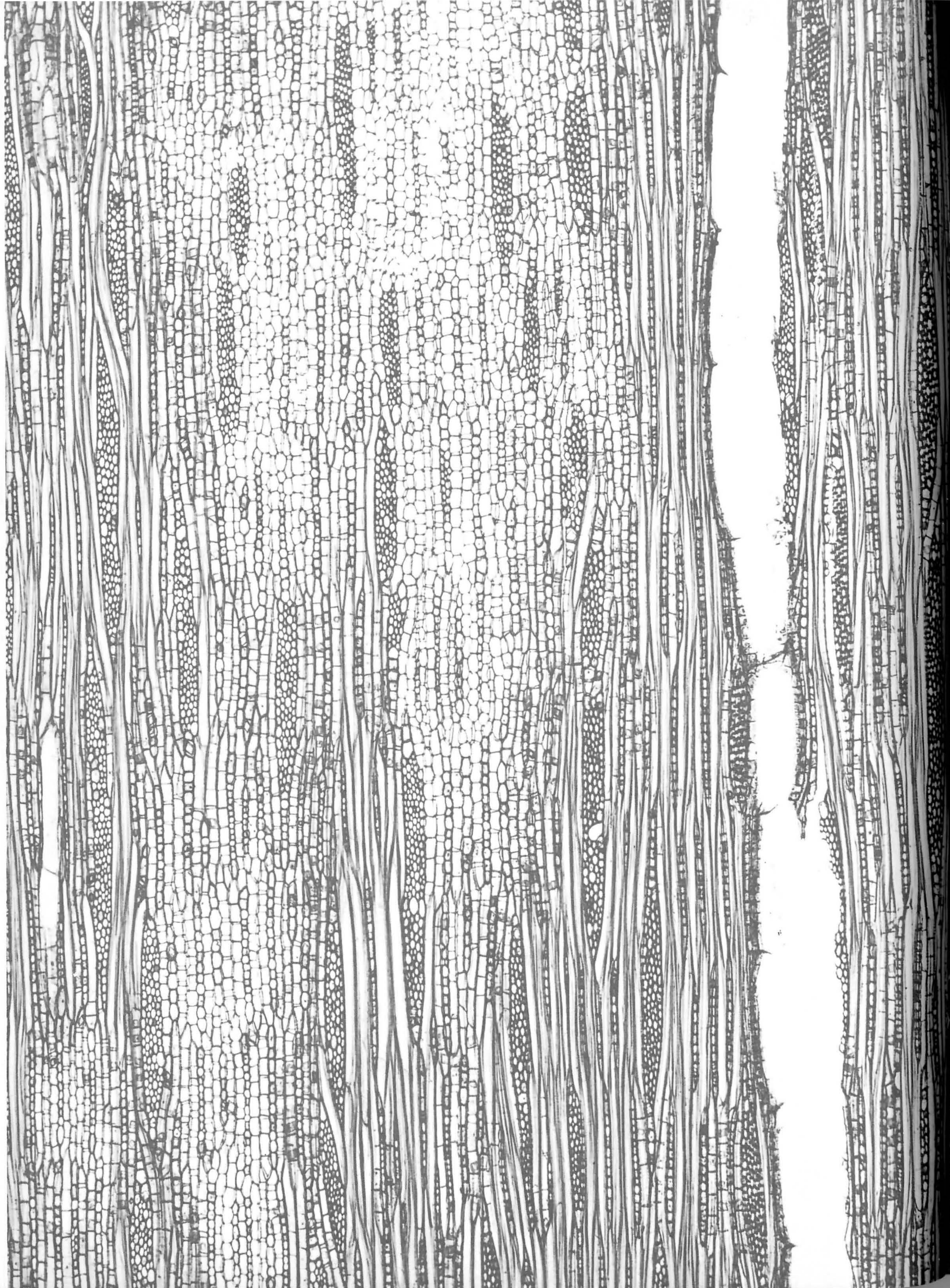

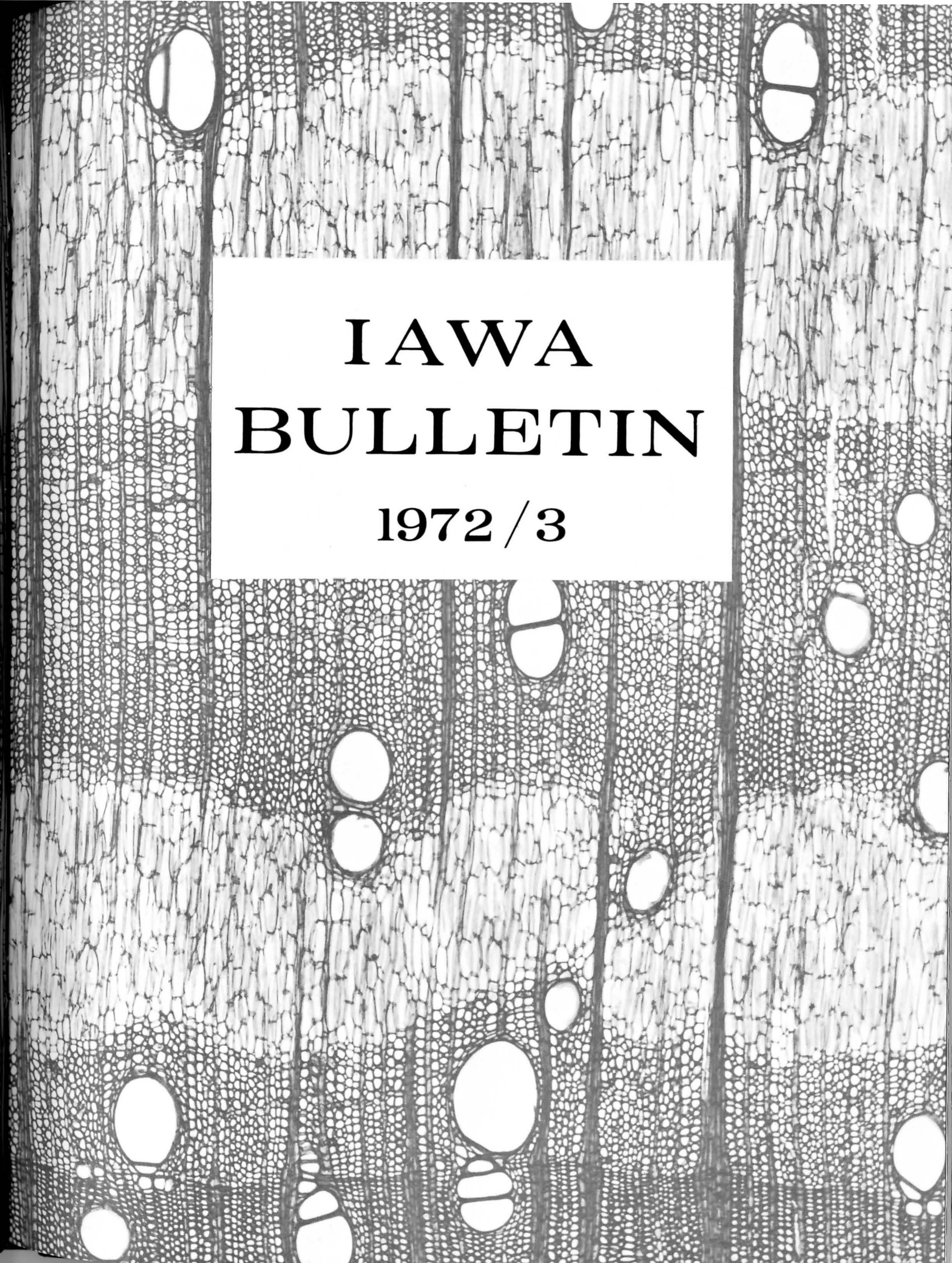

IAWA BULLETIN

1972/3

OUR COVER

The cover of the IAWA Bulletin for 1972 consists of photomicrographs (cross- and tangential sections) of *Apeiba membranacea* Spruce ex Benth., Family Tiliaceae. Broad bands of radially aligned parenchyma cells are prominent features in this species.

The material was collected on 5 August 1933 by Boris A. Krukoff (No. 5304) in the Territory of Acre, on the Rio Purus, Brazilian Amazonia. The slide was prepared by Mr. A. C. Day from specimen BWC_w No. S12437 which was borrowed from the Harry Philip Brown Memorial Wood Collection at State University of New York College of Environmental Science and Forestry. Photomicrographs were prepared with the assistance of Mr. J. J. McKeon. Magnification: 70X

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The International Association of Wood Anatomists was organized in 1931 to advance the knowledge of wood anatomy in all its aspects. It does this in part by attempting to promote and facilitate cooperation among the relatively small number of specialists in wood anatomy.

Prospective members are invited to write to the Office of the Executive Secretary for a copy of the Constitution, an application form, and information about IAWA. Membership dues, which includes a subscription to the IAWA Bulletin, are currently $3.50 (U. S.) per year.

EDITORIAL

Our readers may be startled at seeing the nature of the two articles in this issue. What are the limits on subjects that fall logically under the title, "wood anatomy"? Your editors judged these two papers to be of some interest to enough members of IAWA to justify publishing them in the 1972/3 Bulletin. They are relevant even though many will argue, with good reason, that they are not classical wood anatomy. Besides our desire to bring interesting and timely subjects to your attention, we still face the fact that papers on traditional material are simply not coming in. Your cooperation is needed if the IAWA Bulletin is to continue on a quarterly basis.

