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Short Communication

Variation in Seed Characteristics of *Acacia seyal* Delile *var.seyal* From Two Provenances in Sudan

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Abstract
Variability studies are necessary to the begging of tree improvement program. The objective of this study is to evaluate the magnitude of variation in seed characteristic traits and estimate the genetic parameters among two provenances of the *Acacia seyal var.seyal*. Significant differences were found among the two provenances for all parameters studied. The two provenances of *Acacia seyal var.seyal* showed that seed weight was influenced by environmental variance. For Damazin provenance the partitioning of the total variance revealed that seed width was recorded at genotypic variance, while for Heritability value was found high for seed weight (85.71%). The results showed that seed weight and seed germination are under genetic control, they can be used as parameters for selection and improvement of this species.
Keywords: Provenance variation, Phenotypic, Genotypic, Environmental Variance, Heritability, Genetic Gain.

Introduction
Acacia seyal is the most common tree species on clay plains that flood during the rainy season (McAllan, 1993). Two varieties occur in the Sudan; var. seyal without inflated spines and green-white and red bark, wide spread in grass and wood land savanna on dark cracking clay and var. fistula schweinf., with inflated spines and whitish bark, common in Central and Southeast Sudan in deciduous forests on clay of seasonally wet depression (ElAmin, 1990).

Acacia seyal is an important source of fuel wood, building poles, forage, commercial gums, and tannins (ElAmin, 1990); (Mustafa, 1997). *Acacia seyal* produces gum which though of inferior quality in comparison with that of *Acacia senegal*, is traded in Sudan under the name (gumtalha) and makes up to 10 percent of the annual exported gum Arabic (Barbier *et al*., 1990; McAllan, 1993; NFTA,1994) .

Morphological variation in seed and pods traits among the natural populations of the species is useful in selection programme for genetic improvement (Bahadur and Hooda, 1995). The morphological variability signifies the adaptation of the species to the environment and it may be genetically determined or environmentally induced (Chiveu *et al*., 2009).

Limited work has been conducted in Sudan on *Acacia seyal var.seyal*, genetic variability at morphological traits basis, however,

variation study is an important research work in our National Tree Seed Center program because the mandate of the center is to collect seed from provenances where genotype presents good quality for reforestation programs.

The objective of the preset study is to evaluate the variation in seed characteristic traits and estimate the genetic parameters among two provenances of the *Acacia seyal var.seyal.*

Material and Methods

The experimental material was collected from two geographic locations (Table 1).

Table 1: Locations of the collected seed sources of *Acacia seyal var. seyal*

Provenance	Lat°- N[1]	Long°- E [1]
Gedarif	14. 14	33.42
Damazin	11.81	33.86

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Observations on seed length, seed width, and seed weight, were recorded per each provenance per each species. Germination percentage was calculated according to ISTA (ISTA, 1999) using the formula:

$$\text{Germination\%} = \frac{\text{Number of germinated seeds} \times 100}{\text{Total number of seeds}}$$

For analysis of variance; genotypic, phenotypic and environmental variances were calculated according to Gupta (Gupta, 1994).

Statistical analysis: The data were statistically analyzed using Statistic 6.1 Analytical software 1985-2003. Analysis of Variance (ANOVA) was applied to test the variations between different seed sources through seed characteristics. Least square differences (Lsd at 5% level) was also subjected on significant observations.

Results

Variability estimates and genetic parameters were calculated for seed traits, namely length, width, weight and germination percentage among two provenances of *Acacia seyal var. seyal* as given in table (2). Seed length, seed width and seed weight were found maximum in Damazin seed sources (0.706 cm, 0.450 cm and 4.531 g respectively). Seed germination was found maximum in Gedarif (11.25%). The differences between the two provenances were statistically significant at 0.0001 level of significance for seed length and seed weight, while seed germination and seed width were not significantly different.

Table 2: Variation between two seed sources of *Acacia seyal var.seyal* on seed characteristics

Province	Seed length	Seed width	Seed weight	Seed germination (%)
Damazin	0.706a	0.450a	4.531a	9.75a
Gedarif	0.663b	0.427a	3.159b	11.25a
PV value	0.0000	0.1	0.0000	0.5
SE	0.002	0.010	0.037	2.282

Values are mean of four replications.
Means followed by the same letters within a column are not significantly different.

For *Acacia seyal var.seyal* from the two provenances, the partition of the total variance revealed that maximum variance was recorded at phenotypic level through genetic variance for seed weight and seed germination, while seed width and seed length were influenced by environmental variation. However, genotypic, phenotypic and environmental coefficient of variation obtained the same pattern as variance (Table3).

Table 3: Variances and coefficient of variability for seed characteristics of *Acacia seyal* *var.seyal*

Provenances	Parameters	**GV**	**PV**	**EV**	**PCV**	**ECV**
Damazin+++	Seed length	0.002	0.970	0.968	11.721	11.759
Gedarif	Seed length	0.071	1.750	1.679	16.240	15.913
Damazin	Seed width	0.1002	1.002	0.900	15.715	14.907
Gedarif	Seed width	0.003	0.856	0.853	14.414	14.388
Damazin	Seed weight	0.001	0.002	0.001	0.210	0.148
Gedarif	Seed weight	0.006	0.007	0.001	0.463	0.177
Damazin	Seed germination	0.331	0.630	0.299	2.541	1.751
Gedarif	Seed germination	4.311	5.031	0.720	6.687	2.529

Table 4 showed the genetic component variation in *Acacia seyal var.seyal* from Damazin and Gedarif. Heritability values varied between 85.71% (seed weight) to 0.206% (seed length). Similarly maximum value of genetic advance was calculated for seed germination (10.354) and minimum for seed length (0.004). On the other hand the values of genetic gain were found maximum for seed width (50.864%) and minimum for seed length (0.566%).

