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BIOCHEMICAL CHANGES AND CONSERVATION OF WATERMELON (*CITRULLUS LANTAUS* THUNB.) GERMPLASM

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Watermelon (*Citrullus lanatus* Thunb.) germplasm is commonly preserved in the form of seeds, which is simple, inexpensive and practical means of conservation. Watermelon seeds are short lived for two years under ambient conditions. Seeds of cv **Arka Manik** having 8.0 per cent moisture were packed in polyethylene (200 gauge) and aluminium foil laminated bags (paper-foil- polyethylene) and stored at ambient (16-35°C), low (5°C) and sub- zero (–20°C) temperatures. With the low temperature storage of seeds, the longevity was extended to 5 years without decline in seedling vigour. Both polyethylene and laminated bags were effective for retaining the viability for 5 years at 5°C and –20°C. Biochemical changes were studied in stored seeds, as a result there was increased leaching of electrolytes, soluble sugars and free amino acids and decreased in dehydrogenase activity on deterioration. Storage of seeds in polyethylene or laminated bags at 5°C or –20°C was effective in conserving germplasm in the form of seeds for five years without decline in vigour.

Key words : Watermelon, *Citrullus lanatus*, conservation, germplasm, biochemical changes

Germplasm plays an important role in crop improvement for high yield, better quality, resistance to pests, diseases and stress conditions. Improper handling and storage of germplasm causes invaluable loss of genetic resources. Seeds are widely used for conservation of genetic variability in several vegetable crops including watermelon owing to convienient and less expensive for the operation. Seed looses viability rapidly under ambient conditions and it is predominantly dependent on storage conditions *viz.*, temperatures and humidity (Abdul-Baki and Anderson, 1972). High temperature and high humidity promote seed deterioration and shorten the longevity period in cucurbits (Villareal *et al.*, 1972). Such seeds are less vigourou and reduce the yield (Frohlich and henkel, 1964). Loss of seed viability is associated with certain changes in seed, causing excessive leakage of electrolytes, soluble sugars (Doijode, 1985) and amino acids (Givelberg *et al.*, 1984) from seeds and decrease in enzymatic activity in seeds (Copeland, 1976). The present experiment deals with increasing longevity of watermelon seeds by selecting suitable containers for low temperature storage and studying biochemical changes in relation to loss of viability.

MATERIALS AND METHODS

Seeds of watermelon cv **Arka Manik** were extracted from fully ripe fruits and dried to 8.0 per cent moisture. Seeds were stored in polyethylene (200 gauge) and aluminium foil laminated bags (Paper-foil-polyethylene) at low (5°C) and sub-zero (–20°C) temperatures. Seed viability was expressed in percentage of germination. Seeds were germinated in moist rolled towel at an alternate temperatures of 20-30°C for 16 and 8 hours, respectively, in seed germinator. Seedling length was measured on four days old seedlings. Dry weight was recorded on seedlings dried at 65° C for 48 hours. Seedling vigour was compared by means of indices I and II which were calculated by multiplying percentage of germination with seedling length and dry weight, respectively. For biochemical studies, seeds were surface sterilized with 0.1 per cent mercuric chloride, washed thrice with sterile water and surface dried with tissue paper. Seeds were soaked in 15 ml sterile water for 18 hours at 25°C. Electrical conductivity of seed leachates was measured by conductivity meter. Soluble sugars were analysed as per the method of Dubois *et al.* (1958), and free amino acids according to procedure of Lee and Takahashi (1966) in leachate. Dehydrogenase activity was measured by reduction of tetrazolium salt (Kittock and Law, 1968) in stored seeds.