News from Professor Yatsenko-Khmelevsky of the Kirov order Lenin Forest Academy reminded us of the early planning required for the XII International Botanical Congress. The next Congress will be held in Leningrad in 1975 and, if IAWA follows the tradition of scheduling its business meeting as part of the Congress program, planning should begin soon. Three years of lead time is not excessive for a meeting of this kind.

A program theme should also be selected for a technical session, half- or full-day, if IAWA members wish to take responsibility for arranging a program as they have for recent Congresses. Please consider both questions, business and technical sessions, and write to the Office of the Executive Secretary with your ideas. The Council needs them if it is to plan in accordance with your wishes.

W. A. Côté

C. H. de Zeeuw

Specific Gravity Variation in *Gmelina arborea* Roxb.

By

Carl de Zeeuw[1] and Richard L. Gray[2]

Gmelina arborea Roxb. (Verbenaceae) is one of the fast growing tropical tree species which has attracted interest in recent years because of its potential for production of pulpwood as well as utility construction timber and plywood. A comprehensive study of the morphological and related physical properties of both plantation and wild trees of this species was initiated a few years ago by Dr. Bassett Maguire of the New York Botanical Garden. Unfortunately the study was inactivated after only one phase had been completed. This report summarizes the work which has been completed under that study on the variation in specific gravity of wood from two groups of plantation-grown trees and a single lot of naturally seeded wild trees from Thailand.

Reference to Table 1 shows that single disks were collected from six trees growing in young plantations in British Honduras and eight trees from Nigerian plantations. The tabulation lists seven disk samples from Thailand, however, the three samples labeled T-4A, T-4B, and T-4C may be from the same tree and represent different heights in the stem. This conclusion can be reached from the code designations and a careful comparison of the cross

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[1]Professor of Wood Products Engineering, State University of New York College of Environmental Science and Forestry, Syracuse, New York 13210.

[2]Graduate Student, Wood Products Engineering Department, State University of New York College of Environmental Science and Forestry, Syracuse, New York 13210.

section photographs as well as the estimates of the section ages from increment counts. (Table 1 summarizes almost all of the data supplied on these collections and estimates of tree ages as well.) The tree ages were not given as such for the plantation material but rather stated as dates of planting and cutting. However, since the age for planting stock of *Gmelina* is usually only a few months, the dates can be equated with age of the tree. Estimates of the ages of the wild samples from Thailand were made using the dark zone lines of incremental growth. Lamb* notes that growth rings are visible and are usually annual. A check on the plantation-grown cross sections confirmed this statement so that it can be assumed that the estimated age of the Thailand tree sections is within reasonable limits. Apparently all of the plantation material was cut at heights between 50 and 75 cm. above the ground in the stem. Direct evidence of this is available for only three of the trees sampled. The Thailand cross sections are also believed to come from just above stump height in the stem with the possible exception of the three samples labeled T-4. In this case the photographs of the cross sections strongly suggest a series of samples at different heights in the stem of a single tree.

Only a few of the disks were circular in outline and most also showed piths that were off center. Only three, the T-4 samples from Thailand were markedly eccentric for pith location. Some small patches of light-colored tension wood were associated with the stem irregularities but there was no special indication of tension wood in the three most markedly eccentric samples (T-4). There were traces of rot in the central areas around the

*Lamb, A. F. A., Fast Growing Timber Trees of the Lowland Tropics, No. 1 *Gmelina arborea*. Commonwealth Forestry Institute, Oxford, Jan. 1968.

pith for two of the British Honduras samples, four of those from Nigeria and one of the trees from Thailand.

The air dried sample disks were studied for variation in basic specific gravity from pith to bark. Each cross section was sampled by cutting a one inch square strip from a radius drawn through the maximum diameter of the section. Usually the radius selected was the larger one. An exception was made in the case of T-1 which consisted of somewhat less than half of a complete cross section with a conformation that limited the sample location to one position.

The radial strips were dissected into blocks 1 cm. long in the radial direction except in the case of five rather small radii (BH-1, BH-2, BH-3, T-1, T-3). For these five samples the radial strips were cut into 0.5 cm. blocks in order to provide a sufficiently large number of samples for regression analysis.

Each of the blocks from the different radii was measured for basic specific gravity using water immersion of the saturated blocks for volume determination and weight after oven drying at 103 ± 2°C.

The data for each radial series in each of the disks was fitted to a regression model relating basic specific gravity to distance from the pith. Five forms of linear equations were tried but only straight line equations, exponential forms and parabolic equations yielded significant and reasonable fits with the data.

The computed regressions for specific gravity on radial position with the best fit, i.e., the largest F values, are listed in Table 2. Sixty percent of the regressions conform closely enough to the data to be statistically significant (.05 level) or highly significant (.01 level) as shown by the columns labeled F value and df. The remainder of the regressions are in most cases well below any degree of significance of fit. It is not possible to relate stem cross section shape to the lack of fit since some of the sections that failed to show any significance were nearly circular in outline and others were definitely irregular or had badly eccentric piths.

