Erbil Polytechnic University

Khabat Technical Institute

Medicinal Plants Production

Second Stage/ Project Report

Pre-Germination Treatments of some Medicinal Plant Seeds

Prepared by:

Omar R. Mahmood

Firaz O. Darwesh

Mustafa K. Mustafa

Mihraban T. Hassan

Supervised by:

Dr. Ismail A. Said

2023-2024

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Abstract

Plant seeds is structure complete with a tiny embryo, which is capable of growing into new plant. This structure faces mostly dormancy problem. Several methods were applied to break the dormancy of some seeds; including, *Silybum marianum, Ricinus communis, Moringa oleifera, Prosopis farcta, Coriandrum sativum.* Soaking in water (24, 48 and 72 hours), H_2SO_4 (3, 5 and 7%) and stratification (one week, two and three weeks) were applied, and the germination process was done under the laboratory condition by keeping the temperature between 25-30 ^oC. The result showed that *Coriandrum* had the highest germination percent by all treatments, while the minimum germination was recorded by *Prosopis*. *Silybum* had better germination with stratification of the two weeks.

Introduction

There are several definitions of plant seeds. To a botanist, a "seed" is a specialized plant structure, complete with a tiny embryo, which is capable of growing into a new plant (Kumar et al., 2009). The seeds also can be defined that are the principal means of regeneration of most plants. They serve as the delivery system for the transfer of genetic materials from one generation to the next (Bonner, n.d.). They vary markedly in size, shape, color and texture (Streich, 2007). In addition, each seed has an embryo and food storage structures enclosed in a seedcoat. Seed coats are the hard outer covering of seeds, as it protects seeds from diseases, insects and unfavorable environmental conditions. Water must be allowed through the seed coat for germination to occur. Endosperm is a food storage tissue found in seeds. It can be made up of proteins, carbohydrates, or fats. Embryos are immature plants in an arrested state of development. They will begin growth when environmental conditions are favorable in a process called germination (Streich, 2007).

Seeds germination is affected by several environmental factors; including, temperature moisture, light and air (oxygen). The temperature is considered a main determinant of germination when other factors are not limiting and temperature effects are variable for plants species, as with most reactions, germination generally occurs faster at warmer temperatures. Moisture stress may delay, reduce or prevent the seed germination (Javaid et al., 2022). Another factor is oxygen The germination percent of most seeds will be retarded if the oxygen percent falls below 20 percent. Normal air is 20 percent oxygen. Light prevents stored seed reserves from being depleted. Some seeds germinate equally well in light and darkness, whilst others germinate better under only light or darkness (Motsa et al., 2015). Seeds viability and are also considered internal factors that influence the germination process. This work aims to break dormancy by different methods to fasten the germination the seeds of some medicinal plants.

Dormancy

Seed dormancy could be considered simply as a block to the completion of germination of an intact viable seed under favorable conditions (Finch-Savage and Leubner-Metzger, 2006). Generally, there are three types of dormancies:

1-Seed coat dormancy is a physical condition in which the seed coat is impermeable to water and oxygen. In order to break seed coat dormancies, the seed coat needs to be softened or cracked. Methods used to break seed coat dormancy include sand paper, hot water, weathering, fire, microorganisms, and passage through the digestive system of animals. The process of physically breaking the seed coat dormancy is called scarification. Examples of plants having seed coat dormancy include honey locust, Kentucky coffee tree and linden.

2-Embryo dormancy is a physiological condition of the embryo. This type of dormancy requires a
specific period of cold or heat treatment in order for germination to occur. This temperature treatment is called stratification. Examples of plants having embryo dormancy include elm, witch hazel, and dogwood.

3-Double dormancy is when the seed has both seed coat and embryo dormancy. An example is redbud seed (Streich, 2007).

However, several have been reported to be useful to break or manage the problem of seeds dormancy; including, soaking, scarification, acids, hot water, mulch, fire, heat and stratification (Finch-Savage1 and Leubner-Metzger, 2006).

Aim of the study:

The aim is to breakdown dormancy of some medicinal plant seeds through different methods.

Material and Methods:

Materials:

1-Plant Seeds:

Plant seeds were obtained commercially (Table-1).

