UNIVERSITI PUTRA MALAYSIA

PERIODICITY OF XYLEM GROWTH OF FOUR PLANTED TREE SPECIES FROM MALAYSIAN FOREST

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By

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Abstract of thesis submitted to the Senate of Universiti Pertanian Malaysia in fulfilment of the requirements for the degree of Master of Science

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Chairman : Dr. Mohd. Hamami Bin Sahri

Faculty : Forestry

Tree ring analysis is an important aspect in forestry and ecology as it provides information on factors influencing growth rates, wood production and quality, rotation times, and replacement rates before it will be felled and used. Growth rate information from tree ring analysis is useful for harvesting, plantation planning, sustenance of natural forest, as well as managing timber as a renewable resource.

This study was carried out to determine the periodicity of xylem growth in four selected Malaysian plantation tree species, viz., *Hevea brasiliensis* (rubberwood) 8-year old , *Pinus caribaea* (Pine) 10-year old , *Shorea leprosula* (Meranti Tembaga) 22-year old and *Dryobalanops aromatica* (Kapor) 21-year old, through cambium wounding by minute pinning and knife-cutting. Diameter growth increments were measured by a dendrometer band and the climatic data were also collected. After a year, one tree of each species was felled, and the cambial response to wounding measured. The xylem produced subsequent to the cambial response was measured in two different ways, i.e., total radial growth increment (length from the scars to the end of the cambium) and actual radial growth increment (length from the growth zone boundary/ standard line to the scars).

Actual radial growth increment was found to be more meaningful than total radial growth increment in relating the radial growth to the diameter growth increment recorded by dendrometer. From the dendrometer readings, it could be concluded that *H. brasiliensis*

experienced a seasonal growth as shown by the actual radial growth increment, *P. caribaea,* a rhythmic growth, whilst both, *S. leprosula* and *D. aromatica* exhibited continuous growth during the one-year study period.

D. aromatica had the highest annual diameter growth increment (15.30 mm), followed by *S. leprosula* (14.00 mm), *H. brasiliensis* (11.10 mm) and *P. caribaea* (4.5 mm).

In general, it can be concluded that in tropical regions where the climatic conditions are more or less uniform throughout the year, the possibility of relating the periodicity of xylem growth or cambial activity with climate proves to be difficult though not impossible. Although climatic conditions are uniform throughout the year, diameter growth varies from species to species as indicated in this study.

Abstrak tesis ini dikemukakan kepada Senat Universiti Pertanian Malaysia untuk memenuhi keperluan untuk Ijazah Master Sains.

JANGKAMASA PERTUMBUHAN XILEM EMPAT SPESIES KAYU YANG DITANAM DI HUTAN MALAYSIA

Oleh

NOR RAHMAT BIN ABDUL JALIL

September 1995

Pengerusi : Dr. Mohd. Hamami Bin Sahri

Fakulti : Perhutanan

Kepentingan analisis gelang pertumbuhan terhadap perhutanan dan ekologi di hutan tropika sedikit sebanyak dapat memberikan maklumat terhadap faktor-faktor yang dapat mempengaruhi kadar pertumbuhan, penghasilan kayu dan kualitinya, pusingan tanaman dan kadar penggantian sesuatu spesies sebelum ianya boleh ditebang dan digunakan. Sehubungan dengan itu maklumat kadar pertumbuhan sesuatu spesies dari penyelidikan

gelang pertumbuhan begitu penting untuk pengurusan hutan tropika sebagai sumber yang berkekalan.

