International Journal of Research in Agricultural Sciences
Volume 6, Issue 3, ISSN (Online): 2348 – 3997

Influence of Storage Conditions and Containers on seed Germination and Seedling Quality in *Flemingia Semialata Roxb*

Kameshwar Kumar Rajak[1*], Ravi Hunje[2] and Krishna A.[3]
*Corresponding author email id: kumar.kameshwar1207@gmail.com

Date of publication (dd/mm/yyyy): 02/07/2019

***Abstract* – The consequence of storage temperature showed higher germination per cent in cold storage (74.33%, 70.83%, 63.08%, 57.16% and 52.83%) than ambient condition (72.00%, 66.99%, 60.75%, 55.08% and 51.33%) for 30, 60, 90, 120 and 150 days respectively. At first polythene bag attains highest germination per cent in 30 days (78.67%) but at 150 days cloth bag attains highest germination (57.00%). The extent of decrease in germination per cent due to storage of seeds in cold condition and containers was found to be 5.80, 15.37, 23.29 and 28.81 per cent over 30 days of storage at 60, 90, 120 and 150 days after storage respectively. The gradual reduction in germination parameter with the increase in storage period was noticed in all the seed storage containers. At the end of five months of storage higher seed quality parameters were recorded with cloth bag (E1) (57.00 %, 1.26, 1.95, 2.75, 4.91 cm, 3.29 cm, 462.11, 0.910 g and 0.111 g respectively) and lower seed quality parameters were found with air tight plastic container (E4) (47.33 %, 0.89, 1.59, 1.81, 4.30 cm, 2.83 cm, 338.8, 0.761 g and 0.088 g respectively). Interaction effect between seed quality and seed priming treatments was found to differ significantly for quality parameters throughout storage period. The variation in germination percentage showed significant difference due to the interaction between seed storage temperature condition and storage containers at all months of the storage period. Highest germination percentage (80.67 %) in cold storage with polythene bag (T2E2) and lowest (66.67 %) in ambient temperature with paper bag (T1E3) were recorded at the 30 days of storage. The gradual reduction in germination percentage with the increase in storage period was noticed in all the treatment combinations. Seeds stored in cloth bag kept under cold storage was found to be better seed container for keeping seeds for long term with relatively more viability.**

***Keywords* – Ambient Temperature, Cold Condition, Germination, Peak Value and Vigour Index.**

I. INTRODUCTION

Flemingia semialata host is fast growing with high coppicing response, bushy in nature and known for producing best quality of lac resin, this species was promoted for intensive lac cultivation on plantation basis. This species is highly suitable for production of good quality Kusmi Lac crop during winter season (Agahani) and can be cultivated during summer season (Jethwi). Tiny gregarious lacinsects, *Kerria lacca*, producing three versatile natural products *viz.,* resin, wax and dye, having huge commercial value. In India, two strains of this species Kusmi and Rangeeni are mainly grown on three tree host species viz., Kusum *(Schleicheraoleosa*), Palas (*Butea monosperma*) and Ber (*Ziziphus mauritiana*) found scattered in forest and farmers holdings in Jharkhand, Madhya Pradesh, Chhattisgarh, West Bengal, Orissa and parts of other states.

The problem associated with *Flemingia semialata* is hard coat of seed due to which germination gets affected. Use of treatments which are designed to soften the hard coat of seeds has been found to be very effective. The seed treatments have a profound influence in growth aspects of seedlings, as the early germinated seeds show significant growth when compared to other seedling. Treated seeds often showed better growth in terms of height, collar girth, number of branches and number of leaves (Asare and Otsyina, 1980).

The prime objective of the seed storage is to preserve the seed for a reasonable period. Many of the forest tree

seeds tend to lose viability at a faster rate under ambient storage conditions (Khan, 2013). In storage, viability and vigour of the seeds is regulated by many physiological factors like moisture content of the seed, atmospheric relative humidity, temperature, initial seed quality, physical and chemical composition of seed, gaseous exchange, storage structure, storage insects, packaging materials (Doijode, 1988). Hence, storage of seed till next planting time assumes prime importance for successful seed production program and consistent supply of seed to the farmers. Seed storage is an integrated part of well-planned and timely executed seed programme for maintenance of high quality seeds in terms of germination, vigour and health. During storage, considerable quantities of seeds are lost due to biotic and abiotic factors. In order to prevent quantitative and qualitative seed losses in storage, various prophylactic methods are being adopted in many plants i.e. keeping seeds in different moist condition and in different temperature ranges. Thus the present investigation was undertaken with the objective to determine seed behaviour under ambient condition and cold storage to know storability of *Flemingia* seeds.

