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PRETREATMENT FOR REMOVING SEED COAT IMPERMEABILITY IN *CORCHORUS* SPECIES

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The effect of different pre-treatments to reduce the seed coat imposed dormancy in the two species of *Corchorus* viz. *olitorius* and *capsularis* were studied. Results indicated that the two species exhibited significant differences in their response to various treatments. For *olitorius*, the best overall response was obtained when seeds were subjected to hot water treatment, the optimum durations being 65°C for 30 minutes (80%) and 80°C for 3 minutes (79%). On the other hand, concentrated acid treatment and mechanical scarification using fine sand paper provided the most rapid and effective methods for breaking seed coat imposed dormancy (96% germination as against 13%) in *capsularis* seeds. Besides, the effects of sub-zero storage at −20°C for one year and application of dry heat at 65°C for 24 hrs were also studied and the results discussed.

Key words : *Corchorus capsularis, C. olitorius*, scarification, sub-zero storage, dry heat, hard seed

Jute, now the most important long vegetable fibre has attained commercial importance since 19th century. 95 per cent of world's jute is produced in India and Bangladesh and is one of the cheapest amongst the textile fibres. Jute is obtained from two species of *Corchorus* belonging to family Tiliaceae. *Corchorus* has about 40 species but only two are commercially important and cultivated i.e. *olitorius* and *capsularis*.

While testing the seeds of *Corchorus* species received from the Central Research Institute for Jute and Allied Fibers (CRIJAF), Barrackpore for long term storage in the National Gene bank, NBPGR, it was observed that a several accessions of both the species exhibited hardseededness ranging from 80-96 per cent. Hardseededness is an adaption allowing seeds to remain dormant for various periods of time before imbibing water and germinating. Variations in the degree of individual seeds are of significant ecological benefit to the species since they thereby multiply their chances of establishment (Serrato-Valenti *et al.*, 1989). In agriculture, hardseededness can be disadvantageous, the lack of simultaneous germination preventing the establishment of uniform stand of seedlings (RiggioBevilaqua *et al.*, 1985). This problem needs considerable attention especially in genebanks because it can not only seriously interfere with the results of the germination tests designed to assess the viability of accessions but also can reduce the amount of precious seed which emerges when sown for regeneration, multiplication or other purposes. Treatments applied to break this dormancy are highly specific and no one type is universally accepted because even within a genus, distinct differences in the seed coat dormancy have been observed for several species of crop plants (Bhattacharya and Saha, 1990; Lopez and Aviles, 1988; Todaria and Negi, 1992). The present study was undertaken to evaluate the efficacy of various physico-chemical treatments in breaking the seed coat impermeability of *Corchorus* seeds.

MATERIALS AND METHODS

One accession each of *Corchorus olitorius* (OIN 124) and *Corchorus capsularis* (CIN 169) exhibiting maximum hardseededness of 92 and 88 per cent respectively were subjected to the following treatments in order to break the seed coat impermeability :

(a) **Acid scarification** : Seeds were immersed in concentrated sulphuric acid for 5, 10, 15, 20, 25, 30, 40 and 50 minutes and rinsed several times in running tap water.

(b) **Hot water treatment** : Seeds were subjected to hot water treatment by varying immersion time and temperatures. The time temperature combinations selected are given in Table 2.

(c) **Mechanical scarification** : Seeds were placed between two sheets of fine and coarse sand paper and gently rubbed for 2 minutes.

(d) **Storage at sub-zero temperature** : Seeds were packed in trilayered aluminium foil packets and stored for one year at –20°C.

(e) **Dry heat treatment** : Seeds were subjected to dry heat at 65°C for 24 hours in a forced draught air oven.

The data were subjected to statistical analyses in randomized complete block design using MSTATC software.

