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Variability in action of some germination allied bio-molecules considering seed storability of Lentil genotypes

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Abstract
Physiological performances and bio-molecular activity at germination initiation stage may be considered for assessing the quality seed. The study was not only to identify the resourceful strains, the deterioration pattern with container effect at storage were also documented for achieving the successful seed production. In assessment, the factorial CRD was allowed considering the genotypic influence, storage durations and storage containers. High significant variability was noticed for characters utilising those factors. Considering the genotypes, WBL77 and PRECOZ exposed prominence though a contradiction was perceived for some characters. In storage, the Plastic container specified significant storing ability by reducing deterioration rate and the stage M1 (0 months) was noticeably superior in advancement of storage. The least deviation in GCV and PCV recognized genetic influence in seed traits that was reinforced by upper value of heritability (H^2%) excluding EC. High genetic advance (GA%) apart from germination percentage specified the influence of additive gene. In correlation matrix, the positive significant effect among parameters along with negative relationship only to EC was indicating the usefulness of these characters for seed quality maintenance. Hence, the considerable parameters can be included in strain selection for successful quality seed production of Lentil.

Keywords: Variability, seedling parameters, bio-molecules, storage, Lentil

Introduction
Lentil is one of the early domesticated plant species, and it was found in Neolithic, aceramic farming villages which were occupied in the 7th millennium BC in the near east arc (Helbeck, 1959) [12]. The important lentil-growing countries of the world are India, Canada, Turkey, Bangladesh, Iran, China, Nepal and Syria (Ahlawat, 2012) [2]. The total cultivated area in the world above 4.6 million hectares producing 6.3 million tons of seeds (FAO, 2019). Lentil (*Lens culinaris* Medik) is occupied a major cultivable land among various pulses due to its cultivation prospects, adapted nutrition status, generalised demand, upgrading of soil property etc. But, the crop suffers substantial yield losses from various biotic and abiotic stresses where the non-availability of qualitative seed materials is one of the crucial reasons as the quality retaining during storage is not proper in India. The post-harvest handling in seed production system can be upgraded after retaining the seed quality up to next season which was achieved in pre-harvest stage. The sustaining physiological performances of seeds is related to the operated storage systems as the water vapour exchange in between seeds and surrounding atmosphere is highly responsible (Marcos Filho, 2005) [17]. In seed storage, the abiotic factors like seed moisture content, storage temperature, O_2 accessibility and relative humidity are the most imperative factors distressing storage life. The frequency of ageing in stored seeds principally depends on chemical configuration of seeds (Mayer AM and Poljadoff AM, 1982) [18] where the storage systems are accompanying with it. Seed quality is to be quantified through incidence of biochemical parameters at seed germination. Studies on genotypic variability in respect to different parameters on germination and activity of bio-molecules, especially in qualitative aspects may be proper in seed production system in addition to strategic exploitation in breeding plan for creation of resourceful strains. The observation on genetic variability and selection of vital seed traits is the primary responsibility of a plant breeder to achieve seed superiority that was very much accommodating in seed quality maintenance with optimum production in ultimate. Heritability can be defined as the measure of the correspondence between breeding values and phenotypic values (Falconer, 1996) [9]. Genetic Advance is the degree of gain for a character attained under a definite selection pressure. Thus, genetic advance is yet additional vital selection guideline that serves information to the breeder in a selection program. High genetic advance in addition to high heritability estimates the offer under most effective condition for selection (Larik *et al*., 2000)

[16]. In this perception, the current study was undertaken to evaluate the effect on seed storability under dissimilar micro-environment containing storing devices with duration in respect to variable aberration considering physiological performances of seed. Appropriate selection measures might supportive to realize the required production potential with quality through founding the superior genotypes with adept storability.