II. Material and Methods

A comprehensive laboratory study entitled **Influence of storage behaviour on seed and seedling quality in *Flemingia semialata* Roxb.** was undertaken at Department of Forest Biology and Tree Improvement, College of Forestry, University of Agriculture Sciences, Dharwad during 2014-16. The fresh seeds of *Flemingia semialata* were obtained from the Indian Institute of Natural Resin and Gums (IINRG) Namkum, Ranchi, Jharkhand. The seeds are stored under ambient condition and cold storage (4 ^{0}C) for 150 days of storage period with four different containers *viz.,* cloth bag, polythene bag, paper bag and air tight plastic container. The experiment was carried out in Factorial Completely Randomized Design (FCRD) with three replication. Seeds were stored up to 150 days in both storage conditions and containers. Monthly samples were drawn and tested for five months. Daily observations were taken for 28 days from the date of sowing. The observations on seed germination percentage, rate of germination, peak value, mean daily germination, shoot length, root length, seedling fresh weight, seedling dry weight and seedling vigour index were recorded as per the standard procedures.

III. Results and Discussion

Marked and consistent variation in seed quality parameters were observed in the entire 150 days of storage period irrespective of storage condition and containers. Germination per cent, germination rate, mean daily germination, peak value, shoot length, root length, seedling vigour index, seedling fresh weight and seedling dry weight were significantly maximum (73.16%, 1.96, 2.58, 4.28, 6.01 cm, 4.37 cm, 763.98, 1.473 g and 0.151 g, respectively) at 30 days after storage but declined gradually to minimum value (52.08%, 1.05, 1.76, 2.21, 4.56 cm, 3.07 cm, 400.35,0.838 g and 0.100 g, respectively) at the end of 150 days of storage. The marked decrease in the seed quality parameters during advancing storage period may be attributed to seed coat characters (Delouche *et al*, 1973), impermeable container which was completely impermeable to the moisture and gases, so there may be more accumulation of carbon dioxide in the container as the exchange of gases with the outside environment is negligible, which leads to the death of seeds due to suffocation (Narkhede, 2010), ageing also induced physicochemical seed deterioration, lipid peroxidation leading to production of toxic metabolites that act upon cell and cell organelles (Maguire, 1977 and Sohal, 1987), denaturation of proteins and enzymes (Roberts, 1972).

Influence of Storage Conditions

Irrespective of seed storage container, seed quality parameters differed significantly due to seed storage condi-

-tion throughout the 150 days of storage period. The seed quality differed significantly due to seed storage conditions. Germination per cent, germination rate, mean daily germination, peak value, shoot length, root length, seedling vigour index, seedling fresh weight and seedling dry weight showed significant difference due to temperature condition. Among two storage conditions, seeds kept in cold storage (T2) recorded higher seed quality parameters (74.33%, 2.02, 2.63, 4.42, 6.04 cm, 4.47 cm, 786.19, 1.502 g and 0.154 g, respectively) over seed stored at ambient temperature (T1) (72.00%, 1.89, 2.53, 4.15,5.99 cm, 4.27 cm, 741.77, 1.444 g and 0.148 g respectively) at 30 days of storage. The gradual reduction in germination percentage with the increase in storage period was noticed in both the seed storage condition. At the end of five months of storage higher parameters were recorded in cold storage (52.83%, 1.07, 1.82, 2.32, 4.61 cm,3.09 cm, 406.96, 0842 g, 0.102 g) as compared to the seeds stored at ambient temperature (51.33%, 1.03, 1.71, 2.17, 4.57 cm, 3.05 cm, 393.74, 0.834 g, 0.099 g). The loss of seed viability is generally attributed to free radical generation and lipid peroxidation, resulting in membrane damage as well as the generation of toxic by-products. Oxidative damage to DNA and proteins is almost certainly involved in seed deterioration. Failure of repair mechanisms in cells, which comprise of a complex system of 'enzymatic and non-enzymatic' antioxidant defences to protect against the harmful consequences of activated oxygen species, is also likely to contribute to loss of viability (Umarani *et al,* 2015).