RESULTS AND DISCUSSION

Various treatments (chemical, enzymes, pressure, scarification, freezing, radiation etc), that force hard seeds to germinate have been known for many years. Early methods have been reviewed by Rolston, 1978. Concentrated sulphuric acid (Hopkins, 1923) and mechanical scarification (Hughes, 1915) have been widely used with considerable success on many species. The results of the present study indicated that among all the methods tested, hot water treatment in the case of *C. olitorius* and sulphuric acid scarification along with sand paper scarification in the case of *C. capsularis* were the most effective pretreatments for breaking coat imposed dormancy. Significant differences existed between genotypes and treatments and genotypes over treatments. Scarification with acid for 15-40 minutes did on the average result in more germination than either shorter or longer periods in *C. capsulars* (96% as against only 13% in the control). In *C. olitorius* acid treatment could raise the germination percentage to a maximum of 54-57 per cent when treated for 15-20 minutes. Shorter durations were less effective and longer durations were detrimental resulting in significant increase in the number of decayed seedlings (Table 1). The efficacy of sulphuric acid treatments have been reported by

Table 1. Effect of concentrated sulphuric acid on the germination of *Corchorus* species

	Normal			Abnormal			Hard			Dead		
Duration (Min)	*C. caps.*	*C. olit.*	Mean	*C. caps.*	*C. olit.*	Mean	*C. caps.*	*C. olit.*	Mean	*C. caps.*	*C. olit.*	Mean
5	66.0	11.0	38.5	4.0	4.0	4.0	23.0	79.0	51.0	7.0	6.0	6.5
10	79.0	21.0	50.0	0.0	6.0	3.0	17.0	63.0	40.0	4.0	9.0	6.5
15	96.0	55.0	75.5	0.0	12.0	6.0	0.0	20.0	10.0	4.0	13.0	8.5
20	96.0	57.0	76.5	0.0	19.0	9.5	0.0	12.0	6.0	4.0	12.0	8.0
30	95.0	29.0	62.0	1.0	33.0	17.5	0.0	13.0	6.5	3.0	24.0	13.5
40	96.0	23.0	56.5	0.0	27.0	13.5	0.0	10.0	5.0	4.0	41.0	22.5
50	82.0	17.0	49.5	5.0	12.0	8.5	0.0	0.0	0.0	13.0	71.0	42.0
Control	12.0	5.0	8.5	4.0	0.0	2.0	80.0	95.0	87.5	4.0	0.0	2.0
Mean	77.8	27.5	52.1	1.8	14.1	8.0	15.0	36.5	25.8	5.4	22.0	13.7
CD		5%	1%		5%	1%	5%		1%		5%	1%
(V)		1.28	1.73		1.14	1.54	1.11		1.51		0.89	1.70
(T)		2.56	3.46		2.28	3.08	2.23		3.01		1.78	2.40
(V) × (T)		3.63	4.89		3.23	4.35	3.16		4.26		2.52	3.00

Horn and Hill (1974) in *Lupinus cosentine*, Tomer and Promila (1991) in *Vigna mungo*, Singh *et al.* (1985) in *Lens esculentus*, Rao *et al.* (1985) in *Atylosia platycarpa* and Cheema and Qadir (1973) in *Acacia senegal*. Concentrated sulphuric acid causes rapid desiccation of the seed coat resulting in the fragmentation of the integuments thus allowing the passage of moisture to the embryo (Duran and Tortosa, 1985). Treatments lasting for more than the optimal durations i.e. 15-40 minutes in *C. capsularis* and 15-20 minutes in *C. olitorius* resulted in death and decay of seeds and seedlings probably due to the acid finding its way into the embryo, thereby causing injury.

As for the hot water treatment, best response was shown by *C. olitorius* seeds where 80 and 79 per cent germination could be achieved by treating the seeds at 65°C for 3 min. respectively. For *C. capsularis* hot water treatment was slightly inferior to acid or sand paper scarification and the best combination of time and temperature was 75°C for 15 minutes which produced 92 per cent normal seedlings. Species specificity to a given treatment has already been reported by (Aveyard, 1986; Clemens *et al.*, 1977). The results reveal that with increasing temperatures, shorter exposures became sufficient to render seeds permeable. Longer exposures at higher temperatures resulted in heat impairment of germinability (Table 2). This could be due to thermal inactivation or damage to the embryo.