Materials and Methods

The freshly harvested seeds of ten lentil genotypes were separately collected from field plots in 2017-18 which were evaluated at RKVY laboratory, Department of Seed Science and Technology, Bidhan Chandra Krishi Viswavidyalaya, Nadia, West Bengal. The qualitative assessment of these seeds was done on storage settings under unlike micro-environment observing the effect ofstoring devices and durations. The considerable genotypes were WBL81 (V1), DPL62 (V2), Subrata (V3), PL639 (V4), WBL77 (V5), PL406 (V6), Asha (V7), KLS218 (V8), K75 (V9), PRECOZ (V10). The three storing styles like brown paper packet as control (C1), Polythene packet (40 micron, sealed) symbolized as C2, Plastic container (hard plastic, air-tight) symbolized as C3 were operated for keeping of collected fresh seeds under the condition of room temperature that were projected at an interim of three months considering 0, 3, 6 months (symbolized as M1, M2, M3) from initial storage. In assessment of seed storability, the measurable parameters were categorised into two where the estimation on germination percentage, speed of germination and vigour index-II utilising Glass-Plate method (Chakraborti, 2010) [7] were considered (following the rule of ISTA) as an indication of physiological performances of seed and the biochemical activity was measured at the stage of germination initiation through electrical conductivity (E.C.), soluble protein content, alpha-amylase activity (colorimetric method with DNS reagent) and peroxidase activity (Kar and Mishra, 1976) after 24 hours of seed soaking. The complete randomised design was followed for statistical analysis considering 3 replications for each character. The value was achieved at 1% level of significance through usage of OPSTAT software. The assessing of genotypic and phenotypic coefficient of variation was examined in the method of Burton (1953) [6] and broad sense heritability (H^2 %) was designed as per method of Allard (1960) [3] and Robinson *et al.* (1949) [20]. The projected Genetic Advance as per cent of mean (GA %) was calculated through validation of method of Johnson *et al.* (1955) [14].

Result and Discussion

The study on some physiological performances of seed in addition to seed quality exposing bio-molecular activity quantified on particular genotype would be valuable for qualitative up gradation of the produce. Seed is the most vital component in plant life cycle as well as basic input in agriculture though characterization of this component in different crops was meagre. The strategic approach on different research especially in cultivation practices and breeding programme were very much dependent on seed specification, where variable nature of seed on a crop genotype should be informative (Biswas and Chakraborti, 2018) [4].

Present observations in table -1 evidently displayed necessary variability among lentil genotypes to permit selection for the considered seed traits. The quality estimation of harvested seeds of lentil was analysed through some physiological and biochemical activities on seed. The physiological performances of seed indicated topmost or nearer to topmost activity in V5 (WBL-77), V10 (PRECOZ) and V7 (Asha) with a significant disparity within them though the topmost value was not constant for a specific cultivar. The rest genotypes also showed significant demarcation among them as well as with upper three superior genotypes. In concern to EC value, V_{10} genotype was not retained the continuation of highest performance in electrical conductivity (E.C.) where lesser value was maintained to display the seed vigour. The smallest value was indicating preferable result as it was an indication of least leakage of solutes from seed as a result of stable membrane integrity in seed. High peroxidase activity was observed in the above genotypes favouring the progression of germination that was also observed in endosperm and seed coat of wheat seed after 24 hrs. soaking (Rogozhin *et al*., 2001) [21].

In considerable systems of storage, the greater effectivity was observed in C_3 (plastic container) with significant discrimination to the others. The progression of deterioration was sustained with storage durations where the obvious conditions, M_2 (3 months) and M_3 (6 months) followed a significant distinct deterioration for each considerable parameter. The deterioration pattern responding in electrical conductivity (E.C.) showed noticeable value in significant manner with the advancement of storage where lowest value was observed in M_1 (0 months) indicating highest seed vigour. The variable nature of E.C. exposed non-significant variation in-between M_1 and M_2.The significant observation was followed for interacted values of three factors like genotypes, containers and storage durations predominantly in percent of germination, EC value and alpha-amylase activity. The non-significant observations were also displayed in some interacted values considering the speed of germination and vigour index-II. In view of total observation, the variability was followed for all considerable factors under the storage system of seed. Zia-Ur Rehman *et al*. (1999) [25] reported that amylase activity, total soluble sugars decreased up to 37% with the progress of 6 months storage.The anti-oxidative nature of peroxidase reduced seed deterioration by increasing its activity up to a definite period then, the action was failed similar to the present study of M2 and M3. To prevent the rate of deterioration or retaining of seed quality irrespective of genotypes, the present study specified the influential effect of storage system in noticeable mode, similar to the information of earlier researcher (Shelar *et al*., 2008) [23].