Influence of seed Storage Container

Among the four storage containers, seeds stored in polythene bag (E2) recorded higher seed quality parameters (78.67 %, 2.29, 2.82, 4.78, 6.79 cm, 4.69 cm, 903.49, 1.695 g and 0.166 g respectively) and lower seed quality parameter were found with seeds stored in paper bag (E3) (68.00 %, 1.59, 2.30, 3.52, 5.24 cm, 4.02 cm, 630.41, 1.308 g, and 0.137 g respectively) at 30 days of storage. The gradual reduction in germination parameter with the increase in storage period was noticed in all the seed storage containers. At the end of five months of storage higher seed quality parameters were recorded with cloth bag (E1) (57.00 %, 1.26, 1.95, 2.75, 4.91 cm, 3.29 cm, 462.11, 0.910 g and 0.111g respectively) and lower seed quality parameters were found with air tight plastic container (E4) (47.33 %, 0.89, 1.59, 1.81, 4.30 cm, 2.83 cm, 338.8, 0.761 g and 0.088g respectively).

Interaction

Interaction effect between seed quality and seed priming treatments was found to differ significantly for quality parameters throughout storage period. The variation in germination percentage showed significant difference due to the interaction between seed storage temperature condition and storage containers at all months of the storage period. Highest germination percentage (80.67 %) in cold storage with polythene bag (T2E2) and lowest (66.67 %) in ambient temperature with paper bag (T1E3) were recorded at the 30 days of storage. The gradual reduction in germination percentage with the increase in storage period was noticed in all the treatment combinations. At the end of five months of storage the highest germination (59.33 %) was recorded in seeds stored in cold storage with cloth bag (T2E1) and lowest (46.33 %) in seeds stored in cold storage with air tight plastic container (T2E4). The germination rate, mean daily germination and peak value showed significant difference due to the interaction between seed storage temperature condition and storage containers at all months of the storage period. At the end of 30days of storage highest germination rate, mean daily germination and peak value (2.40, 2.92 and 4.91, respectively) were recorded in T2E2; lowest (1.57, 2.26, 3.51, respectively) were recorded in T1E3. At the end of five months storage highest germination rate, mean daily germination and peak value (1.37, 2.02 and 2.97, respectively) were recorded in T2E1; lowest quality parameters (0.88, 1.58 and 1.77, respectively) were recorded

in T2E4. The shoot length, root length seedling vigour seedling fresh weight and seedling dry weight index showed significant variation due to the interaction between seed storage condition and storage containers at all months of the storage period. A gradual reduction in these parameters was noticed with increase in storage period. At the end of 30 days of storage highest shoot length (6.81 cm), root length (4.85 cm), seedling vigour index (940.61) seedling fresh weight (1.766 g) and seedling dry weight (0.171 g) were recorded in T2E2; minimum quality parameters (5.22 cm, 4.01cm, 615.36, 1.301 g and 0.136 g respectively) were recorded in seeds stored in ambient temperature with paper bag (T1E3). At the end of five months of storage highest shoot length (4.96 cm), root length (3.39 cm,), seedling vigour index (495.40), seedling fresh weight (0.925 g) and seedling dry weight (0.112 g) were recorded in T2E1; compared to other treatments and minimum quality parameters (4.19 cm, 2.81cm, 324.31, 0.737 g and 0.085 respectively) were recorded in T2E4. It is clear from the present study, in case of *Flemingia semialata* the seed viability can be prolonged by storing the seeds in perforated bags like cloth bags instead of airtight containers. Based on the information related to storage conditions, it concluded that the seeds can be kept in cold storage instead of ambient temperature to endure the viability. Ajiboye *et al.* (2009) also studied the storage behaviour of *Tamarindus indica, Prosopis africana, Parkia biglobossa* and *Albizia lebbeck* and observed that the 5 weeks cold storage treatments at 4°C gave 80% germination in *Albizia lebbeck* and 70% in *Tamarindus indica* compared to untreated seeds served as control. Sumy *et al.* (2000) also reported that seeds of *Vateria indica* could be stored in gunny bags for a period of one month after which its viability is lost. Several studies on *Azadirachta indica* (Dod *et al.*, 1997; and Nayal *et al.*, 2001), *Syzygium cumuni, Terminalia myriocarpa* and *Shorea robusta* (Bahuguna and Rawat, 1991) also observed better seed quality parameters if stored in perforated containers as compared to the sealed containers.

