

**I A W A
B U L L E T I N**

1974 / 2

OUR COVER

The corrected identification for this photomicrograph is that it is probably a species of *Brownea* in the Leguminosae according to B. F. Kukachka of the Center for Wood Anatomy Research at Madison, Wisconsin. Although the wood sample is labeled Pittier 4394 which is the type collection (US 679549-50) for *Eschweilera reversa* Pittier there has been a confusion of material as is discussed in the editorial for 1974/2.

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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 \$5.00 (U. S.) per year.

EDITORIAL

Our faces are red! First, we were disappointed with the quality of printing of the covers for the 1974 issues of the Bulletin. Our printer retired from business and his replacement obviously lacks the skill his predecessor had. We can hope for something better in 1975.

The second cause for embarrassment arises from an error in identification of the wood from which the cover photo was made. We stated that this photomicrograph represents an unusual example for the Lecythidaceae. Carl de Zeeuw had recognized that this sample has the characteristics of a legume, however two factors combined to cause him to mislabel the photomicrograph. First the wood collection is fully substantiated with vouchers and was collected by Henri Pittier who was normally very careful. Secondly, another collection in the same genus, *Eschweilera wachenheimii* (Ben.) Sandw., had appeared as a single sample with a distinct Leguminos pattern of parenchyma. The alertness of B. F. Kukachka, R. Koeppen and A. Mennega has brought our attention to the fact that Pittier obviously made a mistake in collecting fruits from the ground that did not belong to the wood which is probably a *Brownea* according to B. F. Kukachka. All this is documented in Woodson and Schery, *Annals Missouri Botanical Gardens* 45(8):131 (1958). Subsequent receipt of other material of *Eschweilera wachenheimii* has shown that the first collection is undoubtedly another confusion between numbering of vouchers and wood sample.

While this situation is embarrassing it is revealing in the fact that several people were alert enough to catch the error. Also it points out the ever present difficulty that exists for misnumbering wood samples even in the field work of experienced collectors.

We have corrected the cover description with this issue and hope that in the future this will not occur again.

Finally, we want to share with you some bad news. Effective March 2 the United States Postal Service announced substantial rate increases for all classes of mail. For us this means that our second most important budget

(Continued on page 31)

Cell Wall Thickenings in the Ray
Parenchyma of Yellow Cypress

By

S. C. Chafe¹

INTRODUCTION

Cell wall structure in xylem parenchyma has often been regarded as similar to that found in fibers and tracheids in that it may display S_1 , S_2 , S_3 layering (See Chafe and Chauret, 1974). Occasional observations suggesting lamellate structure have been made, however, (Frei *et al.*, 1957; Harada, 1965; Timell, 1972), and recently crossed polylamellate structure has been clearly demonstrated in the parenchyma walls of both hardwood and softwood species (Chafe, 1974a; Chafe and Chauret, 1974). Cell wall structure in hardwood parenchyma has been further shown to be highly complex and to include amorphous or "isotropic" layers poor in cellulose and rich in pectin and lignin (Chafe and Chauret, 1974). In the case of vessel-associated ray parenchyma, a rather similarly structured "protective layer" occurs, the significance of which remains, for the most part, unresolved (Chafe, 1974b; Czaninski, 1973; Meyer and Côté, 1968; O'Brien, 1970).

Recent investigations thus suggest considerable variability in parenchyma cell wall structure and tend to preclude its inclusion in the same category as that of fibers and tracheids. The present paper considers a further elaboration of parenchyma wall variability as perceived in the ray cells of yellow cypress where distinctive, localized wall thickenings have been observed.

MATERIALS AND METHODS

Small samples of dried wood of yellow cypress (*Chamaecyparis nootkatensis* [D. Don] Spach) were aspirated in water and immersed for two

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to three hours in 2% aqueous KMnO_4 ; additional samples were extracted for all non-cellulose by treating with a mixture of two parts H_2O_2 and one part acetic anhydride. Cell macerations were also prepared by the latter method.

After washing, all samples were dehydrated in a graduated acetone or ethanol series and embedded in Epon or according to Spurr (1969). Thin sections were cut with a Reichert OmU2 ultramicrotome, picked up on copper grids, and examined with a Philips 100 electron microscope. In the case of extracted material, sections were first shadowed with platinum-palladium following removal of the embedding medium (Mayor *et al.* 1961). One- or two-micron sections of all preparations were also examined with a Reichert "Zetopan" optical microscope equipped with polarized light accessories. Macerated cells were observed either in the unstained condition or following staining by congo red.

Other aspirated samples of yellow cypress, and also Japanese cedar (*Cryptomeria japonica* D. Don), were sectioned smooth with a steel microtome knife, dried, and coated with gold prior to examination with a Cambridge "Stereoscan" scanning electron microscope.

OBSERVATIONS

Transverse sections examined by light and electron microscopy, revealed localized thickenings in the ray parenchyma wall adjacent to the tangential boundaries of longitudinal tracheids (Figs. 1, 2). In macerated ray cells viewed normal to their horizontal walls, that is, from a similar perspective as in transverse section, the thickened regions of the wall, following staining by congo red, were reflected by darker staining points along the outer margin of the cell (Fig. 3). When such cells were viewed normal to the radial wall, a system of faint "bars" could be seen, thus suggesting that the exclusive location of the thickenings was this wall (Fig. 5). The examination of the cells between crossed nicols provided additional support for these observations (Figs. 4, 6).

The shape of the thickenings was further clarified by the scanning electron microscope where it could be seen that they formed an internally protruding ridge along the radial wall (Figs. 8, 9). So viewed, the extent

of development of these thickenings was variable. Least development appeared to involve an interrupted thickening in which only the radial-horizontal wall corners were thickened (Fig. 7). Most commonly, they were continuous along the radial wall, as suggested by light microscopy, and disappeared approaching the horizontal wall (Fig. 8). While the extent of development towards the horizontal wall was variable and, as suggested in Fig. 9, at times appeared to encroach upon it, the thickening did not extend along this wall. As can be seen from Fig. 9, no protruding thickenings continuous with the thickened ridges were evident where the horizontal walls were sectioned.

