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ABSTRACT

Comparative Study of Seeds, Seedlings Characteristics of *A.senegal*, *A.mellifera* and *A.laeta*

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The objective of this study is to find the easy methods for distinguishing between seeds of *A.senegal*, *A.mellifera* and *A.laeta*. This is because there is a confusion in collecting seeds of *A.laeta* with seeds either of *A.senegal* or *A.mellifera*. Based on this confusion, the study aimed to support the hypothesis that there are two morphological forms of *A.laeta*, one is very similar to *A.mellifera*, which is considered as Shubahi Kitir, and the other is very similar to *A.senegal* which is considered as Shubahi Hashab. According to the above mentioned confusion, this work is concentrated on comparative study of pods, seeds and seedlings characteristics of *A.senegal*, *A.mellifera* and their Shubahis. The study includes the similarities and differences between the four mentioned trees in their pods parameters (length, width, full and abortive seeds per pods), seeds characteristics (length, width, thickness and etc. .), numbers of seed per kilogram and herbarium specimens were collected for leaves and leaflets measurement. All these measurements were done at National Tree Seed Center Soba.

A natural seed source of Elmazmum is representing the location of this study. It is spreading a cross the gum belt with rainfall varied from 300-600mm per annum. Pods of each type were collected from not less than 10 trees, at least a hundred meters apart from each other. After seed cleaning, parts of seeds of *A.senegal*, *A.mellifera* and their Shubahis were stored in ventilated containers (cotton bags) at room temperature $30 \pm 5^{\circ}\text{C}$ and relative humidity 45-55%

(normal store). And other parts of the same species were stored in an air tight containers (drum, small Jerican) in a cold store at ($12 \pm 1^{\circ}\text{C}$) and relative humidity 55-65% for 18 months.

The moisture content and germination of the stored seeds were checked every 3 months. The imbibition rate of seed was calculated daily after soaking in water for 8 weeks. Also the traits of seedling growth were measured for 3 ages at one-month interval. The results of this work were analyzed statistically using ANOVA followed by Tukey Kramer range test for mean variation.

The study showed significant differences between *A.senegal*, *A.mellifera* and their Shubahis in their leaves and leaflets, Shubahi Kitir tree has long leave length followed by Shubahi Hashab, *A.melliefra* and *A.senegal* respectively. And then *A.melliferra* tree has long and wide leaflets, followed by Shbahi Kitir , Shubahi Hashab and *A.senegal* respectively.

The study showed considerable differences between *A.senegal*, *A.mellifera* and their Shubahis in their pods parameters and seed characteristics. *A.senegal* has longer pod and big seed than the other species, while *A.mellifera* has shorter pods and smaller seeds than the other. But the two Shubahis have intermediate pod and seed parameters dispersed between those of *A.senegal* and *A.mellifera*. Seed viability of *A.senegal*, *A.mellifera* and their Shubahis was tested by cutting and tetrazoilum test. They showed no significant differences between *A.senegal*, *A.mellifera* and their Shubahis in seed viability. Germination rate showed no significant differences between the treated and untreated seed of *A.senegal*, *A.mellifera* and their Shubahis during the 12 months of storage, but after this period, a significant dropping appear in seed viability *A.senegal*, *A.mellifera* and their Shubahis. During the storage period ,*A.mellifera* seed has top germination rate which followed by *A.senegal* , Shubahi Kitir and Shubahi Hashab respectively. *A.senegal*, *A.mellifera* and their Shubahis showed no significant differences in moisture content during the storage period. The imbibition of seed of *A.senegal*, *A.mellifera* and their Shubahis with soaking in water showed two strategies of two groups of species. The first group is represented by *A.senegal* and Shubahi hashab, while the other group is

