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# EFFECT OF VARIOUS PRE-TREATMENTS FOR BREAKING THE DORMANCY OF *RICINUS COMMUNIS* LINN.

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**ABSTRACT**

In the present investigation, seeds of *Ricinus communis* were subjected to various treatments to achieve early germination by breaking dormancy. At the end of 17$^{th}$ day, highest germination (82%) was achieved in the seeds subjected to mechanical injury followed by IAA treated seeds (79%). The germination percentage was 28, 48, 54, 23, 40, 17, 37, 4, 27, 38, 43, 27, 30 and 77 respectively in the seeds kept as control, pretreated with hot water, scarified, stratified, subjected to alternate high and low temperature, $KNO_3$, thiourea, kinetin, $GA_3$, $H_2SO_4$, pre soaking treatment and those which were put in electric field and those which were subjected to coumarin and brassinolide. Thus, to achieve germination of *R. communis* seeds, the most suitable method is mechanical injury. IAA and brassinolide are also useful methods as they respectively resulted 79% and 77% germination in the present study (Table 1).

**Keywords:** *Ricinus communis*, germination, dormancy, mechanical injury.

## Introduction

The seeds of some plants easily germinate after sowing in nature but the seeds of a number of plants do not germinate easily and exhibit dormancy for varying period of time. The dormancy may be due to internal factors or may be due to external factors. Certain plants may immediately germinate after the harvest, it can be best exemplified by the seeds of *Pisum sativum,* which sometimes germinate in the fruit itself which is still on the plant, a phenomenon known as vivipary. However, sometimes the dormancy period is very prolonged and can take months together for germination. This is true for the seeds of *Malus domestica* which has a hard seed coat and *Entada gigas* which has a very thick seed coat and do not germinate easily.

The castor oil plant, "*R. communis"* is a species of flowering plant in the spurge family, Euphorbiaceae. It belongs to a monotypic genus, *Ricinus* and subtribe, Ricininae. The evolution of castor and its relation to other species are currently being studied using modern genetic tools. Its seed is the castor bean with despite its name, is not a true bean. Castor is indigenous to the South eastern Mediterranean Basis, Eastern Africa and India but is wide spread throughout tropical regions and widely grown elsewhere as an ornamental plant.

Castor seed is the source of castor oil, which has a wide variety of uses. The seeds contain between 40% and 60% oil that is rich in triglycerides, mainly *ricinolein*. The seed contains ricin, a toxin, which is also present in lower concentrations throughout the plant. Castor oil has many uses in medicine and other applications. Alcoholic extract of the leaf was hepatoprotective in rats. Castor oil is a good motor lubricant and has been used in internal combustion engines, including those of World War-I airplanes, some racing cars and some model airplanes.

In the present study, seeds of this plant were tested for their germination potential and shortening of dormancy period. Initial studies exhibited that there was only 28% germination till 17$^{th}$ day of sowing recorded under untreated seeds. Therefore, it was thought imperative to undertake this investigation to find out the substance that can break the dormancy of this plant. The seeds were subjected to various treatments which are mentioned in Table 1.

According to Berlyn (1972), germination is a sequential series of morphogenetic events that result in the transformation of an embryo in to a seedling. The seeds of every plant have the capability to germinate but their germination is affected due to some factors, such as seed coat, hard seed coat, rudiment embryo, over ripening, presence of plant growth inhibitors, due to absence of water, oxygen and due to unfavourable conditions. Dormancy of seeds is due to external factors or due to internal factors. When it is caused due to internal factors, it is called as true dormancy or innate dormancy or primary dormancy, and when it is caused due to external factors, it is called as imposed dormancy or quiescent dormancy or secondary dormancy. Both of these primary and secondary dormancy influences are mutually dependent and can not be singled out. True dormant seeds do not germinate even if they are provided with suitable environmental factors. Secondary dormant seeds may germinate immediately after shed off. After some storage, they fail to germinate and thus exhibit secondary dormancy. Some seeds such as *Brassica alba, Ambrosia tripolia* and *Xanthium pennsylvanicum* exhibit secondary dormancy. Secondary dormancy is opposite to after ripening. Presence of high carbon dioxide concentration, absence of light and very high or low temperature induce the secondary dormancy.