It is evident that the most consistent relationships of specific gravity on radial distance from the pith appear in the Nigerian plantation-grown trees. There is some spread among the significant regressions that are plotted as Figure 1 but the divergence is small enough so that a regression line calculated on all data from the eight trees has a highly significant statistical fit. All the regressions conform to the straight line form with increasing specific gravity from pith to bark. The increase in specific gravity from 0.30 at the pith to 0.42 at 30 cm. diameter corresponds to the relationship reported by A. F. A. Lamb* for work done on Nigerian plantation-grown *Gmelina* by R. F. Esan. However, the Nigerian trees sampled in this study were consistently less dense than the values determined by Esan. Calculation of air dry densities shows that the minimum values for this study are from 15 to 20 percent lower than the minimum of 25 lbs/cubic foot which Esan measured. Furthermore the calculated density for the pooled Nigerian data at a 30 cm. radius is equal to the average of 30 lbs/cubic foot in the study by Esan.

The other data for plantation-grown trees, i.e., British Honduras, are much less consistent among themselves even though these data fall into the same general range as those from Nigeria, Figure 2. The two highly

*Ibid, page 17.

significant regressions are both straight lines, however only one has a positive slope. The other two regressions which show statistical significance differ with only one showing an increasing specific gravity from the pith outward. The parabolic equation for BH-5 is unlike any other significant regression in this study. Pooling the data for these trees from British Honduras does not yield a regression in any form that shows significance at any level.

The data for the wild trees from Thailand yielded only three significant regressions, all of which show positive slopes. It is evident from the examination of the data in Table 2 and the plotted curves of Figure 3 that the *Gmelina* samples from Thailand are consistently higher in specific gravity than either of the groups of plantation trees. This difference may be explainable on the basis that the estimated ages for the Thailand trees are all as large or larger than those for the plantation-grown trees. The three regressions for T-4, A, B, C were all computed from measurements on the major radii in very similar eccentric cross sections that may very possibly have been cut from the stem of a single tree. As has been noted earlier, the shape of these tree cross sections suggests the presence of tension wood in the radii measured. The high variability of the data and the negative regression slope could be explained on this assumed presence of tension wood.

The probable sampling vertically within a single stem that is shown by the three sections of the Thailand material (T-4A, T-4B, T-4C) indicates a trend to increasing specific gravity with height in the stem. This trend is opposite to that reported by Esan* who noted a slight decrease of specific gravity with height in the merchantable stem.

Summary

1. The fourteen trees collected from two groups of plantation-grown *Gmelina arborea* Roxb. are quite similar in specific gravity ranges and are consistently lower than the specific gravity of the wood from the five wild trees sampled from Thailand. The difference shown may be attributable to the greater age of the trees from Thailand.
2. The majority of the sample disks yielded data that could be fitted to regression models closely enough to show either significant or highly significant statistical conformation. The reasons for the large scatter of data in 40 percent of the regressions that do not show any statistical significance is not evident from any examination of the samples which has been made.
3. The majority of the statistically significant regressions of basic specific gravity on distance from the pith reveal an increasing specific gravity from the pith outward. Within this group most of the regressions are in the straight line form with three fitted to exponential equations.
4. Two of the regressions that show statistical significance indicate a decrease in specific gravity from pith to bark. One of these is a highly significant straight line equation and the other is parabolic in form.

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*Ibid, page 17.

Table 1

Data on *Gmelina arborea* Roxb. Trees Sampled

Tree Code No.	Tree Age Years*	Girth cm.	Max. Diam. cm.	Radius Sampled cm.	Locality of Collection
BH-1	3	20.0	16	8.5	British Honduras, Melinda
BH-2	3	10.2	8	5.0	" " "
BH-3	3	23.0	19	9.5	" " "
BH-4	4	29.0	24	13.5	" " "
BH-5	7	24.5	20	11.5	" " , Augustine
BH-6	12	65.0	54	26.0	" " , Melinda
N-1	14	91.0	74	38.0	Nigeria
N-2	12	66.0	52	26.5	"
N-3	12	57.0	46	23.0	"
N-4	9	47.0	39	19.5	" , Bende Forest Reserve
N-5	10	47.0	41	25.0	" " " "
N-6	8	38.0	30	18.0	" " " "
N-7	7	40.5	33	20.0	" " " "
N-8	6	34.5	28	17.0	" " " "
T-1	12+	--	--	11.5	Thailand
T-2	15	34.0	27	14.5	" , Mae Sa Falls
T-3	16	21.0	18	11.0	" , Doi Saket
T-4A	14	26.0	20	13.0	" " "
T-4B	13	25.0	21	13.5	" " "
T-4C	12	25.0	20	14.0	" " "
T-5	11	40.0	33	17.5	"

*Determined from known planting dates for BH and N samples. Estimated from increment counts for T samples.