REFERENCES

[1] Ajiboye, A.A., Atayese, M.O. and Agboola, D.A . (2009). Effect of pre-sowing treatments on seed germination and percentage starch content levels in*Tamarindus indica, Prosopis africana, Parkia biglobossa* and *Albizialebbeck*. *J. of App. Sci. Res.*, 5(10):1515-1519.
[2] Asare, E. O. and Otsyina, R. H. M. (1980). The effect of six pre-sowing treatments on germination of *Flemingia macrophylla*. *Ghana J. Agri. Sci*.,13: 19-22.
[3] Bahuguna, V. K. and Rawat, M. M. S. (1991). Handling of short-lived forest tree seeds. ICFRE, Dehradun.
[4] Delouche, J. C.(1973).Percept of seed storage (Revised). S. C. Proc. Mississippi State University, pp. 97-122.
[5] Dod, V.N., Gabhane, V.V., Pagar, P.G. and Patil, B.N. (1997). Effect of storage conditions on germination of shisam (*Dalbergia sissoo*) seed. *PKV Res. J.*, 21 (2): 171-172.
[6] Doijode, S.D.(1988). Comparison of storage containers for storage of French bean seeds under ambient conditions. *Seed Res.*, 16: 245-247.
[7] Khan, M.R. (2013). Effect of various seed treatments and storage containers on seed germination of *Sterculia urens* Roxb. *Int. Multidisciplinary Res. J*.,3(6):1-4.
[8] Maguire, B.J., Goodman, J. and Hochstein, C. (1977). Generation of free radicals and lipid peroxidation by redox cycling of adriamycin and dunomycin. *Bioche. and Biophy. Res. Comm.,* 77(2):797-803.
[9] Narkhede, S, S. (2010). Storage behaviour of *Simaruba glauca* seed under different temperature and containers. *J. of Non Timber Forest Products*, 17(2):183- 185.
[10] Navale, M. R.and Channabasappa (2011). Standardization of nursery techniques in *Hydnocarpus pentandra* (Buch-Ham). *M. Sc. Thesis*, Univ. Agric. Sci., Dharwad.
[11] Roberts, E.H. (1972). Predicting storage life of seeds. *Seed Sci. Tech.*, 1: 499- 514.
[12] Sohal, R.S. (1987). The free radical theory of ageing: a critique. *Rev. Biol. Res. Ageing*, 3: 431-499.
[13] Sumy Oommen, Ved, D.K. and Krishnan. (2000). Tropical Indian medicinal plants propagation methods. FRLHT, Bangalore. pp. 342-34.3
[14] Umarani, R., Aadhavan, E.K. and Faisal, M.M. (2015). Understanding poor storage potential of recalcitrant seeds. *Curr. Sci*., 108(11):2023-2035.

Table 1. Effect of storage condition and containers on germination in *Flemingia semialata*

Treatments	Initial			30 DAS			60 DAS			90 DAS			120 DAS			150 DAS		
	AT (T_1)	CS (T_2)	**Mean**	AT (T_1)	CS (T_2)	**Mean**	AT (T_1)	CS (T_2)	**Mean**	AT (T_1)	CS (T_2)	**Mean**	AT (T_1)	CS (T_2)	**Mean**	AT (T_1)	CS (T_2)	**Mean**
Cloth bag (E_1)	69.33	70.00	**69.66**	70.67	71.33	**71.00**	65.33	68.67	**67.00**	62.00	64.67	**63.33**	57.33	62.67	**60.00**	54.67	59.33	**57.00**