These thickenings were more pronounced in yellow cypress than similar structures previously observed in *Cryptomeria* (Chafe, 1974a). In the latter they were evident in the scanning electron microscope only as shallow ridges extending along the "trough" produced by abutting tracheids (Fig. 10). In this connection, it may be noted that the longitudinal tracheids appear to be responsible for the often "sculptured" appearance of macerated ray cells (Chafe, 1974a). Figs. 3 and 4 illustrate, for example, the presence of shallow, concave wall indentations bounded by wall thickenings. It would seem that this shape derives from an impingement of adjacent longitudinal tracheids on the ray cell, presumably during the early stages of differentiation (Fig. 1). It may also be noted that no such "sculptured" effect is evident in cells viewed normal to the radial wall (Figs. 5, 6).

One exception to the above observations occurs, however, when the ends of longitudinal tracheids, as viewed in radial section, abut ray cells. In this case localized thickenings of the horizontal ray wall may be evident opposite the intercellular region of the tracheids (Fig. 11). Such ray cells may also exhibit a "sculptured" horizontal wall (Fig. 11).

The cell wall thickenings display, as does the remainder of the wall, a lamellate structure (Fig. 2). Since material was prepared with potassium permanganate, this may suggest, as in *Cryptomeria* (Chafe, 1974a), a lamellate distribution of lignin. It is also clear, however, that the wall is comprised of a number of cellulosic lamellae. In non-cellulose extracted

material, the thickenings and non-thickened regions of the wall demonstrated typical crossed polylamellate structure (Fig. 12).

The significance of these features is not immediately clear. Wall structure in thickenings is similar to that observable in the remainder of the parenchyma wall, *viz.* crossed polylamellate, the only difference involving--as with localized wall thickenings in other cell types (Chafe, 1970; Chafe and Wardrop, 1972)--the relative thickness of lamellae. Possibly such features may develop during early differentiation as a mechanical reinforcement in response to increasing pressure from adjacent longitudinal tracheids. In this respect it may be of interest to note that tracheid tangential walls abutting rays have been observed to be thicker than when non-ray-associated (Ladell, 1967).

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DESCRIPTION OF FIGURES*

- Figure 1. Light micrograph of transverse section of xylem showing thickenings (arrowheads) of ray parenchyma cell wall. Longitudinal tracheids tend to bulge into ray cell. KMnO_4 . 1,400X.
RC - ray parenchyma cell, T - tracheid.
- Figure 2. Electron micrograph of area similar to that of Figure 1 showing lamellation of the thickened and unthickened wall. KMnO_4 . 8,500X.
- Figure 3. Macerated ray parenchyma cell stained with congo red, oriented parallel to the plane of polarization, and viewed normal to its horizontal walls. Thickenings appear as dark points along cell margin. Photographed in the polarizing microscope with the analyzer withdrawn. 280X.
- Figure 4. Similar to that of Figure 3 except photographed between crossed nicols in the 45° position. Thickened areas display greater birefringence than unthickened wall. 280X.
- Figure 5. Macerated parenchyma cells prepared as in Figure 3 except viewed normal to radial walls. Thickenings now appear as bar-like structures. 280X.
- Figure 6. Similar to Figure 5 except photographed between crossed nicols in the 45° position. 280X.
- Figure 7. Scanning electron micrograph of ray parenchyma cells showing poorly developed thickenings (arrowheads) restricted to radial-horizontal wall corners. More fully developed thickening at upper left. Radial surface of the xylem. 1,700X. R - radial wall, H - horizontal wall, EW - end wall.

*With the exception of Figure 10, all micrographs are of yellow cypress.

Figure 8. Scanning electron micrograph similar to Figure 7 showing thickenings (arrowheads) developed along radial walls and diminishing toward horizontal walls. Radial surface of the xylem. 1,900X.

Figure 9. Scanning electron micrograph demonstrating well developed thickenings on radial walls. Despite apparent encroachment onto horizontal wall, extension along these walls is not present as horizontal walls appearing in section show no thickening (arrowheads). Radial surface of the xylem. 3,700X.

