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Effect of storage containers on seed germination and viability in *Aconitum heterophyllum* and *Podophyllum hexandrum* - endangered medicinal plants species of Himalayan region

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ABSTRACT

The experiment was conducted to study the effect of different storage containers under complete darkness and partial light. The study revealed that maximum germination (92%), viability (95%), germination speed (1.58), germination energy (70.0%) were recorded in polybags under complete darkness in *Aconitum heterophyllum* wall ex. Royle while minimum were recorded under partial light in cloth bags. Similarly, in case of *Podophyllum hexandrum* same results were obtained.

Keywords : Storage containers, complete darkness, partial shade

INTRODUCTION

Proper storage of seed is an important sequel to the production of seed. The successful cultivation in any cultivated crop is determined to a large extent by germinability and viability of the seeds. There is no pertinent information about germination of *Aconitum* and *Podophyllum* plant species. Therefore, it is of great significance to take up the research work on storage to develop best storage material to commercialize these crops suitable for growing in the high altitude region of Himalayas.

MATERIALS AND METHODS

The experiment was conducted to see the effect of storage container on germination and viability of *Aconitum* and *Podophyllum*. Eight treatment comprises four storage containers viz. polythene bags, paper bags, cloth bags and plastic containers and two storage condition (complete darkness and partial light) to store freshly harvested seeds for six months, replicated thrice and experiment was laid out in complete randomized block design. Observations were recorded on germination percentage, germination energy (%), germination speed as given by Megure (1962) and viability percentage. The data recorded was subjected to statistical analysis as described by Gomez and Gomez (1984). The analysis of variance was done by the method described by Fisher. For the present study, seeds of *Aconitum heterophyllum* and *Podophyllum hexandrum* were collected from their natural place of occurrence from Rahla, Gulaba and Marhi areas of Manali in Kullu district of Himachal Pradesh.

RESULTS AND DISCUSSION

i) Effect of different storage methods on seed viability of *Aconitum heterophyllum* Wall ex Royle

Four types of storage containers namely polythene bags, paper bags, cloth bags and plastic containers were placed in complete darkness and partial light assessed for their effect on germination and viability percentage for *Aconitum heterophyllum* and *Podophyllum hexandrum* seed under storage. The data in Table 1 revealed that maximum germination (92.0%) was recorded in the seeds stored in S_1CD closed followed by S_2CD (91.7%), S_5PL (91.3%), S_6PL (91.0%) and 90.0 per cent in the S_4CD stored seeds which were found statistically at par with each other. However,

the lower germination of 71.3 per cent was recorded in S_7PL stored seeds which was found significantly lower from other treatments. Similarly, germination of 85.0 per cent was recorded in S8PL and 78.0 per cent in S_3CD stored seeds which were significantly different from each other (Table 1).

As regards the germination energy, it was also recorded maximum of 70.0 per cent in S_1CD closely followed by 69.3 per cent in S_2CD, 68.7 per cent each in S_5PL and S_6PL containers which were found statistically at par with each other while the significantly lower i.e. 50.0 per cent each germination energy was recorded in S_3CD and S_7PL containers stored seeds. Similarly 64.7 per cent was recorded in S_4CD and 60.7 per cent in S_8PL which was at par with each other. The germination energy period ranged between 12 to 15 days.

Regarding the germination speed, it was also recorded maximum (1.59) in S_1CD followed by 1.56 in S_2CD and 1.54 each in S_5 and S_6PL containers which were found statistically at par with each other while the minimum (1.11) germination speed was recorded in S_7PL stored seeds which was statistically at par with 1.18 in S_3CD treatment. Similarly, 1.50 in S_4CD was at par with 1.37 in S_8PL. The germination speed was recorded upto 24 days.

As regards the viability percentage, it was also found maximum (95.0%) in S_1CD followed by 94.0 per cent in S_2CD, 93.7 per cent in S_6PL, 93.3 per cent in S_5PL and 93.0 per cent in S_4CD stored seeds which however, were found statistsically at par with each other. The minimum of 75.3 viability per cent was recorded in S_7PL stored seeds. Similarly, 87.0 per cent viability was recorded in S_8 treatment followed by 81.3 per cent in S_3 which was significantly lower than former value but was higher than S_7.

ii) Effect of different storage methods on seed viability of *Podophyllum hexandrum* Royle

The data presented in Table 2 revealed that maximum germination of 78.0 per cent was recorded in seeds stored in S_1CD closely followed by 77.3 per cent in S_5PL, 76.7 per cent in S_4CD, 76.0 per cent in S_2CD and 75.3 per cent in S_6PL stored seeds which were found statistically at par with each other (Table 2). Similarly, 74.7 per cent germination was recorded in S_8PL and 60.0 per cent in S_3CD which was significantly higher than former values but was significantly higher than 53.7 per cent in S_7PL stored seeds which was the lowest value.

