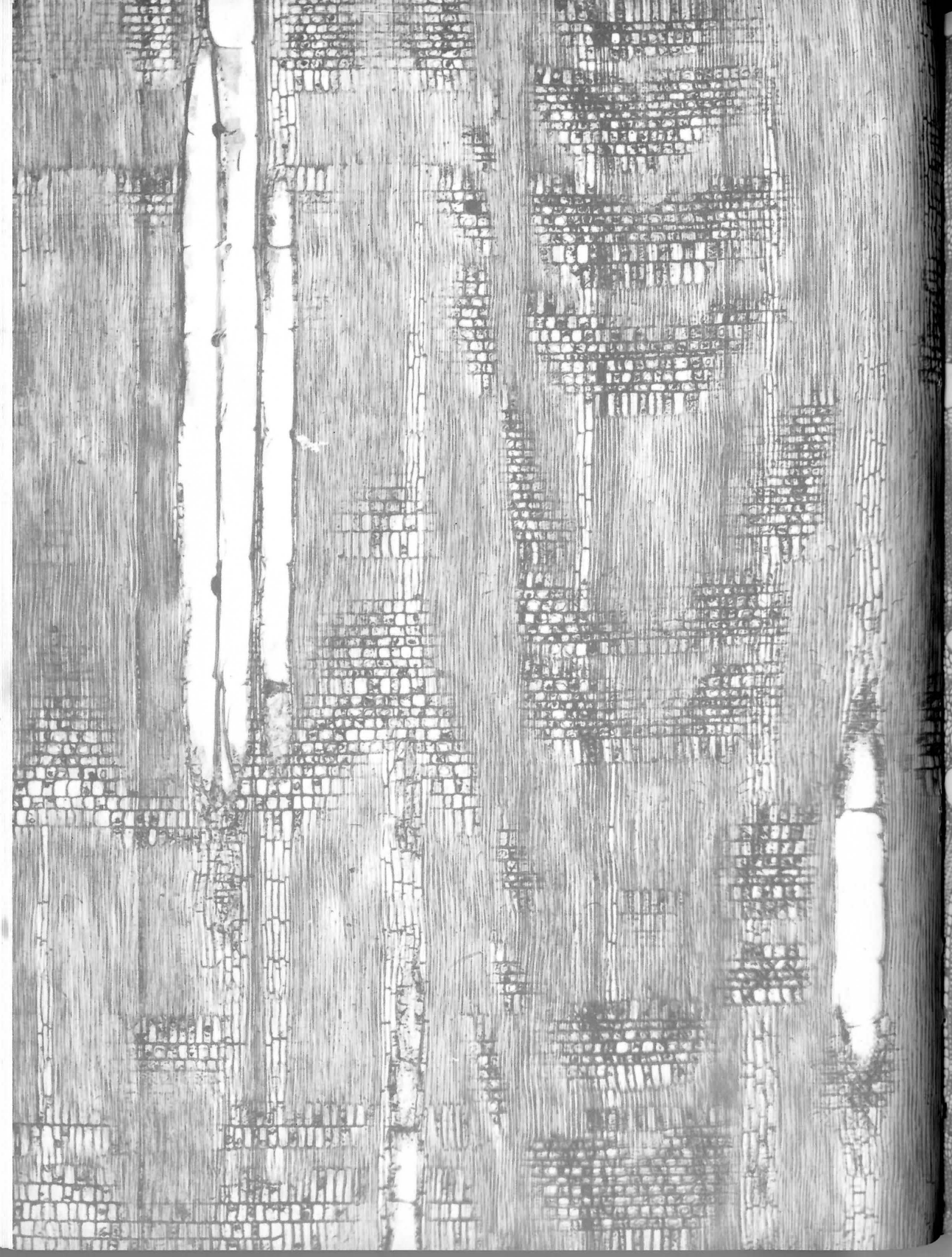
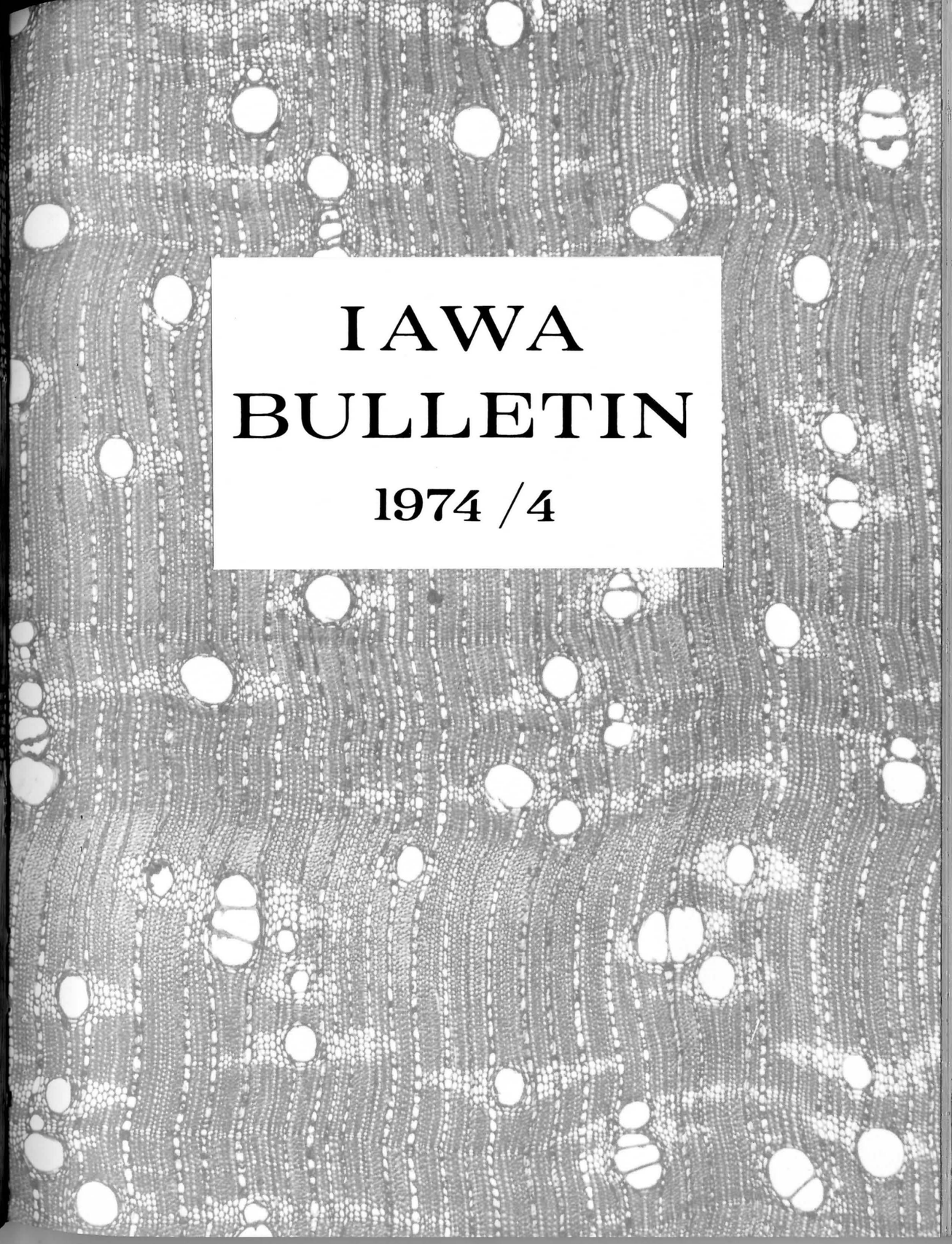