represented by *A.mellifera* and Shubahi kitir. This high imbibitions indicates that, *A.senegal*, *A.mellifera* and their Shubahis have physical dormancy (thin-coated seed) and it can be overcome by soaking in water. Significant differences were observed between *A.senegal*, *A.mellifera* and their Shubahis in shoot length during seedling growth rate. These results showed that the two Shubahis' seedlings are fast growing than *A.mellifera* and *A.senegal* seedling. Irrigation regimes did not give significant differences between *A.senegal*, *A.mellifera* and their Shubahis in their shoot length and fresh and dry weight of seedlings, but they have considerable effect on their root length. Therefore the irrigation once every two weeks gave the higher value of root length, followed by once a week and twice a week irrigation regimes respectively. This illustrates that, the root length and biomass production increased with seedling age and water scarcity (water stress). No significant differences were observed between *A.senegal*, *A.mellifera* and their Shubahis in branches and leaf number of seedlings. And also, no significant differences were recorded between *A.senegal*, *A.mellifera* and their Shubahis in root fresh and root dry weight. The irrigation regimes have no significant effect on root weight and root dry weight at the first age (one month), but they have significant effect on root fresh and dry weight of seedlings of *A.senegal*, *A.mellifera* and their Shubahis at the second and third age (Two and three months). The once every two weeks regimes of irrigation gave the highest value of root biomass, while the twice a week regimes gave the lowest value. The study also showed no significant differences between *A.senegal*, *A.mellifera* and their Shubahis in nodules number at the first and second age (two months), while significant variation was observed at the third age (3 months). The two Shubahis gave bigger number of nodules while the smallest number was obtained by *A.senegal* throughout the age time (3 months). Therefore, the nodulation increased with seedling age and biomass production. The study showed significant differences between *A.senegal*, *A.mellifera* and their Shubahis in the shoot to root ratio at the third age (3 months), but at the first and second age (one and two months) did not appear. Shoot to root ratio was high at the first age, while it decreased with

time (ages). This results confirm the fact that was highlighted by Ledig, (1983), woody species where shoot to root ratio decrease with age, this may be due to the allocation of more nutrients to root system than shoot system.

The study showed an index of similarities percentage in morphological characters between *A.senegal*, *A.mellifera* and their Shubahis, which are shown below:

A.senegal with Shubahi Hashab = 53%

A.senegal with Shubahi Kitir = 47%

A.senegal with *A.mellifera* = 58%

A.mellifera with Shubahi Kitir = 53%

A.mellifera with Shubahi Hashab =58%

Shubahi hashab with Shubahi Kitir =58%

Considerable recommendations were drawn from this work it is recommended that further studies are needed on: taxonomy (chemo, cytology..etc), genetic, anatomoy (seed and timber). Separate plantations of each of *A.senegal*, *A.mellifera* and their Shubahis are recommended and seed orchard could be established for tree improvement in case of gum production.

دراسة مقارنة بين خصائص بذور و شتول أشجار الهشاب والكتر والشباهى

الحاج البشير موسى

خلاصة الأطروحة

تهدف الدراسة إلى إيجاد طرق لفرز ثمار و بذور هذه الأنواع من بعضها البعض والتعرف عليها بسهولة وذلك نتيجة للتشابه الدقيق بين هذه الأنواع. فقد ركزت الدراسة على خواص الثمار والبذور ودرجة إنبات البذور ومحتواها المائى وصفات النمو وتأثير الري على نمو الشتلات.

تم إختيار موقع الدراسة بمنطقة المزموم بولاية سنار , حيث جمعت بذور الهشاب والشباهى والكتر. وقد لاحظنا فى الحقل أن شجرة الشباهى تتواجد كنوعين من ناحية الشكل الظاهرى للشجره وفى ضوء هذه الملاحظة بنى إفتراض تسمية نوعين من شجرة الشباهى هما نوع يشبه الهشاب فى شكل وحجم الأوراق والوريقات و الساق إقترحنا له إسم (شباهى الهشاب) و نوع آخر يشبه الكتر فى شكل و حجم الأوراق والوريقات والساق و إقترحنا له إسم (شباهى الكتر). و بناءً على المقترحين أعلاه أصبحت أنواع الأشجار المقترحه للدراسه أربعة أنواع هى (شجرة الهشاب, شجرة الكتر, شجرة شباهى الهشاب, شجرة شباهى الكتر).