Treatments		Initial			30 DAS			60 DAS			90 DAS			120 DAS			150 DAS		
		AT (T_1)	CS (T_2)	Mean	AT (T_1)	CS (T_2)	Mean	AT (T_1)	CS (T_2)	Mean	AT (T_1)	CS (T_2)	Mean	AT (T_1)	CS (T_2)	Mean	AT (T_1)	CS (T_2)	Mean
Polythene bag (E_2)		70.67	70.00	**70.33**	76.67	80.67	**78.67**	71.33	77.33	**74.33**	63.67	64.33	**64.00**	56.33	55.33	**55.83**	52.33	51.33	**51.33**
Paper bag (E_3)		70.67	69.33	**70.00**	66.67	69.33	**68.00**	64.00	67.33	**65.66**	59.33	62.67	**61.00**	54.67	59.33	**57.00**	50.00	55.33	**52.16**
Air tight plastic container (E_4)		69.33	70.67	**70.00**	74.00	76.00	**75.00**	67.33	70.00	**68.66**	58.00	60.67	**59.33**	52.00	51.33	**53.66**	48.33	46.33	**47.33**
Mean		**70.00**	**70.00**	**70.00**	**72.00**	**74.33**	**73.16**	**66.99**	**70.83**	**68.91**	**60.75**	**63.08**	**61.91**	**55.08**	**57.16**	**56.12**	**51.33**	**52.83**	**52.08**
SEm±	Temperature condition		**2.12**			**0.58**			**0.61**			**0.49**			**0.42**			**0.37**	
	Containers		**2.99**			**0.82**			**0.87**			**0.69**			**0.60**			**0.53**	
	Interaction		**4.24**			**1.15**			**1.22**			**0.97**			**0.85**			**0.74**	
CD @1%	Temperature condition		**NS**			**1.75**			**1.85**			**1.47**			**1.28**			**1.12**	
	Containers		**NS**			**2.47**			**2.62**			**2.08**			**1.82**			**1.59**	
	Interaction		**NS**			**3.47**			**3.67**			**2.92**			**2.55**			**2.25**	

*AT- Ambient temperature, CS- Cold storage, DAS-Days after storage

Table 2. Effect of storage condition and containers on peak value in *Flemingia semialata*

Treatments		Initial			30 DAS			60 DAS			90 DAS			120 DAS			150 DAS		
		AT (T_1)	**CS (T_2)**	**Mean**	**AT (T_1)**	**CS (T_2)**	**Mean**	**AT (T_1)**	**CS (T_2)**	**Mean**	**AT (T_1)**	**CS (T_2)**	**Mean**	**AT (T_1)**	**CS (T_2)**	**Mean**	**AT (T_1)**	**CS (T_2)**	**Mean**
Cloth bag (E_1)		3.63	3.47	**3.55**	4.12	4.43	**4.27**	3.77	4.07	**3.92**	3.45	3.82	**3.63**	3.05	3.42	**3.23**	2.54	2.97	**2.75**
Polythene bag (E_2)		3.56	3.63	**3.59**	4.66	4.91	**4.78**	4.04	4.26	**4.15**	3.58	3.73	**3.65**	2.92	3.09	**3.00**	2.26	1.97	**2.11**
Paper bag (E_3)		3.65	3.59	**3.62**	3.51	3.54	**3.52**	3.31	3.37	**3.34**	3.21	3.29	**3.25**	2.60	3.19	**2.89**	1.95	2.60	**2.27**
Air tight plastic container (E_4)		3.48	3.65	**3.56**	4.35	4.82	**4.58**	3.80	4.12	**3.96**	3.18	3.09	**3.13**	2.41	2.81	**2.61**	1.86	1.77	**1.81**
Mean		**3.58**	**3.58**	**3.58**	**4.15**	**4.42**	**4.28**	**3.73**	**3.95**	**3.84**	**3.35**	**3.48**	**3.41**	**2.74**	**3.12**	**2.93**	**2.17**	**2.32**	**2.21**
SEm±	**Temperature condition**		**0.07**			**0.03**			**0.02**			**0.02**			**0.02**			**0.02**	
	Containers		**0.09**			**0.04**			**0.03**			**0.03**			**0.02**			**0.02**	
	Interaction		**0.13**			**0.05**			**0.04**			**0.04**			**0.03**			**0.03**	
CD @1%	**Temperature condition**		**NS**			**0.08**			**0.07**			**0.06**			**0.05**			**0.05**	
	Containers		**NS**			**0.11**			**0.09**			**0.09**			**0.07**			**0.07**	
	Interaction		**NS**			**0.16**			**0.13**			**0.12**			**0.10**			**0.10**	