Table 2

Regressions of Basic Specific Gravity on Distance from Pith (cm.) for Three Groups of *Gmelina arborea* Roxb. Trees

No.	Regression Equation	"F"	df	Mean Spec. Grav.
BH-1	$Y = 0.3669 - 0.0073X$	12.60**	1/10	.32
BH-2	$Y = 0.1741 + 0.2345 \text{ Log } X$	6.55*	1/10	.30
BH-3	$Y = 0.3322 + 0.0118 \text{ Log } X$	0.21	1/12	.34
BH-4	$Y = 0.2907 + 0.0133X - 0.0012X^2$	1.53	2/8	.31
BH-5	$Y = 0.2858 + 0.0539X - 0.0050X^2$	5.44*	2/6	.40
BH-6	$Y = 0.2810 + 0.0055X$	23.23**	1/20	.34
N-1	$Y = 0.3618 + 0.0019X$	4.48*	1/31	.39
N-2	$Y = 0.3387 + 0.0032X$	19.73**	1/21	.38
N-3	$Y = 0.3131 + 0.0040X$	25.10**	1/19	.36
N-4	$Y = 0.2502 + 0.0046X$	8.37*	1/14	.29
N-5	$Y = 0.2913 + 0.0021X$	1.95	1/18	.31
N-6	$Y = 0.3297 + 0.0006X$	0.29	1/17	.34
N-7	$Y = 0.2459 + 0.0059X$	12.57**	1/15	.30
N-8	$Y = 0.3236 + 0.0009X$	0.38	1/11	.33
N Pooled	$Y = 0.2998 + 0.0039X$	67.58**	1/160	.34
T-1	$Y = 0.4738 + 0.0002X$	0.01	1/16	.47
T-2	$Y = 0.3140 + 0.1198 \text{ Log } X$	38.80**	1/11	.40
T-3	$Y = 0.2742 + 0.0071X$	12.60**	1/15	.34
T-4A	$Y = 0.4475 - 0.0017X$	0.90	1/10	.44
T-4B	$Y = 0.4429 - 0.0009X$	0.21	1/10	.44
T-4C	$Y = 0.4755 - 0.0014X$	0.40	1/10	.47
T-5	$Y = 0.3497 + 0.0792 \text{ Log } X$	7.59*	1/13	.41

*Significant at the 0.05 level

**Significant at the 0.01 level

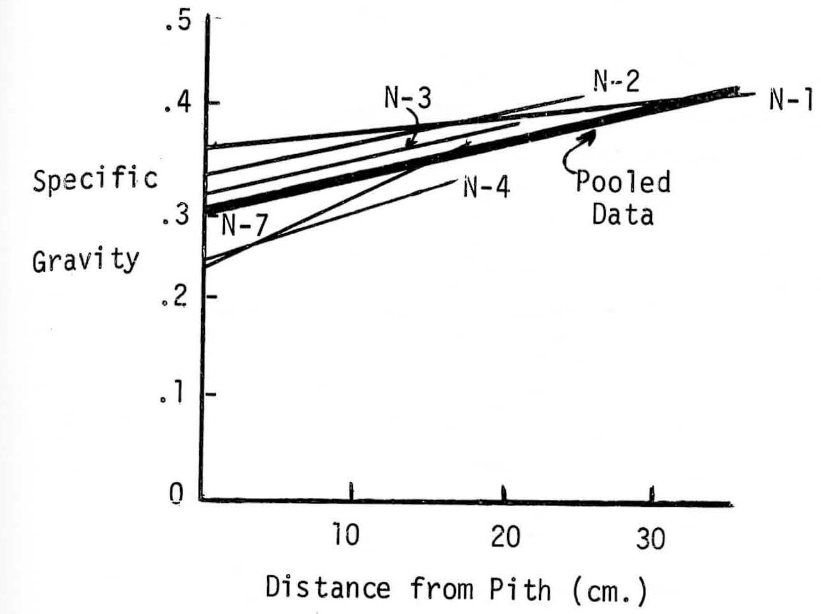

Figure 1. Regressions for specific gravity on distance from pith for eight Nigerian plantation-grown trees of *Gmelina arborea* Roxb.

