

Effect of Storage and Priming on Seed Viability and Vigour in *Khirni* (*Manilkara hexandra* L.)

K. BHANUPRAKASH, H.S. YOGESHA, M.N. ARUN AND L.B. NAIK

Indian Institute of Horticultural Research, Hessarghatta, Bangalore 560 089
kbp_ihr@yahoo.co.in

ABSTRACT *Khirni* is a commercially important crop as it serves as a promising rootstock for sapota propagation. In the present investigation, studies were conducted to understand *khirni* seed viability during storage and their response to seed priming treatments. At the end of one year, seeds stored under ambient temperature and at 4°C lost viability whereas those stored at 15°C maintained germination up to 56 per cent. Priming with gibberellic acid and thiourea enhanced germination of six month old seeds stored at ambient conditions to the extent of 23 and 11 per cent, respectively. Further, priming improved seedling vigour both in fresh and aged seeds. The early seedling vigour obtained through seed priming in fresh and aged seeds could be exploited commercially for attaining graftable seedling size at the earliest to save nursery raising costs.

Key words: *Khirni*, vigour, viability, storage

Khirni (*Manilkara hexandra* L.) is extensively used as rootstock since it has been found to be the most promising among various rootstocks used for sapota propagation. *Khirni* seeds are available only for short period of 3-4 months during winter season. Besides, poor germination, short viability and slow growth of seedlings are major problems in *Khirni*, which limit its rapid multiplication [1]. To meet the growing demand for sapota planting material (grafts), nurserymen have to produce large number of rootstocks with graftable size in shorter time. Growth substances are reported to be useful in accelerating the growth of sapota seedlings to enable them to attain graftable size earlier and reduce the nursery cost [2].

Pre-sowing seed treatments with growth substances such as gibberellic acid have been found to improve the seedling growth of many species [3 & 4]. Studies were therefore taken up to understand *khirni* seed viability during seed storage and their response to seed priming treatments.

MATERIAL AND METHODS

Khirni (*Manilkara hexandra*) is an under utilized fruit crop, despite its fruits are good source of minerals and vitamins with less fat content. Ripe fruits are sweet and eaten fresh or dried. The tree is ideally suited for growing on waste and barren lands. Seeds are recalcitrant in nature with hard seed coat. *Khirni* seeds, extracted from mature fruits, were obtained from Ghodra region of Gujarat state. Seeds stored under ambient condition for various durations (one, three and six months) were subjected to priming treatments (soaking in GA₃ 1000 ppm, thiourea 1 per cent and distilled water for 48 hours). After the treatment, seeds were rinsed with water, shade dried and tested for germination and vigour under controlled conditions (30±2°C and 80 per cent RH in dark) using between paper method as per standard test procedures. Four replicates of hundred seeds each were used for each treatment. Total seedling length and seedling dry weight were recorded at 40th day after sowing. Shoot vigour index [5] was calculated by

multiplying per cent germination and shoot length. In another experiment, seeds stored at three different temperature regimes *viz.*, ambient, 15 and 4°C for a period of one year were tested for germination at six monthly intervals, in plastic protryas filled with cocopit, under open field conditions. Six replicates of fifty seeds for each treatment were used for this study. The data were analysed using factorial design as per the procedure outlined by Panse and Sukhatme [6].

RESULTS AND DISCUSSION

Effect of storage period and priming on seed quality:

Seed storage under ambient conditions affected seed viability and vigour significantly. Reduction in seed germination from 84.8 to 56.8 per cent was noticed in seeds stored for six-months. When compared to fresh seeds, seeds stored for one, three and six months showed loss in viability to the extent of 11.7, 23.2 and 38.0 per cent, respectively [Table 1]. Significant reduction in vigour was also noticed during the period of storage. The decrease in shoot vigour was 13.2, 27.0 and 35.7 per cent due to one, three and six month storage, respectively [Table 1]. Decrease in seedling vigour during storage was also reported by other workers in recalcitrant seeds of mandrins [7] and jackfruit [8].

Seed priming significantly improved seed germination per cent and vigour. Due to seed priming an increase in germination, shoot length and shoot vigour index to the extent of 7.5, 36.5 and 47.0 (mean values), respectively, was noticed. Among the priming treatments, osmopriming using gibberellic acid followed by thiourea was found better than hydropriming. Due to priming using distilled water, gibberellic acid and thiourea, the per cent increase in germination and shoot length and shoot vigour was 0.9, 9.9, 3.9 and 19.1, 43.8, 46.9 and 20.6, 65.4, 54.7, respectively [Table 1]. Increase in seedling vigour due to priming has also been recorded by other workers in sapota [2] and *khirni* [9].

