

Plant Anatomy and Morphology in the Neotropics: Recommendations

6 July 1962

- I. In order to facilitate study in the morphological and anatomical aspects of neotropical plants, on which all taxonomic work depends, and upon which much physiological and ecological understanding is based, it is necessary that repositories (collections and botanical gardens) of dried, fluid-preserved, and living plants suitable for these studies, be vigorously expanded, and new ones, strategically situated in the neotropics, be established. These centers should be adequately staffed with plant morphologists, systematists and microtechnicians in order to provide fullest cooperation with other botanical specialists, wood technologists, archeologists, and foresters, by having available large and complete series of microslides illustrating morphologically important parts of neotropical plants. Duplicates of raw plant materials, as well as microslides, should be distributed as widely as possible as a routine procedure.
- II. Plant anatomists- and morphologists-in-training should be encouraged to spend part of their graduate careers in the tropics where they could undertake research projects employing living plants which need to be gathered and examined in ontogenetic series, and where they can obtain the needed perspective of the abundant, vigorous, and diversified plant life of the tropics so necessary in the ferial interpretation of their data.
- III. Because of the uniqueness and great importance as a reference work to neotropical scientists, over a 20-year period, of S.J. Record's Timbers of the New World, and because this work is becoming out-of-date, but need for it is still on the increase, it is imperative that it be revised, amplified, and up-dated. Along with this requirement, is the urgent need to enlarge and collate Record's series of keys to American woods in order to facilitate work in wood identification, plant taxonomy, paleobotany and archeology.
- IV. Because the work of the plant anatomist often complements that of botanists in other fields, and because the results of his work are most effectively presented in context with the studies of systematists, ecologists and physiologists, it is recommended that whenever possible, he be enabled to work closely with such specialists, thereby achieving maximum results from his investigation, and broadest application.
- V. Because of the many collections of plant morphological materials currently in existence which are not associated with corresponding herbarium vouchers, and because morphological research based on such unvouched for specimens may be suspect with regard to identification and subsequent scientific usefulness, it is urgently recommended that herbarium vouchers be gathered as a routine matter with any morphological collections and that these be lodged in an institutional herbarium.

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EDITORIAL

From April 15 to 19 this year, a second International Cabot Symposium was held in Harvard Forest, Petersham, Mass., U.S.A. Whilst the first Symposium in April 1957 dealt with "The Physiology of Forest Trees" (published under this title by K. V. Thimann, W.B. Critchfield and M.H. Zimmermann at the Ronald Press Company New York 1958), this time the subject was "The Formation of Wood in Forest Trees". Since only invited papers were read, the presentations followed by debates of a high standard circled round definite problems, such as : The Cambium and Its Derivatives, Biochemistry of Cambial Derivatives, Translocation of Photosynthetic Products to Areas of Growth, Effects of Internal and External Environment on Wood Formation. The discussions covered Paleontology, Anatomy, Ultrastructural Cytology, Macromolecular Chemistry, Molecular Biology, Physiology and Ecology.

Harvard Forest offered a wonderful ambiency for concentrated and enthusiastic work. It was a privilege to share a few days with such pioneers of our science as Prof. I.W. Bailey (Harvard) and Prof. K. Freudenberg (Heidelberg, Germany) together with a score of wood scientists from the upcoming generation.

The results of this Symposium will be published before the end of the year at the Academic Press Inc., New York.

November 1963

A. Frey-Wyssling

SCIENTIFIC REVIEW

NEW DISCOVERIES IN TREE-RING RESEARCH

by Prof. Dr. Bruno Huber

Director of the Institute of Forest-Botany  
University of Munich

For the past 25 years, the tree-ring chronology initiated by A.E. Douglass in Tuscon, Arizona, has been pursued in Europe mainly in the author's dendrological institutes in Tharandt (until 1946) and Munich (since 1946). The U.S. methods could not directly be applied in Europe for the annual variations of the width of tree rings are much less pronounced in Central Europe's more balanced climate than in the semidesert climate of Arizona. If possible, we work with the mean curves of at least five samples and plot the ring widths at the logarithmic scale as the abscissa on transparent paper. Several curves are then synchronized either according to appearance examination over the luminous table or automatically in an electrical contact process. Missing or double rings are less important in Europe; rings are hardly ever missing in ring-porous oak because the foliage appears only after formation of the spring pore circle of which the failure means death. The methods having been repeatedly described, I will here report only on some recent discoveries which may claim to be of general interest.