Genotypic co-efficient of variation (GCV) and phenotypic co-efficient of variation (PCV) (table 2) in present analysis (table 2) delivered a measure to compare the variability pattern through exposing of the genetic pressure on these seed traits or representing the noticeable genetic influence which may be reassuring in selection of good strain (Parvathi *et al*., 2011; Seyoum *et al*., 2012) [19, 22]. The degree of variances between PCV and GCV was distinguished to be somewhat low for all seed traits corresponding to the observation of Parvathi *et al.* (2011) [19] though a minor exception was followed in electrical conductivity. In physiological performances of seed, the GCV was high only for vigour index-II than other parameters considering all factors of storage which can be the consequence of dry weight. In germination percentage and alpha-amylase activity, the value of both GCV and PCV were very small, though the heritability was high in consideration of diverse factors of seed storage. But, the genetic advance (GA%) was inferior for the above two seed traits. Highheritability (H^2%) in addition to high genetic advance

(GA %) as percent mean was recorded in speed of germination, and vigour index-IIunder considerable physiological performances of seed as their more impact on variability through the consequence of additive gene. But, the action of peroxidase and soluble protein showed moderate values. So, the designated seed traits may be careful in consideration of selection criteria for advancement of good strain similar to the study of some recent workers (Abebe *et al*., 2017; Yadav *et al*., 2010) [1, 24]

The genetic variability on different crops was assessed by different researchers, few scientists (Idris *et al*., 2010, Debbarma *et al*., 2018) [8] though the observation involving physiological performances of seed was very meagre exclusively in seed storage. The definite indication of existing work may be appropriate for planning in selection to satisfy the breeders objective in improvement of seed quality akin to the current opinion on seed traits in rice (Biswas and Chakraborti, 2018; Ghosh *et al*., 2020) [4, 11].

In table3, the considerable physiological performances of seed exposed a pronounced positive correlation by indication of their close association within them that was also followed in Rice seed (Biswas and Chakraborti, 2019)and Lentil seed (Ghosh *et al*., 2020) [11]. The value, 0.1729 for R^2 indicating the inclination of significant positive relationship for the considerable characters. All parameters showed positive significant mode though an exception was revealed in electrical conductivity under non-significant mode in most cases. The negative significant relationship of electrical conductivity indicated its definite close relationship with diverse physiological performances and bio-molecular activity connected to seed vigour of the crop genotype.

Considering the above outcome, it is predictable that the divergent parameters continued a relationship within them, expressing the extreme influence in V_5 (WBL77) and V_{10} (PRECOZ) in comparison to others. The seed storage in C_3 (Plastic container) identified as the most compatible and the significant deterioration was advanced with storage duration demonstrating the variability in different storage containers. The detected results stated the core set of germplasm hold high genetic variability. The broad sense heritability (H^2) and genetic advance (GA) as percentage of mean have chosen the parameters speed of germination, vigour index-II under considerable physiological performances of seed as the most significant characteristics of seed. The selection based on these qualities would be really valuable for lentil genotypes. Addition of these outcomes may be proper for upgradation of cultivation primarily seed production of Lentil.

Table 1: Variability in germination allied activities of seed considering diverse genotypes, storage durations, storage containers and their interactions.

