

**EFFECT OF MEDIA COMPOSITIONS, CYTOKININS AND
AUXIN ON BUD PROLIFERATION, CALLUS AND
SOMATIC EMBRYOGENESIS INDUCTION ON
SOLOMON TEAK
(*Tectona grandis L.*)**

DYAGA FOLLEN MKOMWA



**PLANT BREEDING AND BIOTECHNOLOGY STUDY PROGRAM
FACULTY OF AGRICULTURE
INSTITUT PERTANIAN BOGOR
BOGOR
2026**



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RINGKASAN

DYAGA FOLLEN MKOMWA. Pengaruh Komposisi Media, Sitokinin, dan Auksin terhadap Proliferasi Tunas, Induksi Kalus, dan Embriogenesis Somatik pada Jati Solomon (*Tectona grandis* L.). Dibimbing oleh DARDA EFENDI dan DEWI SUKMA.

Jati Solomon (*Tectona grandis* L.) merupakan klon unggul dengan pertumbuhan cepat dan kualitas kayu yang tinggi, namun perbanyakannya masih menghadapi kendala akibat rendahnya viabilitas benih serta keterbatasan metode perbanyakan vegetatif secara konvensional. Kultur jaringan menjadi salah satu alternatif yang menjanjikan untuk menghasilkan bibit dalam jumlah besar, seragam secara genetik, dan tersedia sepanjang tahun. Penelitian ini bertujuan mengoptimalkan proliferasi tunas serta mengembangkan sistem induksi kalus sebagai dasar pembentukan kalus embriogenik dalam perbanyakan in vitro jati Solomon.

Penelitian ini terdiri atas dua percobaan. Percobaan pertama mengevaluasi pengaruh dua media dasar, yaitu Murashige dan Skoog (MS) dan Woody Plant Medium (WPM), yang dikombinasikan dengan benzylaminopurine (BAP) pada konsentrasi 6, 8, 10, dan 12 mg L⁻¹ terhadap proliferasi tunas dari eksplan buku tunggal. Percobaan kedua dilakukan dalam tiga tahap. Tahap pertama mengevaluasi pengaruh kombinasi thidiazuron (TDZ) 3 mg L⁻¹ dengan indole-3-butyric acid (IBA) pada konsentrasi 0,01; 0,05; 0,10; dan 0,15 mg L⁻¹ terhadap induksi dan pertumbuhan kalus dari eksplan ruas batang. Tahap kedua menguji pengaruh TDZ pada konsentrasi 0,1; 1; dan 3 mg L⁻¹ terhadap pertumbuhan kalus, sedangkan tahap ketiga mengevaluasi respons kalus hasil tahap kedua setelah disubkultur ke media MS yang mengandung TDZ 6 atau 8 mg L⁻¹.

Hasil penelitian menunjukkan bahwa media WPM yang diperkaya BAP menghasilkan proliferasi tunas lebih tinggi dibandingkan media MS, dengan rata-rata tiga hingga lima tunas per eksplan, sedangkan media MS hanya menghasilkan sekitar dua tunas. Pada tahap induksi kalus, seluruh kombinasi media menghasilkan kalus kompak dan belum mampu menginduksi kalus embriogenik secara langsung. Namun, setelah disubkultur ke media yang mengandung TDZ 6 atau 8 mg L⁻¹, kalus mengalami perubahan morfologi yang menunjukkan karakteristik kalus embriogenik. Temuan ini mengindikasikan bahwa peningkatan konsentrasi TDZ pada tahap subkultur berpotensi meningkatkan kompetensi embriogenik kalus.

Secara keseluruhan, penelitian ini berhasil mengidentifikasi media yang efektif untuk proliferasi tunas serta menunjukkan pendekatan yang berpotensi dalam menghasilkan kalus dengan karakteristik embriogenik pada jati Solomon. Hasil penelitian ini diharapkan menjadi dasar pengembangan sistem regenerasi in vitro yang lebih efisien untuk mendukung perbanyakan massal, konservasi plasma nutfah, serta program pemuliaan dan bioteknologi jati.

Kata kunci: Embriogenesis somatik, Induksi kalus, Jati Solomon, Media dasar, Proliferasi tunas, TDZ.



SUMMARY

DYAGA FOLLEN MKOMWA. Effect of Media Compositions, Cytokinins, and Auxin on Bud Proliferation, Callus Induction, and Somatic Embryogenesis on Solomon teak (*Tectona grandis* L.). Supervised by DARDA EFENDI and DEWI SUKMA.