IAWA BULLETIN

1974 /4



OUR COVER

This photomicrograph is a species of *Brownea* (Leguminosae) according to information from B. F. Kukachka of the Center for Wood Anatomy Research, Madison, Wisconsin. Magnification: 50X.

. . . . . .

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 $5.00 (U. S.) per year.

EDITORIAL

It has often been said that change is a symptom of a healthy and growing organization. It is also well known that too frequent change can lead to chaos. In the International Association of Wood Anatomists we have been conscious of these bits of wisdom and have tried to take the reasoned approach to change. With this issue of the Bulletin we can cite two examples.

This is the last issue of our publication for 1974. It represents the end of five years of publishing with the present format. We have not changed too rapidly. We have waited to see how this design would work, aesthetically and practically. Now we anticipate that changes may be forced upon us for 1975 and we will likely have to change the way we operate, and the appearance of the Bulletin as well. Some members have suggested that we should use volume numbers as they do with the major journals. Others have suggested that the contents of the issue be listed on the front or back cover. These ideas have not been dismissed but have been saved for the moment when change could be carried out smoothly. Then all such changes could be considered at one time and acted upon. So if you have any additional ideas for the 1975 IAWA Bulletin, please submit them at your early convenience so that the January issue can reflect your suggestions if they are practicable.

