



UNIVERSITI PUTRA MALAYSIA

**EFFICACY OF FUNGICIDE AGAINST MOULD (*FUSARIUM SOLANI*
SACC.) AND STAIN (*LASIODIPLODIA THEOBROMAE* PAT.) FUNGI
ON FOUR CLONES OF HEVEAWOOD**

NORIDAH OSMAN

FH 2001 15



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ON FOUR CLONES OF HEVEAWOOD**

By

NORIDAH OSMAN

**Thesis Submitted in Fulfilment of the Requirement for the
Degree of Master of Science in Faculty of Forestry
Universiti Putra Malaysia**

March 2001



DEDICATION

Inspiration & Aspiration

IN LOVING MEMORY of MY LATE BELOVED FATHER
ARWAHYARHAM OSMAN B. HASHIM
THE FOUNDATION OF MY ACADEMIC CAREER,

MY LATE BELOVED GREAT GRANDMOTHER
ARWAHYARHAMAH SAENAH BT. TAHA,

AND

To my mother, RUSIAH@RASEAH JALIL; my grand mother,
JERIAH PERAL; my brother, IKWAN OSMAN;
my sister FARY AKMAL OSMAN; my youngest brother,
LOKMAN HAKIM OSMAN; my youngest sister,
TEH ZAWAHIR OSMAN, my antie, my uncle,
ROHIZA ATAN & READZUAN YUSOF



Abstract of thesis presented to the Senate of the Universiti Putra Malaysia in fulfilment of the requirement for the degree of Master of Science

EFFICACY OF FUNGICIDE AGAINST *FUSARIUM SOLANI* SACC. AND *LASIODIPLODIA THEOBROMAE* PAT. FUNGI ON FOUR CLONES OF HEVEAWOOD

By

NORIDAH OSMAN

March 2001

Chairman : Zaidon Ashaari, Ph.D

Faculty : Forestry

New formulations of safe preservatives are being searched to treat heveawood to resolve discolouration problem so as to preserve and protect its original colour.

Sodium pentachlorophenate (NaPCP) has been widely used to control stain fungi on heveawood. However, this substance has been phased out due to its mamalian hazardous. This study was conducted to determine the efficacy of Evotek® 230 SE against wood staining fungi on four clones of heveawood.

A formulation of Evotek® 230 SE was tested at various concentrations to control wood staining fungi in four clones of heveawood. The solution concentrations used in this study were 0.1, 0.25 and 0.5 %. A concentration level of 0.5 and 1% for sodium pentachlorophenate was used as a standard.



Laboratory studies using freshly cut heveawood blocks, demonstrated the anti-fungal properties of Evotek® 230 SE. This formulation was effective for protection against stain fungi at a low level (0.1%) while sodium pentachlorophenate was effective only at 1.0%.

The efficacy of this formulation against *Fusarium solani* and *Lasiodiplodia theobromae* on different clones of heveawood was also observed. Evotek® 230 SE was effective to protect clones IAN 873 and RRIM 703 at low concentration (0.1%). However, RRIM 600 required higher concentration more than 0.25% to control the growth of the fungi.

Clone RRIM 703 was found to be the most resistant against the stain fungi. This is followed by BPM9 and RRIM 600. The infection of stain was observed at the end of the 1st week of incubation for clones IAN 873 and RRIM 703 and for the other two clones, the symptom showed up at the beginning of the 1st week.

The higher the starch content, the higher the rate of infection, the less resistant of heveawood to fungi. This was demonstrated by the characteristic of clone RRIM 600. Wood treatment analysis revealed that starch content in the wood was one of important element in determining the performance of preservative.



Among the four clones, RRIM 600 (0.92 %) contained the highest amount of starch when compared to BPM9 (0.73 %), IAN 873 (0.48 %) and RRIM 703 (0.39 %).

A scanning electron microscope study revealed that the present of intervessel pits, simple perforation plates, tyloses, crystal and starch have implications on penetration of preservatives.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia
sebagai memenuhi keperluan untuk mendapatkan ijazah Master Sains

**KEBERKESANAN RACUN KULAT TERHADAP *FUSARIUM SOLANI*
SACC. AND *LASIODIPLODIA THEOBROMAE* PAT. PADA EMPAT
KLON KAYU GETAH**

Oleh

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Formulasi baru rawatan kayu getah dengan bahan kimia yang selamat masih dicari. Ia bertujuan mengatasi masalah kulat pewarna kayu getah sebagai mengekalkan dan mengawal warna asal kayu tersebut serta selamat buat pengguna.

