

بِسْمِ اللّٰهِ الرَّحْمٰنِ الرَّحِیْمِ

Sudan University of Science and Technology
College of Graduate Studies

**Studies on Genetic Diversity, Seedlings performance
and Rooting of Cuttings of *Albizia lebbeck* (L.) Benth.
Trees Grown in Khartoum State-Sudan**

**دراسات في التنوع الوراثي ومراحل نمو الشتول
وتجذير العقل لشجرة دقن الباشا في ولاية الخرطوم ،
السودان**

A Thesis submitted for fulfillment of the requirements for the
degree of Master of Science in Forestry

By

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Dedication

*To my family,
My parents,
My brothers,
My sisters,*

*Who helped me to make this success.
To those who never refrained from
rendering their help when I need,*

*And all my dear friends
I dedicate this work*

With sincere love.....

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Abstract

STUDIES ON GENETIC DIVERSITY, SEEDLINGS PERFORMANCE AND ROOTING OF CUTTINGS OF ALBIZIA LEBBECK (L.) Benth. GROWN IN KHARTOUM STATE-SUDAN

Albizia lebbek is a multipurpose, fast-growing tree species widely grown in the tropical region. It has been introduced to the Sudan before since the sixty of last century and was basically used as an ornamental or shade tree across the country landscape including roads, parks and dwellings. However, trees of *Albizia lebbek* growing in Khartoum state show two distinct crown forms viz. round (RC) and irregular crown (IC). Because no information exists about the original sources of its introduction, especially the provenances or the genotypes, consequently it has been found difficult to say with certainty whether this variation in this very important characteristics is genetically controlled or due to environment x genotype interaction.

The present work is an attempt forward to study the genetic variation between the two crown ideotypes displayed by the tree populations grown within Khartoum state in the Sudan. In this connection, an investigation into the genetic variation was conducted using random amplified polymorphic DNA (RAPD) analysis. Using four RAPD primers a total of 40 polymorphic bands out of 43 were detected. The Shannon's index and Nie's genetic diversity were used to partition the variation. Nonetheless, comparisons showed high similarities between the two crown ideotypes viz. RC and IC.

In addition, a nursery experiment was conducted to study the early growth characteristic related to crown form. Seedlings showed significant differences between the two crown ideotypes for crown length, crown

diameter, branch length, number of leaves and crown /stem ratio but not for stem length and number of branches characteristics.

To complete the picture a rooting of cutting experiment was undertaken using IBA at concentrations of 0.00, 400 and 800 ppm. Analysis of variance showed highly significant differences between the effects of the IBA concentrations for the number of roots produced but neither for the root length nor the shoot/root ratio characteristics. However, IBA at 400 ppm produced the biggest mean number of roots per stem cutting. Results were discussed on the basis of assumed genetic variation in crown form of *Albizia lebbeck* and the consequences of the possibility of the production of the desired form using juvenile seedlings phenotypic characteristics. Further more, the study explored the possibility of establishing a rooting of stem cutting protocol in an effort to standardize vegetative propagation technique for the species in Sudan in case it is needed to produce seedlings clonally.

الخلاصة

دراسات في التنوع الوراثي ومراحل نمو الشتول وتجذير العقل لشجرة دقن الباشا في ولاية الخرطوم ، السودان

شجرة دقن الباشا شجرة متعددة الاغراض ،سريعة النمو وتزرع بصورة واسعة في المناطق المدارية في العالم. تم استجلابها الى السودان قبل ستينات القرن الماضي وتستخدم بصورة اساسية كشجرة زينة او ظل لتحسين المناظر الطبيعية في القطر التي تشمل الطرق و الحدائق والمسكن . على كل حال فان اشجار دقن الباشا المزروعة في ولاية الخرطوم اظهرت شكليين مختلفين من التاج هما: تاج مستدير منتظم (RC) وتاج غير منتظم الاستدارة (IC). وبما انه لا توجد مصادر و معلومات متوفره عن أصول مصدر الإستجلاب خاصة فيما يتعلق بالطراز الوراثي فإنه من الصعب التأكيد على ان هذه الإختلافات فى صفات مهمه للشجرة تتحكم فيها وراثيا أو أنها نتاج تفاعل وراثي- بيئي.

الهدف من هذا البحث هو دراسة الإختلافات الوراثية بين شكلي التاج التي اظهرت بواسطة عشائر الشجرة الموجوده داخل ولاية الخرطوم بالسودان. فى هذا الصدد، فقد تم إجراء إستقصاء التباين الوراثي بإستخدام تحليل (RAPD) وذلك بإستخدام أربعة من بادئات (RAPD) ، مجموع اربعين حزمة من ثلاثة واربعين تم تحديدها . استخدم مؤشر شانون والتباين الوراثي (ني) للتفريق بين المتباينات.مع ذلك، فالمقارنة اوضحت تشابه عاليا بين شكلي التاج (IC وRC).

اضافة الى ذلك ، تم اجراء دراسة خصائص النمو الاولية المرتبطة بشكل التاج . اظهرت الشتول اختلافاً معنوية بين شكلي التاج و قطر التاج و طول الافرع و عدد الاوراق و نسبة التاج / الساق، ولكن ليس لطول الساق وعدد الافرع .

لاكمال الصورة فانه تم اجراء تجربة تجذير للعقل باستخدام هرمون IBA بتركيز 0.0 و 400 و 800 جزء / المليون .

تحليل التباين اظهر مستوى تباين معنوي كبير في تأثير IBA بين التراكيز المختلفة لعدد الجذور التي تم احداثها ولكن ليس لطول الجذور ولا لنسبة المجموع الخضري / الجذري . على كل حال فان تركيز IBA عند 400 جزء للمليون احدث اكبر متوسط لعدد الجذور لكل عقلة.

تمت مناقشة النتائج على اساس التباين الوراثي المفترض في شكل التاج لشجرة دقن الباشا ونتيجة امكانية انتاج شكل التاج المرغوب فيه باستخدام شتول صغيرة العمر اكثر من ذلك ، الدراسة استكشفت امكانية تاسيس بروتوكول التجذير للعقل الساقية كجهد لتحديد تقنية الاكثار الخضري للنوع في السودان في حالة الاحتياج لانتاج الشتول استنساخيا.

LIST OF ABBREVIATIONS

PCR	Polymerase Chain Reaction
AFLP	Amplified Fragment Length Polymorphisms
DAF	DNA Amplification Fingerprinting
NAA	Naphthalene Acetic Acid
RAPD	Random Amplified Polymorphic DNA
SSR	Simple Sequence Repeats
Kb	Kilo Base Pair
MgCl ₂	Magnesium Chloride
bp	Base Pair
EDTA	Ethylene Diamine Tetra Acetic Acid
OPA	Operon Primer Set - A
SDS	Sodium Dodecyl Sulphate
TE	Tris – EDTA
UV	Ultra Violet
DNTP	Deoxyribonucleotide Triphosphate
Taq	Thermus Aquaticus
UPGMA	Unweighted Pair Group Method with Arithmetic Averages
RLFP	Restriction Fragment Length Polymorphisms
SPAR	Single Primer Amplification Reaction
IBA	Indole Butyric Acid
MAAP	Multiple Arbitrary Amplicon Profiling
ISSR	Inter-Simple Sequence Repeat