Table 4: Estimate of genetic components for seed characteristics of *Acacia seyal var.seyal*

Provenances	Parameters	H^2**%**	GA	GG
Damazin	Seed length	0.206	0.004	0.566
Gedarif	Seed length	4.628	0.108	16.200
Damazin	Seed width	10.01	0.206	50.864
Gedarif	Seed width	0.350	0.006	1.456
Damazin	Seed weight	50.0	0.045	0.993
Gedarif	Seed weight	85.71	0.146	4.621
Damazin	Seed germination	52.53	0.857	8.789
Gedarif	Seed germination	85.68	10.354	3.953

Discussion

The two provenances of *Acacia seyal var.seyal* shown significance different in some seed characteristics. The variability seems to be in accordance with those observed for other tree species (Ginwall *et al*., 1996; Ibrahim, 1996; Ngulube *et al*., 1997; Oteybeye, 1983; Nilson and Tauer, 1987 and Ladipo, 1989). On the other hands, these variations can be topographic, rainfall and climatic differences, (Elfeel and Warrag, 2004) who attributed differences in seed characteristics of *Acacia senegal* among population to soil differences, while (Ahmed and Warrag, 2007) attributed differences in seed characteristics of *Acacia senegal* to geographical isolation. Also, these differences in seed parameters may partly be due to genetic factor and partly due to environmental effect as (Jain, 1982) stated that variation refers to measurable differences in individual for a particular trait may partly be due to genotype (heritable) and partly to environmental (Non-heritable) effects.

Assessment of relative contribution of genetics and environment to the total variation is a prerequisite for any tree improvement program (Zobel and Talbert, 1984). The present investigation showed that seed weight and seed germination were influenced by genotypic variance. This finding was agreed with (Uniyal, 1998) for seed weight and seed germination of *Grewia*

optiva, and (Saklani, 1999) for seed weight and root length of *Quercus leucotrichophora.*

In the present investigation, a phenotypic coefficient of variation was higher than the genotypic coefficient of variation for all the parameters studied. Similar type of observation was reported by (Fakuta *et al*., 2015) in his experiment, suggesting the presence of environmental influence in the expression of quantitative traits for *Acacia senegal*. GCV and PCV values greater than 20% are regarded as high, whereas values less than 10% are considered to be low (Deshmukh *et al*., 1992). High GCV and PCV recorded for seed length, width, weight and seed germination.

In a population observed variation is due to both factors i.e. genetics and environmental whereas genetic variability is the only heritable from generation to the next generation so the heritability alone does not give an idea about the expected gain in the next generation but it has to be considered in conjunction with the genetic advance. Those characters exhibiting maximum heritability and high genetic advance as a percentage of mean, could be used as the powerful tool in selection process such characters are controlled by the additive genes and less influenced by the environment (Panes and Sukhatme, 1995). The present study disagrees with this observation.

Heritability can be interpreted as the regression between phenotype and genotype (broad-sense heritability) and between phenotype and breeding value (narrow-sense heritability) (Wellendorf and Ditlevsen, 1992). In the present study higher heritability was recorded for seed weight and higher genetic gain for seed width. This remarkable finding is not in the same line with (Volker *et al*., 1990; Singh and Chaudhary, 1993) each one state that Heritability estimates along with genetic gain were reported more useful than heritability alone in predicting the resultant effect of selecting the best genotypes for a given trait.

Conclusion

Thus it is clear that considerable genetic differences exist in all the seed characteristics between the two different seed sources of *Acacia seyal var.seyal*. Damazin was found as a superior seed source by the basis of seed morphological characteristics such as seed length, seed weight and seed width. On the other hand in case of seed germination Gedarif emerged as superior seed source. The variations in almost all studied parameters are under genetic control between seed sources. It is suggested that the seed germination or seed weight were found superior characters for selection of best seed source for tree improvement program by the basis of heritability value.

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التباين فى خصائص شجرة الطلح من مصدرين جغرافيين فى السودان

عبد الجبار شرف الدين أحمد

هيئة البحوث الزراعية– مركز بحوث الغابات

المستخلص:

دراسة التباين تعتبر ضرورية لبداية برنامج التحسين الوراثى للأشجار. الهدف من هذه الدراسة هو تقييم حجم التباين لبعض خصائص البذور و تقدير الخصائص الوراثية بين أثنين من مصادر شجرة الطلح. أظهرت الدراسة وجود فروقات معنوية لكل خصائص البذور التى تمت دراستها بين المصدرين الجغرافيين. أوضحت كذلك أن التباين البيئى له تأثير على وزن البذور فى حين أن التباين الوراثى له تأثير على عرض البذور لمصدر الدمازين. أعلى درجة توريث فى هذه الدراسة كانت لوزن البذور (85.71%). خلصت الدراسة بأنه يمكن إستخدام كل من وزن البذور و إنبات البذور كمعايير للإختيار وتحسن شجرة الطلح.