1. A Thousand-Year Oak Chronology as a Calibration Standard for the C<sup>14</sup> Method.

Europe's trees are not so old as America's Sequoia gigantea (up to 3200 years, Douglass) and Pinus aristata (up to 4600 years, Schulman). The famous veneer oaks of Spessart (Quercus petraea) possess at best about 600 rings and enabled a standard chronology to be established in 1949. As numerous mediaeval buildings in the Frankfurt (Hesse) and Nuremberg (Franconia) area have been built of oak, over 200 samples from buildings as famous as the Forchheim Kaiserpfalz, Brüderkirche in Kassel, Darmstädter Schloss and from the old towns of Ziegenhain and Büdingen enabled an oak chronology over a total of one thousand years to be established in subsequent years (Huber, Niess and Siebenlist, printing). In this chronology,

the 10th century	is represented by	1	sample
" 11th	" " "	" 17	samples
" 12th	" " "	" 26	"
" 13th	" " "	" 75	"
" 14th	" " "	" 70	"
" 15th	" " "	" 100	"

This thousand-year oak chronology first supplied the historians with many desirable data regarding the architectural history of the said towns<sup>1)</sup>.

In the meantime, our tree-ring chronology has now assumed importance also for calibrating the radiocarbon method. In the first joy over this elegant possibility of dating, many have considered dendrochronology to be obsolescent. However, certain discrepancies have meanwhile convinced the leading radiocarbon researchers of the fact that the refinement of physical methods cannot provide information on whether the initial C<sup>14</sup> content actually remained constant through centuries and millenia. This can be determined only by the analysis of the C<sup>14</sup> content of samples dated in some other manner. Doubts have even arisen as to whether the initial content was really always the same for the Northern and Southern hemispheres, for the Old and the New Worlds (Tauber). Accordingly, the radiocarbon stations have of late been interested in obtaining dendrologically dated wood samples, and we are pleased to make our material available for such purposes. Our oaks possess the advantage that, as stated above, missing rings as sources of errors are virtually absent.

2. Prehistoric Tree-Ring Chronologies

Radiocarbon and tree-ring datings complement each other in yet another respect: Considering all sources of errors, the radiocarbon method indicates approximately half a millenium (± 250 years) from which the sample stems; tree-ring synchronization, however, will indicate the very year, or fail altogether. It thus provides a much more sensitive rule. An Urnfield period settlement in Switzerland (Zug-Sumpf) which the C<sup>14</sup> method dated back to about 1200 ± 250 B.C. was historically analyzed and we found it to have gradually travelled from the South West to the North East (Huber, B. and W. Merz, Germania 40/1, 1962). In the course of 200 years, the ash, which at first predominated as building timber, was more and more replaced by alder and the building technique evolved from plain driven piles to a ground-beam construction. The tree-ring method has proved its dependability in processing the problem, which is now highly controversial, of the life of neolithic dwellings and the return, if such occurred, of migrant peasants.

Our greatest success to date, however, is the synchronization of a Michelsberg settlement in the Swiss Canton of Schaffhausen with a Cortaillod settlement in the Canton of Berne (Huber, B. and W. Merz, Germania 41/1, 1963). No other method could have determined that two settlements so readily distinguished typologically according to their pottery existed simultaneously, although they belonged to two different cultures.

1) The architectural history of the famous Romanesque and Gothic cathedrals of Constance and Freiburg was discovered by my collaborator Freiherr von Hornstein: the reed roof assumed to have been the original cover in Constance was gradually replaced, from 1158-1236, by the still well-preserved truss formed of huge fir beams, the West wing of the Freiburg Cathedral was arched over only one hundred years later (1252-1307).