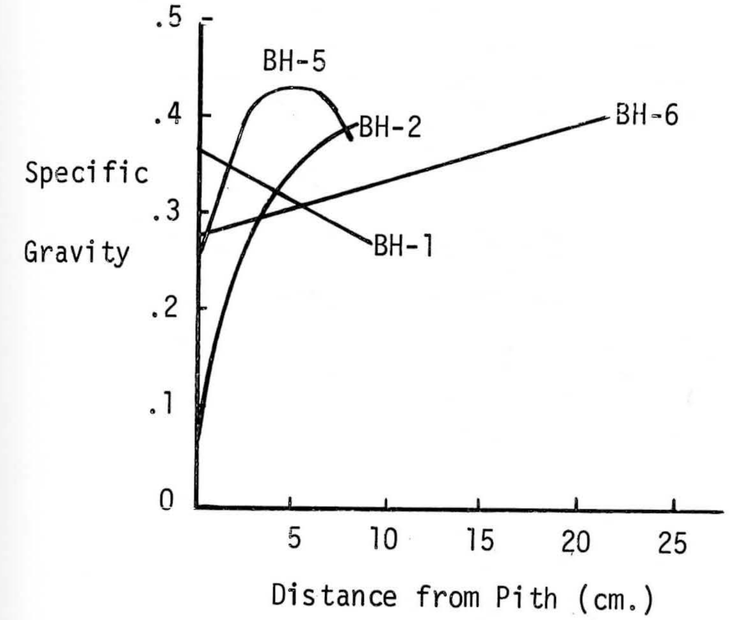

Figure 2. Regressions for specific gravity on distance from pith for four British Honduras plantation-grown trees of *Gmelina arborea* Roxb.

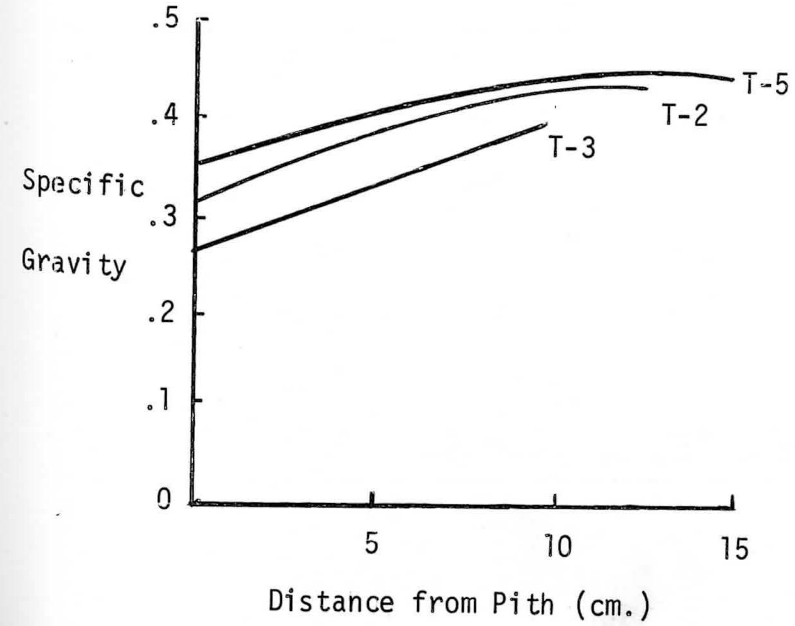

Figure 3. Regressions for specific gravity on distance from pith for three wild trees of *Gmelina arborea* Roxb. from Thailand.

STUDIES ON BARK ANATOMY

By

N. Parameswaran and W. Liese*

Although the International Association of Wood Anatomists is primarily concerned with wood anatomy, the scope of this term has been extended during the last few years. Therefore a note on our studies of bark anatomy might be of interest to members of IAWA. This line of research has received only limited attention in the past, but in the last two decades there has been increased activity in the study of bark in several countries. In the U. S. A. efforts have been concentrated on the study of several properties of tree barks, especially of softwoods, arising as an immediate imperative to the problem of disposal of bark waste and a search for an alternative to burning. In addition, a growing interest exists in some of the botanical laboratories on the cytological aspects of bark tissues.

In contrast to the investigations on temperate zone trees, work on the anatomy of tropical tree barks has been rather meager with the exception of scattered descriptions of bark structure of species which have importance for pharmacology. In some of the countries such as the Philippines, Sabah, India, and Venezuela, studies have been initiated in recent times. In an attempt to obtain further data on tropical tree bark anatomy, as well as on temperate zone

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*Institut für Holzbiologie & Holzschutz der Bundesforschungsanstalt für Forst- und Holzwirtschaft, 205 Hamburg 80, Leuschnerstr. 91d, W. Germany

taxa of special interest, work has been in progress for some years in our laboratory.

The main aim has been to arrive at detailed descriptions of bark structure and to evaluate their characteristics in the identification of taxa. Also the possibility of quality appraisal of stem wood based on certain bark structural features has been analyzed. Inasmuch as our papers were written mostly in German, it is deemed appropriate to list their titles and contents in brief:

Parameswaran, N.: Strukturbesonderheiten von Sklereiden im sekundären Phloem der Bäume. Ber. dtsch. bot. Ges. 81: 199-202 (1968). Describes the presence of special wall protrusions, septa-like cross-walls, and trabeculae development in the sclereids of *Dialyanthera otoba*, *Myristica fragrans*, *Salmalia malabarica*, as well as of *Balanocarpus*, *Hopea*, *Shorea* and *Vatica* of the Dipterocarpaceae.

