ROLE OF POLYPHENOLS IN RELATION TO GERMINATION AND VIGOUR OF SIMAROUBA (SIMAROUBAGLAUCA DC.) STORED IN DIFFERENT STORAGE CONTAINERS AT AMBIENT STORAGE CONDITIONS

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Abstract: Laboratory experiment to study therole of polyphenols in relation to germination of Simarouba (Simaroubaglauca DC.) during storage under ambient conditions was undertaken during 2009-10.

The statistically significant differences within the genotypes, storage containers and storage periods were observed in respect of germination, seedling vigour index and total polyphenols content in Simarouba.

The seed of genotype PS-05 and PS-04 stored in aluminum tin container showed better germination percentage 65.00 and 62 %respectively at the end of five months storage periods.

The total polyphenols content in the seed exhibited highest value at 120 DAH (0.43 %). The total polyphenols (unoxidized) is significantly inhibitthe germination when present in the seed. It was also found that leaching of oxidized polyphenols from the seed during the imbibitions in water soaking at 120 DAH period enhanced the germination percentage. The seed stored in aluminum tin container had recorded highest germination consistently up to five month storage period than that of stored in polylined cloth bag, HDPE bag and cloth bag (). The genotype PS-05 exhibited highest germination (71.00%)and seedling vigour index (1632) when stored in aluminum tin storage container and it has maintained better seed viability at the end of five month storage period under ambient conditions ($25^{o}C + 2$).

Among all the six high yielding genotypes studied, the genotype PS-05 exhibited better seed viability stored at the end up to five month storage period at ambient storage conditions.

Keywords: germination, seedling vigour index, total polyphenols, Simarouba, storage container, storage periods.

Introduction: The increase in country's 1.2 billion population accompanied by the improvement in the general living standard, lead to demand for edible oil, which has eventually higher than that of supply. In the recent past only,out of tree born oilseeds (TBO) only Palm and Mahua gives edible oil (Kumaran et al.,2008), but now, it has been found that the oil from Simarouba (*Simaroubaglauca)* could also be used for edible purpose. *Simaroubaglauca ker*nel has 55 to 65 % of edible oil. The oil of Simarouba is suitable for human consumption without hydrogenation or blending with other fats (Bhagmal and Kochhar, 1991).

Seed germination and seedling vigour is an expression of the integrated effect of genetic makeup of the genotypes and the physiological, biochemical and environmental factors which take place during seed deterioration. Plants contain a large number of aromatic compounds with hydroxyl groups which are collectively referred to as phenolics or phenols. They occur in all parts of plants, they are believed to offer resistance to diseases and pests in the plants. Phenolics include wide range of compound such as catechol, cyaniding, caffeic acid, tannins, flavonols, lignins and capsaicin. The most commonly observed effects of the exogenously applied phenolics are: a] inhibition of growth, cell division and cell enlargement and [b] prevention of germination in many seeds. Because of widespread occurrence of phenolics in plants many plant physiologist are of the opinion that they function as regulatory substances (Thimmaiah,2004).

Seed viability depends upon both internal (level of internal seed moisture, stored food material, hormones, enzymes, biochemical constitute) and external conditions (Oxygen pressure, temperature and humidity) during storage. In India it is difficult to maintain seed viability during storage. Simarouba seeds have short viability (2-3 months) (Sekar, 2003). Information on the role of polyphenol in relation to germinating of seeds of Tree Born Oilseeds is fragmentary and incomplete. As far as Simarouba is concerned, there are hardly any studies on these aspects. The Simarouba seed is having a very short life. The research available on germination and role of polyphenol in germination of Simarouba is very limited. Hence present investigation entitled "Role of polyphenols in relation to germination and vigour of Simarouba (Simaroubaglauca DC.) stored in different storage containers during storage" was undertaken to study the effect of polyphenols on germinating seed at ambient storage conditions in different storage containers.

Material and Methods: The laboratory experiment was conducted in FCRD design. The twenty seeds in three replications were placed in sand germinating media in pot culture. The germination count was taken after 30 days. The seedlings were categorized in to normal and abnormal. The germination percentage was expressed on the basis of normal seedlings only.

Five normal seedlings from each of the treatments of three replications were randomly selected and root and shoot length were recorded in centimeters. The averages were worked out (ISTA, 1999). Seedling vigour was determined in terms of vigour index as per formula given by Abdul-Baki and Anderson, (1972).