### 3. Climatological Evaluation of Tree-ring Curves

In Arizona's semiarid climate, the ring widths largely follow the rain-falls (with a correlative coefficient above 0,8). On this fact, Schulman was in a position to base a tree-ring hydrology of the Colorado extending over many centuries. In more moderate Central Europe, the interrelations between the climate and tree-ring width are not so obvious, but my deceased collaborator von Jazewitsch, in a posthumous paper (1961) described sites in which a factor limits tree-ring width in this area as well: the summer heat at the timber line of the rain-rich North flank of the Alps and the rainfalls in dry areas within the Alps.

More recently, two further indications for the climatological evaluation of tree-ring curves have, however, been found: very early we had observed that the tree-ring widths of prehistoric samples frequently vary more markedly than recent samples of the same sites. Fürst (Flora 153, 1963) has now been able to demonstrate, by virtue of an East-West section of Central Europe from the Vosges to the Beskids, that the variation of tree-ring widths decreases with continentality. Accordingly, the more pronounced variation of neolithic samples indicates that the climate was then more continental.

Another characteristic of tree-ring curves is their periodic length, i.e. the number of years during which they rise or fall. If variation were entirely accidental, one half of all curves should change their direction from one year to the next; one quarter after two, and one eighth after three years etc. However, a certain inertia is observed, which causes the periodic length to increase beyond what would be accidentally expected. This characteristic, too, reveals secular variations which are currently more closely studied (Huber and Courtois).

#### Bibliography

Our tree-ring work until 1956 is listed in Huber, B. und W. von Jazewitsch: Tree-ring studies of the Forest-Botany Institutes of Tharandt and Munich, Tree-Ring Bulletin 21, 28-30 (1956).

The latest papers have been cited in the above paper.

#### BOOK REVIEW

B R A U N , H.J. : Die Organisation des Stammes von Bäumen und Sträuchern  
(The Organisation of Wood in Stems of Trees and Shrubs)

Wissenschaftliche Verlagsgesellschaft m.b.H., Stuttgart,  
162 pages, 137 figures, DM 40.-

This valuable monograph gives full details of the program on the subject outlined by the author in our News Bulletin 1961/2 pp. 2-9. The essence of his contributions is the replacement of the classical three-parted physiological classification of the cell assemblages in Angiosperm woods into translocation (tracheary elements), mechanical (fibres), and storage (parenchyma) tissues, by a more morphological four-parted system: tracheid tissue, fibre tissue (including fibre tracheids), vessel system and paratracheal parenchyma. This permits of the concept of a phylogenetically founded classification of wood structures.

Starting from the Gymnosperm type consisting almost exclusively of tracheids, four levels of Angiosperm wood organisation are distinguished: on the first level structures are characterized by a tracheidal ground tissue mixed with vessels (primitive Angiosperms, Castanea); only on the second level do fibres or fibre tracheids appear both derived from tracheids which are still characteristically represented (Rhamnus, Quercus, Ulmus and Juglans types); on the next level tracheids are rare, but there is a ground tissue of fibres with disseminated vessels (Aesculus, Auconmea types). On the level farthest differentiated, the vessels appear with a paratracheal parenchyma sheath in the fibrous ground tissue (Acer, Fraxinus, Albizzia types). The advantage of this system consists in that the four morphologically characterized levels represent at the same time as many functional classes in which the water translocating hydrosystem becomes more and more specialized and effective. The effectiveness is demonstrated ad oculos by fluorochrome tests with berberin sulphate translocated by the ascending transpiration stream.

A minor shortcoming concerning didactics may be mentioned. Although the terms for the description of wood samples recommended by our I.A.W.A. (such as paratracheal (p. 65), vasicentric, aliform or confluent (p.66) parenchyma) are used, they are nowhere explained, nor is there any reference to our Glossary where the necessary definition could be found. Since this book not only makes stimulating reading for specialists, but can also serve as a general introduction to functional wood anatomy, the needs of less experienced students should be covered as well.