As regards the germination energy, it was also recorded maximum of 58.0 per cent in S_1CD followed by 56.7 per cent in S_6PL, 56.0 per cent in S_8PL and 54.0 per cent in S_4PL stored seeds which were found statistically at par with each other, while the lowest of 28.0 per cent germination energy was recorded in S_7PL stored seeds which was however, found at par with 30.0 per cent in S_3CD stored seeds. The germination energy period ranged between 40 to 45 days.

Regarding the germination speed, it was also recorded maximum of 0.58 in S_1CD followed by 0.57 each in S_4CD and S_5PL, 0.56 each in S_2CD and S_6PL stored seeds, which were found statistically at par with each other. The minimum (0.37) germination speed was recorded in S_7PL stored seeds which was significantly lower than other treatments. The germination period was observed upto 60 days.

The viability percentage was also recorded maximum of 81.7 per cent in S_1CD closely followed by 81.0 per cent in S_4CD, 80.7 per cent in S_5PL, 79.0 per cent in S_2CD and 78.7 per cent in S_6PL stored seeds which were found statistically at par with each other while minimum of 57.0 viability percentage was recorded in S_7PL stored seeds which was found to be significantly lower than other treatments.The maximum germination and viability percentage in both the species under polythene bags, paper bags and plastic containers may be probably due to maintenance of proper moisture content and exchange of gases in the seeds which also helps in maintaining proper level of sugars and starches etc. which are required for good germination and growth of seedlings. These results are in line of those of Ahmed *et al.* (1992) with *Albizia chinensis* and Chand (1994) in *Toona ciliata*. Low viability of cloth

bags stored seeds is due to the reduction in the seed moisture during storage which reduced the seed longevity. The low germination ability and viability of seeds in storage in the cloth bags in the present study may be due to the changes in the physiochemical state of seeds particularly the seed metabolism due to the reduction in moisture content. The changes in seed metabolism are reported as one of the major factors for low seed germination and viability (Abdul Baki, 1980).

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Table 1. Effect of different storage methods on seed viability of *Aconitum heterophyllum* Wall ex Royle

Treatments	**Germination (%)**	**Germination energy (%)**	**Germination speed**	**Viability percentage**
Storage containers [Complete Darkness (CD)]				
Polythene bags (S_1)	92.0 (73.7)	70.0 (56.8)	1.58	95.0 (62.0)
Paper bags (S_2)	91.7 (73.3)	69.3 (56.4)	1.56	94.0 (60.7)
Cloth bags (S_3)	78.0 (62.0)	50.0 (45.0)	1.18	81.3 (50.8)
Plastic containers (S_4)	90.0 (71.6)	64.7 (53.6)	1.50	93.0 (61.1)
[Partial Light (PL)]				
Polythene bags (S_5)	91.3 (72.9)	68.7 (55.9)	1.54	93.3 (61.6)
Paper bags (S_6)	91.0 (72.6)	68.7 (55.9)	1.54	93.7 (60.2)
Cloth bags (S_7)	71.3 (57.7)	50.0 (45.0)	1.11	73.3 (47.1)
Plastic containers (S_8)	85.0 (67.2)	60.7 (51.2)	1.37	87.0 (59.7)
$LSD_{0.05}$	3.2 (2.8)	4.8 (2.9)	0.08	2.8 (1.8)
CV (%)	2.2	4.5	3.1	1.8

Figures in parentheses are arc sine transformed value

Table 2. Effect of different storage methods on seed viability of *Podophyllum hexandrum* Royle

Treatments	Germination (%)	Germination energy (%)	Germination speed	Viability percentage
Storage containers [Complete Darkness (CD)]				
Polythene bags (S_1)	78.0 (62.0)	58.0 (49.6)	0.58	81.7 (64.7)
Paper bags (S_2)	76.0 (60.7)	47.3 (43.5)	0.56	79.0 (62.8)
Cloth bags (S_3)	60.0 (50.8)	30.0 (33.2)	0.40	63.3 (52.7)
Plastic containers (S_4)	76.7 (61.1)	54.0 (47.3)	0.57	81.0 (64.2)
[Partial Light (PL)]				
Polythene bags (S_5)	77.3 (61.6)	50.0 (45.0)	0.57	80.7 (63.9)
Paper bags (S_6)	75.3 (60.2)	56.7 (48.8)	0.56	78.7 (62.5)
Cloth bags (S_7)	53.7 (47.1)	28.0 (31.9)	0.37	57.0 (49.0)
Plastic containers (S_8)	74.7 (59.8)	56.0 (48.5)	0.55	78.0 (62.0)
$LSD_{0.05}$	2.7 (1.8)	4.5 (2.7)	0.02	3.2 (2.1)
CV (%)	2.2	5.5	1.7	2.5

Figures in parentheses are arc sine transformed value