In the Association Affairs section there is a discussion of another change that has been postponed as long as possible -- annual dues. We cannot grow without resources and we trust that you will understand this action of the Council.

W. A. Côté

C. H. de Zeeuw

Vestured Pits in Vessels and Tracheids of *Gnetum*

By

N. Parameswaran and W. Liese*

In recent years, with the advent of the scanning electron microscope, increasing attention is being paid to the fine structure of wall sculpturing of wood cells. Special treatment of the so-called "vestures" has been made by Ishida and Ohtani (1970), Scurfield and Silva (1970), Scurfield, Silva and Ingle (1970) and Butterfield and Meylan (1974). Scurfield, Silva and Ingle reported for the first time the presence of vestured pits in the vessel members of *Gnetum gnemon*. We are reporting here further observations on this genus made in connection with a scanning electron microscope study of multiple perforation plates (Parameswaran and Liese, 1973).

The species examined were:

Gnetum cuspidatum Bl. (Liese coll.)
G. gnemon (Poir.) Bl. (MADw 22847; BWCn 17037)
G. nodiflorum Brongn. (MADw 44227)
G. paniculatum Spruce (MADw 33828)
G. scandens Roxb. (MADw 37204)
G. ula Brongn. (Parameswaran 72)
G. urens (Aubl.) Bl. (MADw 6169)
G. venosum Spruce (MADw 49738)
Ephedra fragilis Fresen. (RBHw 6514)
E. nevadensis S. Wats (MADw 24031)
E. trifurca Torr. (MADw 11270)
Welwitschia mirabilis Hook. (MADw 17078)

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In all of the species of *Gnetum* examined, the vessel members are characterized by the presence of vestured intervascular pits. The intensity of vesture development is different in the various species; extensive vesture proliferations resembling typical vestured pits of dipterocarp woods occur in *G. venosum* and *G. nodiflorum* (Fig. 1). A further notable feature is the formation of vesture-like sculpturings on the vessel side of vessel-ray pits. Here also the extent of their development is equal to that present in the intervascular pits (Fig. 2). The internal surfaces of the vessel walls are provided with small wart-like structures in all the species examined.

An additional observation made in all the species examined is the characteristic occurrence of vestures in the bordered pits of longitudinal tracheids; these pits are arranged either in a single row or in partially double rows at almost regular intervals on the radial walls, with their elliptic to circular apertures oriented parallel or slightly oblique to the long axis of the cells. The vesture-proliferations are mostly confined to the pit aperture areas and floors of pit chambers. Their form may be designated as very weakly to prominently wart-like (Figs. 3, 4), corolloid (Fig. 5) to ramified (Fig. 6).

A comparative examination of the woods of the genera *Ephedra* and *Welwitschia* revealed the absence of vesture-like structures in the former genus. *Welwitschia*, however, showed the presence of prominent bead-like protuberances in the bordered pits of vessels (Fig. 7). Whether these are genuine vestures is a matter for further clarification; our observations would tend to classify them as true sculpturings.

The vestured bordered pits in the tracheids of *Gnetum*, together with those in vessels, add one more feature in support of its angiospermic affinities which have been indicated by other recent studies.

ACKNOWLEDGMENTS

Thanks are expressed to Professor Carl de Zeeuw, S. U. N. Y. College of Environmental Science and Forestry, Syracuse, N. Y., Dr. R. C. Koeppen, U. S. Forest Products Laboratory, Madison, Wisconsin, and to Wiss. Dir. H. Gottwald, Institut für Holzbiologie und Holzschutz, Hamburg, for kindly providing the samples. Grateful acknowledgment is also due to Professor G. Hartmann, Mr. D. Keyser, and Mrs. K. Hoffmann, University of Hamburg, for the use of the Cambridge Stereoscan.

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FIGURES

Figure 1. Extensive development of vestures in vessel pits. *G. nodiflorum*. 7200X.

Figure 2. Bead-like and ramified vestures on the vessel side of vessel-ray pits. *G. urens*. 1500X.