The periodical estimations of total polyphenols present in the defatted seed meal of Simarouba were estimated at an interval of 30 DAH, 60 DAH, 90 DAH, 120 DAH and 150 DAH as per the standard methods of biochemical analysis (Thimmaiah,2004).

Result and Discussion: Simarouba seed deteriorate faster than those of other tree born oilseeds (TBO). Several factors contribute to quality deterioration of Simarouba during storage. The present investigation was carried out to find out "Role of polyphenols in relation to germination and vigour of Simarouba (Simaroubaglauca DC.) stored in different storage containers at ambient storage conditions" conducted during 2009-2010 to study the effect of storage on total polyphenols estimation and their associations with seed germination of Simarouba stored in different storage containers at ambient storage conditions.

Main effects of Genotypes, storage containers and storage periods on total polyphenols content (%): The data pertaining to main effects of genotypes, storage containers and storage periods on total polyphenols content (%) exhibited significant differences and are presented in Table 1.

The mean total polyphenols content ranged from 0.362 to 0.381 per cent in different genotypes under study.The genotype PS-04 and PS-05 recorded lowest total polyphenols (%) which was found to be associated with higher germination percentage, irrespective of storage containers and storage periods. The genotype PS-45 recorded the highest mean total polyphenols (0.381%) with lower germination (53.00%), irrespective of storage containers and storage periods.

The decrease in total polyphenols content was found to be associated with an increase in germination percentage and seedling vigour index. These observations are in conformity with the findings of Schuab*et al*. (2001) wherein they reported that the presence of p-coumaric acid (p-CA) inhibitor there was decrease in fresh and dry biomass of seedling and increase in lipids and protein. The lowest mean total polyphenols content was recorded in the cloth bag storage (0.361). In general, the mean total polyphenols content was observed to be higher at 120 DAH. The mean germination percentage was slightly lowest at 90 DAH (46.29) than 120 DAH (48.42%). It might be due to the deoxidizedphenolic compounds present in the embryo and seed in early stage which inhibit the germination by making the tough seed coat. The phenolics were the antioxidant, however, it affects the respiration of seed also. These findings are in agreement with the observations reported by Desai (2004). The result of the present investigation are also consistent with the findings of Miyamoto and Everson (1958) wherein they noticed that wheat testa contains catechins (tannins). The red-coated wheat are therefore, thought to have high level of inhibitory catechins, whereas the white wheat have low levels of these compounds. Dormancy in some wheat cultivars may actually be controlled by inhibitors present in seed coats.

The seed stored at 120 DAH exhibited higher level of polyphenols, might be due to oxidation of phenolic compounds during the storage period. The oxidized phenols might be leached out during 24 hr prior water soaking seed treatment, causing the colour of water used for soaking from colourless to dark brown. The leaching of oxidized polyphenols during seed soaking resulted in significantly higher germination at 120 DAH. These results are in consonance with Sircar and Dey (1967) where in they reported that accumulation of supra optimal concentration of indole acetic acid and other derivatives in rice phenols including caumarin and ferulic acid also occurred. It has been suggested that seed colour correlates with permeability to water and that the colour is due to the presence of oxidized phenolic compounds.

The higher proportion of oxidized polyphenols was observed at 120 DAH, might be due to oxidation of phenolic compounds by peroxidation from embryo and seed to seed coat with an advancement of storage period. During the extraction of oil, the phenolic compounds were found to be leached in the oil of Simarouba and it was clearly seen by the change in oil colour yellow to pinkish brown in the higher polyphenols containing genotypes at 120 DAH storage period only and thereafter it was found to be decreased.

The lowest total polyphenols content was recorded at 150 DAH and at 30 DAH, irrespective of genotypes and storage containers. The total polyphenols found to be increased at 120 DAH and thereafter, it was decreased and was lowest at 150 DAH. The oxidized polyphenols were found to be highly correlated with the seed colours and they were increased with advancement of storage during seed ageing from lower to higher level up to certain period and thereafter it was decreased. The findings are in conformity with the observations of Singh (1991) who reported an increase in seed colour intensity during seed ageing of pea.

