

Seed Potentiation under Stressful Storage Condition

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Abstract: Pretreatment of black gram (*Vigna mungo*) seeds with the leaf extract of calendula (*Calendula arvensis*) 25g in 500 ml distilled water before accelerated ageing treatment (100% RH) for different durations (0, 15 and 30 days) slowed down the rapid loss of seed germination. The plant extract also significantly arrested the reduction of protein and activity of catalase enzyme of seed kernels during forced ageing period. Again, stimulation of the activity of amylase enzyme was alleviated by the seed pretreating agent during ageing. The promising effect of the present plant extract on storage potentiation of the experimental seed species is apparent in this investigation.

Keywords: Black gram, calendula, seed potentiation, stressful storage, accelerated ageing.

1. INTRODUCTION

The problem of retention of seed vigor particularly in Bankura and Purulia Districts in West Bengal state of India is much more acute because of semiarid climate where high temperature and high relative humidity (RH) prevailing during the major part of a year is very conducive to the growth of microorganisms (Christensen and Kaufmann, 1965; Aziz and. Shair, 1977). Keeping in mind the above problem of seed storing, an attempt has been made in this investigation to prolong the storage life of a black gram species. An experiment of this investigation was carried out under accelerated ageing condition to obtain more or less uniform and expeditious results. In fact, accelerated ageing treatment, as imposed by high temperature and high relative humidity, provide a powerful tool for studying the process of seed deterioration over a very short period (Heydecker, 1972; Pati and Bhattacharjee, 2013). Thus, the prime objective of this work is to probe the efficacy of leaf extract of calendula on enhancement of seed vigour of a black gram species by analysing germination behaviour and metabolic status of seeds.

2. MATERIALS AND METHODS

After surface sterilization (0.1% HgCl₂ for 90 seconds) the seeds of black gram (*Vigna mungo*) was presoaked in aqueous solution of leaf extract of calendula (*Calendula arvensis*) 25g in 500 ml distilled water for 2 hours (h) and then dried back to the original dry weight of the seeds. This was repeated twice allowing maximum penetration of the bioactive substances present in the aqueous solution. The pretreated seed lot was taken in cloth bag and thus stored in a desiccator in which 100% relative humidity (RH) was preimposed within it. This experimental set up was kept at room temperature for allowing the seeds to experience forced ageing treatment for different durations (0, 15 and 30 days).

To analyse the percentage germination, treated seeds was transferred to separate Petri dishes containing filter paper moistened with distilled water. Germination data was recorded after seed soaking following the International Rules for Seed Testing (ISTA, 1976). Protein as well as activities of catalase and amylase enzymes were analysed from seed kernels of each sample. Quantification of Protein level was estimated as per the method of Lowry *et al.*, 1951. Extraction and estimation of the enzyme catalase was made following the method of Snell and Snell, 1971 as modified by Biswas and Choudhuri, 1978. Amylase activity was estimated as per the method of Khan and Faust, 1967.

Data were statistically analysed at the treatment and replication levels and least significant difference (LSD) values were calculated at 95% confidence limits (Panse and Sukhatme, 1967).

3. RESULTS AND DISCUSSION

Data clearly revealed that pretreatment of the black gram seed species with aqueous solution of leaf extract of calendula significantly alleviated the accelerated ageing-induced loss of germination (Table 1), alleviated the loss of protein (Table 1) and catalase enzyme (Table 2) as well as reduces the stimulation of the activity of amylase enzyme (Table 2).

The proposal that a decrease in membrane lesions might play a significant role in deterioration of seeds has been supported by the work on solute leakage accompanying a loss in germinability and viability (Powell and Matthews, 1977; Pati and Bhattacharjee, 2015). Much evidence has been put forward to suggest that membrane status within the germinating embryo is an important factor in deterioration (Pati, 2019). The experimental plant extract-induced substantial amelioration of all these deleterious effects are indicative of seed potentiation under adverse storage environment. The results therefore point out that although deterioration is a common phenomenon in treated and control sample of the seed species, the catabolic processes within the treated seed sample remained somewhat subdued, thereby rendering them tolerant against unfavourable storage environment. In this investigation, the arrestation of rapid loss of the catalase enzyme activity and alleviation of the ageing-induced stimulation of the activity of amylase enzyme are indicative of strengthening the defence mechanism by the bioactive compounds present in the leaf extract of calendula under adverse storage condition.

Table1. Effect of seed pretreatment with aqueous solution of leaf extract of calendula (25g in 500 ml distilled water) on percentage seed germination and protein (mg/g fr. wt.) values of black gram seeds.

Seed sample	Treatment	Percentage seed germination			Protein		
		Days after accelerated ageing					
		0	15	30	0	15	30
Black gram	Control	100	77	23	65.00	50.13	27.07
	Calendula	100	88	46	66.30	62.00	39.20
	LSD (P = 0.05)	NC	4.15	2.10	NS	4.04	3.19

NC: Not calculated; NS: Not significant.

Table2. Effect of seed pretreatment with aqueous solution of leaf extract of calendula (25g in 500 ml distilled water) on activities of enzyme catalase and amylase ($\Delta OD \times Tv/txv$ of each) of black gram seeds.

Seed samples	Treatments	Catalase			Amylase		
		Days after accelerated ageing					
		0	15	30	0	15	30
Black gram	Control	30.0	20.0	11.0	37.0	47.0	59.0
	Calendula	32.0	30.0	27.4	38.0	42.7	47.5
	LSD (P = 0.05)	NS	1.20	1.04	NS	2.07	3.50

NS: Not significant.

4. CONCLUSION

It can be concluded from the results of this investigation that aqueous solution of leaf extract of calendula is effective in enhancing storage potential of black gram seeds. Thus, invigouration property of the present seed pretreating agent seems to be apparent from these experimental results.

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