Tbale-1: Information of the Plants used in the study.

no.	Scientific Plant Names	Family	Kurdish Names	Arabic Names
1	*Silybum marianum*	Asteraceae	کەڵۆغان	كلغان
2	*Ricinus communis*	Euphorbiaceae	گەنەگەرچەک	خروع
3	*Moringa oleifera*	Moringaceae	مۆرینگا	مورنيغا
4	*Prosopis farcta*	Fabaceae	خەرنوک	خرنوب
5	*Coriandrum sativum*	Apiaceae	گژنیژ	كزبرة

2- Sulfuric acid (H_2SO_4).

3- Sandy Soil.

Methods:

1-Treatments:

A- Soaking:

30 seeds of all selected plants were soaked in water (300 ml) for 24, 48, and 72 Hours.

B- Sulfuric Acid:

Another 30 seeds of all plants were treated with 3%, 5% and 7% concentrations of H_2SO_4 separately for 5 sec.

C- Stratification:

Also, 30 seeds of the plants were kept in cold condition (3-5^oC) inside wet sandy soil differently for 1, 2 and 3 Weeks.

Experiment:

The experiment of the germination test for treated plant-seeds was applied by factorial Complete Randomized Design (CRD) with three replicates, as 10 seeds of every plant after treatment were put in 90 mm petri dish and watered then kept under laboratory condition with temperature between 25-30^{o}C for 10 days.

Data Collection:

During the germination process, the germinated seeds were counted every day. Then, germination % was calculated according to the following formula:

$$Germination\ \% = \frac{no.of\ germinated\ seeds\ during\ 10\ days}{total\ no.of\ seeds} * 100$$

Data Analysis:

The data were statistically analyzed using SPSS program, and the Duncan test was applied to compare the mean of the treatments.

Results and Discussion

The results of the data show that Coriandrum had the highest germination percent (98.519%), while the minimum was recorded by Prosopis (11.481%), Table-2.

Table 2: Germination Percent of the Plant Seeds According to Various Treatments.

no.	Plants	Germination %
1	*Coriandrum sativum*	98.519 a±0.877
2	*Moringa oleifera*	23.704 c±3.77
3	*Prosopis farcta*	11.481 d±2.48
4	*Ricinus communis*	24.074 c±3.03
5	*Silybum marianum*	50.000 b±4.80

In addition, the results in table-3 explain seeds germinations of the plants based on the treatments. Two weeks of stratification and soaking 24 hours of the seeds had the highest germination percent (49.333%) and (47.333%), respectively; whilst, the lowest germination percentage was found by H_2SO_4 3% (32.667).

Table 3: Germination Percent of the Seeds According to the Treatments.

no.	Treatments	Germination %
1	H_2SO_4 %3	32.667 d±9.68
2	H_2SO_4 %5	34.667 bcd±9.14
3	H_2SO_4 %7	33.333 cd±9.13
4	Soaking 24	47.333 a±8.91
5	Soaking 48	46.000 ab±7.91
6	Soaking 72	42.667 abcd±8.13
7	Strat. 1 week	45.333 abc±9.94
8	Strat. 2 weeks	49.333 a±10.30
9	Strat. 3 weeks	42.667 abcd±10.21

Furthermore, the results of interaction are shown in table-4. The data analysis show that the *Coriandrum* seeds were responded positively to the treatments. The highest germination (100%) was obtained by stratification (1, 2, and 3 weeks), soaking (24 and 72 hours) and H_2SO_4 3%; while the lowest germination (93.33%) was observed by H_2SO_4 7%. In addition, the two weeks of stratification for *Silybum* showed best germination percentage (86.66%) than other treatments. However, the lowest germination (3.33%) was recorded by *Prosopis* in the two weeks of stratification. At the point when the seed soaks up water, hydrolytic proteins are actuated what separate these put away food assets into

metabolically valuable synthetic compounds (Hameed, 2022). Also, the complete removal of the seed coat caused rapid imbibition, which caused fracture and bursting of the endosperm and damaging the embryo (Ali, et al., 2011).

