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Seed Dormancy Breaking of Ziziphus Nummularia

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Abstract: In this experiment, scarification of seed endocarp with sandpaper, treatment with sulphuric acid (95%) for periods of 10, 20, 30, 40, 50 and 60 minutes and immersion in boiling water for 10 minutes were applied in order to break the seed dormancy of *Ziziphus nummularia*. The seed germination of *Z. nummularia* is not easy because of hard seed coat. The results showed that the high percentage of germination belongs to the treatment of scarification with sandpaper (65%) and the treatment of sulphuric acid for 10 min (46%). The seeds germination in distillated water as control and boiling water for 10 min were 0 and 5%, respectively. It can be concluded that the dormancy of these seeds is physical kind which inhibits seed imbibition and or gas exchange and the best seed dormancy breaking method is scarification of seed coat with sandpaper.

Key words: Imbibition · Physical dormancy · Scarification · Seed germination · Ziziphus

INTRODUCTION

The genus *Ziziphus* (family Rhamnaceae) has more than 135 species, of which 2 are native of Iran. *Ziziphus nummularia* is a species of *Ziziphus* native to western India, southeastern Pakistan and south Iran [1].

Z. nummularia is a shrub plant up to 2 meters high and a multipurpose species valued for edible fruits, leaves as forage, branches for fencing and as folk medicine. This plant grows in warm and dry climate and on sandy and silicic soil. Its reproduction is by means of root jump and or seed germination. The seed germination of *Z. nummularia* is not easy because of hard seed coat and in nature conditions the seeds are able to germinate by aging and weathering in soil during months to one year [1-4].

Seed dormancy is a condition of plant seeds that prevents germinating under optimal environmental conditions. Living, non dormant seeds germinate when soil temperatures and moisture conditions are suited for cellular processes and division but dormant seeds do not. One important function of most seeds is delayed germination, which allows time for dispersal and prevents germination of all the seeds at same time. There are three types of dormancy based on their mode of action: physical, physiological and morphological [5,6].

Physical or mechanical dormancy is caused by one or more impervious layers of seed coat or fruit. In this condition, seed dormancy continues until the layers are removed by some elements [7]. These elements are great temperature changes, fire, frequent freezing and melting, being eaten by animals and passing through their digestion system and in seed technology, mechanical or chemical scarification. When this dormancy is broken, the seed becomes able to germinate in a wide variety of environmental conditions [8].

In this study, the effect of some treatments on seed dormancy breaking of *Z. nummularia* examined.

MATERIALS AND METHODS

Seeds of *Z. nummularia* were obtained from mature fruits. Then 25 seeds were placed on whatman (No. 1) filter paper in the petri dish and 7 ml of distillated water was added. Three treatments were used for seed dormancy breaking including scarification of seed

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endocarp with sandpaper, treatment with sulphuric acid (95%) for periods of 10, 20, 30, 40, 50 and 60 min and immersion in boiling water for 10 min. Distillated water at room temperature was used as case control.

In scarification of seed with sand paper, seeds were rubbed between two pieces of sandpaper until the seed endocarp becomes slim. In treatment with sulphuric acid, seeds were immersed in 25 ml of acid in a beaker for period of time and the beaker was placed on a stirrer. Then the seeds were washed 3 times and soaked in distillated water for 24 hours. The seed germination was carried with 16h of light and under 30 and 20°C temperatures for day and night, respectively. After 34 days germination percentage was measurement.

The experimental design was a complete randomized design with three replications for each treatment. Each petri dish was used for one replication of treatment. Data were analyzed using SPSS v. 17.0 and mean comparisons were made following the LSD test at $P \leq 0.05$.

RESULTS

As the results show (Figure 1) there is a significant ($P \leq 0.05$) difference between germination control of *Z. nummularia* seed and scarification with sandpaper and or treatment with sulphuric acid. The largest amount of seed germination percentage belongs to scarification with sandpaper (65%) and the treatment of sulphuric acid for 10 min (46%). When the periods of acid immersion increase the seed germination decrease. In 50 and 60 min of acid immersion the seedling after germination did not grow. In 10 min boiling water treatment no remarkable increase of seed germination was observed (5%). The seed germination percentage of the control was zero (Figure 1).

DISCUSSION

Two types of seed dormancy have been recognized, coat-imposed dormancy and embryo dormancy. Coat-imposed dormancy is dormancy imposed on the embryo by the seed coat and other enclosing tissues, such as endocarp. The embryos of such seeds will germinate readily in the presence of water and oxygen once the seed coat and other surrounding tissues are either removed or damaged. In addition, the first visible sign of germination is typically the radicle breaking through the seed coat. In some cases, however, the seed coat may be too rigid for the radicle to penetrate [9].

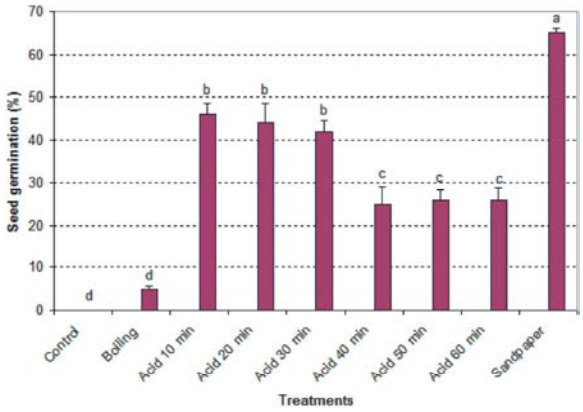

Fig. 1: Germination percentage of Z. nummularia seed under some treatments. The treatments were distillated water as control, boiling water for 10 min, sulphuric acid (95%) with different periods of time (10 to 60 min) and scarification of seed coat with sandpaper. Different lower-case letters indicate significant differences (LSD test at $P \leq 0.05$).

According to the results of this study, scarification with sandpaper can better break seed dormancy of *Z. nummularia* than other methods. The reason of seed dormancy in this species is mechanical resistance of seed coat. Scarification with sandpaper causes slimness of seed coat and sulphuric acid create cracks in it. In the other work, chemical and mechanical scarifications lead to improvement in germination of *Ziziphus* seed [10].

In physical treatment, known as scarification, sometimes the seeds are rubbed on sandpaper manually. At the time of rubbing care should be taken that not to damage the axis of the seed. When seed coat is too hard i.e. of woody nature, the seed coat has to be removing completely by breaking it. Another way is soaking hard seed coat in concentrated or diluted solution of sulphuric acid for 1 to 60 minutes. But most of the seedlings treated with sulphuric acid were not normal and this was probably caused by penetration of acid into seed and contact with seed tissues. Also in this experiment, following 50 and 60 min of acid immersion the seeds of *Z. nummularia* germinated but the seedlings did not grow. In addition, the result showed (Figure 1) that the seed germination has decreased when time period of acid contact has increased. The seeds of *Parkia biglobosa* which soaked in absolute sulphuric acid for 3 min gave the highest germination (50%) but none of the seeds germinated after soaking for 5 min [11]. Makkizadeh and co-workers [12] reported that

treatment with sulphuric acid causes the increase of seed germination, but with damage to embryo. Whereas application of sulphuric acid treatments has problems such as danger of working with acid and the probability of causing damage to seed structure, it is better to use another method. It can be concluded that the dormancy of *Z. nummularia* seeds is physical kind which inhibits seed imbibition or gas exchange and the best seed dormancy breaking method is scarification of seed coat with sandpaper. Pandey and co-workers [1] have also recommended the mechanical breakage of seed coat for dormancy breaking of *Z. nummularia*.

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