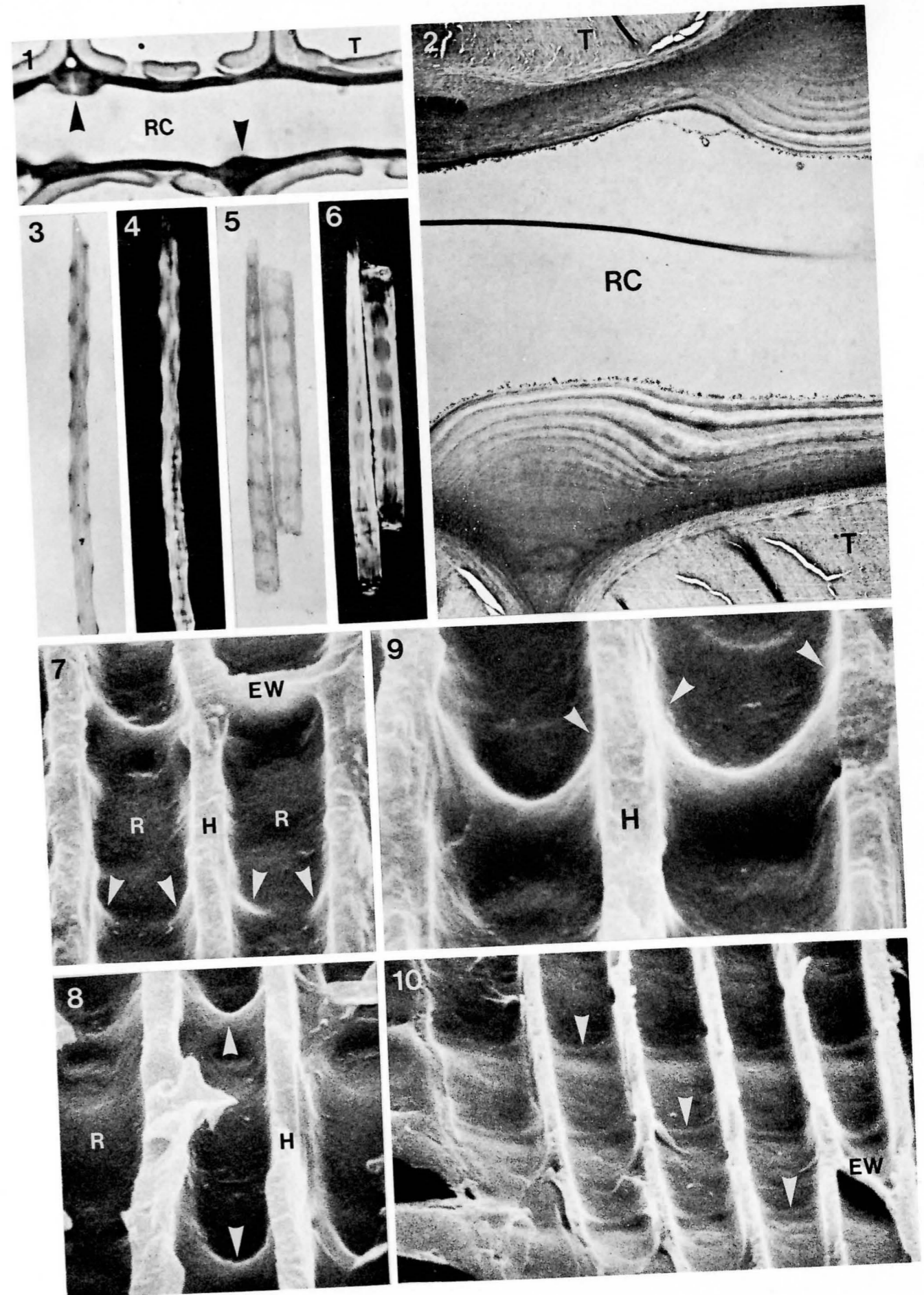
Figure 10. Scanning electron micrograph of *Cryptomeria* ray parenchyma showing inconspicuous thickenings (arrowheads) in valleys formed by impinging tracheids. Radial surface of the xylem. 900X.

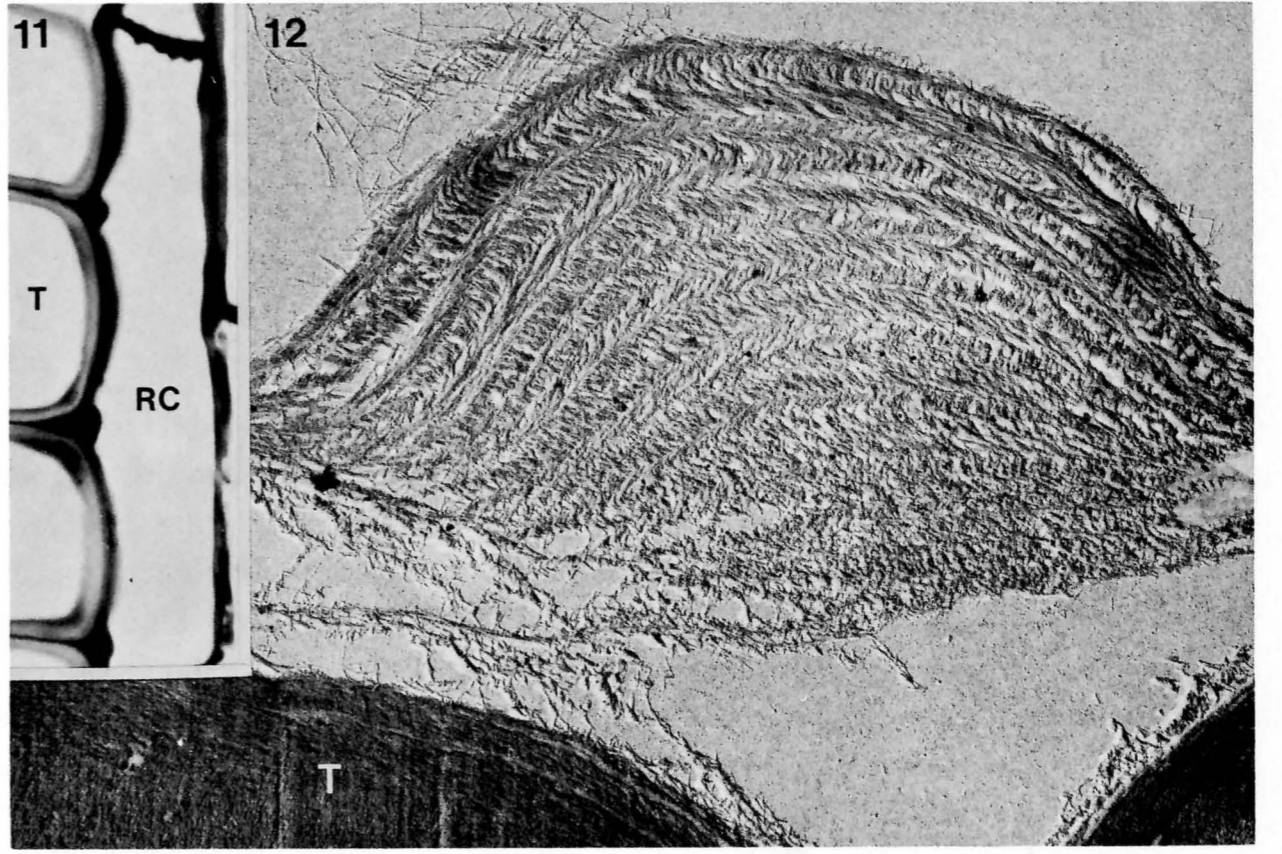
Figure 11. Light micrograph of radial section of the xylem showing thickened areas of the horizontal ray cell wall adjacent to intercellular regions of abutting ends of longitudinal tracheids. $KMnO_4$. Post stained with toluidine blue. 700X.

