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Effect of various pre-treatments for breaking the dormancy of *Plantago ovata* Forsk

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Abstract

In the present investigation, seeds of *Plantago ovata* were subjected to various treatments to achieve early germination by breaking dormancy.

The germination percentage 50, 91, 43, 35, 22, 27, 32, 46, 38, 41, 71, 28, 35, 33, 74 and 85 was respectively achieved for the seeds kept as control, treated with hot water, subjected to scarification, stratification, alternating high and low temperature, KNO_3, thiourea, kinetin, GA_3, H_2SO_4, pre-soaking, electric current, mechanical injury, coumarin, brassinolide and IAA on 17^{th} day. For this plant species, the best results were obtained in the seeds subjected to hot water pretreatment which promoted as high as 91% germination.

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.

P. ovata is a member of the family Plantaginaceae. It is commonly known as Desert Indianwheat or Blond Psyllium or Isabgol. It is a common source of psyllium seed husks, a material used as dietary fibre. This plant can be found growing wild in the Southwestern United States, where it is an introduced species. This plant species has originated from arid and semi-arid zones and is used widely in traditional and industrial pharmacology. Seeds and husk of Isabgol are also widely used in pharmacology as laxatives. Interest in Isabgol has risen primarily due to its use in high fibre breakfast cereals and from claims that it is

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effective in reducing cholesterol.

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 50% germination till 17th 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 into 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 carbondioxide 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,[5] has investigated vernalization

and its relation to dormancy. Experimental induction of dormancy in *Betula pubescens* was investigated by Eagles & Wareing[9]. Evanari,[10] 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[15]. Effects of light, temperature and their interaction on the germination of seeds was investigated by Toole[26].

Hayes & Klein,[12] investigated special quality influence of light during development of *Arabidopsis thaliana* plants in regulating seed germination. Bewley and Black[3] studied the physiology and biochemistry of seeds. Isoenzymes of sugar phosphate metabolism in endosperm of germinating castor beans were studied by Nishimura[20]. Seed germination and dormancy have been studied by Bewley[2]. Improvement of seed germination in *Asparagus racemosus* has been reported by Gupta, S. *et al.*,[11].

Effect of pre-sowing treatment on seed germination of *Babchi* (*Psoralea corylifolia*) and Senna (*Cassia angustifolia*) in nursery has been reported by Koppad, A. G. and Umarbhadsha[14]. Seed germination behaviour of *Asparagus racemosus* (*Shatavari*) under *in-vivo* and *in-vitro* conditions has been investigated by Raghav, A. and Kasera[21]. Siva, *et al.*,[25] have studied the enhanced seed germination of *Psoralea corylifolia* L. by heat treatment. Musara, *et al.*,[18] have investigated the evaluation of different seed dormancy breaking techniques on Okra (*Abelmoschus esculentus* L.) seed germination. Asha and Illa[1] 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.*,[6] 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[7]. 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,[8] *et al.*. Transcriptome analysis of seed dormancy after rinsing and chilling in ornamental peaches (*Prunus persica*) has been investigated by Kanjana[13] *et al.*.

Effect of different pretreatments and seed coat on dormancy and germination of seeds of *Senna obustifolia* has been studied by Mensah and Ekeke[16]. Mishra[17] has investigated the effect of temperature and light on the seed germination of *Sida cordifolia*. Redwood,[22] *et al.*, 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[25].

Effect of various dormancy breaking treatments on seed germination, seedling growth and seed vigour of medicinal plants has investigated by Warghat,[27] *et al.*, Zohra,[28] *et al.*,

Table-1. Showing the effect of various treatments on the germination percentage of *Plantago ovata*

D A S→ Treatment ↓	3rd day	5th day	7th day	9th day	11th day	13th day	15th day	17th Day
Control	0	11	15	22	37	49	50	50
Hot water	30	41	53	75	41	90	91	91
Scarification	10	15	15	22	35	42	42	43
Stratification	16	20	26	26	31	35	35	35
Alt. high & low temp.	10	10	14	17	20	22	22	22
KNO_3	8	11	16	16	19	25	26	27
Thiourea	15	19	23	27	30	32	32	32
Kinetin	22	26	32	32	38	45	45	46
GA_3	12	12	16	16	25	36	38	38
H_2SO_4	14	18	24	27	33	40	40	41
Presoaking	26	38	47	60	66	70	71	71
Coumarin	0	0	15	21	27	33	33	33
Electric current	11	12	12	16	18	26	28	28
Brassinolide	21	44	51	59	67	73	74	74
Mechanical injury	14	20	20	24	30	35	35	35
IAA	24	32	41	63	72	84	85	85

have reported the effect of salicylic acid on germination of *Ocimum gratissimum* seeds induced into dormancy by chlormequat. The release of dormancy, a wake-up call for seeds to germinate has reported by Nee,[19] *et al.*,.

Healthy seeds of *Plantago ovata* 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% H_gCL_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.

The germination percentage 50, 91, 43, 35, 22, 27, 32, 46, 38, 41, 71, 28, 35, 33, 74 and 85 was respectively achieved for the seeds kept as control, treated with hot water, subjected to scarification, stratification, alternating high and low temperature, KNO_3, thiourea, kinetin, GA_3, H_2SO_4, pre-soaking, electric current, mechanical injury, coumarin, brassinolide and IAA on 17th day (table-1).

The seeds of *P. ovata* pretreated with

hot water found to be highly effective in breaking the seed dormancy. It resulted 91% of the seed germination on the 17th day from the date of sowing (table-1). It was followed by 85% and 74% germination respectively under IAA and brassinolide treatments.

On the 3rd day, the germination percentage was 0, 30, 24 and 21 respectively in the seeds kept as control, those pretreated with hot water, IAA and brassinolide. Only 50% of the seeds could germinate on the 17th day which were untreated. In this case, the stimulus comes from hot water treatment which softens the seed coat and makes an easy entry of water and air to facilitate higher germination percentage.

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