بعد جمع البذور لكل من الأشجار الأربعة تم قياس الخواص الفيزيائيه للثمار (الطول , العرض , عدد البذور الكامله النمو و الغير كامله النمو بالثمار) وتم قياس خواص البذور (الطول , العرض, السمك, الحجم, الشكل) وعدد البذور فى الكيلوجرام. , وتم جمع عينات

معشبه من أشجار الهشاب والكتر وشباهياتها. كذلك تم قياس أوراق ووريقات (جافه) أشجار

الهشاب والكرت وشباهياتها. ومن ثم نظفت البذور وتم تقسيم كل منها إلى قسمين، ثم قسم القسم الأول إلى قسمين آخرين. قسم تم تخزينه بالمخزن المبرد في درجة حراره ($12 \pm 1^{\circ}\text{C}$, ورطوبة (55-65%) و قسم تم تخزينه بالمخزن العادي (جو الغرفة) في درجة حرارة ($30 \pm 5^{\circ}\text{C}$.) ورطوبة (45-55%) البذور المخزونه في المخزنين (البارد والعادي) فحص إنباتها خلال فترة التخزين المحدده ب (18 شهراً) . حيث كانت تؤخذ قراءات نسبة الإنبات كل ثلاثة أشهر أثناء فترة التخزين. أما الجزء الثانى من البذور أجريت عليه تجارب نسبة النقاوه والحيويه (بالقطع اليدوى، والتترازوليم) وتجارب إستجابة البذور للغمر بالماء لمدة شهرين. و أجريت تجارب معا لجات البذور بطرق مختلفة (حامض الكبريتيك و جهاز حك البذور والإبره الكهربائيه). إما تجارب المشتل فقد شملت تجربة النمو وقياسات خواصه حيث أستعمل نوع واحد من التربه و هو القريره(السلت) و تم رى التجربه بثلاثه نظم للرى هى (مرتين فى الأسبوع, مرة كل أسبوع, مرة كل أسبوعين) حيث تروى كل شتله بواحد لتر من الماء لمدة ثلاثة أشهر. و قد صممت التجربه على النظام العشوائى الكامل فى القطعة (المنشقه-المنشقه) فى ثلاثة مكررات. وحللت نتائج هذه الدراسه إحصائياً بإستخدام تحليل التباين (ANOVA) و بمتابعة (Tukey Kramer).

أثبتت الدراسة أن شجرة شباهى الكتر تمتاز بطول الورقه وتليها شجرة شباهى الهشاب ثم الكتر و أخيراً شجرة الهشاب. و تمتاز شجرة الكتر بطول وعرض الوريقات وتليها شباهى الكتر ثم شباهى الهشاب و أخيراً شجرة الهشاب التى تمتاز بكثرة عدد الريشات والتى تليها شباهى الهشاب ثم شباهى الكتر و أخيراً الكتر.

أثبتت الدراسة وجود فروقات معنويه عاليه بين أنواع الأشجار الأربعة فى خواص الثمار (طولها) بينما لم تظهر فروقاً معنويه فى عرض الثمار, حيث أظهرت ثمار الشباهيات إحتوائها على نسبة عاليه من البذور غير كامله النمو , و هذا قد يدل على عدم إكمال تلقيح أو تخصيب البويضات بها. وأثبتت الدراسه وجود فروقات معنويه فى خواص البذور لهذه الأنواع الأربعة. كما أن طول وعرض البذره يتناسب طردياً مع وزنها بينما عدد البذور /الكجم يتناسب عكسياً مع وزن البذره. وهذا التباين الواضح فى خواص ثمار وبذور هذه الأنواع الأربعة يدل على إستقلالية كل نوع على حده. حيث أظهرت شجرة الهشاب تميزها بطول الثمار وكبر حجم بذورها . أيضاً أظهرت الدراسة أن هنالك فروقاً معنويه واضحه فى نسبة إنبات بذور الأنواع الأربعة بين المخزن المبرد