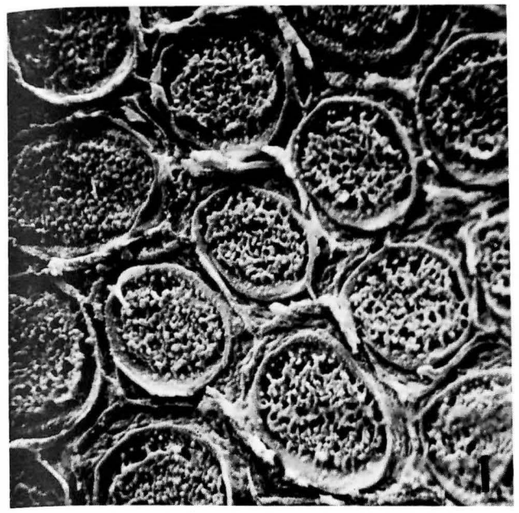
Figure 3. Sparse development of vestures in the pit aperture of a longitudinal tracheid. *G. gnemon*. 7400X.

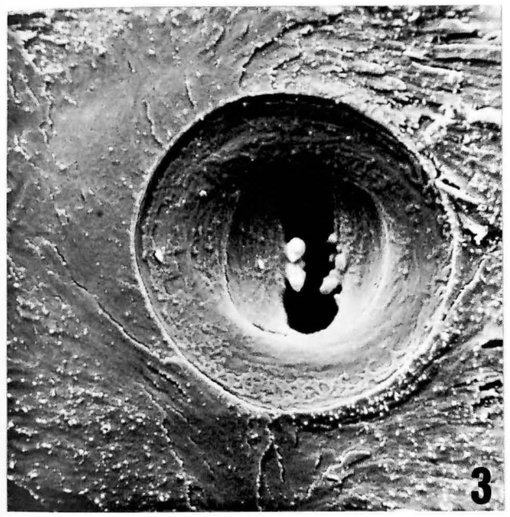
Figure 4. Prominently wart-like and partly corolloid vestures in the pit aperture of a longitudinal tracheid. *G. paniculatum*. 7000X.

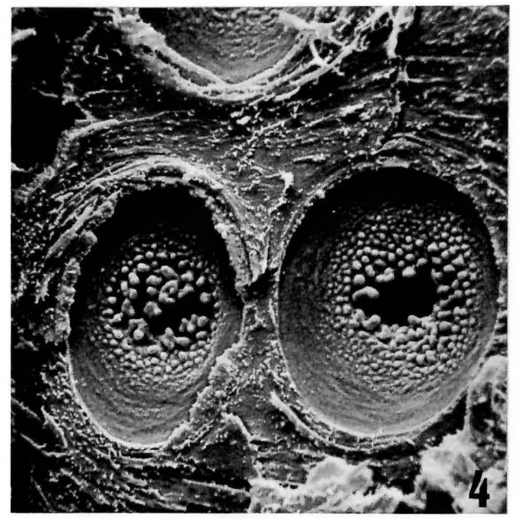
Figure 5. Corolloid vestures in the pit aperture of a longitudinal tracheid. *G. ula*. 6500X.

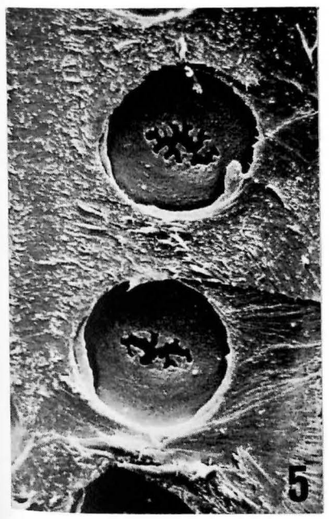
Figure 6. Slightly ramified and coarse development of vestures in the pit chamber floor of a longitudinal tracheid. *G. scandens*. 7000X.

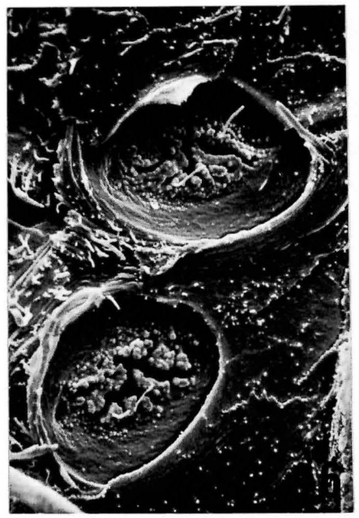
Figure 7. Large wart-like protuberances in the pits of a vessel member. *Welwitschia mirabilis*. 16000X.