*AT- Ambient temperature, CS- Cold storage, DAS-Days after storage

Table 3. Effect of storage condition and containers on shoot length (cm)in *Flemingia semialata*

Treatments		Initial			30 DAS			60 DAS			90 DAS			120 DAS			150 DAS		
		AT (T_1)	CS (T_2)	Mean	AT (T_1)	CS (T_2)	Mean	AT (T_1)	CS (T_2)	Mean	AT (T_1)	CS (T_2)	Mean	AT (T_1)	CS (T_2)	Mean	AT (T_1)	CS (T_2)	Mean
Cloth bag (E_1)		5.29	5.24	**5.26**	5.56	5.62	**5.59**	5.47	5.58	**5.52**	**5.26**	5.46	**5.20**	5.09	5.18	**5.13**	4.78	4.96	**4.91**
Polythene bag (E_2)		5.30	5.32	**5.31**	6.77	6.81	**6.79**	6.06	6.14	**6.10**	**5.36**	5.40	**5.36**	5.00	4.78	**4.89**	4.69	4.32	**4.54**
Paper bag (E_3)		5.31	5.28	**5.29**	5.22	5.26	**5.24**	5.10	5.14	**5.12**	**4.98**	5.01	**4.99**	4.85	4.96	**4.91**	4.57	4.83	**4.59**
Air tight plastic container (E_4)		5.27	5.33	**5.30**	6.46	6.50	**6.45**	5.72	5.77	**5.74**	**5.12**	4.98	**5.05**	4.79	4.55	**4.67**	4.32	4.19	**4.30**
Mean		**5.29**	**5.29**	**5.29**	**5.99**	**6.04**	**6.01**	**5.58**	**5.65**	**5.61**	**5.18**	**5.21**	**5.19**	**4.86**	**4.93**	**4.89**	**4.57**	**4.61**	**4.56**
SEm±	**Temperature condition**	**0.09**			**0.03**			**0.02**			**0.03**			**0.03**			**0.03**		
	Containers	**0.13**			**0.05**			**0.03**			**0.04**			**0.04**			**0.04**		
	Interaction	**0.19**			**0.07**			**0.05**			**0.05**			**0.05**			**0.05**		
	Temperature condition	**NS**			**0.10**			**0.07**			**0.08**			**0.08**			**0.08**		
	Containers	**NS**			**0.15**			**0.10**			**0.11**			**0.11**			**0.12**		
CD @1%	**Interaction**	**NS**			**0.21**			**0.14**			**0.16**			**0.16**			**0.16**		

*AT- Ambient temperature, CS- Cold storage, DAS-Days after storage

Table 4. Effect of storage condition and containers on root length (cm) in *Flemingia semialata*