والعادي، مما يدل على أهمية المخزن المبرد في حفظ وصيانة حيوية البذور لأطول مدة بينما في المخزن العادي تبدأ البذور في فقدان حيويتها بعد 12 شهراً. لم تعط الدراسة فروقات معنوية بين نسبة إنبات بذور الأنواع الأربعة بعد معالجتها بحامض الكبريتيك والإبره الكهربائيه وجهاز حك البذر مما يدل على أن هذه الأنواع من البذور ذات كمون فيزيائي (طبيعي) من ناحيه أخرى فإن عدم وجود فروق معنوية بين نسبة إنبات البذور المعالجه وغير المعالجه يدل على أن بذور هذه الأنواع ذات غطاء رقيق نوعاً. أيضاً أثبتت الدراسة أن هنالك فروقات معنوية عاليه في إستجابة بذور الأنواع الأربعة للمغم في الماء لمدة 8 أسابيع . و قد قادت هذه الإستجابيه إلى تقسيم أنواع البذور إلى مجموعتين فالمجموعه الأولى يمثلها (الهشاب و شباهى الهشاب) بينما المجموعه الثانيه يمثلها (الكر وشباهى الكتر). أيضاً من خلال الدراسه ثبت عدم وجود فروقات معنوية بين حيوية بذور الأنواع الأربعة وفي محتواها المائى، مما يشير إلى أن هذه الأنواع تنتمى إلى البذور ذات الغطاء غير المنفذ للماء والتي يمكن أن تخزن لفترات أطول لقله محتواها من الماء (5-6%). كذلك أثبتت الدراسه وجود فروقات معنويه عاليه في خواص النمو لشتلات الأنواع الأربعة حيث تزداد هذه الفروقات مع عامل الزمن (العمر). و قد أكدت الدراسه أن الشباهيات ذات نمو سريع وفي أغلب الأحيان يأتى شباهى الهشاب فى المرتبه الأولى من حيث سرعة النمو. و أيضاً هنالك فروقات معنوية فى الكتله الحيه المنتجه منساق شتلات الأنواع الأربعة حيث تساوت الشباهيات فى إنتاج الكتله الحيه بينما جأت شجرة الهشاب فى المرتبه الأخيره فى كل الحصدات (شهر، شهرين وثلاثه شهور). و كذلك تباينت الكتله الحيه المنتجه من جذور الشتلات حيث تساوت أيضاً الشباهيات فى إنتاجها و جاءت شجرة الكتر فى المرتبه الأخيره فى الحصدتين الثانيه والثالثه (شهرين وثلاثه شهور). كذلك أثبتت الدراسه بأن تأثير العوامل (الرى، نوع الأشجار) لكل صفات النمو تعتمد على تأثير الزمن (العمر) . حيث كانت هنالك فروقات معنوية فى الثلاث حصدات (شهر، شهرين وثلاثه شهور) بالنسبه للعامل (نوع الأشجار) بينما لا توجد فروقات معنويه بالنسبه لعامل الرى فى المجموع الخضرى بينما كانت هنالك بعض الفروقات المعنويه لعامل الرى فى المجموع الجذرى فى الحصده الأولى (شهر) وهنالك فروقات معنويه للعامل (نوع الأشجار) فى المجموع الجذرى فى الحصدتين الثانيه والثالثه (شهرين وثلاثه شهور). وكذلك أثبتت الدراسه وجود فروقات معنوية للعامل (نوع الأشجار) فى إنتاج العقد البكتيرييه فى الحصده

الثالثة (ثلاثة شهور) بينما لا توجد فروقات معنوية بالنسبة لعامل الرى فى جميع الحصص (شهر، شهرين وثلاثة شهور).

أثبتت الدراسة أن هناك نسبة تشابه بين الشباهيات فيما بينها تساوى 58 % و النسبه بين شباهى الهشاب والهشاب أيضاً 53% بينما نسبة التشابه بين الهشاب وشباهى الكتر تساوى 47% و كذلك بلغت نسبة تشابه الكتر وشباهى الكتر 53% وبين الكتر و شباهى الهشاب 53% ونسبة التشابه بين الكتر والهشاب تساوى 58%.