Some Notes on Longitudinal Epithelium in the Xylem of Spruce (*Picea* species), With Special Reference to the Pitting

By

P. B. Laming*

Summary

One of the characteristics of parenchyma is the occurrence of simple pits (IAWA 1964). In this study, indications were found that this characterization does not invariably hold. In spruce the cell walls of epithelial cells, which line the vertical resin ducts, showed blind bordered pits which were directed towards the radially oriented intercellular spaces in the ray parenchyma. An identical type of pitting with similar orientation has also been observed in the cell walls of the strand tracheids which were adjacent to the ray parenchyma. In corresponding areas in which blind bordered pits have been observed, structures were present which seemed to be "intercellular cavities". Whether there is a relationship between the vertical epithelial cells and the strand tracheids is discussed.

Introduction

In the xylem of the genus *Picea*, radial and longitudinal resin canals are present as a constant feature. The latter are fairly evenly distributed throughout the outer portion of the growth ring. Resin canals are tubular intercellular spaces of indeterminate length, surrounded by a layer of secretory parenchymatous cells (epithelium) (IAWA 1964), which, in the case of *Picea*, are thickwalled. More specialized data on this subject are given by Bannan (1965); Chattaway (1951); Engström and Back (1959); Nyrén and Back (1960) and Sudo (1968). Our investigations confirm the results of Nyrén and Back (1960), that, in *Picea*, strand tracheids are present in the vicinity of

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the longitudinal resin canals and that they can be associated with the epithelial cells in the latter.

As is the case with longitudinal tracheids, the epithelial cells and strand tracheids can be in contact with ray parenchyma cells. The pitting in these contact areas is the main interest in this investigation.

Materials

Tangential longitudinal and radial longitudinal sections (10 µm thick) of home-grown and Scandinavian *Picea abies* were studied with the use of normal and polarized light. In addition, samples of *Picea engelmannii* have also been investigated. The sections were stained with Astrablue.

Area of Investigation

The study was mainly concentrated on the epithelial cells and strand tracheids in contact with the ray parenchyma, especially where they touch the radially oriented intercellular spaces in the rays (Fig. 1). Laming (1974) has discussed these intercellular spaces. Comparisons have been made with other literature (Esau 1960; McLean and Ivimey-Cook 1958), particularly concerning the ray parenchyma of spruce (Back 1969).

Blind Simple Pits in Ray Parenchyma

The ray parenchyma cell walls adjacent to the radially oriented intercellular spaces are pitted. These are blind pits because they do not have a complementary pit (IAWA 1964). Here the blind pits are always simple.

Blind Bordered Pits

In some cases bordered pits have been observed in the epithelium of the vertical resin ducts. The term "blind bordered pit" seems to be the most relevant for this feature. In TL sections, bordered pits were observed in the cell walls of the axial elements, where they border on the intercellular spaces of the ray parenchyma (Figs. 2 and 3). Figure 5 shows a schematic representation which was developed from a series of observations.

The diameters of the component parts of the pits (aperture, cavity, torus/margo) are similar to those in the bordered pit-pairs in strand tracheids and of those in the latewood tracheids in general. In RL sections blind bordered pits were also noticeable.

In areas where blind bordered pits have been observed, structures can be found which give the impression of being "intercellular cavities". They are similar in size to the cavities of the blind bordered pits although pit characteristics are lacking. These structures are separated from the radial intercellular spaces and the lumen of the adjacent cell by very thin parts of the cell wall (Fig. 4). This phenomenon has only been observed in the cell walls of the strand tracheids and not in the cell walls of the epithelial cells.

When a blind pit is present in the ray parenchyma wall, and the blind bordered pit or an "intercellular cavity" is on the other side, the pit membrane of the parenchymatous blind pit does not fully correspond with the radially oriented intercellular space. In these situations the membrane is shared between the radial intercellular space and the "intercellular cavity" (Fig. 4) or the bordered blind pit. In all other cases the blind pits of the ray parenchyma have membranes, which match completely with the radial intercellular spaces.

Orientation of the Blind Bordered Pits

From the above it is clear that blind bordered pits can be found in both strand tracheids and epithelial cells.

1. Blind bordered pits in strand tracheids. The ray can be touched by:
    a. strand tracheids on both sides
    b. longitudinal tracheids on one side and strand tracheids on the other side
    c. epithelial cells on one side and strand tracheids on the other side

In all cases the blind bordered pits are on the side of the ray nearest to the resin canal lumen.