Treatments		Initial			30 DAS			60 DAS			90 DAS			120 DAS			150 DAS		
		AT (T_1)	CS (T_2)	Mean	AT (T_1)	CS (T_2)	Mean	AT (T_1)	CS (T_2)	Mean	AT (T_1)	CS (T_2)	Mean	AT (T_1)	CS (T_2)	Mean	AT (T_1)	CS (T_2)	Mean
Cloth bag (E_1)		3.97	3.98	**3.97**	4.16	4.32	**4.24**	3.89	3.95	**3.93**	**3.62**	3.81	**3.71**	3.30	3.49	**3.39**	3.19	3.39	**3.29**
Polythene bag (E_2)		3.91	3.86	**3.88**	4.53	4.85	**4.69**	4.13	4.24	**4.18**	**3.70**	3.77	**3.74**	3.29	3.18	**3.24**	3.10	2.95	**3.03**
Paper bag (E_3)		3.98	3.99	**3.98**	4.01	4.05	**4.02**	3.76	3.75	**3.77**	**3.58**	3.65	**3.62**	3.21	3.29	**3.21**	3.04	3.21	**3.12**
Air tight plastic container (E_4)		3.90	3.85	**3.86**	4.38	4.68	**4.53**	4.00	4.09	**4.04**	**3.39**	3.50	**3.46**	3.18	3.01	**3.14**	2.89	2.81	**2.83**
Mean		**3.92**	**3.92**	**3.92**	**4.27**	**4.47**	**4.37**	**3.96**	**4.00**	**3.98**	**3.59**	**3.68**	**3.64**	**3.21**	**3.29**	**3.25**	**3.05**	**3.09**	**3.07**
SEm±	**Temperature condition**	**0.12**			**0.02**			**0.02**			**0.02**			**0.02**			**0.02**		
	Containers	**0.17**			**0.03**			**0.03**			**0.02**			**0.04**			**0.03**		
	Interaction	**0.23**			**0.03**			**0.04**			**0.04**			**0.04**			**0.04**		
	Temperature condition	**NS**			**0.05**			**0.06**			**0.05**			**NS**			**NS**		
	Containers	**NS**			**0.07**			**0.08**			**0.08**			**0.11**			**0.09**		
CD @1%	**Interaction**	**NS**			**0.10**			**0.12**			**0.11**			**0.13**			**0.13**		

*AT- Ambient temperature, CS- Cold storage, DAS-Days after storage

Table 5. Effect of storage condition and containers on seedling vigor index in *Flemingia semialata*

Treatments		Initial			30 DAS			60 DAS			90 DAS			120 DAS			150 DAS		
		AT (T_1)	CS (T_2)	Mean	AT (T_1)	CS (T_2)	Mean	AT (T_1)	CS (T_2)	Mean	AT (T_1)	CS (T_2)	Mean	AT (T_1)	CS (T_2)	Mean	AT (T_1)	CS (T_2)	Mean
Cloth bag (E_1)		641.99	645.4	**643.69**	686.91	709.02	**697.96**	611.48	654.42	**632.95**	553.04	610.73	**581.88**	486.73	569.35	**528.04**	428.82	495.40	**462.11**
Polythene bag (E_2)		640.19	642.6	**642.29**	866.37	940.61	**903.49**	726.85	801.91	**764.38**	576.85	589.26	**583.05**	466.97	440.42	**453.69**	412.36	365.89	**389.12**
Paper bag (E_3)		652.36	642.68	**648.02**	615.36	645.46	**630.41**	567.04	598.56	**582.8**	507.86	542.72	**525.29**	440.64	489.47	**465.05**	380.5	442.25	**411.37**
Air tight plastic container (E_4)		37.87	648.75	**643.81**	798.46	849.68	**824.07**	654.44	690.2	**672.32**	493.58	514.48	**504.03**	414.44	388.05	**401.24**	353.29	324.31	**338.8**
Mean		**644.52**	**644.72**	**644.62**	**741.77**	**786.19**	**763.98**	**639.95**	**686.27**	**663.11**	**532.83**	**564.29**	**548.56**	**452.19**	**471.82**	**462.01**	**393.74**	**406.96**	**400.35**
SEm±	**Temperature condition**	**9.79**			**6.50**			**6.22**			**4.96**			**6.46**			**4.83**		
	Containers	**13.84**			**9.20**			**8.80**			**7.01**			**9.14**			**6.83**		
	Interaction	**19.58**			**13.00**			**12.44**			**9.92**			**12.92**			**9.66**		
CD @1%	**Temperature condition**	**NS**			**19.66**			**18.81**			**14.88**			**19.39**			**14.49**		
	Containers	**NS**			**27.81**			**26.60**			**21.21**			**27.64**			**20.66**		
	Interaction	**NS**			**39.01**			**37.32**			**29.10**			**38.77**			**29.22**		

AT- Ambient temperature, CS- Cold storage, DAS-Days after storage