Interaction effects of genotypes x storage containers x storage periods on germination, SVI and total polyphenols: The data pertaining to the interaction effects of genotypes x storage containers x storage periodson germination (%) and seedling vigour index exhibited statistically significant differences (Table 2). The highest value of germination percentage was recorded in genotype PS-04 stored in aluminum tin container stored at 30 DAH (93.00%) and seedling vigour index in PS-05 stored in aluminum tin container up to 60 DAH (92.00%).

The genotype PS-05 (65%) and PS-04 (62.0%) stored in aluminum tin container exhibited better germination (%) at the end of 150 DAH as compared to the other interactions. These findings are in consensus with the observation reported by Singh (2002) wherein he reported that among packaging material, seed viability and vigour was maintained in polythene bag followed by aluminum container at ambient storage conditions.

The lowest germination percentage was observed at 90 DAH (12.0%) and lowest seedling vigour index was observed at 150 DAH (273) in the seed of the genotype PS-46 stored in cloth bag container.

The cumulative result of interaction effects revealed that, the genotype PS-05 stored in aluminum tin container at 150 DAH showed the lowest total polyphenols content (0.277).The cloth bag storage container are not air tight container, however, the phenols oxidized earlier than other airtight containers which resulted in to higher total polyphenols and protein content at 60 DAH.

Correlations of germination and seedlingvigour index with Total polyphenols (%): The data pertaining to the correlation of germination percentage and seedling vigour index with total polyphenol content presented in Table 3.

The germination percentage and seedling vigour index were found to be affected by the higher levels of total polyphenols which are supposed to be the germination inhibitors present in seed when it was not oxidized and leached during water soaking prior to germination. Similarly, Amen (1965) stated that seed germination is controlled by balance between growth inhibitors and growth promoters. The presence of inhibitors was found negatively correlated with growth promoters, ensuring germination. The triggering agents light and temperature were found essential to inactivate or decrease the level of inhibitors of seed. In the present investigation concluded that, the germination percentage and seedling vigour index were found to be decreased significantly with an increased levels of in total polyphenols.

References:

1. Abdul-Baki, A. A. and J. D. Anderson . 1972. Physiological and biochemical deterioration of seeds. In T. T. Kozolwski [ed.], Seed biology, 2: 283-315. Academic Press, New York 1980. Baki and Anderson, pp. 972.
2. Amen R. D., 1965. A model of seed dormancy, Bot. Rev. 34: 1Bhagmal and Kochhar. 1991. Under-utilized trees for food: Promise and potentials. Indian Farming, pp.36-4.
3. Desai B. B., 2004. Seeds Handbook. Biology, production, processing and storage (ed.). Marcel dekker, Inc. New York. Basel.pp.37,38,51,58,63and67-68.
4. HombeGowda H. C., and R. Vasudeva. 2004. Effect of presowing treatment on seed germination and seedling parameters of Nothapodytesnimmoniana-an important anti-cancer drug yielding tree. In J. non-timber Forest Product., 11(3): 193-198.
5. ISTA, 1999. International rules for seed testing. Seed Sci. Technol. 27, Supplement 2, pp.132
6. Isley, D. 1957. Vigour Tests Proc. Association official Seed Analyst, 3:1-152.
7. Kumaran,K.K.,P.Srimathi and Paramathma M.,2008.Forest tree seed production. Advances in seed science and technology (II) (eds):373-389.
8. Marbach, I. and A. M. Mayer. 1974. Permeability of seed coat to water as related to drying conditions and metabolism of phenolics. Plant physiology, 154 (6): 817-820.
9. Miyamoto T. E. and E. H. Everson. 1958. Biochemical and physiological studies of wheat seed pigmentation. Agron. J. 50: 733
10. Schuab, S.R. P., A. L. Braccini, O. Ferrarese-Filho, C. A. Scapim and Braccini, M.C.L., 2001. Physiological seed quality evaluation and seedling lipid and protein content of soybean (Glycin max L. Merril.) in the presence of p-coumaric acid. Seed Sci. Technol., (29):151.
11. Sekar, I., 2003. Seed storage, seed source variations, molecular characterization and in vitro propagation in Simaroubaglauca DC. Ph.D. (For.) A Thesis submitted to Tamil Nadu Agriculture university, Coimbatore.
12. Singh, K. 2002. Effect of different methods of seed extraction, packaging material and ambient storage conditions in tomato (Lycopecicumesculentus Mill.) seeds. A thesis submitted to the ChaudhariCharansingh Haryana Agricultural University.
13. Sircar S. M. and B. Dey. 1967. Dormancy and viability of rice. Proc. Int. Symp. Physiol. Ecol. Biochem. Germinatio, 1963. (Ed. H. Borrispp 969-973).
14. Thimmaiah, S. R., 2004. Estimation of phenolics, standard methods of biochemical analysis (eds),

Kalyani publishers, Ludhiana, New Delhi pp.287- 302.