Figure 12. Electron micrograph of thickened area of ray parenchyma wall showing crossed polylamellate structure. Transverse section. Shadowed with platinum-palladium following removal of the embedding medium. 18,500X.

ACKNOWLEDGEMENTS

The author wishes to thank Mr. G. Chauret for technical assistance and Mr. Ed Quinn of the Division of Building Research, N. R. C., for scanning electron microscopy.





Anatomical Characteristics of Redwood
[*Sequoia sempervirens* (D. Don) Endl.] of Seed and Sprout Origin

By
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Sprouting is a valuable property of forest trees with regard to production of wood. Many forests are composed of sprouts (coppice forests). Species that sprout are mainly broad-leaved. Sprouting conifers include pine species, baldcypress, redwood and others, but only redwood can produce sprouts that reach tree size (1).

Comparative studies on the anatomy (or properties) of wood deriving from seeds and sprouts are lacking. It is possible that such differences exist, and also that wood may differ depending on sprout origin. This hypothesis is based on growth of seedlings and sprouts, and origin of sprouting buds.

Growth and Origin of Sprouts

Sprouts grow faster than seedlings during early age, because the former are served by an extensive root system and food stored in the stump. In a number of broad-leaved species, it has been observed that height growth of sprouts is very fast in the first 2-3 years (due to root system and stored food), then declines; it reaches a second (autotrophic) maximum at 10-15 years, and again slowly declines. Diameter growth was reported similar (2). It is understood, however, that growth pattern may be affected by changing sprout competition and climatic conditions.

With regard to origin, sprouts derive from two kinds of buds: adventitious and suppressed or dormant (6). Adventitious buds are produced in parenchyma tissues not directly associated with apical meristems. They may arise in any tissue exterior to the xylem--mostly in the cork cambium, phloem parenchyma, or ray initials of the vascular cambium--and may develop into shoots the same season they are formed. All buds on roots are considered adventitious in origin. Suppressed buds differ in that they can be traced in

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the xylem, sometimes connected to the pith. They grow each season, keeping pace with the radially expanding cambium and, as in the case of adventitious buds, may develop into shoots after a tree is felled.

Such differences with regard to growth rate, root system conditions, maturity and kind of originating tissues, may be expected to create differences in wood anatomy between sprouts, and between sprouts and shoots of seed origin--especially in the region of juvenile wood.

Material and Method

The material for the present study consisted of two discs of redwood supplied from California (USA)*. The provenance of the sprout disc (with regard to type of initiating bud) is not known, but according to literature "redwood sprouts originate close to the stumps from adventitious buds on the large lateral roots" (5). The seed disc had an average diameter (inside bark) of 18.2 cm and 51 growth rings, and the sprout disc a diameter of 19.5 cm and 56 growth rings.

Samples were obtained along a radius of each disc, and were used to determine: width of growth rings, length of tracheids, proportion of latewood, and amount of cell wall substance--an index of specific gravity. All these characteristics were microscopically measured. Cell wall substance was determined by the point sampling method. The method consists of taking samples at intervals and recording whether they fall on cell wall or cell lumen. A grid with 49 points at regular intervals was used (3).

Results

The results are shown in Table 1 and Figures 1 to 4. Because in both discs the last growth ring had not been completed, and for reasons of uniformity, all comparisons are based on 50 growth rings.

The results may be summarized as follows:

- Growth ring pattern was typical in that the sprout had grown faster at the beginning (Figure 1). Mean values of ring width were about equal, however (Table 1). Alternating peaks of wide rings appear in early growth of the sprout (Figure 1).

*Thanks are due to Prof. R. A. Cockrell and to Mr. W. A. Dost for procurement of the material.

- Tracheids were longer in the wood of sprout origin, especially in young age (Figure 2), in spite of its wider rings (4), but the difference of mean values was not statistically significant (Table 1).

- Proportion of latewood (in percent of total ring width) was higher in the wood of seed origin, and typically (4) increased from pith outward in the first few growth rings; such an increase was not observed in the wood of sprout origin (Figure 3). The difference of mean values was statistically significant (Table 1).

- Changes in amount of cell wall substance (proportion of points falling on cell wall) followed a pattern similar to that of latewood (Figure 4, Table 1).

TABLE 1. Statistics of investigated anatomical characteristics (Mean values and statistical comparison)

Origin of Wood	Ring Width (mm)	Tracheid Length (mm)	Latewood (%)	Cell Wall Substance (%)
Seed	1.76	2.76	22.88	60.22
Sprout	1.73	3.16	14.28	52.45
t-test	NS	NS	***	***

