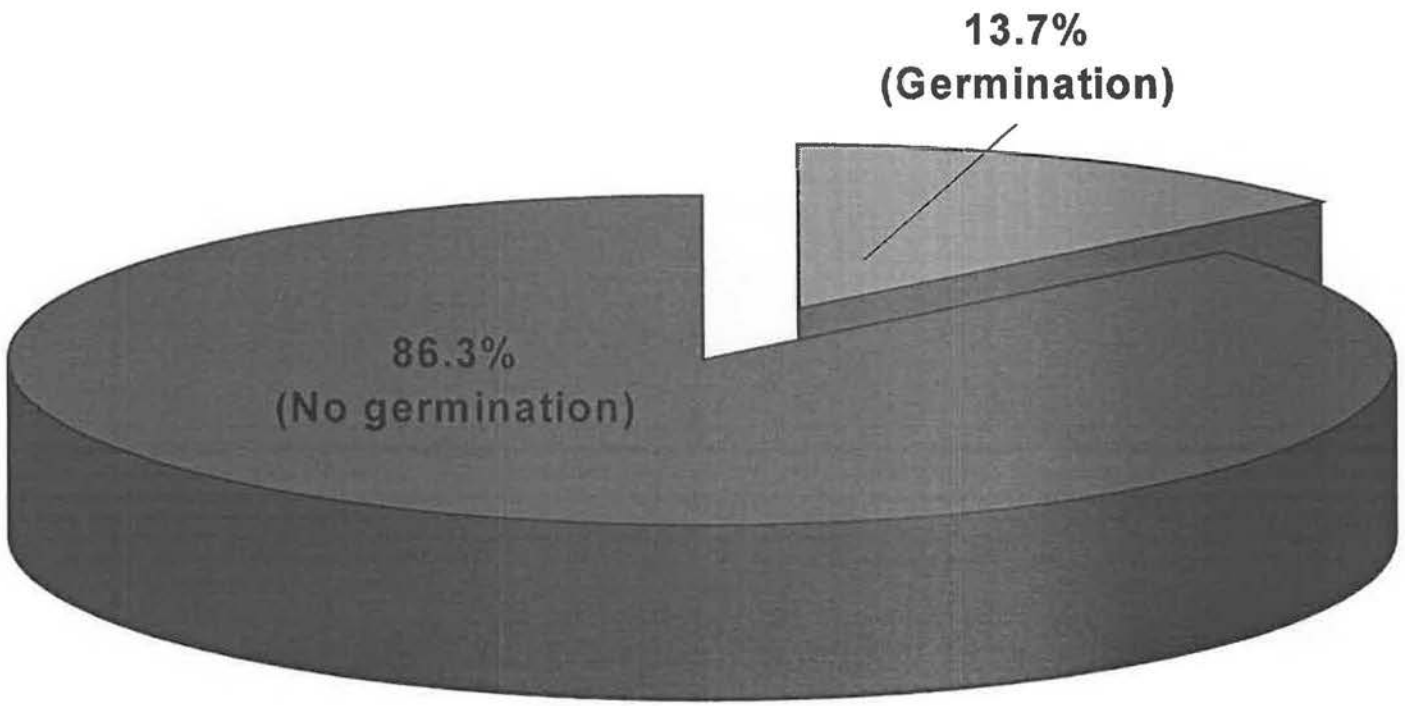


Figure 2.--Germination rates of the 260 non-eaten seeds.