وقد أوصت الدراسة بمزيد من الدراسة فى ترتيب و تصنيف الشباهيات و إيجاد تسميه علمية لها و أيضاً أوصت الدراسة بدراسة الجينات الوراثيه و تشريح الخلايا (البذور والأخشاب) و أيضاً أوصت الدراسة بزراعة حقول بستانيه محسنه لهذه الأنواع الأربعة كل على حده حتى يمكن متابعة تطور نموها فى الأجيال القادمه وتقييم منتجاتها من الأصماغ وغيرها.

TABLE OF CONTENTS

	Page
Acknowledgement	i
Abstract	li
Arabic abstract	vi
Table of contents	ix
List of tables	xiii
List of figures	xvi
Abbreviations	xvii
Chapter one Introduction	1
1.1 Sudan forests	1
1.1.1 Natural forests	1
1.1.2 Plantation forests	2
1.2 Sudan Acacias	2
1.2.1 Variation within the genus Acacia	2
1.2.2 Distribution and environmental importance of Acacias	5
1.2.3 Economic importance of Acacias	6
1.2.4 Taxonomy of Acacia species	6
1.3 Species under study	7
1.3.1 <i>Acacia senegal</i>	7
1.3.2 <i>Acacia mellifera</i>	7
1.3.3 <i>Acacia laeta</i>	7
1.4 <i>Acacia mellifera (Vahl) Benth</i>	7

1.4.1 Description	8
1.4.2 Distribution	8
1.4.3 Uses and economic importance of <i>Acacia mellifera</i>	8
1.4.4 Tree requirement	9
1.5 <i>Acacia senegal (L) willd.var.senegal</i> Brenan	9
1.5.1 Botanic description	9
1.5.2 Distribution	10
1.5.3 Uses	10
1.6 <i>Acacia laeta R.Br.ex Benth</i>	11
1.6.1 Brief description	11
1.6.1.1 Shubahi Hashab tree	11
1.6.1.2 Shubahi Kitir tree	12
1.7 Choice of species	12
1.8 Increase in seed demands	13
1.9 Species under study	13
1.9.1 Research problem	14
1.9.2 Research objectives	14
Chapter two Literature review	15
2.1 Natural hybridization	15
2.2 Environmental influences and geographic variation	16
2.3 Regional differences in ecology and genetic systems	16
2.3.1 Temperate and Boreal regions	17
2.3.2 Tropical regions	17
2.3.3 Savanna and subtropical regions	17
2.4 The main problems of tree seed	18
2.5 Seed storage	18
2.6 Natural longevity of tree seeds	19
2.7 Factors affecting longevity of storage	20
2.8 Choice of stored methods	23
2.8.1 Storage at ambient temperature and humidity	23
2.8.2 Dry storage with control of both MC and temperature	23
2.8.3 Dry storage with control of MC but not temperature	24
2.8.4 Dry storage for long-term gene conservation	24
2.9 Storage containers	24
2.9.1 Materials permeable to moisture and gases	24
2.9.2 Materials completely impermeable, when sealed, to moisture and gases	24
2.9.3 Materials resistant, but not completely impermeable to moisture	25
2.10 Use of desiccant in containers	25
2.11 Plant water relations (water stress)	25
Chapter three Materials and methods	28
3.1 Seed collection, extraction, cleaning, measurement and testing	28
3.1.1 Seed collection, extraction and cleaning	28
3.1.2 Drawing of a working sample for seed testing	30
3.1.3 Testing & measurements of seed characteristics	30
3.1.3.1 Cutting test	30
3.1.3.2 Tetrazolium test	31