Table-4: Response of Germination Percent to Interaction of the Treatment.

no.	1	2	3	4	5
Plants	*Coriandrum sativum*	*Moringa oleifera*	*Prosopis farcta*	*Ricinus communis*	*Silybum marianum*
H_2SO_4 3%	100a± 0.00	6.66f±6.66	6.66f±6.66	16.66def±6.66	33.33cdef±8.81
H_2SO_4 5%	96.66a±3.33	6.66f±3.33	10.0f±0.00	16.66def±8.81	43.33cde±3.33
H_2SO_4 7%	93.33a±6.66	13.33df±3.33	6.66f±3.33	10f±5.77	43.33cde±12.01
Soaking 24 hr.	100a±0.00	56.66bc±6.66	6.66f±6.66	46.66cd±12.01	26.66cdef±8.81
Soaking 48 hr.	96.66a±3.33	43.33cde±12.01	26.66cdef±8.81	30cdef±11.54	33.33cdef±12.01
Soaking 72 hr.	100a±0.00	33.33cdef±3.33	30.0cdef±10	16.66def±6.66	33.33cdef±3.33
Strat. 1 week	100a±0.00	20def±0.00	6.66f±3.33	23.33def±3.33	76.66ab±12.01
Strat. 2 weeks	100a±0.00	23.33def±8.81	3.33f±3.33	33.33cdef±8.81	86.66a±6.66
Strat. 3 weeks	100a±0.00	10f±10	6.66f±6.66	23.33def±3.33	73.33ab±3.33

Conclusion

Seeds soaking in water is required to promote germination. Also, using stratification in cold condition is necessary for seeds that germinate slowly by other methods. Seeds of *Prosopis* should be treated with methods more effective to increase the germination percentage.

References

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Appendices

Figure 1: Soaking the Plant Seeds in Water.

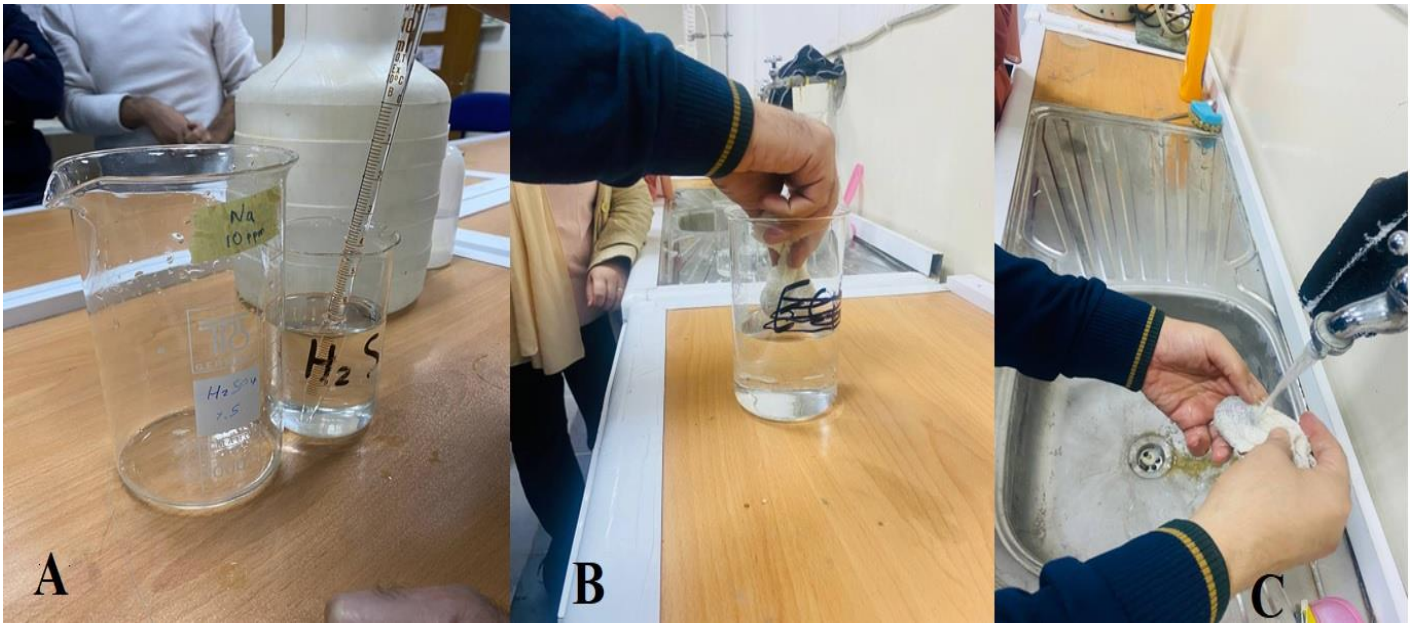

Figure 2: Preparing H_2SO_4 (A), Treating Seeds with The Acid (B) and Washing after Treatment (C).

Figure 3: Steps of the Seeds Stratification.

Figure 4: Separating the Seeds from the Sand after the Stratification.

Figure 5: The Seeds were Put in Petri Dish and Designed.