Fig.1 : Main effect of genotypes, storage containers and storage periods on germination and seedling vigour index and total polyphenols of Simarouba

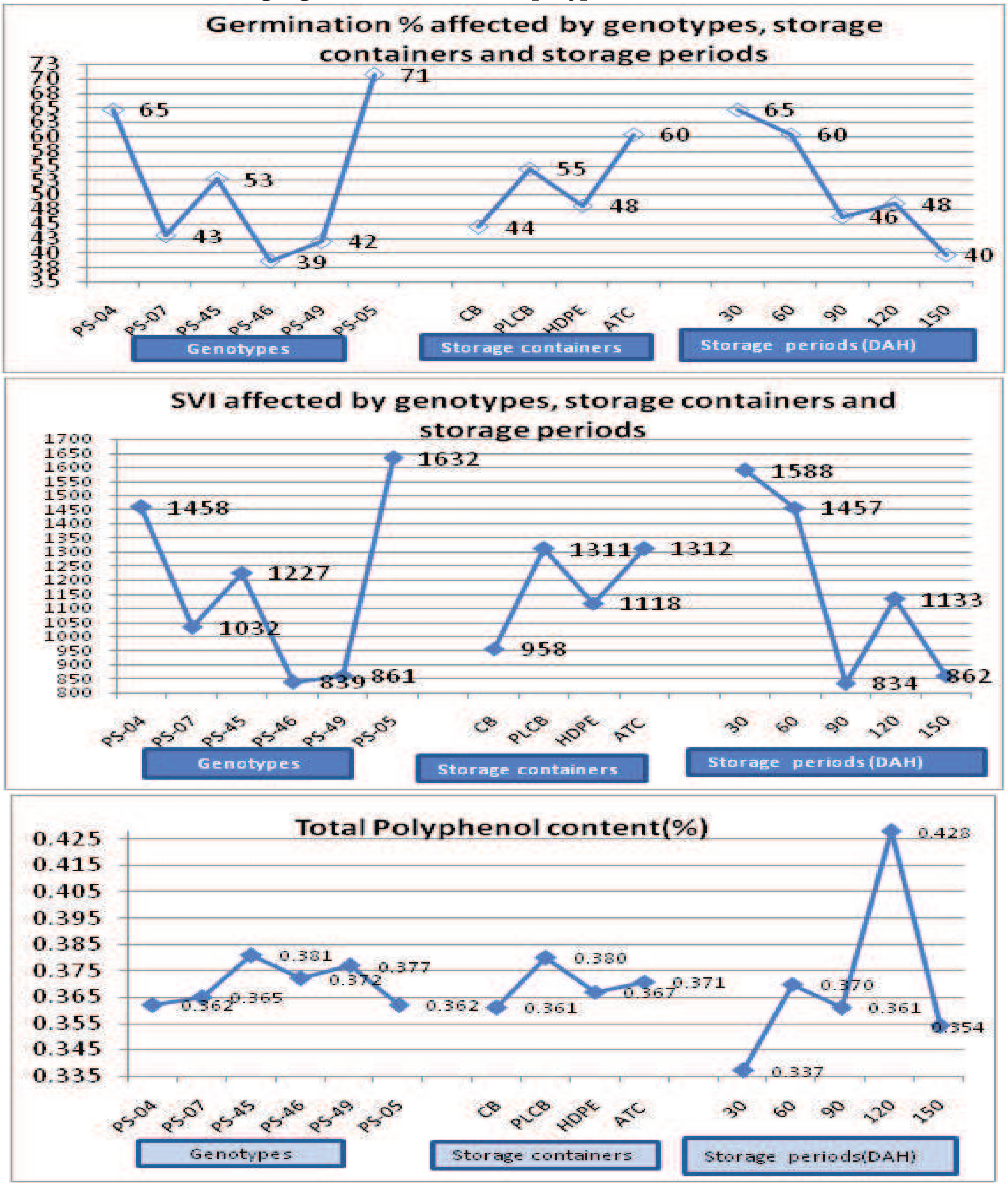

Table 2; Interaction effect of G, SC and SP on Germination %, SVI and Total Polyphenol content of Simarouba