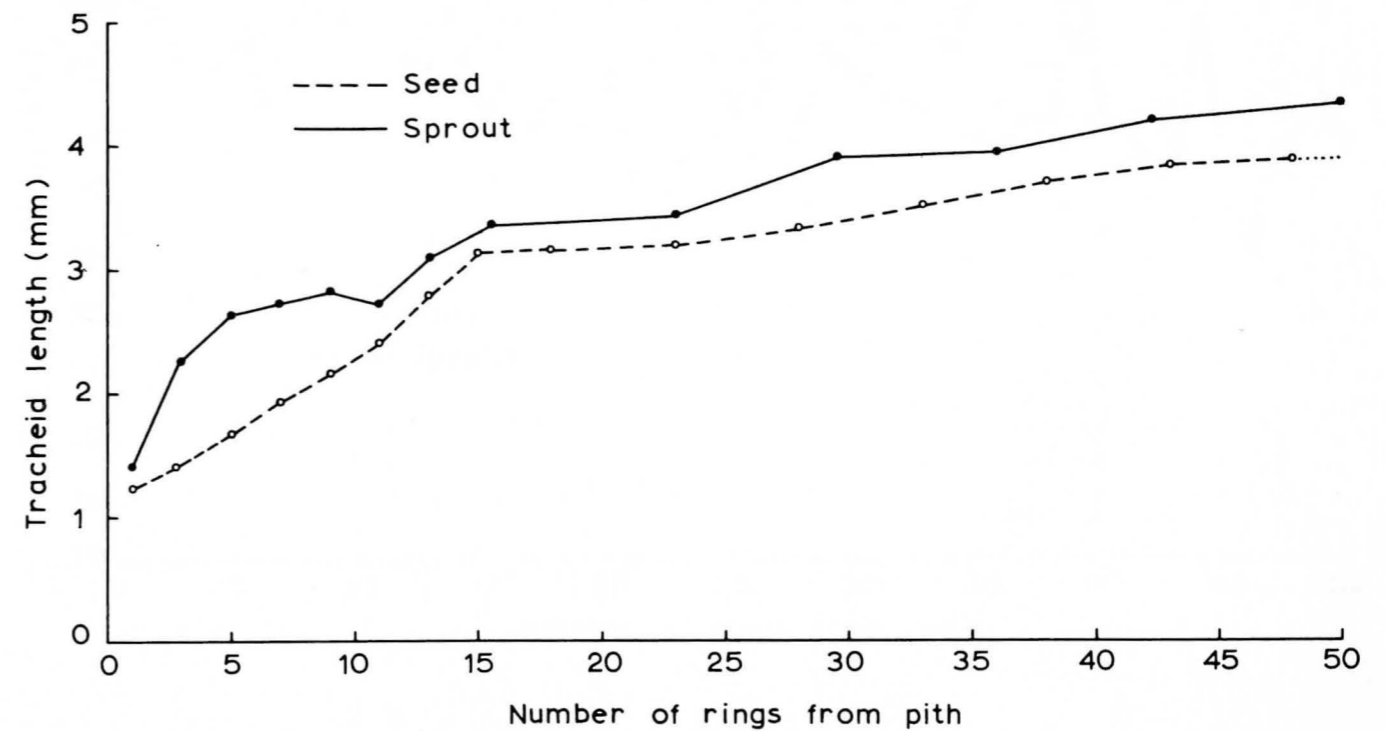
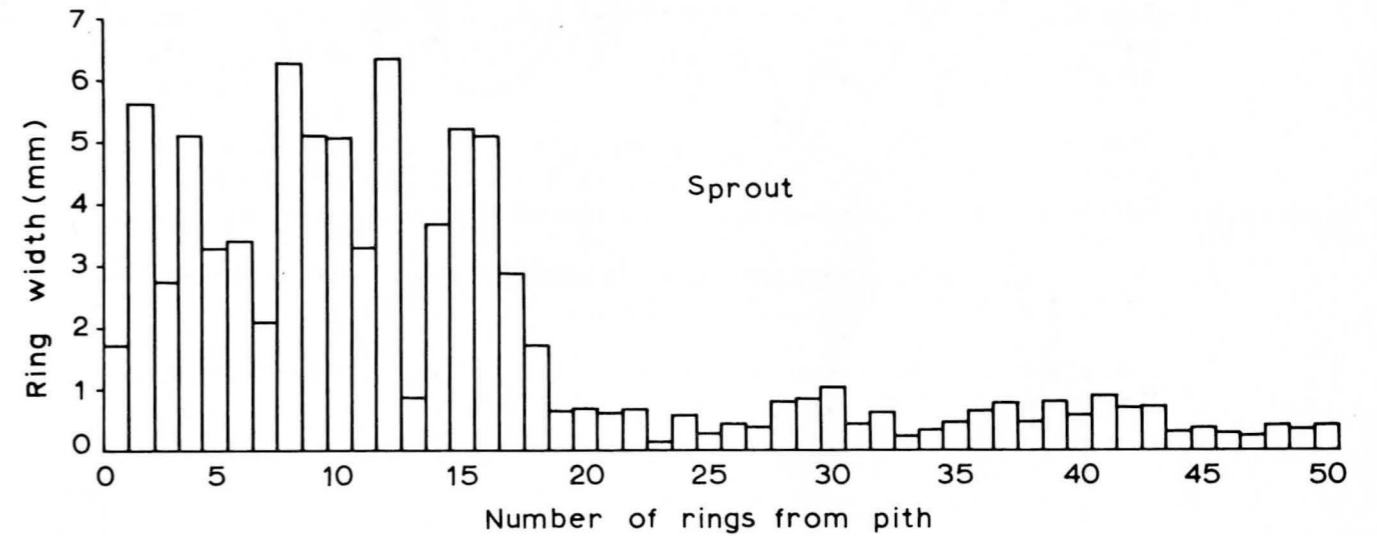
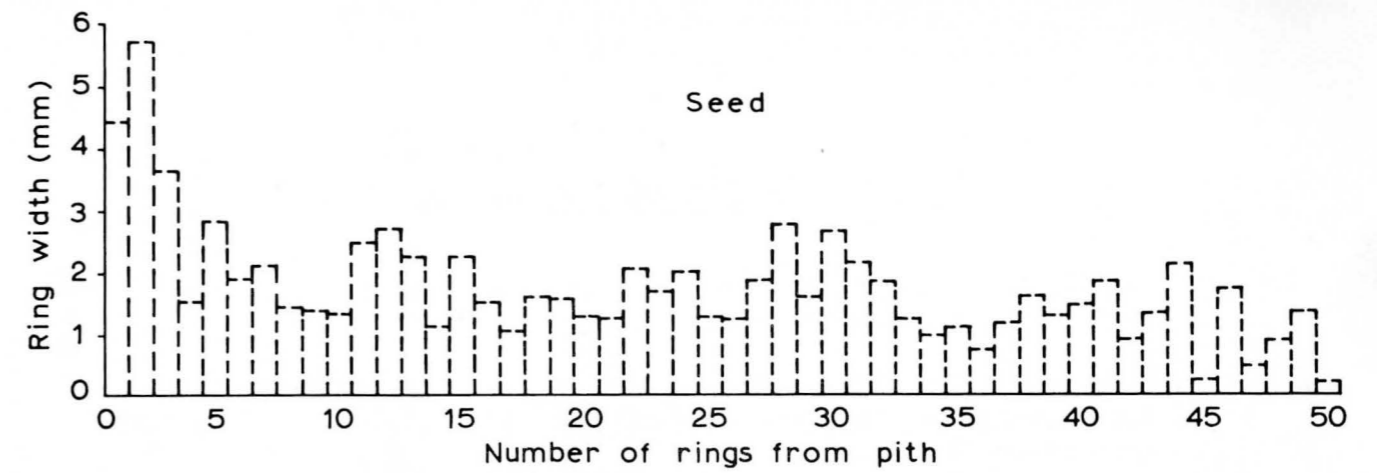
NS: non-significant and ***: significant at P = 0.001