Marked increase in germination per cent to the extent of 17 and 23 and 12.6 and 10.6 was noticed in three and six month ambient stored seeds due to priming with gibberellic acid and thiourea,

respectively. However, no significant effect of priming was observed in fresh and one month old seeds. Interaction studies further revealed that osmopriming was better than hydropriming in improving *khirni* seed germination. Due to osmopriming 14.0 and 4.7 per cent higher germination over hydropriming was noticed in three and six month stored seeds, respectively. Enhanced germination due to priming using gibberellic acid and thiourea might be due to increased enzyme activity, protein synthesis and changes in nucleic acid [10]. Seed priming further enhanced vigour of fresh and stored seeds as well. Increase in shoot vigour to the tune of 37.6 (mean value) was noticed in fresh primed seeds. The response to priming was more pronounced in stored seeds when compared to fresh seeds. The per cent increase in shoot vigour due to priming in six month old seeds was 23.2 per cent higher to that of fresh seeds. Increase in seedling vigour due to priming has also been recorded by other workers in sapota [2] and *khirni* [9].

Effect of temperature and storage period

Among various temperature treatments, 15°C was found best as there was higher germination compared to other treatments. The germination was increased by 30 per cent when stored at 15°C compared to ambient storage [Table 2]. Decline in seed vigour during the dry storage was earlier reported in four tropical recalcitrant species whose sensitivity to desiccation varied with species [11]. *Sal* seeds exhibited rapid loss of viability during storage at ambient condition, which was due to decline in nucleic acid and increase in RNase activity [12]. However at 4°C, complete loss in seed viability was noticed, which might be due to chilling sensitivity of seeds [Table 2]. Most of the tree species, which are sensitive to desiccation, cannot withstand chilling temperature and so lose viability quickly [13].

Seed storage also affected seed viability. Decrease in viability was noticed with increase in storage duration. When compared to 85 per cent germination in fresh seeds, seed stored for 6 and 12 month showed only 33.9 and 16.1 per cent germination, respectively [Table 2].

Among various interactions studied, 15°C x six

Table 1. Effect of storage and priming on seed viability and vigour in fresh and old *khirmi* seeds

Treatments	Priming														
	Germination (%)				Shoot length (cm)				Root length (cm)						
	D	DW	GA	TU	Mean (A)	D	DW	GA	TU	Mean (A)	D	DW	GA	TU	Mean (A)
Fresh seeds	85.0	84.0	85.0	85.0	84.8	5.40	6.50	8.00	7.92	6.96	10.6	12.3	12.8	12.4	12.0
1 month old	72.6	72.0	73.0	75.0	73.1	5.50	6.40	8.00	7.95	6.96	10.5	12.6	12.5	12.0	11.9
3 month old	54.0	54.6	71.0	66.6	61.6	5.35	6.39	8.00	7.89	6.91	10.2	10.0	11.7	11.1	10.8
6 month old	49.0	54.6	72.0	50.6	56.8	5.31	6.40	7.00	7.91	6.65	7.3	6.8	8.8	8.1	7.75
Mean (B)	65.4	66.3	75.3	69.3		5.39	6.42	7.75	7.92		9.65	11.5	10.4	10.9	
		SEm±		CD@5%			SEm±		CD@5%			SEm±		CD@5%	
Storage(A)		0.57		1.63			0.08		0.22			0.18		0.53	
Priming(B)		0.57		1.63			0.08		0.22			0.18		0.53	
A*B		1.15		3.26			0.15		0.44			NS		NS	
Treatments	Shoot vigour Index														
	Shoot dry weight (mg)				Root dry weight (mg)				Shoot vigour Index						
	D	DW	GA	TU	Mean (A)	D	DW	GA	TU	Mean (A)	D	DW	GA	TU	Mean (A)
Fresh seeds	135	169	224	222	188	222	283	294	285	271	460	546	680	673	589
1 month old	138	166	224	207	184	210	265	263	252	248	399	461	584	596	511
3 month old	107	141	200	197	161	173	170	234	222	200	289	349	568	526	430
6 month old	106	134	175	174	147	123	123	185	162	148	260	349	504	400	379
Mean (B)	122	206	153	200		182	244	210	230		353	426	584	546	
		SEm±		CD@5%			SEm±		CD@5%			SEm±		CD@5%	
Storage(A)		4.78		13.8			5.66		16.3			7.99		22.7	
Priming(B)		4.78		13.8			5.66		16.3			7.99		22.7	
A*B		NS		NS			11.3		32.6			16.0		45.5	