Variety	**Gr (%)**	**Sp. of Gr.**	**Protein (mg g^{-1})**	**α- amylase (μg min^{-1} g^{-1})**	**Peroxidase (ΔAmin^{-1}g^{-1})**	**VI-II**	**E.C. (μSm^{-1}g^{-1})**
V_1	87.46 (69.74)	24.57	24.03	72.63	1.62	2598.87	3.69
V_2	84.95 (67.60)	20.72	23.43	70.99	1.67	2634.15	3.22
V_3	86.31 (68.73)	20.83	22.49	71.38	1.53	2759.02	3.49
V_4	82.51 (65.67)	21.56	22.20	74.07	1.32	2774.82	3.25
V_5	89.48 (71.57)	25.09	27.56	77.15	1.71	4440.34	2.05
V_6	82.87 (65.94)	22.77	21.45	70.79	1.51	3059.85	2.92
V_7	88.94 (71.09)	26.74	25.73	75.99	1.76	3862.33	2.49
V_8	83.16 (66.17)	21.50	20.46	70.18	1.67	2731.92	2.84
V_9	81.90 (65.21)	21.01	22.40	74.16	1.62	2455.89	2.98
V_{10}	83.72 (66.89)	30.22	24.49	77.01	1.70	4806.18	2.98
SEm (±)	0.10	0.35	0.11	0.17	0.02	33.35	0.02
LSD (0.01)	0.28	0.99	0.32	0.46	0.04	93.07	0.06
Storage Durations (M)							
M_1	85.74	24.06	23.95	78.74	1.61	3283.96	2.93
M_2	85.41	23.96	23.58	73.26	1.70	3157.75	2.88
M_3	84.73	22.46	22.74	68.30	1.52	3195.30	3.17
SEm (±)	0.06	0.19	0.06	0.09	0.01	18.27	0.01
LSD (0.01)	0.16	0.54	0.17	0.25	0.02	50.97	0.03
Storage Containers (C)							
C_1	76.12	22.52	23.17	71.89	1.67	3194.14	3.23
C_2	84.91	23.90	23.46	74.05	1.58	3175.00	3.01
C_3	86.13	24.09	23.66	74.36	1.59	3267.87	2.73
SEm (±)	0.06	0.19	0.06	0.09	0.01	18.27	0.01
LSD (0.01)	0.16	0.54	0.17	0.25	0.02	50.97	0.03

Interaction effects (V x M x C)														
	SEm (±)	**LSD (0.01)**	**SEm (±)**	**LSD (0.01)**	**SEm (±)**	**LSD (0.01)**	**SEm (±)**	**LSD (0.01)**	**SEm (±)**	**LSD (0.01)**	**SEm (±)**	**LSD (0.01)**	**SEm (±)**	**LSD (0.01)**
(V×C)	0.18	0.49	0.61	NS	0.19	0.55	0.29	0.79	0.03	NS	57.76	NS	0.04	0.11
(V×M)	0.18	0.49	0.61	1.71	0.19	NS	0.29	0.79	0.03	0.07	57.76	161.20	0.04	0.11
(C×M)	0.10	0.27	0.34	0.93	0.11	0.29	0.16	0.43	0.02	0.04	31.64	88.29	0.02	0.06
(V×C×M)	0.31	0.85	1.06	NS	0.34	NS	0.49	1.384	0.05	NS	100.04	NS	0.07	0.19

G%- Percent of germination (TR-Transformation/Arcsine value); SpG- Speed of germination; VI-II - Vigour Index-II; EC- Electrical conductivity.

Table 2: Genetic evaluation in germination allied seed parameters as influenced by storage conditions

Characters	GCV	PCV	H^2 (%)	GA (%)
G%	3.38	3.43	96.63	4.65
SpG	13.33	13.44	98.41	18.51
Protein	8.98	9.05	98.49	12.48
α- amylase	3.51	3.74	88.09	4.61
Peroxidase	8.05	8.18	96.68	11.08
VI-II	26.24	26.31	99.46	36.63
E.C.	15.20	17.29	77.26	18.71

GCV- Genotypic coefficient of variation; PCV- Phenotypic coefficient of variation;
H^2- Heritability; GA- Genetic advance.

Table 3: Correlation Matrix of different germination allied parameters of seed.

Characters	Germ% (TR value)	Sp. of Germ	Soluble protein	Alpha amylase	Peroxidase	VI-II
Speed of Ger.	0.419*					
Soluble protein	0.795**	0.608**				
α- amylase	0.437*	0.709**	0.734**			
Peroxidase	0.390*	0.379*	0.472**	0.141NS		
VI-II	0.416*	0.845**	0.705**	0.706**	0.447*	
EC	-0.345NS	-0.356NS	-0.488**	-0.567**	-0.301NS	-0.559**