Parameswaran, N. and W. Liese: Beitrag zur Rindenanatomie der Gattung *Entandrophragma*. Flora Abt. B, 158: 22-40 (1968). The presence of certain specific and constant features in the secondary phloem facilitates the identification of the four commercially important species of *Entandrophragma*, *E. utile* (Sipo), *E. cylindricum* (Sapelli), *E. angolense* (Tiana) and *E. candollei* (Kosipo). Bark structural features can be used especially in combination with xylotomical criteria for a definite determination.

Parameswaran, N. and W. Liese: Mikroskopie der Rinde tropischer Holzarten. IN: H. Freund, Handbuch der Mikroskopie in der Technik, Bd. V, Teil 1, pp. 227-306, Umschau Verlag, 2. Aufl. Frankfurt a. M. (1970). This is in continuation of W. Holdheide's publication on temperate zone tree barks in the first edition of this "Handbuch" in 1951. Gives a general description of the various cell elements as well as detailed analyses of the bark anatomy of 25 timber producing species from Asia, Africa, and South America. The evaluation of the macro- and micromorphology of bark in the identification of tropical tree species, indicates an urgent necessity of a complete morphological description of bark surface and blaze features in tropical floras.

Parameswaran, N.: Über die Struktur der tropischen Baumrinde und ihre Verwertungsmöglichkeiten. Forstarchiv 41: 193-198 (1971). A short resumé on the anatomy of tropical tree barks and possibilities of their utilization.

Parameswaran, N. and W. Liese: Bark features as an aid in assessing wood quality and identification. Presented at Section 41 Meeting, XIV. IUFRO Congress, Gainesville, Florida, U. S. A., 1971. Summarizes features of bark, both macroscopical and microscopical, in the identification of timber species and in the prediction of wood quality without damage to the tree.

Liese, W. and N. Parameswaran: Über die Rindenanatomie starkborkiger Fichten. Forstwiss. Cbl. 90: 370-375 (1971). Anatomical characterization of unusually thick (5 cm.) spruce bark which develops sporadically in certain genetically reproducible individuals. The outermost layers of the bark consist entirely of cork cells which do not exfoliate. They are therefore effective in protecting the tree from damage.

Liese, W. and N. Parameswaran: On the variation of cell length within the bark of some tropical hardwood species. IN: A. K. M. Ghouse & M. Yunus, Research Trends in Plant Anatomy, K. A. Chowdhury Commemoration Volume, p. 83-89, Tata McGraw-Hill Publ. Co. Ltd., New Delhi, 1972. The study of cell length variation within the bark has shown that similar to the trend observed in the secondary xylem a general tendency exists for an increase in length from periderm to cambium for sieve tube members and bast fibers, although exceptions to this rule are present. The considerable fluctuations in length of sieve tube members may be explained as a result of growth influences of the accompanying parenchyma cells and companion cells.

Karstedt, P. and N. Parameswaran: Wood and bark anatomy of the Atlantic species of *Rhizophora* with special reference to their taxonomy. (In preparation). The three Atlantic species of *Rhizophora*, *R. mangle*, *R. harrisonii* and *R. racemosa* can be distinguished from each other on the basis of bark anatomical criteria. The supposition that *R. harrisonii* is probably a hybrid between the other two species seems to find support in certain bark features such as sclereid form and development.

Parameswaran, N. and I. T. Zamuco, Jr.: Bark anatomy of the "Philippine Red Mahogany" group, with special reference to identification. (In preparation). Analyzes the possibility of identifying the species of *Shorea*, *S. negrosensis*, *S. polysperma*, *S. squamata*, *S. almon*, *S. teysmanniana*, and *S. agsaboensis* using features of bark anatomy and comparison with wood anatomy.

It may also be mentioned that a bark collection has been started in combination with slide preparations. The aim is to achieve a set of sections, including all the three directions, which will help in the identification of

tree taxa either on the basis of bark characters alone or in combination with wood microscopy. In this connection we would like to appeal to all members in tropical regions to help us in this endeavor by sending us bark samples along with wood specimens when they are collected.

ASSOCIATION AFFAIRS

Shall We Publish A Yearly Bibliography of Wood Anatomy?

From IAWA Member Dr. William C. Dickison we have received the following suggestion which we consider to be feasible provided that we can obtain the cooperation of our membership in carrying it out. Dr. Dickison proposes that we publish a yearly Bibliography of Wood Anatomy. He points out that other botanical associations produce such a publication through the individual contributions of all their members.

As a start, if each member of IAWA submitted his previous year's publications, and those in press, it could lead to a very useful reference. The titles could be arranged in various ways for easy accessibility and could possibly appear in a particular issue of the Bulletin. Obviously this would not cover the field, but eventually, if there was adequate cooperation, the entire area of wood anatomy and related topics could be covered. In this way those members who are not associated with schools of forestry, for example, would be made aware of articles that have appeared in journals not readily available to them.