Lazimnya, kayu getah akan direndam didalam bahan kimia selepas penebangan dilakukan. Bagi kilang-kilang kayu bahan kimia yang digunakan untuk mencegah serangan kulat pewarna ini adalah sodium pentachlorophenate (NaPCP). Meskipun, bahan kimia ini sangat berkesan mengawal masalah kulat pewarna tetapi, ia sangat beracun dan berbahaya kepada alam sekitar. Bahan kimia ini sekarang berada di dalam peringkat penyahgunaan.

Oleh itu, kajian ini bertujuan mencari bahan kimia baru dengan prestasi yang lebih baik bagi menggantikan kompoun NaPCP tadi. Formulasi bahan kimia baru



Evotek® 230 SE yang diiktirafkan lebih selamat telah diuji. Keberkesanannya diuji terhadap kulat pewarna kayu getah pada aras konsentrasi yang berbeza.

Di dalam kajian ini, pada aras konsentrasi 0.1%, 0.25% dan 0.5% bahan kimia Evotek® 230 SE diuji manakala aras konsentrasi 0.5% dan 1% bagi NaPCP digunakan sebagai kawalan. Kajian makmal ini bertujuan membentangkan unsur-unsur bahan kimia anti-kulat pewarna kayu getah.

Nyata, formulasi bahan kimia baru ini sangat berkesan mengatasi masalah kulat pewarna pada konsentrasi serendah 0.1% manakala kompon bahan kimia NaPCP berkesan pada konsentrasi lebih tinggi iaitu 1%. Dengan ini, bahan kimia baru Evotek® 230 SE adalah setanding dengan bahan kimia kawalan NaPCP. Ia berjaya menghalang kulat pewarna getah pada ketiga-tiga konsentrasi 0.1%, 0.25% dan 0.5%. Ini bermaksud, ia berupaya mengawal pertumbuhan kulat *Lasiodiplodia theobromae* dan *Fusarium solani*.

Kajian ini menunjukkan Evotek® 230 SE keberkesanan yang tinggi terhadap klon IAN873 dan RRIM703 walaupun pada konsentrasi yang rendah. Manakala, klon RRIM600 memerlukan konsentrasi yang tinggi pada 0.25% dan 0.5% untuk mencegah kulat pewarna.

Tahap perkembangan kulat juga berbeza di mana klon RRIM703 menunjukkan ketahanan yang lebih tinggi untuk dijangkiti kulat pewarna diikuti dengan klon

IAN873, klon BPM9 dan RRIM600. Klon RRIM600 amat mudah dijangkiti kulat pewarna *F. solani* dan *L. theobromae*. Jangkitan dapat dilihat pada awal pengkulturan dan klon yang lain pada penghujung minggu.

Semakin tinggi kandungan kanji semakin cepat serangan kulat dan semakin mudah kayu getah dijangkiti. Ini dibuktikan dengan klon RRIM600 yang mempunyai kandungan kanji yang tertinggi, Evotek® 230 SE gagal mencegah jangkitan kulat pewarna pada tahap konsentrasi yang rendah dan serangan awal kulat terhadap klon ini.

Kajian kandungan kanji dalam kayu getah menunjukkan bahawa klon RRIM600 mempunyai kandungan kanji tertinggi diikuti dengan klon BPM9, IAN873 dan RRIM703.

Penelitian mikroskop elektron menggambarkan bahawa kewujudan ‘intervessel’ pit/lubang, plat leliang, tilosis, hablur kristal dan kandungan kanji dalam kayu memberi kesan kepada penembusan bahan kimia. Unsur-unsur ini dapat dilihat pada klon-klon yang dikaji.

