UNIVERSITI PUTRA MALAYSIA

RADIAL GROWTH PERIODICITY OF SELECTED TROPICAL TREES GROWN IN MATA AYER, PERLIS AND KEPONG, SELANGOR, MALAYSIA

AMIR AFFAN BIN ABDUL AZIM
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By

AMIR A'FFAN BIN ABDUL A'ZIM

Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in fulfilment of the Requirements for the Degree of Master of Science

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

RADIAL GROWTH PERIODICITY OF SELECTED TROPICAL TREES GROWN IN MATA AYER, PERLIS AND KEPONG, SELANGOR MALAYSIA

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February 2011

Chairman : Professor Tadashi Nobuchi, PhD

Faculty : Forestry

Radial growth periodicity of *Azadirachta excelsa* Jack. Jacobs, *Hopea odorata* Roxb., and *Khaya ivorensis* A. Chev. grown in North Peninsular Malaysia (NPM) and West Peninsular Malaysia (WPM) were investigated. Three methods, dendrometer, knife-cutting method and collection of wood blocks from living tree were applied along with phenological observation and wood anatomical investigation. Meteorological data of the experimental period were also obtained.

A. excelsa (NPM) showed seasonal radial growth pattern based on the dendrometer measurement. This was considered to have close relation with the uniform shedding of leaves in middle of December 2008 until the end of February 2009. *A. excelsa* (WPM) also showed seasonal radial growth pattern, but not uniform as in NPM. This was considered that the shedding of leaves occurred separately among individuals. *H. odorata* (NPM) showed seasonal radial growth. This was considered as the

influenced of dried water drainage beside plot. As *A. excelsa* in WPM, *H. odorata* (WPM) also showed weak seasonal radial growth pattern, but the period of gradual slows down of radial growth was different for each individuals. *K. ivorensis* (NPM and WPM) showed continuous radial growth pattern.

A. excelsa (NPM) showed seasonal cambial activity when the cells number in cambial and enlarging zone decreased in November 2008 and February 2009. Pattern of anticlinal division and enlarged vessel element were observed in August 2008, November 2008 and May 2009. *A. excelsa* (WPM) showed no seasonal cambial activity, even in shedding of leaves period. *H. odorata* (NPM) showed similar seasonal cambial activity as in *A. excelsa* (NPM). *H. odorata* (WPM) showed continuous cambial activity. Enlarged vessel element was observed in each month and axial resin canal was observed to be formed in November 2008 and February 2009. *K. ivorensis* (NPM and WPM) showed active cambial activity, even growing in less amount of rainfall. Enlarge vessel element was observed almost in each month.

Band of axial parenchyma with large vessels diameter was investigated as ring structure in *A. excelsa* (NPM) while band of axial parenchyma with small to medium vessels diameter was observed in *A. excelsa* (WPM). Extension of tangential band alongside marking made in February 2009 was estimated as ring-like structure in *A. excelsa* (NPM) when the anatomical features were similar as its ring structure. Ring structure of *H. odorata* (NPM) was featured by band of axial parenchyma with resin canals while band of thick walled fibre cells in *H. odorata* (WPM). In *K. ivorensis* (NPM), the ring structure was characterized by wider band of thick walled fibre cells

with small vessel diameter while narrower band of thick fibre cells with larger vessel diameter in *K. ivorensis* (WPM). No clear tangential band can be estimated for *H. odorata* and *K. ivorensis* as ring-like structure. Traumatic resin canals were easily formed in *H. odorata* and *K. ivorensis*, especially in rainy period.

The highest positive correlation between radial growths with meteorological conditions was relative humidity in NPM and precipitation in WPM. Further field investigation and laboratory experiment are needed to deepen the understanding of radial growth periodicity in tropical trees.

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

PERTUMBUHAN DIAMETER POKOK TROPIKA TERPILIH YANG TUMBUH DI MATA AYER, PERLIS DAN KEPONG, SELANGOR MALAYSIA

Oleh

AMIR AFFAN ABDUL AZIM

Februari 2011

Pengerusi : Professor Tadashi Nobuchi, PhD

Fakulti : Perhutanan

Tempoh pertumbuhan radial (pertumbuhan diameter) bagi spesis *Azadirachta excelsa* Jack. Jacobs, *Hopea odorata* Roxb., and *Khaya ivorensis* A. Chev. yang tumbuh di Utara Semenanjung Malaysia (NPM) dan Barat Semenanjung Malaysia (WPM) telah dikaji. Tiga kaedah, iaitu dendrometer, kaedah '*knife-cutting*' (mencederakan pokok dengan pisau penanda) dan pengambilan blok kayu dari pokok hidup telah diaplikasikan beserta pemerhatian fenologi dan anatomi kayu. Data meteorologi bagi tempoh eksperimen juga diperolehi.