A number of techniques are available for breaking the dormancy of seeds, such as; scarification, exposure to light, alternating high & low temperatures, stratification, impaction, pressure, electric current, pretreatment with coumarins, kinetin, $GA_3$, $H_2SO_4$, thiourea, $KNO_3$ and hot water.

Studies on germination and dormancy of seeds have been carried out by various workers on different types of species. These include; the studies of Shul (1911) on the oxygen minimum and the germination of *Xanthium* seeds. A detailed account of seed dormancy mechanics was given by Crocker (1916). Influence of low temperature in improving germination percentage was found out by Conville (1920). Similarly, alternating temperatures to break the dormancy was used by Harrington (1923). Morinaga (1926) has studied the germination of seeds under water.

Davis (1928) used high pressure to achieve higher seed germination. Denny & Stanton (1928) suggested chemical treatments for breaking the seed dormancy. Joseph (1929) investigated the germination and vitality of birch seeds. Barton (1930) investigated on coniferous seeds. In 1936, Crocker investigated the effect of visible spectrum upon the germination of seeds and fruits. In 1938, Crocker also gave an account of life-span of seeds.

Chouard (1960) has investigated vernalization and its relation to dormancy. Experimental induction of dormancy in *Betula pubescens* was investigated by Eagles & Wareing (1963). Evanari (1965) has studied the physiology of seed dormancy, after ripening and germination. Ribosome and enzyme changes during maturation and germination of the castor bean seeds was investigated by Marre (1967). Effects of light, temperature and their interaction on the germination of seeds were investigated by Toole (1973).

Hayes & Klein (1974) investigated special quality influence of light during development of *Arabidopsist haliana* plants in regulating seed germination. Bewley and Black (1978) studied the physiology and biochemistry of seeds. Isoenzymes of sugar phosphate metabolism in endosperm of germinating castor beans were studied by Nishimura (1981). Seed germination and dormancy have been studied by Bewley (1997). Improvement of seed germination in *Asparagus racemosus* has been reported by Gupta *et al.* (2002).

Effect of pre-sowing treatment on seed germination of *Babchi Psoralea corylifolia*) and Senna (*Cassia angustifolia*) in nursery has been reported by Koppad and Umarbhadsha (2006). Seed germination behavior of *Asparagus racemosus* (*Shatavari*) under *in-vivo* and *in-vitro* conditions has been investigated by Raghav and Kasera (2012). Siva *et al.* (2014) have studied the enhanced seed germination of *Psoralea corylifolia* L. by heat treatment. Musara *et al.* (2015) have investigated the evaluation of different seed dormancy breaking techniques on Okra (*Abelmoschus esculentus* L.) seed germination. Asha and Illa (2016) have studied the effect of seed direction and growth media on *in vitro* seed germination and seedling establishment of *Pterocarpus marsupium*.

Cantoro *et al.* (2016) have reported seed dormancy QTL identification across a *Sorghum bicolor* segregating population. Dave *et al.* (2016) have investigated the regulation of *Arabidopsis thaliana* seed dormancy and germination by 12-oxo-phytodienoic acid. *Entada phaseoloids* seed dormancy and germination: implications for conservation and restoration has been reported by Deepa and Shinde (2016). The effect of the use of temperature on the breakage of dormancy and the subsequent performance of rice (*Oryza* spp.) has been investigated by Doku *et al.* (2016). Transcriptome analysis of seed dormancy after rinsing and chilling in ornamental peaches (*Prunus persica*) has been investigated by Kanjana *et al.* (2016).

Effect of different pretreatments and seed coat on dormancy and germination of seeds of *Senna obustifolia* has been studied by Mensah and Ekeke (2016). Mishra (2016) has investigated the effect of temperature and light on the seed germination of *Sida cordifolia*. Redwood *et al.* (2016) have reported seed longevity and dormancy state in a disturbance-dependent forest herb, Ageratina. Germination pretreatments to break hard-seed dormancy in *Astragalus cicer* L. has been studied by Statwick (2016).