Sr. No.	Name of treatment	Germination					Seedling Vigour index					Total Polyphenol content(%)				
		30	**60**	**90**	**120**	**150**	**30**	**60**	**90**	**120**	**150**	**30**	**60**	**90**	**120**	**150**
1	PS-04 X CB	52	43	40	48	43	1065	889	692	1105	1315	0.332	0.370	0.353	0.375	0.359
2	PS-04 X PLCB	92	90	57	62	54	2297	2394	1092	2109	1573	0.366	0.380	0.373	0.443	0.325
3	PS-04 X HDPE	68	65	57	63	50	1479	1443	1072	1559	1058	0.312	0.362	0.349	0.381	0.323
4	PS-04 X ATC	93	90	80	85	62	1904	1924	1329	1789	1070	0.363	0.373	0.396	0.301	0.301
5	PS-07 X CB	45	38	28	33	18	999	855	447	793	738	0.289	0.293	0.388	0.408	0.374
6	PS-07 X PLCB	65	62	43	37	20	1662	1514	1002	844	1189	0.322	0.372	0.324	0.452	0.398
7	PS-07 X HDPE	45	40	37	40	38	1063	939	723	939	800	0.311	0.314	0.326	0.404	0.359
8	PS-07 X ATC	73	72	45	52	28	2035	1950	797	1085	276	0.365	0.404	0.392	0.415	0.396
9	PS-45 X CB	58	57	52	41	36	1348	1227	931	767	829	0.321	0.371	0.351	0.393	0.360
10	PS-45 X PLCB	65	68	43	57	47	1616	1685	983	1801	794	0.393	0.427	0.339	0.490	0.392
11	PS-45 X HDPE	55	58	45	42	35	1512	1614	877	1179	800	0.339	0.393	0.356	0.464	0.401
12	PS-45 X ATC	75	70	58	48	43	1934	1933	841	819	1054	0.350	0.346	0.342	0.400	0.382
13	PS-46 X CB	42	37	22	27	25	922	817	473	568	273	0.313	0.317	0.386	0.419	0.353
14	PS-46 X PLCB	58	48	28	33	32	1436	900	492	672	656	0.368	0.418	0.372	0.437	0.361
15	PS-46 X HDPE	42	43	41	35	*31*	957	733	841	565	*981*	0.320	0.336	0.389	0.392	*0.368*
16	PS-46 X ATC	65	45	38	42	*36*	1617	1043	610	1404	*808*	0.351	0.383	0.364	0.432	*0.360*
17	PS-49 X CB	55	50	38	43	28	1333	1194	390	631	291	0.345	0.389	0.303	0.487	0.355
18	PS-49 X PLCB	65	55	35	28	30	1556	1339	757	524	662	0.374	0.404	0.297	0.421	0.362
19	PS-49 X HDPE	42	38	33	45	37	849	657	634	1362	692	0.368	0.427	0.340	0.471	0.413
20	PS-49 X ATC	60	50	35	32	32	1491	1180	372	368	368	0.323	0.341	0.337	0.498	0.296
21	PS-05 X CB	82	82	55	65	50	2169	2195	968	1464	1059	0.322	0.372	0.405	0.416	0.321
22	PS-05 X PLCB	88	87	65	64	58	2236	2113	1178	1124	1120	0.317	0.378	0.401	0.364	0.329
23	PS-05 X HDPE	75	70	58	62	55	2066	1895	1097	1931	1239	0.311	0.346	0.398	0.410	0.321
24	PS-05 X ATC	92	92	78	70	65	2559	2531	1414	1229	1049	0.323	0.353	0.378	0.494	0.277
	Mean	65	60	46	48	40	1588	1457	834	1110	862	0.337	0.370	0.361	0.424	0.354
	C.D.at 5% CV%	7.03 8.46					178.89 9.51					0.032 5.44				

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