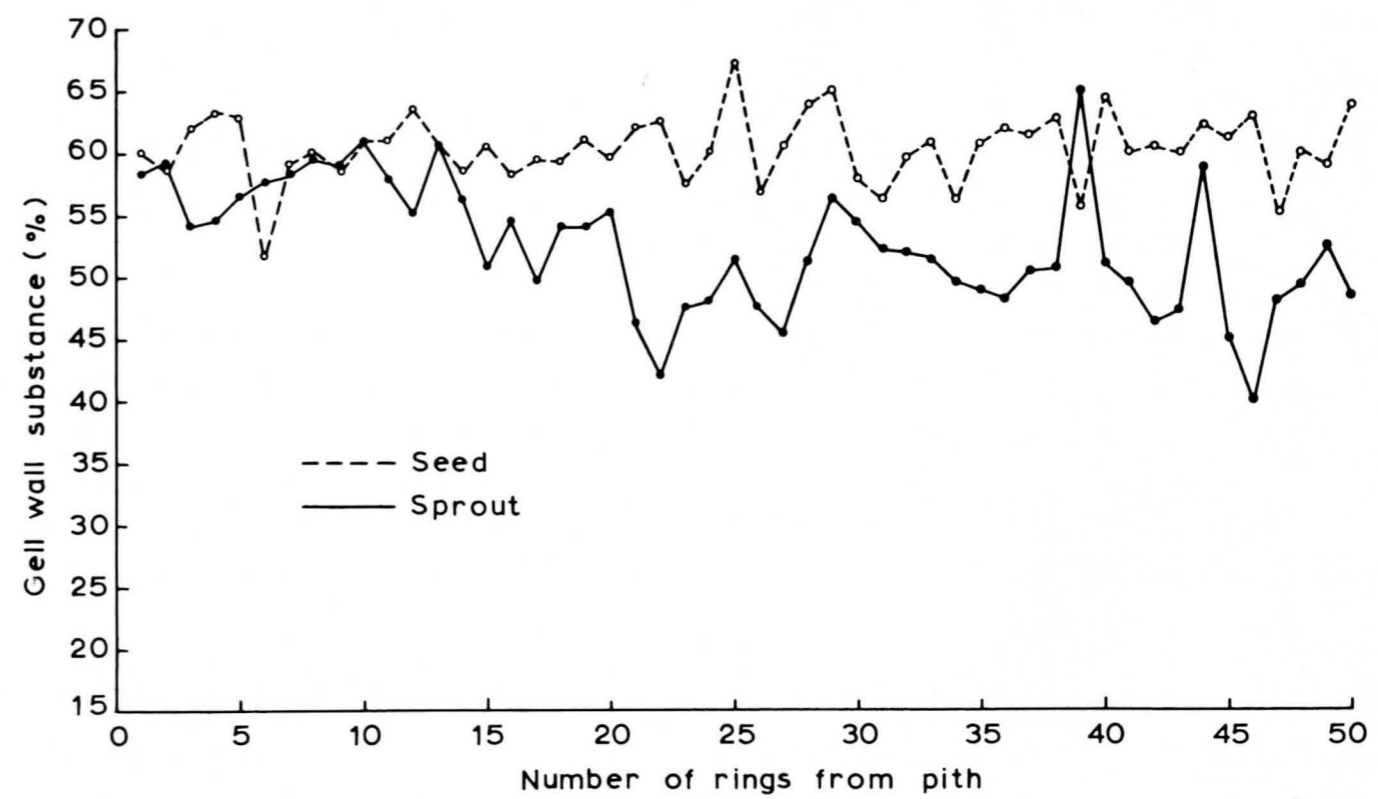
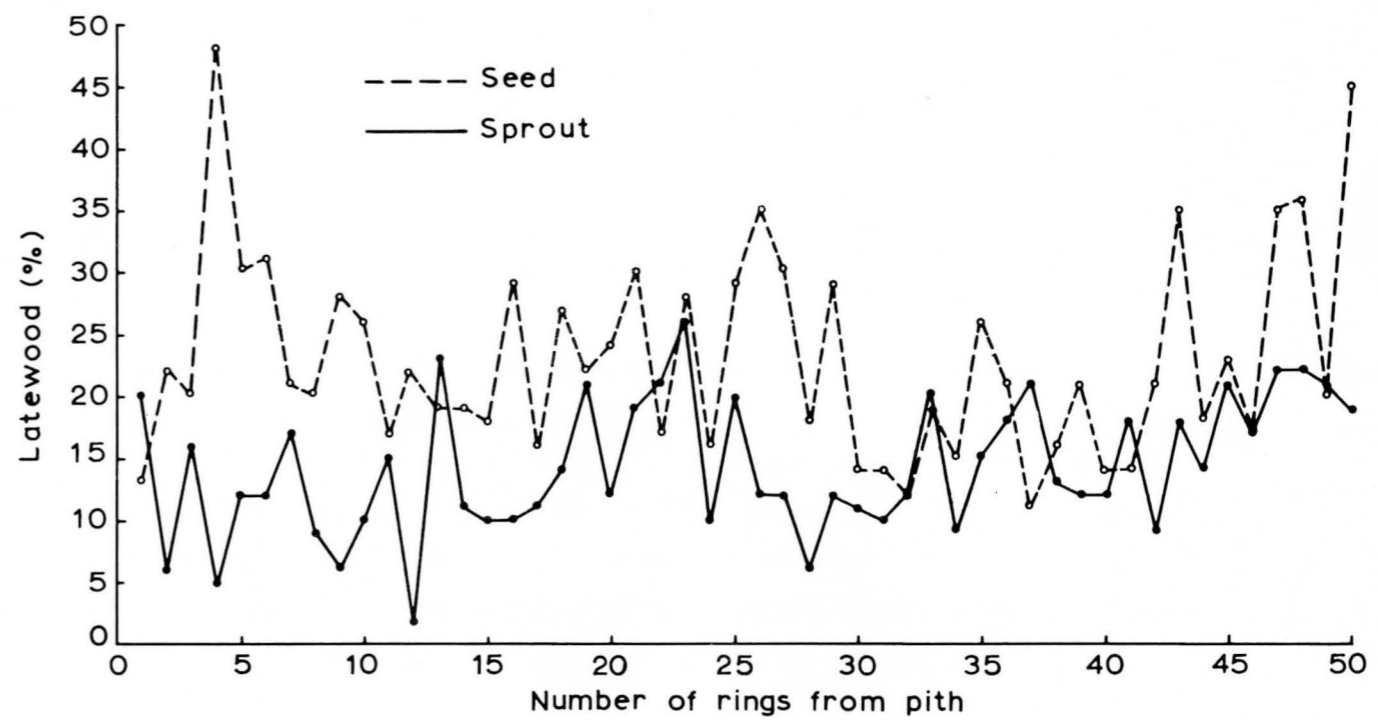
FIGURES