3.1.3.3 Determination of seed moisture content	31
3.1.3.4 Germination test (germination percent)	32
3.1.3.5 Seed response to soaking in water	32
3.1.4 Measurements of pod and seed characteristics	33
3.1.4.1 Pod length and width and the number of seed per pods	33
3.1.4.2 Seed length, width, size and shape indices	33
3.1.4.3 Number of seed per kilogram	33
3.1.4.4 Purity percentage analysis	34
3.2 Seedling juvenile development of <i>A.senegal</i> , <i>A.mellifera</i> and the two Shubahis	35
3.3 Herbarium specimens	37
3.4 Data analysis	37
Chapter four Results and Discussion	38
4.1 Morphological characters	38
4.1.1 Leaf parameters	38
4.2 Pod parameters	42
4.3 Seed characteristics	44
4.3.1 Seed weight & number of seed /kg	47
4.3.2 Moisture content	48
4.3.3 Response of seed of <i>A.senegal</i> , <i>A.mellifera</i> and their Shubahis to soaking in water for two months	49
4.3.4 Seed viability	52
4.3.5 Germination rate %	53
4.4 Seedlings performance	58
4.4.1 Shoot system	58
4.4.1.1 Shoot length	58
4.4.1.2 Shoot dry weight	63
4.4.1.3 Branches number	66
4.4.1.4 Leaves number	67
4.4.2 Root system	69
4.4.2.1 Root length	69
4.4.2.2 Root dry weight	72
4.4.2.3 Nodules number	75
4.4.3 Shoot/Root Ratio	77
Chapter five Conclusion and Recommendation	85
5.1 Conclusions	85
5.1.1 Morphological characters	85
5.1.2 Seed and pods parameters	85
5.1.3 Seedlings performance	86
5.2 Recommendations	87
References	88

LIST OF TABLES

Table 1 Leaf parameters of <i>A.senegal</i> , <i>A.mellifera</i> and their Shubahis	38
Table 2 Morphological similarities between <i>A.senegal</i> , <i>A.mellifera</i> and their Shubahis	38
Table 3 Pod parameters of <i>A.senegal</i> , <i>A.mellifera</i> and their Shubahis	42
Table 4 Mean seed characteristics of <i>A.senegal</i> , <i>A.mellifera</i> and their Shubahis	44
Table 5 Seed weight of <i>A.senegal</i> , <i>A.mellifera</i> and their Shubahis	47
Table 6 Mean moisture content (M.C) of each of <i>A.senegal</i> , <i>A.mellifera</i> and their Shubahis during storage period	48
Table 7 Effect of soaking time (8 weeks) on seeds of <i>A.senegal</i> , <i>A.mellifera</i> and their Shubahis	51
Table 8a Seed viability of the <i>A.senegal</i> , <i>A.mellifera</i> and their Shubahis as tested By tetrazolium (T.T.Z)	52
Table 8b Test of seed viability of the <i>A.senegal</i> , <i>A.mellifera</i> and their Shubahis by using cutting	52
Table 9a Mean germination rate of the <i>A.senegal</i> , <i>A.mellifera</i> and their Shubahis under different storage conditions	53
Table 9b Germination rate of the treated seeds of <i>A.senegal</i> , <i>A.mellifera</i> and their Shubahis after different periods of storage	54
Table 9c Germination rate of the untreated seeds of <i>A.senegal</i> , <i>A.mellifera</i> and their Shubahis after different periods of storage	56
Table 9d Effect of treatment on the germination rate % of <i>A.senegal</i> , <i>A.mellifera</i> and their after 12 months on the cold store ($12 \pm 1^{\circ}$ C)	57
Table 10a Mean shoot length (cm) of seedling of the <i>A.senegal</i> , <i>A.mellifera</i> and their Shubahis at three different ages	58
Table 10b Effect of different irrigation regimes on the growth of seedlings (cm) of <i>A.senegal</i> , <i>A.mellifera</i> and their Shubahis at three different ages	59