2. Blind bordered pits in epithelial cells. The ray can be touched by:
   a. epithelial cells on both sides
   b. longitudinal tracheids on one side and epithelial cells on the other side
   c. strand tracheids on one side and epithelial cells on the other side

   In cases a and b, the blind bordered pits are on the side of the ray which is nearest to the resin canal lumen.

Both 1c and 2c are in fact the same situation. Investigations showed that these conditions exist in both species of *Picea*.

In summary it may be said that for these two species of *Picea* the following anatomical features have been revealed:

1. Blind bordered pits in strand tracheids. The shape of these pits and of those in the ray tracheids are alike.
2. In the epithelium, the bordered pits may occur as blind pits.

Both in strand tracheids and in vertical epithelial cells, blind bordered pits may occur in those areas which are abutting on radial intercellular spaces in the ray parenchyma.

Discussion

To elucidate the structural details which were found in this study, the following has to be considered.

It is already known that in conifers, epithelial cells and strand tracheids arise from fusiform cambium initials (Jane 1970; Panshin and de Zeeuw 1970).

Blind pits are a well known feature (IAWA 1964). This type of pitting is seen particularly in parenchyma cell walls. Its occurrence in tracheids, to our knowledge, has not been mentioned previously. This investigation

established the existence of blind bordered pits in the strand tracheids where they are in contact with the radially oriented intercellular spaces in the rays.

These intercellular spaces, however, can, in a similar way, also be in contact with the special type of parenchyma; viz., epithelium.

These observations fit well with the line of thought of Panshin and de Zeeuw (1970) who stated that strand tracheids may be regarded as transitional elements between epithelial cells or longitudinal parenchyma cells and longitudinal tracheids.

It is known that parenchyma is characterized by the occurrence of simple pits in its cell walls (IAWA 1964; Jane 1970). In contradistinction to this, it has been found that in the vertical epithelial cells bordered pits can occur under special circumstances. Because of these unexpected features, a certain ambiguity in the character of the epithelial cells has been demonstrated. Therefore, a relationship between the vertical epithelial cells and the strand tracheids may be suggested, due to the genetic impact on the original fusiform initial.

This supports the theory of Jeffrey (1917) which proposes that both radial and longitudinal parenchyma elements were derived from modified tracheary cells, because the xylem was primarily built up out of tracheary elements.

ACKNOWLEDGMENT

The author wishes to thank Dr. Susanna M. Jutte for the valuable discussion relating to this work.

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FIGURES

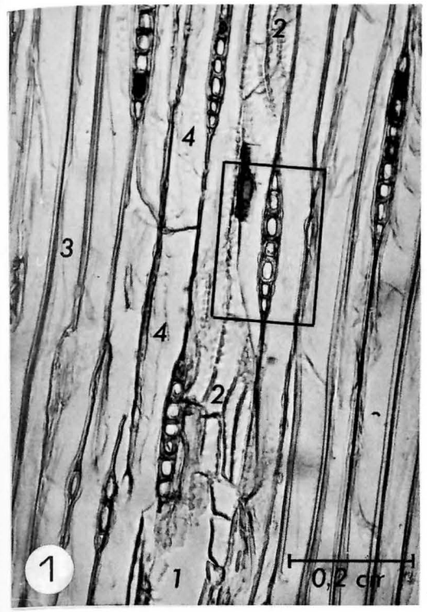
Figure 1. Tangential longitudinal section of the epithelial area in spruce. Epithelial cells (2) and strand tracheids (4) surround the resin canal lumen (1). The epithelium as a whole is enclosed by longitudinal tracheids (3).

Figure 2. Detail of inset in Figure 1. On the left side of the ray, blind bordered pits (6) may be seen. They occur opposite radial intercellular spaces between the ray parenchyma cells (5). On the outer left are cell walls of secretory parenchymatous cells.

Figure 3. Tangential longitudinal section of a part of a ray in spruce. Opposite the radial intercellular space (7) between ray parenchyma cells (5), a blind bordered pit (6) is present. Its cross-sectioned border is outlined well. This bordered pit is a part of the cell wall of a parenchymatous cell (epithelial cell) which is simple pitted (2) on its left side. Photographed between crossed nicols.

Figure 4. Tangential longitudinal section of a ray between strand tracheids (4) and a longitudinal tracheid (3). Enclosed by cell walls of ray parenchyma cells (5), strand tracheids (4) and a radial intercellular space (7), unusual "intercellular cavities" (8) may be observed. Its diameter corresponds with that of a blind bordered pit, although the typical pit characteristics are lacking.