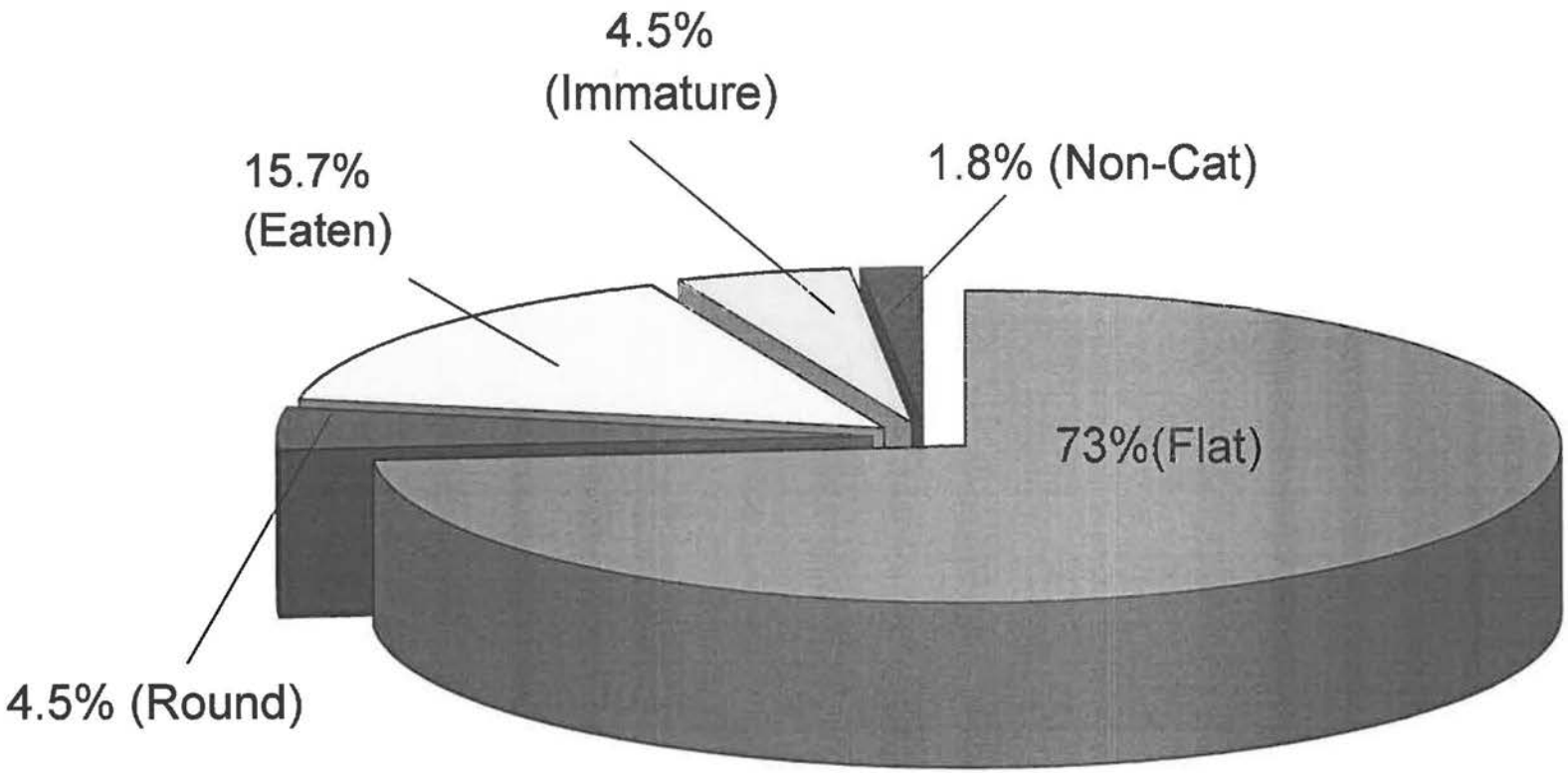


Figure 4.--Seed percentages within sample population.

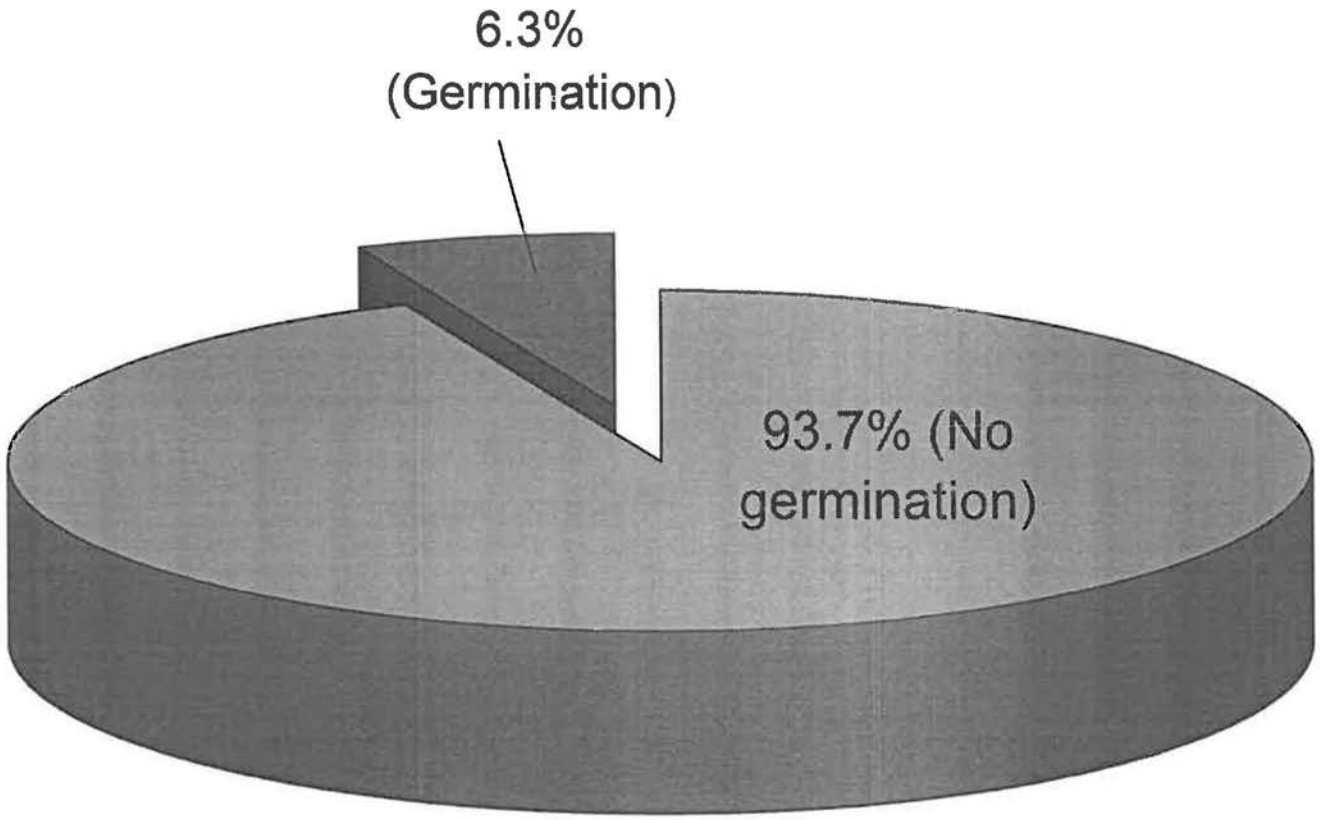


Figure 5.--Actual germination rate in current study