NS- Non-Significant;* Significant; **Highly significant

References

1. Abebe T, Alamerew S, Tulu L. Genetic variability, heritability and genetic advance for yield and its related traits in rainfed lowland Rice (*Oryza sativa* L.) genotypes at Fogera and Pawe, Ethiopia. Advances in Crop Science and Technology 2017;5(2): 272.
2. Ahlawat IPS. Agronomy – rabi crops, Lentil. Division of Agronomy, Indian Agricultural Research Institute, New Delhi – 110 012, Agronomy 2012.
3. Allard RW. Principles of Plant Breeding. John Wiley and Sons Inc., New York 1960, 485.
4. Biswas U, Chakraborti P. Genetic variability in seedling pattern of rice genotypes under water stress and normal condition. Journal of Pharmacognosy and Phytochemistry 2018;7(4):3177-3179.
5. Biswas U, Chakraborti P. Variability in aromatic and non-aromatic rice genotypes considering seed morphology with some bio-molecules. International Journal of Chemical Studies 2019;7(3):3648-3651.
6. Burton GW, De Vane EH. Estimating heritability in tall fescue (*Festuca arundinacea*) from replicated clonal material. Agronomy Journal 1953;45:478-481.
7. Chakraborti P. Effect of Na-salts on seedlings of Sesame genotypes. Crop Research 2010;36(1, 2 & 3):160-165.
8. Debbarma M, Laloo B, Mandal J, Chakraborti P. Genetic variability in yield attributes of Lentil genotypes under new alluvial zone. Current Journal of Applied Science and Technology 2018;30(5):1-6.
9. Falconer DS, Mackay TFC. Introduction to quantitative genetics, 4th edn. New York: Longman 1996.
10. FAOSTAT. Production of Lentils in 2018, United Nations, UN Food and Agriculture Organization, Statistics Division.2019; Retrieved 28 March, 2020.
11. Ghosh Pabitra Kumar, Biswas Utpal, Chakraborti Prabir Genetic diversity in physiological performances of seed considering Lentil genotypes under diverse seed storage. International Journal of Chemical Studies 2020;8(3):2018-2021.
12. Helbeck H. Domestication of food plants in old world. Science 1959;130:365-372.
13. Idris AE, Justin FJ, Dagash YMI, Abuali AI. Genetic Variability and Inter Relationship between Yield and Yield Components in Some Rice Genotypes American. Journal of Experimental Agriculture 2012;2(2):233-239.
14. Johnson WW, Robinson HF, Comstock RE. Genotypic and phenotypic correlation in soybeans and their implications in selection. Agronomy Journal 1955;47:477-482.
15. Kar M, Mishra D. Inorganic pyrophosphatase activity during rice leaf senescence. Can. J Bot 1975;53:503-510.
16. Larik AS, Malik SI, Kakar AA, Naz MA. Assessment of heritability and genetic advance for yield and yield components in *Gossypium hirsutum* L. Scientific Khyber 2000;13:39-44
17. Marcos Filho, J. Physiology of plant seeds cultivated. FEALQ, Piracicaba: Scientific Research An Academic Publisher 2005, 465.
18. Mayer AM, Poljadoff AM. The germination of seed.3rd Ed. Pergamon Press Ltd. Headington Hill Hall. England 1982, 10-37.
19. Parvathi PS, Satyanarayana Rao V, Lal Ahmed, Anil Kumar P. Correlation and path analysis of yield and quality attributes in rice. The Andhra Agriculture Journal. 2011;58(3):310-314.
20. Robinson HF, Comstock RE, Harvey PH. Estimates of heritability and the degree of dominance in corn. Agronomy Journal 1949;41:353-359.
21. Rogozhin VV, Verkhoturov, Kurilyuk TT. The antioxidant system of wheat seeds during germination. Biology Bulletin 2001;28:126-133.
22. Seyoum M, Alamese S, Bantte K. Genetic variability, heritability correlation coefficient and path analysis for yield and yield related traits in upland rice (*Oryza sativa* L.). Journal of Plant Science 2012;7(1):13-22.
23. Shelar VR. Role of mechanical damage in deterioration of soybean seed quality during storage a review. Agric. Rev 2008;29(3):177-184.
24. Yadav P, Rangare NR, Anurag PJ, Chaurasia A. Quantitative analysis of rice (*Oryza sativa* L.) in Allahabad agro-climatic zone. Journal of Rice Research 2010;3:16-18.
25. Zia-UR Rehman, Shah WH. Biochemical changes in wheat during storage at three temperatures; Plant Foods for Human Nutrition 1999;54:109-117.