D-Dry; DW-Distilled water; GA-GA₃ 1000ppm; TU-Thiourea 1 %

Table 2. Effect of storage at different temperatures on seed germination in *Khirmi*

S.No.	Treatments	Germination(%)*		
		6 months	12 months	Mean(A)
1	Ambient	50.0(44.9)	0.00(0.00)	25.0(22.4)
2	15°C	70.0(56.8)	56.0(48.4)	63.0(52.3)
3	4°C	0.00(0.00)	0.00(0.00)	0.00(0.00)
	Mean (B)	40.0(33.9)	18.6(16.1)	29.3(32.8)
		SEm±	CD @5%	
	Storage (A)	1.23	3.66	
	Temperature (B)	1.01	2.99	
	A*B	1.74	5.18	

*Figures in parenthesis represent angular transformed values

**Initial germination of fresh seeds was 85.0 (67.3)

month duration was found best as it resulted in higher germination compared to all other treatment combinations. Seeds stored at 4°C showed complete loss of viability at the end of six month itself. On the other hand, seeds stored for same duration at ambient temperature and 15°C retained 50 and 70 per cent viability, respectively. At the end of one year, seeds stored at 15°C maintained viability up to 56 per cent against zero per cent viability at other two test temperatures [Table 2].

The present study revealed that *khirmi* seeds exhibit recalcitrant behaviour as they are desiccation and chilling sensitive. Since they lose viability quickly, seed priming could be used as a successful technique to restore the lost viability to a considerable extent. Further, seed vigour can be enhanced through priming, so that graftable seedling size could be achieved at the earliest and thus nursery raising cost can be reduced.

REFERENCES

- CHADHA, K.L. (1991). Strategy for optimization of productivity and utilization of sapota in India. In: *Proc national seminar on optimization of productivity and utilization of sapota*, Navasari. p65.
- PAMPANNA, Y. & G.S. SULIKERI (1999). Growth of sapota seedlings as influenced by presowing seed treatments with growth regulator. *Seed Res.*, **27**: 49-53.
- SHANMUGAVELU, K.G. (1970). Effect of giberrellic acid on seed germination and development of seedlings of some tree species. *Madras Agri. J.*, **57**: 311-314.
- SINGH, M., G.N. SINGH, L.N. SINGH & B.N. SINGH (1989). Effect of GA₃ on seed germination in mosambi (*Citrus sinensis* Osbeck). *Haryana J. Hort. Sci.*, **18**: 29-33.
- ABDUL BAKI, A.A. & J.D. ANDERSON (1973). Vigour determination in soybean by multiple criteria. *Crop Sci.*, **13**: 630-637.
- PANSE, V.S. & P.V. SUKHATME (1990). *Statistical Methods for Scientific Workers*. ICAR, New Delhi.
- DOIJODE, S.D. (2003). Changes in viability, vigour and solute leakage during storage of mandarin seeds. *Seed Res.*, **31**: 77-79.
- SHYLLA, M.J. & V. PALINISAMY (2000). Seed viability and storability of jackfruit. *Seed Res.*, **28**: 166-170.
- SRINIVASAMURTHY, B.N. (1984). *Studies on propagation of Ber*. M.Sc. Hort thesis UAS, Bangalore.
- REDDY, Y., & M.M. KHAN (2001). Effect of osmopriming on germination seedling growth and vigour of *khirmi* seeds. *Seed Res.*, **29**: 24-27.
- CORBINEU, F. & D. COME (1988). Storage of recalcitrant seeds of four tropical species. *Seed Sci. & Technol.*, **16**: 97-103.
- KRISHNA CHAITANYA, K.S., B. VARGHEESE & S.C. NAITHANI (2001). Changes in nucleic acid content and RNAase activity in desiccating recalcitrant sal seeds. *Indian J. Pl. Physiol.*, **6**: 335-341.
- PAMMENTER, N.W. & P. BERJAK (1999). A review of recalcitrant seed physiology in relation to desiccation tolerance mechanisms. *Seed Sci. Res.*, **9**: 13-37.