Figure 5. Schematic representation of an intercellular cavity (A) and a blind bordered pit (B) in the vertical epithelium in spruce. Schemes A and B represent tangential longitudinal sections of the wood with the corners of ray parenchyma cells and their adjacent vertical elements. Legend: 1. ray parenchyma; 2a. strand tracheid; 2b. secretory parenchymatous cell; 3. radial intercellular space; 4. blind pit, type of simple pit; 5. intercellular cavity; 6. blind pit, type of bordered pit.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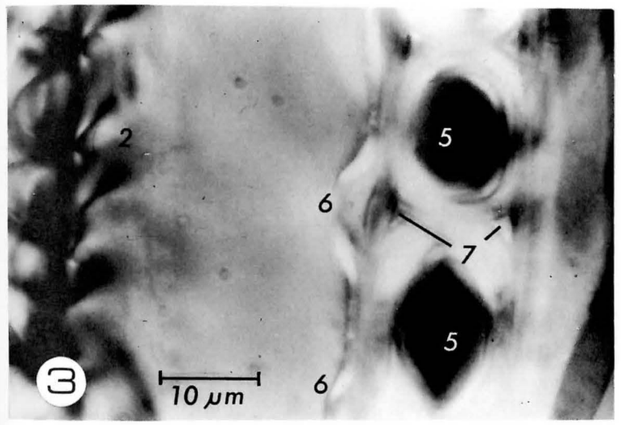
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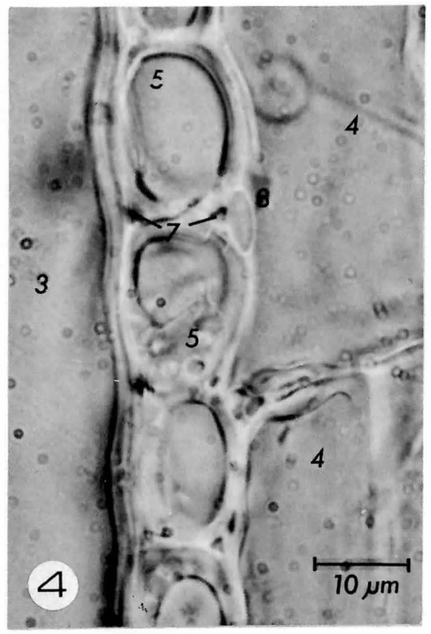
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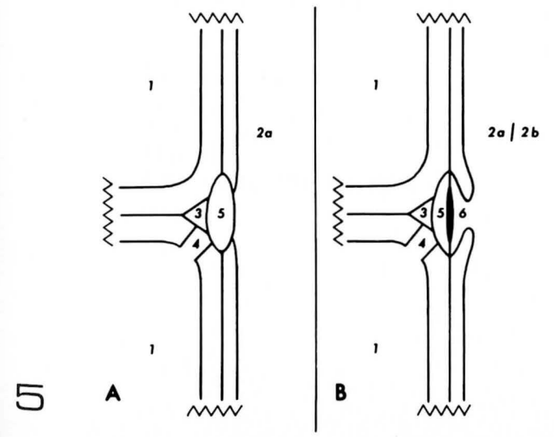
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Increase in Membership Dues

It was with extreme reluctance that the Members of the Council arrived at the recent decision to increase annual membership dues effective January 1, 1975. At that time dues will be raised to $10.00 U. S. As in recent years, notices will be mailed in December. Members are urged to make a special effort to pay promptly as the Association bank balance is dangerously low. The cost of sending a second notice later in the year would be eliminated if all members could cooperate in this way.

In evaluating the financial picture of I. A. W. A., the Council made a thorough survey of all factors contributing to this situation. Obviously, the Association has been unable to escape the effects of an inflationary spiral that is apparently still accelerating. Costs of paper, printing and postage have gone uncurbed in 1974. For 1975 another postage increase can be expected according to reports from Washington.

For the past five years the organization has enjoyed a subsidy from the S. U. N. Y. College of Environmental Science and Forestry. This has been reflected in several ways. First, the time of the Executive Secretary is donated, as is the time of secretarial and staff assistants. The text of the Bulletin has been printed by the College and I. A. W. A. had only to purchase the paper. The mail room personnel and the postage meter arrangement have also been at the disposal of the Association.

In 1975 the printing facilities of the College may be discontinued and the Association will be required to pay commercial printing services for the Bulletin and other mailing pieces such as the Membership Directory, dues notices, announcements, and similar items. If this action is carried out as predicted, dues of $10.00 per year will not be excessive, but should be adequate if all members cooperate.