We earnestly seek your reaction to this proposal so that further exploration of this possibility can be made and perhaps a committee established to assemble the annual Bibliography of Wood Anatomy. Please forward your comments to the Office of the Executive Secretary, or, if you prefer, directly to Dr. Dickison, Department of Botany, The University of North Carolina, Chapel Hill, North Carolina 27514, U. S. A.

Status of Ballot on Constitutional Amendment

To date, we have received only 52 ballots on the amendment to the Constitution as circulated with the 1972/2 issue of the Bulletin. Thus far indications are that the membership is overwhelmingly in favor of the proposed change. A count on this vote will be reported in the next issue of the Bulletin.

Membership Directory Changes

Address Changes

Mr. J. D. Hale
28 Seymour Avenue
Ottawa, Ontario
Canada K2E 6P2

(Temporary Address until July 1973)
Dr. Ganesh S. Paliwal
Lehrstuhl für Zellenlehre
15 Berlinerstrasse
69 Heidelberg 1, West Germany

Mr. K. Ramesh Rao
Officer-in-Charge
Wood Anatomy Branch
Forest Research Institute
P. O. Newforest
Dehra Dun, India

Dr. rer. nat. Rudi Wagenführ
DDR - 8020 Dresden
Forschungsinstitut für Holztechnologie

Dr. Llewelyn Williams
U. S. Department of Agriculture
Box 31
Beltsville, Maryland 20705 U.S.A.

Prof. A. A. Yatsenko-Khmelevsky, Head
Department of Plant Anatomy and
Plant Physiology
Kirov order Lenin Forest Academy
Leningrad K-18, U. S. S. R.

Deletion

Ing. Soewarsono Prodjoharjono, Chief
Division of Wood Properties and Anatomy
Forest Research Institute
Bogor, Indonesia

WOOD ANATOMY ACTIVITIES AROUND THE WORLD

New Publication Anticipated from German Democratic Republic (DDR)

IAWA Member Dr. Wagenführ, author of "Wood Anatomy", has informed us that he and his collaborator, Chr. Scheiber, author of "Tropical Woods", have completed a book under the title, "Wood Atlas". This new book is to appear late in 1972 and will be published by the VEB Fachbuchverlag Leipzig (DDR). It will consist of 450 pages, 800 illustrations, 80 tables, and 754 references. It can be ordered under No. 5457602.

"Wood Atlas" was designed to give the reader a comprehensive survey of the current situation and probable development of wood and forest economics, wood anatomy, defects in wood, wood destroying organisms, care of trees and wood preservation. Particularly notable are the monographs of 135 important commercial woods complete with anatomical characteristics, color photographs and photomicrographs. The book was conceived to serve as a reference book for the scientist, the teacher and as a textbook for students.

Dutch Version of the Multilingual Glossary of Terms Used in Wood Anatomy

A number of wood anatomists in the Netherlands have produced a Dutch version of the Multilingual Glossary of Terms Used in Wood Anatomy. It is titled "Verklarende woordenlijst van in de houtanatomie gebruikte termen". It is anticipated that this work will be in press shortly and should be available to wood anatomists within a few months. Its appearance will be noted in a future issue of the Bulletin.

Involved in the preparation of this Glossary were Dr. A. M. W. Mennega and Dr. Peter B. Laming with the cooperation of Professor Dr. A. L. Stoffers and Dr. Ir. R. W. den Outer. We have been informed that there will be some innovations in this version as compared with the current IAWA Glossary and that these might signal future considerations of changes in nomenclature that would help to clarify some confusion that has arisen in certain instances. Anyone wishing to obtain further particulars about this work before it becomes available may write to Dr. Laming at the Forest Products Research Institute TNO, Schoemakerstraat 97, Delft, Netherlands.

Wood Samples from the Genus *Vitex* Wanted

A comparative wood anatomy study in the genus *Vitex* is being undertaken by Richard L. Gray, a Ph.D. candidate and Associate Member of IAWA, and authenticated wood samples from stems of trees are desired.

The genus *Vitex* is represented by 269 specific taxa which are distributed mostly in the tropics and subtropics of both the Eastern and Western Hemispheres as follows:

Area	No. of Specific Taxa	No. Reaching Tree Size	Samples On Hand
Africa	106	40-50	4
Madagascar	37	8-15	1
Asia	66	40-45	14
Tropical and Central America	55	30-40	21
Australia and New Zealand	4	3	2

Specimens of *Vitex* from the Africa and Madagascar regions are especially needed; however, samples from any area would be greatly appreciated.

If you have samples for exchange or can collect material, please write to:

Carl de Zeeuw, Curator
H. P. Brown Wood Collection
SUNY College of Environmental Science and Forestry
Syracuse, New York 13210
U. S. A.