Kajian ini dijalankan untuk menentukan jangkamasa ataupun waktu sebenar pertumbuhan xilem ke atas empat spesies kayu yang telah dipilih dari beberapa spesies kayu yang ditanam di Malaysia, iaitu pokok *Hevea brasiliensis* (Getah) berumur 8 tahun, *Pinus caribaea* (Pine) berumur 10 tahun, *Shorea leprosula* (Meranti Tembaga) berumur 22 tahun dan *Dryobalanops aromatica* (Kapor) berumur 21 tahun, dengan mencederakan bahagian kambium kayu tersebut menggunakan kaedah mencucukkan pin dan membuat torehan menggunakan pisau. Diameter pokok yang dikaji juga diukur dengan menggunakan dendrometer. Dalam masa yang sama, data cuaca bagi kawasan di mana kajian ini dijalankan juga dikumpul. Setelah setahun kajian ini dijalankan satu pokok dari setiap spesies kayu yang dikaji ditebang, dan tindakbalas kambium yang telah dicederakan (parut) selama setahun itu diukur. Dalam kajian ini pengukuran dan pengiraan xilem yang dihasilkan kerana tindakbalas kecederaan kambium yang dialami telah dibuat dengan menggunakan dua cara yang berlainan. Pertama, ianya

diukur di antara jarak tindakbalas parut sehinggalah kebahagian akhir kambium kayu yang dipanggil Jumlah Tumbesaran Radial. Manakala cara yang kedua iaitu Tumbesaran Radial Sebenar pula diukur dari sempadan zon tumbesaran yang dapat dikesan/garisan yang boleh dijadikan piawai sehingga parut yang terbentuk.

Di dalam kajian ini didapati Tumbesaran Radial Sebenar yang diukur dapat memberikan perkaitan yang lebih meyakinkan dan bermakna jika dibandingkan dengan keputusan yang diperolehi dari Jumlah Tumbesaran Radial, dan dapat pula menunjukkan perkaitannya dengan kadar pertumbuhan diameter yang telah direkodkan oleh dendrometer. Daripada data yang diperolehi dari bacaan dendrometer, *H. brasiliensis* menunjukkan sifat pertumbuhan bermusim (ini disokong oleh keputusan dari pengiraan Tumbesaran Radial Sebenar yang telah dibuat), *P. caribaea* pula menunjukkan sifat tumbesaran bernada/berirama ("rhythmic"), manakala dua lagi spesies yang dikaji iaitu *S. leprosula* dan *D. aromatica* (disokong oleh keputusan Tumbesaran Radial Sebenar) menunjukkan sifat tumbesaran yang berterusan sepanjang satu tahun kajian dijalankan.

D. aromatica mencatatkan tumbesaran diameter yang tertinggi iaitu 15.30 mm , diikuti oleh *S. leprosula*, 14.00 mm, *H. brasiliensis*, 11.10 mm dan akhir sekali *P. caribaea* mencatatkan bacaan tumbesaran yang terrendah sekali iaitu 4.5 mm dalam masa setahun.

Dapat disimpulkan di sini bahawa walaupun keadaan cuacanya agak serupa dan tiada perubahan cuaca yang ketara sepanjang tahun pada kawasan tropika, kajian ini menunjukkan kesukaran untuk mendapatkan perkaitan di antara perubahan cuaca serta kesannya ke atas jangkamasa pertumbuhan xilem atau aktiviti kambium walaupun ianya bukan mustahil untuk diperolehi. Walau bagaimanapun didapati tumbesaran diameter bagi setiap spesies yang dikaji adalah berbeza walaupun tiada perubahan cuaca yang ketara.

CHAPTER I

INTRODUCTION

Recently, there is a growing realization on the importance of tropical forests to mankind. This is due to the fact that many tropical hardwood species are of high commercial values and a major contribution to revenues of tropical countries. In this respect, much of the attention has been focused on the growth and replacement rates of the trees in these forests.

Growth-rate information from tree ring analysis could be extremely important for the management of timber as a renewable resource. For greater understanding on the climate system, there is a need for longer climatic records from tropical regions. If identifiable, cyclical ring growth would be determined and related to the climate; old-aged trees from the tropics could be used to reconstruct climatic history and provide data for better understanding of the global climate systems (Jacoby, 1989).