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Seed Biology: Breaking the Seed Dormancy and Testing Seed Viability

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ABSTRACT

Seed germination is an essential process in ensuring successful natural succession and planting activities. Factors affecting seed germination, namely, seed viability and dormancy, were tested. It was found that seed scarification was the best technique in breaking seed dormancy, wherein 38 out of 40 Acacia mangium wild. Seeds germinated. For seed viability, Zea mays L. was the most viable seeds wherein 40 kernels germinated out of 40 seeds tested using the most simple germination test.

Introduction

Seed germination is scientifically defined as when a radicle emerges from the seed coat (Copeland & McDonald, 2001). In simple terms, germination happens when the plant begins to grow from the seed (Delouche, 1990). However, there are various factors to be considered before a plant grows out from a source. Some of these factors are eed viability and seed dormancy (Koger et al., 2004). Seed dormancy is the state where a seed cannot germinate even under favorable conditions due to certain factors like hard or oily seed coat (International Specialty Supply, 2014). The dormancy of a seed can be broken, and once it is broken, viability may be observed in that particular seed (Mousavi et al., 2011). There are methods of breaking seed dormancy, and some of these are seed scarification, light testing, and hot water treatment. Seed viability is the seed's ability to germinate given a suitable condition and capability to establish itself in the environment (Bradbeer, 1988). There are certain tests that can be performed to know if a seed is viable or not (Tang et al., 2019). Some tests are flotation test, seed germination, blotter test, and tetrazolium dye test (Ma et al., 2016).

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Methodology

2.1 Materials

The study used 60 seeds of mangium (*Acacia mangium* Wild.), 60 seeds of duklitan (*Pouteria duclitan* (Blanco) Baehni), 20 seeds of narra (*Pterocapus indicus Wild. forma indicus*), and 40 kernels of corn (*Zea mays* L.). Ten seeds were placed in each petri dish with filter paper and few drops of water. One treatment is applied for each dish. Mangium and duklitan seeds were tested for seed dormancy, while narra and corn for seed viability testing. The following are the treatments used to the seeds.

2.2. Breaking the Seed Dormancy

In breaking the seed dormancy (Mangium and Duklitan), the following tests were performed:

2.2.1. Seed Scarification

In this method, the students cut a tiny portion of the tip of the mangium and duklitan seeds. Seeds were placed in the dish with filter paper, moistened with few drops of water then covered.

2.2.2. Light test

In this test, three sets of ten pieces of each species, mangium and duklitan seeds were placed in dishes, one species per dish. The dishes were, again, floored with moistened filter papers. The first and second sets of seeds were covered with blue and red cellophanes, respectively. The last set of seeds was covered with a carbon paper.

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Figure 1. Scarified mangium seed (left) and scarified duklitan seed (right)

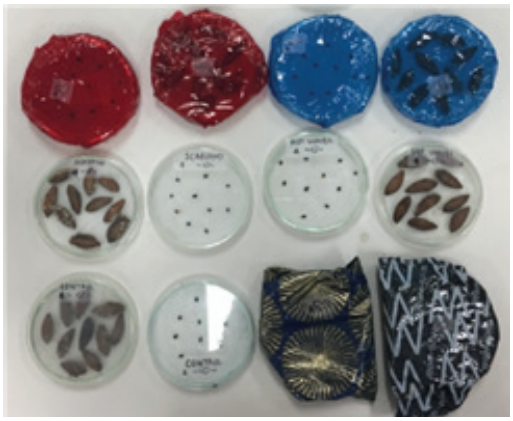

Figure 3. Mangium and Duklitan seeds in all treatments for breaking seed dormancy

Figure 4. Corn kernel before soaking in tetrazolium chloride

Figure 4. (left) Narra seeds and Corn kernel (right) under seed germination and blotter test

Figure 2. (From left to right) A and B (Mangium seeds in red and blue cellophanes, respectively), C and D (Duklitan seeds in red and blue cellophanes, respectively), and E (Mangium and Duklitan seeds in carbon paper)

Appendices

Appendix 1. (lleft to right) Results for light test of mangium, scarification of mangium, and duklitan (with mold) of our group
Appendix 2. (left to right) Results for seed germination, tetrazolium test,

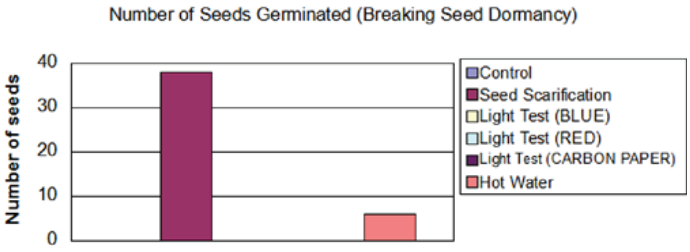

Figure 5. Number of Mangium seeds germinated in each treatment and tests

2.2.3. Hot Water Treatment

The main requirement for this test is the hot water. A hot water bath was used to treat the seeds. Ten seeds per species were subjected under the hot bath by immersing the seeds in the boiling water for a minute. Then, the seeds were placed in the petri dishes with filter paper sprayed with few drops of water. One species per petri dish was prepared.