- Figure 1. Variation of ring width from pith to bark.
 Figure 2. Variation of tracheid length.
 Figure 3. Variation of latewood.
 Figure 4. Variation of cell wall substance.

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The Harvard Wood Collection

By

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As Professor William Stern pointed out in his talk to the symposium audience at the Centennial of the Arnold Arboretum in June, 1972 (Stern, 1973), a wood collection has become a very necessary part of any herbarium which is fundamentally concerned with the phylogenetic classification of plants. He also emphasized the fact that there were until recently only six large wood collections in the United States, of which four now survive at their founding institutions, one of which is at Harvard University. The Harvard collection was planned and was initiated by Bailey and Wetmore in their joint firm conviction that it could play a significant part in research projects concerned with the evolution and classification of vascular plants. Since its initiation in the early thirties, it has grown to include some 30,000 woods and some 30,000 microscope slides of these woods prepared from species of gymnosperms and angiosperms with some 15,000 ancillary slides of pollen, nodes, cleared leaves, flowers and seeds. Secondary xylem alone has provided some 60 tested criteria by which one can compare and establish evolutionary trends in fossil and living vascular plants independent of, yet supplemental to correlations in reproductive organs. Statistical correlations are so firm, as Tupper, Frost, Kribs, Tippon and others have shown, that there is little room for doubt of the significance of correlation techniques in their findings. But, clearly, the collection to be significant must have authenticated herbarium voucher specimens of the plants. Housing a wood collection apart from the herbarium defeats the purpose of its origin and development.

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The Harvard Wood Collection has its beginning from integrated collections of woods of Professor E. S. Jeffrey and of Professor I. W. Bailey. In 1927, Bailey became Professor of Plant Anatomy in the Bussey Institution for Study in Applied Biology, rather than in the School of Forestry of which he had been a member since 1910, and as such had been concerned with problems of forests and forest products. From 1927 until his death, Bailey demonstrated that evolutionary problems in the seed plants were capable of being comparatively and statistically attacked. In 1933, the correlations studies of Frost (1930-31), in relation to others in Bailey's laboratory, Bailey and Tupper (1918), Kribs (1935-37), etc., showed evolutionary trends in the constituent elements of xylem: vessels and tracheids, vascular rays and even in xylem parenchyma. Long tracheids, and long narrow vessel elements with scalariform pits were less effective vehicles of transport in moving liquids up the woody plant than were wider, shorter elements with oblique or transverse terminal pores and small, circular bordered pits, whether the liquids were raised by root pressure or by cohesive water columns. The vessels were envisioned by Bailey and Tupper, and Frost, as appearing in four graded classes, Groups I to IV under these criteria. Correlated with the varying vessel types were the storage tissues, the vascular rays and the xylem parenchyma, as shown by Kribs. It has repeatedly been stated that no more beautiful phyletic picture has been found in natural evolution.

By 1933, Wetmore, supported by Bailey, had begun a wood collection in the Biological Laboratories. This venture followed two planned trips by Wetmore, with a graduate student on each trip, to the Atkins Garden of the Bussey Institution in Cuba and to Barro Colorado Island in the Canal Zone, and was financed in part by Milton Grants, in the summer of 1927 and in December and January, 1931-32. In 1933-1941, money was raised each year for technicians to prepare microscope slides for the slide collection from several voucher-covered wood collections at the Arnold Arboretum. In addition woods for specially planned studies were solicited from collectors going to the field in South America, Africa, South Pacific, etc.; herbaria and museums were canvassed; and close relations were maintained with Professor Samuel J. Record of the Yale Forestry School who was also building

a wood collection. Only woods with documenting herbarium vouchers were requested for both Yale and Harvard Collections.