Effect of various dormancy breaking treatments on seed germination, seedling growth and seed vigor of medicinal plants has investigated by Warghat *et al.* (2016). Zohra *et al.* (2016) have reported the effect of salicylic acid on germination of *Ocimum gratissimum* seeds induced in to dormancy by chlormequat. The release of dormancy, a wake-up call for seeds to germinate has reported by Nee *et al.* (2017).

## Materials and Methods

Healthy seeds of *Ricinus communis* were collected from the seed market (Bhopal). The seeds were washed with running tap water three to four times and once surface sterilized with 0.1% $HgCl_2$ solution for 5 minutes to remove the surface adhering microbes. After surface sterilization, the seeds were again washed with double distilled water. Uniform sized seeds were then transferred to sterilized Petri Plates provided with filter paper pads.

Three replicates of treated and control seeds were kept for germination studies. The filter paper pads were moistened as and when needed. The emergence of radical was taken as germination.

## Results and Discussion

None of the seeds kept as control, stratified, treated with $KNO_3$, $GA_3$ and subjected to electric current and coumarin could germinate on the 3$^{rd}$ day after sowing. Under all these conditions, the germination is started from 5$^{th}$ day onwards. At the end of 17$^{th}$ day, highest germination (82%) was achieved in the seeds subjected to mechanical injury followed by IAA treated seeds (79%). The germination percentage was 28, 48, 54, 23, 40, 17, 37, 4, 27, 38, 43, 27, 30 and 77 respectively in the seeds kept as control, pretreated with hot water, scarified, stratified, subjected to alternate high and low temperature, $KNO_3$, thiourea, kinetin, $GA_3$, $H_2SO_4$, pre soaking treatment and those which were put in electric field and those which were subjected to coumarin and brassinolide (Table 1).

**Table 1 :** Showing the effect of various treatments on the germination percentage of *Ricinus communis.*

| Treatment | DAS | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 3rd day | 5th day | 7th day | 9th day | 11th day | 13th day | 15th day | 17th Day |
| Control | 0 | 8 | 14 | 24 | 24 | 28 | 28 | 28 |
| Hot water | 0 | 19 | 30 | 36 | 45 | 47 | 48 | 48 |
| Scarification | 16 | 24 | 35 | 44 | 52 | 54 | 54 | 54 |
| Stratification | 0 | 9 | 14 | 14 | 20 | 22 | 23 | 23 |
| Alt. high & low temp. | 10 | 15 | 18 | 29 | 36 | 39 | 40 | 40 |
| $KNO_3$ | 0 | 4 | 11 | 11 | 16 | 17 | 17 | 17 |
| Thiourea | 6 | 9 | 14 | 19 | 31 | 36 | 37 | 37 |
| Kinetin | 9 | 16 | 25 | 36 | 41 | 43 | 44 | 44 |
| $GA_3$ | 0 | 4 | 9 | 16 | 24 | 27 | 27 | 27 |
| $H_2SO_4$ | 12 | 16 | 24 | 34 | 36 | 38 | 38 | 38 |
| Presoaking | 15 | 21 | 32 | 32 | 39 | 41 | 43 | 43 |
| Coumarin | 0 | 5 | 13 | 19 | 24 | 29 | 30 | 30 |
| Electric current | 0 | 6 | 11 | 22 | 22 | 26 | 26 | 27 |
| Brassinolide | 16 | 22 | 31 | 43 | 65 | 76 | 77 | 77 |
| Mechanical injury | 21 | 36 | 42 | 51 | 69 | 80 | 82 | 82 |
| IAA | 18 | 31 | 37 | 48 | 67 | 78 | 79 | 79 |

The seeds of *R. communis* have a thick seed coat and are very big in size. Under experimental conditions, no germination was recorded on the 3rd day in the seeds kept as control whereas, mechanically injured seeds and those treated with IAA and brassinolide respectively exhibited a germination percentage of 21, 18 and 16 for the same duration. The germination percentage improved with the passing of time and ultimately on the 17th day from the date of sowing, the germination percentage was found to be 28, 82, 79 and 77 respectively in the seeds kept as control, those mechanically injured and treated with IAA and brassinolide. The mechanically injured seeds become more permeable to water and air which makes them germinate easily and thus a higher germination percentage in *R. communis* can be achieved by this method.

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