F.W.

Charles H. Carpenter, Lawrence Leney, Harold A. Core, Wilfred A. Côté, jr. and Arnold C. Day: Papermaking Fibers, a photomicrographic atlas of woody, non-woody, and man-made fibers used in papermaking.

Technical Publication No. 74, State University College of Forestry at Syracuse University - 1963

In the preface to the new edition of "Papermaking Fibers" the author's statement shows that Charles H. Carpenter published, as early as 1931, an "Atlas of Papermaking Fibers". This booklet has been out of print for rather a long time, a Syracuse team of scientists planned a new edition which appeared in October 1962. The index of the contents recites 42 softwoods and 45 hardwoods together with 18 plant fibres of miscellaneous origin. In addition to that, natural fibres of animal origin such as wool and silk, mineral fibres such as asbestos and man-made fibres such as rayon, nylon are included. In a short glossary, the most important terms of fibre structure are explained and in 77 plates the structures are described with extremely good photomicrographs. Each plate is commented on by a short text describing the single fibres. This atlas is a very helpful tool for anybody who has to identify fibres or describe special properties of fibre material. In this light, we can highly recommend it.

This publication is available, at a cost of \$ 4.00 per copy, from the State University of Forestry at Syracuse University.

H.H.B.

#### MISCELLANEOUS

The IUFRO Section 41 has held a congress in Madison, Wisc., U.S.A. from September 11 to 13. During this meeting, a new organisation of this section was established. There are now three Working Groups, and the one on "Wood Quality" may be of interest for our members. Our former Secretary-Treasurer Dr. H. E. Dadswell, Director of the Forest Products Research Laboratories in Melbourne, is the chairman of this group. Under his most active and stimulating leadership the discussions in the field of wood quality have been a real success. It is planned to work in future along four different lines: spiral grain, specific gravity, fibre characteristics and hardwood formation. These subjects are covered by one sub-group for microscopic characteristics where Prof. Dr. W. Knigge holds the chairmanship. Another sub-group (Chairman: Dr. J. H. Jenkins) deals with the macroscopic characteristics and will concentrate its work on: quality requirements for each specific end use, relationship between the visible surface characteristics and the interior wood quality, standardization of terminology and preparation of a glossary, tree-growth stresses and effect of pruning on wood quality.

A number of our members has attended the Madison Congress; thus close co-operation between the IUFRO Section 41 and our Association will be easily possible and will certainly contribute to the benefit of both.

H.H.B.

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#### EDITORIAL

Your Secretary Treasurer has the pleasure of announcing that the "Multilingual Glossary of the Terms used in Wood Anatomy" is now ready for publication. The 2nd English edition of 1957 has been translated into French, German, Italian, Portuguese, Serbo-Croatian and Spanish, so that we possess a comparative dictionary covering seven languages. A certain number of definitions have been improved and terms mentioned as deprecated in the last edition have been dropped.

The funds at disposal are insufficient for a manual published by the I.A.W.A. alone. We tried to place it in a similar series as the former edition which appeared in the periodical "Tropical Woods". The director of the Swiss Forest Research Institute, Prof. Dr. A. Kurth, took an interest in our Multilingual Glossary and offered to publish it in the Proceedings of his Institute. Further financial help could be obtained from the president of the Centenary Foundation ETH 1955, Prof. Dr. H. Pallmann.

The total costs of our publication amounts to about sFrs. 10'000.-- which sum will be covered by the following budget: I.A.W.A. sFrs. 2'000.--; Swiss Forest Research Institute sFrs. 3'000.--; Centenary Foundation ETH sFrs. 5'000.--.

I wish to thank President Pallmann and Director Kurth in the name of the members of the I.A.W.A. very sincerely for their really substantial help.

We hope to issue the Glossary with a comparative index by the time of the Xth International Botanical Congress at Edinburgh in August 1964 and to circulate it whenever possible to the members beforehand.

Hoping to seeing many of you in Edinburgh,

A. Frey-Wyssling  
Secretary Treasurer

April 1964