Table 11a Mean shoot dry weight (g) of seedling of the <i>A.senegal</i> , <i>A.mellifera</i> and their at three different ages	63
Table 11b Effect of the watering regimes on shoot dry weight (g) of seedlings of <i>A.senegal</i> , <i>A.mellifera</i> and their Shubahis at three different ages	64
Table 12a Mean number of branches per seedlings of <i>A.senegal</i> , <i>A.mellifera</i> and their Shubahis at three different ages	66
Table 12b Mean number of branches of the seedlings of <i>A.senegal</i> , <i>A.mellifera</i> and their Shubahis at three irrigation regimes	66
Table 13a Mean number of leaves per seedlings of the <i>A.senegal</i> , <i>A.mellifera</i> and their Shubahis at different three ages	67
Table 13b Effect of watering regimes on number of leaves of <i>A.senegal</i> , <i>A.mellifera</i> and their Shubahis at three different ages	68
Table 14a Mean of root length (cm) of seedlings of <i>A.senegal</i> , <i>A.mellifera</i> and their Shubahis at three different ages	69
Table 14b Mean of root length (cm) of the seedlings of <i>A.senegal</i> , <i>A.mellifera</i> and their Shubahis at three irrigation regimes	71
Table 15a Mean of root dry weight (cm) of seedlings of <i>A.senegal</i> , <i>A.mellifera</i> and their Shubahis	72
Table 15b Effect of the watering regimes on root dry weight (g) of the seedlings of the <i>A.senegal</i> , <i>A.mellifera</i> and their Shubahis at three different ages	74
Table 16a Mean number of nodules per seedlings of <i>A.senegal</i> , <i>A.mellifera</i> and their Shubahis at three different ages	75
Table 16b Effect of different irrigation regimes on number of nodules per seedlings of <i>A.senegal</i> , <i>A.mellifera</i> and their Shubahis at three different ages	76
Table 17a Mean shoot: root ratio of seedlings <i>A.senegal</i> , <i>A.mellifera</i> and their Shubahis at different ages	77
Table 17b Effect of different watering regimes on shoot: root ratio of the seedlings of <i>A.senegal</i> , <i>A.mellifera</i> and their Shubahis at three different ages	78
Table 18 Summary of level of significant between the <i>A.senegal</i> , <i>A.mellifera</i> and their Shubahis in shoot and root parameters	80
Table 18 (continued)	81
Table 19 Summary of level of significance of irrigation on shoot & root parameters <i>A.senegal</i> , <i>A.mellifera</i> and their Shubahis	82
Table 19 (continued)	83
Table 20 Index of similarities between <i>A.senegal</i> , <i>A.mellifera</i> and their Shubahis(%) in seed characteristics	84

LIST OF FIGURES

Figure 1 Map showing the location of study area	29
Figure 2 <i>A.senegal</i> and Shubahi Hashab trees	40
Figure 3 <i>Acacia mellifera</i> tree and Shubahi Kitir trees	41
Figure 4 Pods of <i>A.senegal</i> , <i>A.mellifera</i> and their Shubahis	43

Figure 5 Seed characteristics (cm) of the <i>A.senegal</i> , <i>A.mellifera</i> and their Shubahis	45
Figure 6 Seeds of <i>A.senegal</i> , <i>A.mellifera</i> and their Shubahis	46
Figure 7 Average shoot length (cm) of the seedlings of <i>A.senegal</i> , <i>A.mellifera</i> and their Shubahis at three different ages (months)	61
Figure 8 Twigs of <i>A.senegal</i> , <i>A.mellifera</i> and their Shubahis	62
Figure 9 Shoot dry weight (g) of seedlings of <i>A.senegal</i> , <i>A.mellifera</i> and their Shubahis at three different ages (months)	65
Figure 10 Root length (cm) of seedlings of <i>A.senegal</i> , <i>A.mellifera</i> and their Shubahis at three different ages (months)	70
Figure 11 Root dry weight (g) of seedlings of <i>A.senegal</i> , <i>A.mellifera</i> and their Shubahis at three different ages (months)	73

ABBREVIATIONS&ACRONYMS

Hybrid	Intermediate species, created from out crossing of two or more species
Shubahi Hashab	Its the first morphological form of <i>A.laeta</i> , which is very similar to <i>A.senegal</i> in morphological characters
Shubahi Kitir	It's the second morphological form of <i>A.laeta</i> , which is very similar To <i>A.mellifera</i> in morphological characters
Hashab	<i>A.senegal</i> tree
Kitir	<i>A.mellifera</i> tree

FNC	Forest National Corporation
ISTA	International Seed Testing Association
MC	Moisture content
RH	Relative humidity
Gardud	Loamy soil
IBPGR	International Board for Plant Genetic Resources
F₁	First vital generation.
VPD	Vapour pressure deficient
MP_a	Ma Molecular weight of air
	P Atmospheric pressure
DNA	Deoxy Nucleic Acid
Jerican	A container for seed storage, which is made from plastic material
Chemo	Study of chemical components of the plant parts