It has been suggested that a membership campaign to recruit more wood anatomists might be one way of improving the financial condition of the Association in the future. Your Membership Committee would welcome new applications and the Office of the Executive Secretary stands ready to process all such materials.

Error Noted

According to Dr. H. R. Höster, author of "On the Nature of the First-formed Tracheids in Compression Wood", which appeared in the 1974/1 issue of the Bulletin, page 3, the following change should be made:

Line 8. Reads: "They possess a rectangular form and helical cavities; intercellular spaces do not occur".

Should read: "They possess a rectangular form, helical cavities and intercellular spaces do not occur."

We regret any confusion that may have arisen from this editorial change in the original manuscript.

PROGRAM

for

TECHNICAL SESSIONS OF INTERNATIONAL ASSOCIATION OF WOOD ANATOMISTS

at the

XII INTERNATIONAL BOTANICAL CONGRESS

Leningrad, July 3-10, 1975

SESSION I - Cambium

Chairman: V. Necesany

Taylor, F. W.:	Variation in the Angiosperm, Cambium and Xylem Derivatives
Bosshard, H. H.:	Cambial Activity and Differentiation Evaluated on the Basis of Three-Dimensional Anatomical Studies
Datta, P. C.:	Effects of Compression and Aeration on Wood Formation in *Lennea grandis* Eng. (with Basantika Mitra)
Ayensu, E.:	Structural Analysis of Anomalous Stems in Vines; with Special Reference to *Passiflora multiflora*.
Höster, H. R.:	Cambial Activity and Differentiation of Normal and Reaction Tissues
Keith, C. T.:	Fixation of Conifer Cambium for Ultra-structural Study
Catesson, A.: (Invited non-member)	(Title Not Received)

SESSION II - Wood Differentiation

Chairman: E. Ayensu

Necesany, V.:	Mechanism of the Primary Wall Growth
Kutscha, N. P.:	Studies of Lignification in Balsam Fir

Wardrop, A. B.:	Recent Evidence Relating to the Mechanism of Lignification in Plants
Isebrands, J. G.:	Vascular Organization in the Node of Eastern Cottonwood
Ifju, G.:	Quantitative Changes in Cell Walls and Cell Wall Constituents of Differentiating Secondary Xylem of *Tsuga canadensis* (L.) Carr. (with George A. Grozdits)
_____: (Invited non-member)	

SESSION III - Taxonomic and Evolutionary Value of Wood Anatomy

Chairman: W. C. Dickison

Necesany, V.:	Structure and Function of Living Wood Rays
Braun, H. J.:	Wood Ray Types--Their Principles
Mennega, A. M. W.:	Wood Anatomy and the Classification of the Euphorbiaceae
Gottwald, H.:	The Anatomy of Magnoliaceae with Reference to Systematic Classification
Grosser, D.:	On the Anatomy of Bamboos, with Special Reference to the Classification
Czaninski, Y.: (Invited non-member)	Wood Cells Associated with Vessels and Its Physiological Role

SESSION IV - Wood Anatomy and the Environment

Chairman: W. Liese

Baas, P.:	Wood Anatomical Variation in Widely Distributed Taxa in Relation to Ecological Factors and Phylogeny
Liese, W.:	Environmental Effects on Wood Structure

Mariaux, A.: Studies of Dendrochronology in the Sahelian Climate (Essais de dendro-climatologie en climat Sahelien)

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(Invited non-member)

Standby Paper: The Influence of Environmental Factors
(Wardrop, A. B.) on Cell Wall Structure

SESSION V - Ultrastructure of Woody Tissues

Chairman: W. Côté

Thomas, R. J.: Differentiation of Hardwood Perforation Plates and Bordered Pits

Wagenfuhr, R.: Importance of the Wood Anatomy for Identification of the Wood Species and Wood Properties

Parameswaran, N.: Fine Structure and Lignin Character of Sclereids in Tree Bark

Ifju, G.: Application of the Principles of Stereology to the Quantitative Microscopy of Wood (with J. A. Johnson and J. H. Steele, Jr.)

Côté, W.: Ultrastructural and Diagnostic Studies of Wood Using SEM and EDXA

Boyd, J.: Microfibrils in primary and secondary wall growth develop trellis configuration (with R. C. Foster)

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(Invited non-member)

BUSINESS MEETING OF IAWA