The Solomon teak (*Tectona grandis* L.) is a superior clone with fast growth and good quality wood. However, its multiplication is still a problem because of the low viability of the seeds and the limitations of typical vegetative propagation methods. Plant tissue culture has become one of the promising alternatives for mass production of genetically uniform planting materials available throughout the year. The present study was undertaken to optimize shoot proliferation and to develop a callus induction system for in vitro propagation of Solomon teak as a basis for embryogenic callus formation.

This study consisted of two experiments. The first experiment evaluated the effects of two basal media, Murashige and Skoog (MS) and Woody Plant Medium (WPM), supplemented with benzylaminopurine (BAP) at concentrations of 6, 8, 10, and 12 mg L⁻¹ on bud proliferation from single-node explants. The second experiment comprised three sequential stages. Experiment 2a evaluated the effect of different concentrations of indole-3-butyric acid (IBA; 0.01, 0.05, 0.10, and 0.15 mg L⁻¹) on callus induction from 0.5 cm internode explants cultured on MS medium containing a constant concentration of 3 mg L⁻¹ thidiazuron (TDZ). Experiment 2b investigated the effects of TDZ (0.1, 1.0, and 3.0 mg L⁻¹) in MS and WPM media on callus induction. Experiment 2c evaluated somatic embryogenesis by transferring calli from the most responsive treatment in Experiment 2b onto MS medium supplemented with 2 mg L⁻¹ BAP, 5 mM Ascorbic acid (AA), and either 6 or 8 mg L⁻¹ TDZ.

The results showed that WPM supplemented with BAP promoted greater shoot proliferation than MS medium, producing three to five shoots per explant compared with approximately two shoots on MS medium. In Experiment 2a, varying the IBA concentration influenced callus development, with all treatments producing compact white callus but none directly inducing embryogenic callus. In Experiment 2b, MS medium supplemented with 0.1 mg L⁻¹ TDZ produced the healthiest and most vigorous callus, making it the most suitable material for subsequent embryogenesis. In Experiment 2c, subculturing these calli onto media containing 6 or 8 mg L⁻¹ TDZ induced marked morphological changes, including cream-to-yellowish nodular structures and densely stained meristematic cells characteristic of embryogenic callus. These findings indicate that while IBA concentration affected callus formation during the initial induction stage, increasing TDZ concentration during subculture enhanced embryogenic competence and provided a promising approach for somatic embryogenesis in Solomon teak.

Therefore, the present work identified an effective medium for bud development and presented a potential technique in creating calluses with embryogenic features in Solomon teak. The results of this research are likely to serve as the foundation for designing a more effective in vitro regeneration system to promote mass propagation, germplasm conservation and teak breeding and biotechnology efforts.

Keywords: Basic medium, bud proliferation, somatic embryogenesis, Solomon teak, TDZ, callus induction.



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DYAGA FOLLEN MKOMWA

Thesis

Proposal submitted as one of the requirements for obtaining
a master's degree
in the Plant Breeding and Biotechnology Study Program

**PLANT BREEDING AND BIOTECHNOLOGY STUDY PROGRAM
FACULTY OF AGRICULTURE
INSTITUT PERTANIAN BOGOR
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PREFACE

All praise and gratitude are due to Allah SWT for His blessings, mercy, guidance, and strength that have enabled the author to complete this thesis entitled “Effect of Media Compositions, Cytokinins and Auxin on Bud Proliferation, Callus and Somatic Embryogenesis Induction on Solomon teak (*Tectona grandis* L.)”. This thesis was prepared as one of the requirements for obtaining the degree of Master of Science in Plant Breeding and Biotechnology at IPB University. The author would like to express sincere gratitude and appreciation to the supervisory committee, supervisors Prof. Dr. Ir. Darda Efendi M.Si and Prof. Dr. Dewi Sukma S.P. M.Si. for their valuable guidance, constructive suggestions, encouragement, and support throughout the research and thesis writing process. The author also extends appreciation to the lecturers and staff of the Department of Agronomy and Horticulture, IPB University, for their assistance and support during the study period.

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Special thanks are dedicated to the author’s family and friends for their prayers, unconditional support, motivation, and encouragement. Their belief in the author has been a constant source of strength throughout this journey.

The author realizes that this thesis is not free from limitations and imperfections. It is hoped that this thesis will contribute to the advancement of knowledge in Teak tissue culture and provide useful information for researchers, regulatory agencies, and forest sectors.