A. excelsa (NPM) menunjukkan corak pertumbuhan '*radial*' bermusim berpandukan pengukuran dendrometer. Ini mungkin berkaitan dengan tempoh fenomena daun luruh yang berlaku serentak bermula dari pertengahan bulan Disember 2008 hingga akhir bulan Februari 2009. *A. excelsa* (WPM) juga menunjukkan corak pertumbuhan '*radial*' bermusim, tetapi tidak serentak seperti di NPM. Ini mungkin berkaitan

dengan tempoh fenomena daun luruh yang berlaku tidak serentak bagi setiap dirian pokok. *H. odorata* (NPM) menunjukkan corak pertumbuhan '*radial*' bermusim. Ini mungkin dipengaruhi oleh sungai kecil yang terletak bersebelahan plot telah kering. Seperti *A. excelsa* (WPM), *H. odorata* (WPM) juga menunjukkan corak pertumbuhan '*radial*' bermusim, tetapi tempoh di mana pertumbuhan '*radial*' menjadi perlahan berbeza bagi setiap dirian pokok. *K. ivorensis* (NPM dan WPM) menunjukkan corak pertumbuhan '*radial*' yang berterusan.

A. excelsa (NPM) menunjukkan aktiviti kambium bermusim apabila bilangan sel dalam zon kambium dan pembesaran berkurangan pada November 2008 dan Februari 2009. Corak pembahagian '*anticlinal*' (peningkatan barisan sel-sel berjejari dalam arah tangen atau melintang) telah diperhatikan berlaku pada bulan Ogos 2008, November 2008 dan Mei 2009. *A. excelsa* (WPM) tidak menunjukkan aktiviti kambium bermusim, walaupun pada tempoh daun luruh. *H. odorata* (NPM) menunjukkan aktiviti kambium yang lebih kurang sama dengan *A. excelsa* (NPM). *H. odorata* (WPM) menunjukkan aktiviti kambium yang berterusan. '*Vessel*' (liang) yang sedang membesar telah diperhatikan pada setiap bulan dan salur damar menegak diperhatikan telah dihasilkan pada November 2008 dan Februari 2009. *K. ivorensis* (NPM and WPM) menunjukkan aktiviti kambium yang aktif, walaupun membesar dalam tempoh yang kurang hujan.

Jalur paksi parenkima menegak dengan '*vessel*' berdiameter besar telah diselediki sebagai struktur gelang bagi *A. excelsa* (NPM), manakala jalur paksi parenkima menegak dengan '*vessel*' berdiameter kecil telah diselediki sebagai struktur gelang bagi *A. excelsa* (WPM). Jalur melintang yang bersambungan sepanjang tanda yang

dilaksanakan pada bulan Februari 2009 dianggarkan sebagai pembentukan struktur seperti gelang dalam *A. excelsa* (NPM) apabila struktur anatomi yang diselidiki serupa dengan struktur gelang asal. Struktur gelang bagi *H. odorata* (NPM) dibentuk oleh jalur paksi parenkima menegak bersama salur damar manakala jalur paksi serat berdinding tebal telah diselidiki sebagai struktur gelang bagi *H. odorata* (WPM). Bagi *K. ivorensis* (NPM) struktur gelang dicirikan oleh jalur paksi serat berdinding tebal yang lebar bersama-sama dengan '*vessel*' berdiameter kecil manakala jalur paksi serat berdinding tebal yang sempit bersama-sama dengan 'vessel' berdiameter besar telah diselidiki sebagai struktur gelang bagi *K. ivorensis* (WPM). Tiada jalur melintang yang jelas dapat diselidiki dan dianggarkan sebagai pembentukan struktur seperti gelang dalam *H. odorata* dan *K. ivorensis*. Salur damar trauma senang terhasil, terutama pada tempoh hujan yang banyak.

Korelasi tertinggi yang dianalisa antara pertumbuhan '*radial*' dengan factor meteorologi di NPM adalah kelembapan relatif dan jumlah hujan di WPM. Eksperimen lapangan dan makmal perlu dilanjutkan bagi mendalami pemahaman terhadap tempoh pertumbuhan '*radial*' pokok tropika.

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I certify that an Examination Committee has met on 22nd February 2011 to conduct the final examination of Amir Affan Bin Abdul Azim on his Master of Science thesis entitled "Radial Growth Periodicity of Selected Tropical Trees Grown in North and West Peninsular Malaysia" in accordance with Universiti Pertanian Malaysia (Higher Degree) Act 1980 and Universiti Pertanian Malaysia (Higher Degree Regulations 1981. The Committee recommends that the student be awarded the relevant degree.

Members of the Examination Committee were as follows:

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This thesis was submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfilment of the requirement for the degree of Master of Science. The members of the Supervisory Committee were as follows:

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Date:

DECLARATION

I declare that the thesis is my original work except for quotations and citations which have been duty acknowledged. I also declare that it has not been previously, and is not concurrently, submitted for any other degree at Universiti Putra Malaysia or at any other institution.

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AMIR AFFAN ABDUL AZIM

Date: 22 February 2011

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