RESULTS AND DISCUSSION

Seed viability and longevity were significantly affected by storage temperatures and containers. The percentage of seed germination was rapidly decreased in ambient storage, the rate of reduction was more in seeds stored in polythelene bags than aluminium foil laminated pouches. Seed germinability was reduced by 50 per cent after 2 years of storage, and there was no germination at the 3rd year of storage (Fig..1). The initial seed viability maintained for 5 years at 5°C and –20°C storage. Seeds stored in polyethylene and laminated bags effectively retained viability at low temperature (Fig.2). Seedling vigour, comprising vigour indices I and II, were rapidly decreased in ambient stored seeds while it maintained in seeds stored at 5°C and –20° C (Table 1). The retention of seedling vigour was greater in seeds stored in laminated pouches than polyethylene bags (Table 2). The electrical conductivity of seed leachate was higher in ambient stored seeds than seeds stored at 5°C or –20°C. Leaching of soluble sugars doubled in ambient than low temperature stored seeds. Similarly there was increase in quantity of amino acids in leachates of ambient stored seeds, which was coincided with loss of seed viability (Table 3). There was sharp decline in dehydrogenase activity in ambient stored seeds as compared to seeds stored at 5°C or –20°C. This indicates decrease in seed viability associated with increase in leaching of metabolites and decrease in dehydrogenase activity in seeds. Loss of germinability was positively correlated with extent of leakage in terms of conductivity and soluble sugars (Shamasherry