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I certify that an Examination Committee met on 8th March 2001 to conduct the final examination of Noridah Osman on her Master of Science thesis entitled "Efficacy of Fungicide Against Mould (*Fusarium solani* Sacc.) and Stain (*Lasiodiplodia theobromae* Pat.) Fungi on Four Clones of Heveawood" in accordance with Universiti Pertanian Malaysia (Higher Degree) Act 1980 and Universiti Pertanian Malaysia (Higher Degree) Regulations 1981. The Committee recommends that the candidate be awarded the relevant degree. Members of the Examination Committee are as follows:

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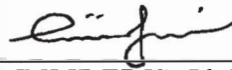


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Date: **12 JUL 2001**

DECLARATION

I hereby declare that the thesis is based on my original work except for quotations and citations which, have been duly acknowledged. I declare that it has not been previously or concurrently submitted for any other degree at UPM or other institutions.



(Noridah Osman)

Date: 8 May 2001

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LIST OF ABBREVIATIONS

ANOVA	Analysis of Variance
AVROS	Algemene Vereniging Rubberplanters Ooskust Sumatra
BPM	Balai Penelitian Medan, Indonesian
BS	British Standard
CPD	Critical of Point Dry
DNMRT	Duncan Multiple Range Test
FA	Ford Acre, Brazil
FRIM	Forest Research Institute of Malaysia
GLM	General Linear Model
IAN	Instituto Agronomico do Norte
LSD	Least significant difference
MA	Malt agar
MC	Moisture content
MDF	Medium density fibreboard
MS	Malaysian Standard
MTIB	Malaysian Timber Industry Board
NaPCP	Sodium pentachlorophenate
NUV	Near ultra violet
OD	Oven-dry
PB	Prang Besar, Malaysia
PDA	Potato dextrose agar
PEC	Per Cent Effective Control



p.s.i	Pound per square inch
RH	Relative humidity
RRIM	Rubber Research Institute of Malaysia
SEM	Scanning electron microscopic
SG	Specific gravity
SPSS	Statistical Package of Social Science
Tjir	Tjirandi, Indonesia



GLOSSARY

Dipping	Involves immersing the timber in the preservative for a short time
Discoloration	Any alteration of the natural colour of wood, which may be the result of weathering, of contact with chemicals or metals or of infection by fungi or moulds, or of other causes
Durability	The natural resistance of heartwood to destruction by wood-destroying organisms in conditions conducive to their growth
Hardwood	Conventionally a term used to denote the timber of trees, mostly broadleaved, and the trees themselves belonging to the botanical group <i>Angiosperms</i>
Mold	A woolly or powdery fungal growth that forms on the surface of wood in damp, stagnant atmospheres. Similar growth on other materials are popularly referred to as 'mildews'
Penetration	The depth to which preservative enters the wood
Pentachlorophenate, sodium (sodium PCP)	A salt of pentachlorophenol (PCP) used extensively for sapstain control treatment
Sapstain	A discoloration of timber resulting from the growth of certain fungi that derive their nourishment from the cell contents but do not cause decomposition of the timber. It is principally confined to sapwood. Blue stain is the most common form of sapstain. It is most commonly caused by fungi of the genera <i>Lasiodiplodia</i> and <i>Curvularia</i>
Sapstain control	The application of chemicals to green timber to protect it from sapstain



Sapwood	The outer layers of wood which, in the growing tree, contain living cells and reserve materials (e.g. starch); generally lighter in colour than heartwood though not always clearly differentiated. All sapwood has low natural durability
Stain	Blue, see sapstain
Surface treatment	Any treatment in which a liquid preservative is applied to the surface of timber by brushing, spraying or dipping
Wood preservative	A chemical or mixture of chemicals in a form suitable for application to wood in order to preserve it from attack by wood-destroying organisms

CHAPTER 1

INTRODUCTION

General Background

Malaysia through the Malaysian Timber Industry Board (MTIB) has been successful in promoting both heveawood products and heveawood as a timber in international and local market. Malaysian Timber bulletin (1998) reported about 80% Malaysia's furniture exports, which was expected to reach RM 3.2 billion in 1998 is made from heveawood (Anonymous, 1998). The demand has been increasing for the furniture manufacturing industry and it is estimated that in the next few years there will be an imminent shortfall in heveawood supply.

In order to sustain adequate supply and maintain the quality of heveawood production, a further step by integrating the heveawood growing and heveawood processing industry has been undertaken with the support of the Malaysian government.

Heveawood processing industry is incorporating wood preservation process as part of its operation. Wood preservation industry has been established in Malaysia since 1900. Since then, this industry gradually grows and become one of the important subjects in the heveawood industry.