Table 2. Effect of hot water treatment on the germination of *Corchorus* species

Treatment	Duration	Normal			Abnormal			Hard			Dead		
Temp °C	Minutes	*C. caps.*	*C. olit.*	Mean	*C. caps.*	*C. olit.*	Mean	*C. caps.*	*C. olit.*	Mean	*C. caps.*	*C. olit.*	Mean
65	30	40.0	80.0	60.0	17.0	0.0	8.5	27.0	12.0	19.5	17.0	8.0	12.5
70	30	25.0	74.0	49.5	20.0	5.0	12.5	23.0	9.0	16.0	31.0	11.0	21.0
75	15	92.0	68.0	80.0	0.0	5.0	2.5	4.0	25.0	14.5	4.0	2.0	3.0
75	30	17.0	48.0	32.5	43.0	16.0	29.5	12.0	1.0	12.0	29.0	4.0	26.5
80	3	81.0	79.0	80.0	9.0	4.0	6.5	5.0	3.0	9.0	5.0	4.0	4.5
80	5	47.0	65.0	56.0	31.0	11.0	21.0	10.0	9.0	9.5	12.0	15.0	13.5
80	10	27.0	30.0	28.5	21.0	39.0	30.0	4.0	0.0	2.0	47.0	31.0	39.0
Control	-	13.0	4.0	8.5	4.0	0.0	2.0	81.0	96.0	88.5	2.0	0.0	1.0
Mean	-	42.7	56.0	49.3	18.1	10.0	14.3	20.7	22.0	21.4	18.3	11.8	15.1

CD	5%	1%	5%	1%	5%	1%	5%	1%
(V)	1.15	1.55	0.94	1.26	0.99	1.33	1.14	1.53
(T)	2.30	3.09	1.86	2.51	1.97	2.67	2.28	3.06
(V) × (T)	3.25	4.38	2.64	3.55	2.79	3.75	2.22	4.34

Mechanical scarification by scraping the seed coat or rubbing over sand paper to create an abrasive force has been a very common method of treating seed coat dormancy for small lots of seeds. Duran and Tortósa (1985) in *Sinapis arvensis*, and Mitter *et al.* (1993) in *Psoralea corylifolia*, have emphasized the efficacy of this method for breaking coat impermeability (Table 3).

Table 3. Effect of some physical treatments on the germination of *Corchorus* species

Treatment	Normal			Abnormal			Hard			Dead		
	C. caps.	C. olit.	Mean	C. caps.	C. olit.	Mean	C. caps.	C. olit.	Mean	C. caps.	C. olit.	Mean
Fine scarification	96.0	75.0	85.5	0.	14.0	7.0	0.0	5.0	2.5	4.0	6.0	5.0
Coarse scarification	50.0	71.0	60.5	27.0	19.0	23.0	5.0	6.0	5.5	18.0	5.0	11.5
Dry heat	49.0	58.0	53.5	11.0	9.0	10.0	28.0	25.0	26.5	13.0	7.0	10.0
Storage at –20°C	46.0	6.0	26.0	4.0	0.0	2.0	46.0	94.0	70.0	4.0	0.0	2.0
Control	12.0	5.0	8.5	4.0	0.0	2.0	80.0	95.0	87.5	4.0	0.0	2.0
Mean	50.6	43.0	46.8	9.2	8.4	8.8	31.8	45.0	38.4	8.6	3.6	6.1

CD at	5%	1%	5%	1%	5%	1%	5%	1%
(V)	1.07	1.46	1.16	1.59	1.95	1.29	0.87	1.19
(T)	1.69	2.31	1.84	2.51	1.51	2.06	1.37	1.86
(V) × (T)	2.39	3.26	2.60	3.55	2.12	2.93	0.94	2.64

Besides the above mentioned treatments, which were highly effective in breaking seed coat dormancy of jute species, storage at –20°C for one year as well as dry heat application were tried in the present study. There was a partial response of *C. capsularis* to sub-zero treatment which resulted in 46 per cent germination as against 13 per cent in the control whereas it was totally ineffective for *C. olitorius*. On the other hand subjecting the seeds to dry heat for 24 hrs. evoked equal response of both the species and resulted in 48 and 58 per cent germination in *C. capsularis* and *C. olitorius* respectively.

From the results obtained in this study, it is very clear that the two species of *Corchorus* respond in a significantly different manner with regard to various treatments used for breaking seed coat dormancy. Also the results clearly advocate the use of hot water treatment for *C. olitorius* and acid or sand paper scarification for *C. capsularis* as effective methods to overcome this problem.

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