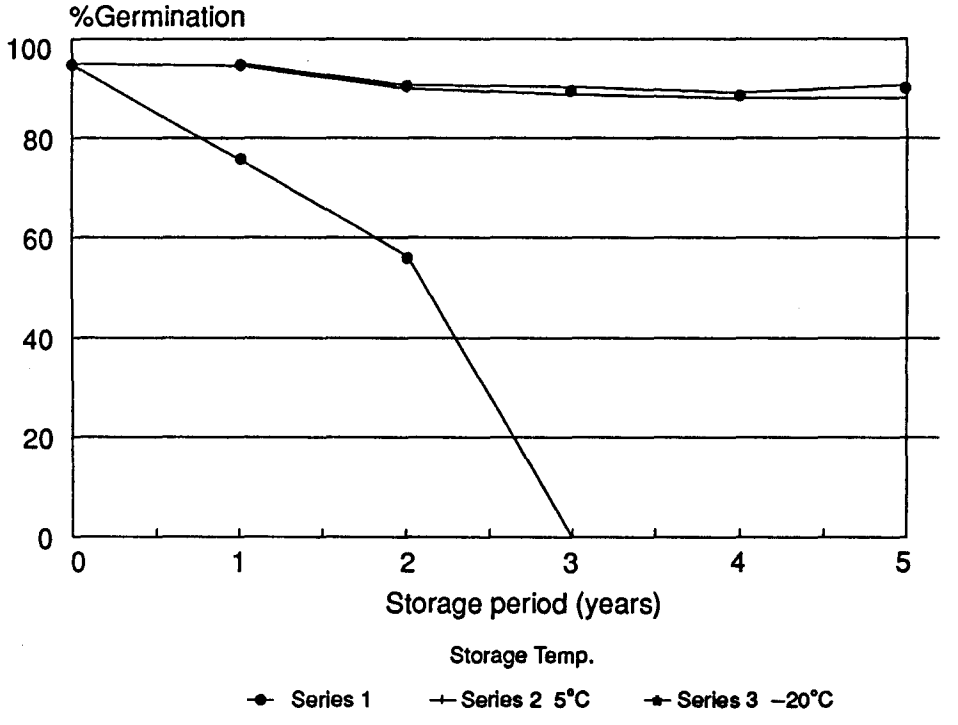

Fig. 1. Seed storability as influenced by temperatures in watermelon

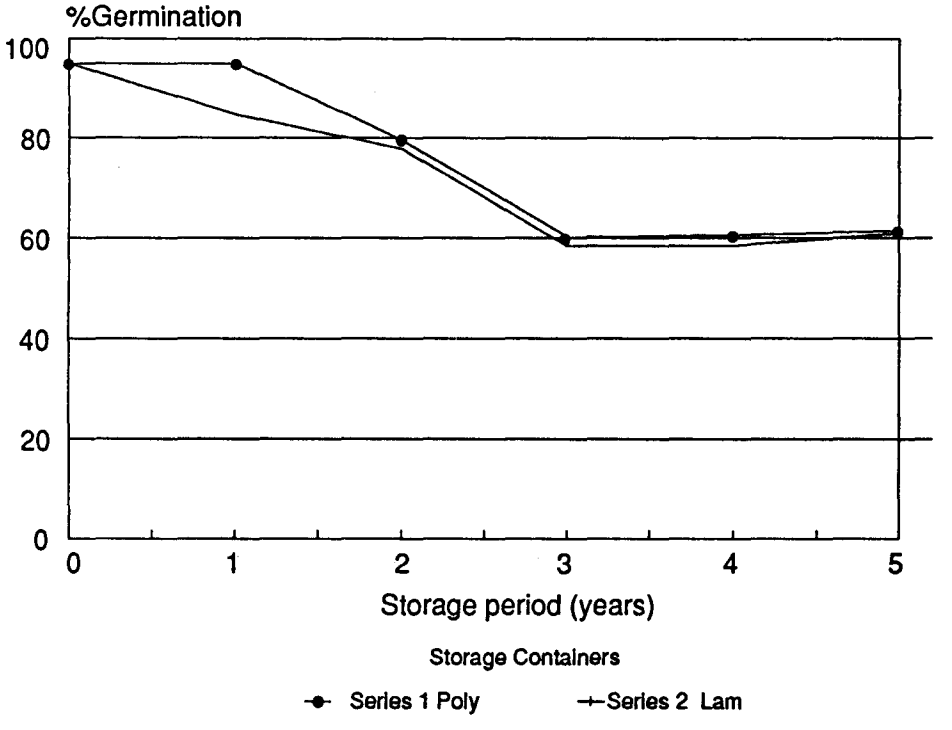

Fig. 2. Influence of packaging on storability of watermelon seeds

and Banerji, 1979). This excessive leakage was attributed to disruption on cell membrane (Schoettle and Leopold, 1984).

Table 1. Vigour Index-I of seedling during storage of watermelon seeds

Storage temperature	Storage containers	Storage period (years)				
		1	2	3	4	5
Ambient	Poly	250	51	0	0	0
	Lam	327	79	0	0	0
5°C	Poly	385	304	337	369	352
	Lam	407	371	375	400	360
–20°C	Poly	373	337	390	379	360
	Lam	431	357	425	375	275

C.D. at 5% = 62.8

Table 2. Vigour Index- II of seedling during storage of watermelon seeds

Storage temperature	Storage containers	Storage period (years)				
		1	2	3	4	5
Ambient	Poly	928	768	0	0	0
	Lam	1269	1100	0	0	0
5°C	Poly	1615	1800	1599	1875	1807
	Lam	1687	1855	1678	1947	1819
–20°C	Poly	1689	1894	1429	1972	1864
	Lam	1754	2047	1831	2067	1901

C.D. at 5% = 198.6

Table 3. Biochemical changes in seed and leachate as influenced by temperatures after five years of storage

Storage temp. (°C)	Storage Containers	E (μv)	Sugars (mg/g)	Amino acids (mg/g)	DHA (A480)
Ambient	Poly	113 ± 1.8	6.20 ± 0.31	0.85 ± 0.00	0.21 ± 0.00
	Lam	110 ± 3.5	6.02 ± 0.38	0.78 ± 0.04	0.32 ± 0.00
5	Poly	80 ± 0.7	3.81 ± 0.07	0.61 ± 0.04	0.67 ± 0.00
	Lam	79 ± 0.7	3.76 ± 0.00	0.52 ± 0.01	0.71 ± 0.00
–20	Poly	80 ± 1.4	3.44 ± 0.19	0.69 ± 0.01	0.58 ± 0.00
	Lam	75 ± 0.7	2.87 ± 0.06	0.64 ± 0.01	0.72 ± 0.01

Watermelon seeds were viable for two years and retention of viability was greater in laminated than polyethylene bag under ambient conditions. The rate of deterioration was faster at high temperature and high moisture while germination decline slowly at cooler temperature (Harrington, 1972). Seed viability reduced rapidly under ambient temperature (Villareal *et al.*, 1972) and longevity prolonged with low temperature storage of seeds (Boros and Hadnagy, 1969). Seedling vigour also preserved at low temperature. With decrease in vigour, certain changes occured in seeds, which are useful for quick prediction of seed quality. The leaching of electrolytes, soluble sugars and amio acids was more at ambient temperature than at 5°C or –20°C. Fonseca *et al.* (1980) reported that seeds stored in ambient temperature begins to deteriorate faster and show low germination and low vigour. Polyethylene and laminated pouches were ideal packaging material for storage at low or sub-zero temperature. Storage of seeds either in polyethylene or laminated pouches at 5°C or –20°C was effective for conserving watermelon germplasm for 5 years wihout loss of vigour.

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