Bogor, August 2026

Dyaga Follen Mkomwa



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TABLE OF CONTENTS

LIST OF TABLES	iii
LIST OF FIGURES	iii
LIST OF APPENDIX	iv
I INTRODUCTION	1
1.1 Background	1
1.2 Problem Statement	3
1.3 Research Objectives	4
1.4 Benefits of the Study	4
II LITERATURE REVIEW	6
2.1 Tissue Culture in Forestry	6
2.2 Callogenesis and Somatic Embryogenesis	8
2.3 Teak Biology and Economic Importance	9
2.4 Phenolic compound	10
2.5 Browning Control in Tissue Culture	10
2.6 Contamination on Tissue Culture	12
III METHODS	13
3.1 Materials and Methods	13
3.2 Time and Place	13
3.3 Plant Material and Preparation	13
3.4 Culture Media and Sterilization	13
3.5 Experimental Design	13
3.6 Culture Conditions and Maintenance	14
3.7 Data Collection and Statistical Analysis	14
3.7.1 Growth and morphological parameters	14
3.7.2 Measurement of Callus Area Using ImageJ	15
3.7.3 Histological Preparation and Microscopic Observation	16
3.7.4 Calculation of Growth and Response Variables	16
3.7.5 Shoot Efficiency Index (SEI)	17
3.7.6 Statistical Analysis	18
IV RESULT AND DISCUSSION	19
4.1 Experiment 1: Effect of BAP and Basal Media on lateral bud proliferation	19
4.1.1 Culture sterility and Contamination Frequency	19
4.1.2 Explant Survival Dynamics	19
4.1.3 Shoot Height	20
4.1.4 Shoot Number	22
4.1.5 Nodes Number	23
4.1.6 Internode Length	23
4.1.7 Total Shoot Height	24
4.1.8 Shoot Formation Efficiency and Performance Metrics	24
4.1.9 Morphogenic Trade-offs and Proliferation Kinetics	26
4.1.10 Leaf Number	27
4.1.11 Leaf Area and Temporal Development	29
4.2 Experiment 2a: Callus induction	31
4.3 Experiment 2b: Callus induction	32
4.4 Experiment 2c: Somatic Embryogenesis and Callus Performance	34



4.4.1 Histological Observations	34
V CONCLUSION AND RECOMMENDATION	37
5.1 Conclusion	37
5.2 Recommendation	37
REFERENCE	38
APPENDIX	42
BIOGRAPHY	47

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LIST OF TABLES

1	Analysis of Variance (ANOVA) for the effects of medium and BAP concentration	16
2	Tukey's HSD grouping, means shoot height, shoot number, nodes number, internode length and total on different media and BAP concentration	17
3	Analysis of Variance (ANOVA) for the effects of medium and BAP concentration on leaf production	22
4	Tukey's HSD grouping, mean number of leaves on different media and BAP concentration	22
5	Two-way ANOVA for the effects of medium and BAP concentration on leaf area	23
6	Callus induction percentage under different concentrations	26
7	Analysis of variance (ANOVA) for the effects of basal medium, BAP concentration, and their interaction on callus area of Solomon teak in vitro.	27
8	Effect of basal media and BAP on callus induction and callus area in Solomon Teak	27
9	Callus performance (originated from MS + 0.1 mgL ⁻¹ TDZ) on transfer media supplemented with 2 mgL ⁻¹ BA + 5 mM AA and 6 or 8 mgL ⁻¹ TDZ.	28

LIST OF FIGURES

1	Research flow chart	5
2	Tissue culture (Singh 2022)	7
3	Comparative analysis of contamination in MS and WPM media under varying BAP level	15
4	Comparative analysis of survival in MS and WPM media under varying BAP levels	15
5	Effect of BAP concentration on shoot induction frequency	19
6	Effect of BAP Concentration and Culture Medium on SEI	19
7	Effects of BAP on (A) percentage of explant forming shoot (B) shoot number (C) shoot height	20
8	Relationship between mean shoot number and mean shoot height	20
9	Leaf production response under different culture media and BAP levels	22
10	Effects of MS and WPM media supplemented with BAP on leaf growth	24
11	Weekly trend of leaf area development under different BAP treatments	24
12	Representative morphology of Solomon teak (<i>Tectona grandis</i> L.) plantlets cultured on MS and WPM supplemented with different concentrations of BAP, showing differences in shoot proliferation and basal callus formation after 7 weeks of <i>in vitro</i> culture	25
13	Effect of IBA Concentrations on Callus Area Development	26
14	Histological section of compact callus tissue showing organized cellular arrangement and localized regions of enhanced stain uptake, suggestive of morphogenically active tissue	29



LIST OF APPENDIX

1	Composition of Murashige and Skoog (MS) basal medium used in the study	43
2	Composition of McCown Woody Plant Medium (WPM) used in the study	43
3	PGRs and supplements used in the experiments	44
4	Picture show the type of explants used through the experiment	45
5	Demonstrate the orientation of the ruler	45