Another set of seeds, ten seeds of mangium, and ten seeds of duklitan were placed in petri dishes for CONTROL treatment.

All the seeds in the Petri dishes were left in the laboratory for one week. It was observed after a week, and the data and observations were jotted down and recorded. The primary thing that shall be observed is the presence of root

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2.3. Testing the Seed Viability

In the seed viability testing, the seeds used are Narra and Corn. The following are the tests that can be done to know the viability of a seed:

2.3.1. Flotation Test

The seeds in this method are simply placed in a beaker or any container filled with water. Those seeds that will sink (the sinkers) are the viable or useful seeds, and the floaters are the not-so-good ones (Kimsey, 2012). This test was not performed in the laboratory during our session, but it was said to be the easiest but not the most accurate way of testing seed viability for the reason that the result depends on the seeds that will be tested.

2.3.2. Seed Germination and Blotter Test

The seeds in this test were just placed in a petri dish floored with wet filter paper. Twenty narra seeds and corn kernels were placed in three different Petri dishes. There are 20 narra seeds because we prepared two replicates, 10 seeds per replicate.

2.3.3. Test using Tetrazolium Chloride

In the laboratory, we used ten corn kernels. Each kernel was cut into half lengthwise. Half of each kernel (10 halves) was soaked into the tetrazolium chloride for an hour. The kernel that will inhibit change in color of its soft portion from white into reddish is the viable seed.

Results and Discussion

All the data recorded by the class were compiled, summing up to 40 seeds. As seen in Figure 5, for the tests in breaking the seed dormancy of mangium seeds, it was found that 38 seeds have germinated through seed scarification, 6 germinated through hot water treatment, and 0 for the remaining tests and treatments. See the photos of the result in the appendices.

Most of the seeds subjected to scarification have germinated. It is said that scarification is needed by the seeds, especially those with hard coats. Seeds of many plant species are often not impenetrable by water and gasses. This characteristic of seed delays its germination (Myers, 2017). Seed scarification through opening the tip of the seeds can make gasses and water pass through, that will make germination possible.

It was also observed that the dormancy of mangium seeds was broken through the hot water treatment. Boiling seeds in water can remove cuticles from the coat that can effectively break seed dormancy (FAO, n.d.) Hot water treatment is also used to prevent diseases from attacking the seeds that can hinder germination (the University of Massachusetts Amherst, n.d.). In seed viability with also a total of 40 kernels of corn, the germination test has germinated all 40 corn kernels. In the tetrazolium chloride test, 38 kernels inhibited change in color, meaning they were viable. In the blotter test of narra seeds wherein there are two replicates per group with a total of 8 replicates in class amounting to 80 seeds, only 10 seeds in replicate one has germinated while only four seeds in replicate two have germinated. The total of narra seeds germinated in the blotter test was 18 out of 80 seeds. See the photos of the result in the appendices.

Tetrazolium chloride test is also termed the quick germination test because it can give results in the most immediate time possible. It is very advantageous since it provides the rapid evaluation of seed viability. The red color in the seeds also signifies the sound tissues while the colorless tissue, even after dying with tetrazolium, may be the dead tissues (20/20 Seed Labs, n.d.). After letting the set-up for breaking seed dormancy stand for a week, each treatment's seeds were observed. It was unfortunate that all duklitan seeds in all tests and treatments were attacked by molds which made us disregard the experiment on those seeds.

Conclusion

The germination of seeds can be affected by many factors. It can be delayed by the hard seed coats that hinder the entrance of water and gasses important for germination and oil or cuticle in the seed coat. Despite that fact, it can be helped through breaking seed dormancy in different methods such as seed scarification, which was found to be the most efficient and effective in the exercise. Also, seed's ability to germinate in spite of different conditions can be tested through different methods. The most successful method found in the practice was the seed germination of corn kernels, which is also the most practical and most comfortable method.

Conflict of Interest: The authors declared no conflict of Interest

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