By 1940, a consolidated Harvard Wood Collection of xylem blocks, and associated sectioned microscope slides had become a reality with 267 families of Gymnosperms and Angiosperms represented by some 280 genera and over 9,040 species of Gymnosperms and Angiosperms with an accompanying assemblage then of over 22,400 slides. In 1936, with the dissolution of the Bussey Institution, Bailey, though on the Arnold Arboretum payroll, was housed in the Biological Laboratories. Room 375 had been assigned to the Wood Collection, with storage facilities provided by the Biological Laboratories to house it. Card catalogs had been provided both for the history of accessions in numerical order and for systematic arrangement of all woods available. Professor Jeffrey's, Professor Bailey's and Professor Wetmore's collections and all others acquired were all accessioned and mostly were sectioned so that microscopic slides were available. Much of the preparation and cutting of woods was done during summers by graduate students of Wetmore and Bailey and full-time technicians were utilized each year. The Department of Biology provided \$1200 each of several years, and the Arboretum, through the sympathetic encouragement of Director Elmer D. Merrill, participated in the support. Most of the money, however, was derived through the Milton Fund and through the cooperative help of Professor S. J. Record of the Yale School of Forestry who bought surplus slides for the Yale Collection. For much of the total endeavor Wetmore used his own departmental budget and facilities.

During the 1930's to 1955, numerous investigations on problems of classification based on xylem studies were carried out and completed by graduate students Abbe, Vestal, Cheadle, Tippe, Taylor and Heimsch under Wetmore and by Barghoorn, Canright, Lilian Money, van der Wyk and Margery Marsden under Bailey. Other studies by Howard, Holt, Marsden and Steeves, Charlotte Nast and Swamy have demonstrated the soundness of the Bailey-Wetmore thesis, that the Wood Collection made possible the resolution of many problems in taxonomic relations and have established the necessity for

continued progress to supplement data available to the herbarium taxonomist.

For proper exploitation of its potentiality and promise, however, a large Wood Collection such as Harvard now has should be expanding and should be available and in open use with a competent "curator", that all may benefit from its scientific assets and stored potential in cooperative investigations.

Since 1955, when the Wood Collection was moved into the then new Herbaria building and in succeeding years when Professor Bailey retired, less than maximum use of the collection was made. It did, however, serve a continuing use on a limited scale to visiting scientists and also an intermittent use in identification of fossil woods and archeological specimens. Although Professor Bailey was retired he gave freely of his time upon request despite the fact that he had little or no help nor official responsibility. The result has been a somewhat neglected facility during the past decade. Geographic accessibility to a variety of workers is as much a necessity as its proximity to the related herbarium material. The retirement of Bailey, Wetmore, and others to come, should not mean lessened use of this facility nor the termination of significant anatomical and evolutionary studies.

During the summer of 1973 in connection with major reorganizations of space in the whole area of Systematic Biology at Harvard, the Wood Collections were moved into a completely renovated area in the immediately adjacent Botanical Museum. This was largely the result of sustained effort by Research Assistant Elisabeth Wheeler and graduate student Bruce Tiffney. Slides have been moved from wooden boxes into 3 x 5 inch aluminum slide holders for more convenient access. Wood specimens have been stored in plastic bags, with labels attached, in open drawers. As a result the Collections are now housed in a facility containing modest but complete services for use in anatomical studies, histological preparation and other aspects of plant anatomy. In addition they are immediately adjacent to very large synoptic collections of fossil woods. Through generous help of National Science Foundation funding, recent acquisitions are being added into the Wood Collection. In addition the collection is being thoroughly and completely recurated and its potential for efficient anatomical studies

of both living and fossil plants is now at a new threshold. The complex has been designated the "Bailey-Wetmore Laboratory of Plant Anatomy and Morphology" with Professor Barghoorn as supervisor, in association with a small informal advisory committee.

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Terminology for Multiperforate Plates in Vessel Elements

By

Richard L Gray and Carl H. deZeeuw¹

Studies by the authors in the wood anatomy of the Lecythidaceae and the genus *Vitex* have revealed the fact that a series of perforation plate types exist that cannot be adequately named under the present system of nomenclature. The terms simple and scalariform perforation plates as established in the IAWA Multilingual Glossary of Terms Used in Wood Anatomy (1964) are well established. However there is no consistent terminology for the forms of multiperforate plates that range from a branching scalariform type (Fig. 4) through an irregular elongate mesh system (Figs. 3, 5, 6, 9, 10) to plates having closely spaced, alternate, isodiametric holes (Figs. 1, 2, 11, 12) and finally to plates with well spaced round holes usually few in number (Figs. 7, 8).

All of these variations in perforation plates have been illustrated previously both by drawings and by photomicrographs (Bliss 1921, Chalk 1933, Frost 1930, Garratt 1933, Metcalfe and Chalk 1950, Meylan and Butterfield 1973). The terms applied to these perforation plates in past work are varied and confusing. For those cases in which the perforations are linear to irregular and the separating bars are branched variously, various terms have been applied: scalariform (Chalk 1933, Meylan and Butterfield 1973), scalariform perforations with branching bars (Frost 1930), and reticulate (Record 1921, Esau 1953). The system of closely spaced alternating, isodiametric perforations which may be hexagonal at one extreme and fairly widely spaced at the other, has been called reticulate (Chalk 1933, Thompson 1923), foraminate (Meylan and Butterfield 1973), multiperforate (Record 1921), "Gnetum-like" (Bliss 1921), and "Cordia type" (Thompson 1923). The form of plate exhibiting a few rounded holes well separated has been called both foraminate and ephedroid (Chalk 1933, IAWA Glossary 1964, Esau 1953).

When considering the terminology to be applied to the various perforation types Chalk (1933) pointed out that there should be some relationship to

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the intervessel pitting types that are in turn associated with vessel development. Investigations by Frost (1930) and later work by Chalk (1933) has clearly shown that scalariform perforations with parallel unbranched bars, the branched scalariform types, and those with irregular elongate perforations are found in the more primitive plants whose vessel elements exhibit scalariform or opposite to transitional linear intervessel pitting. The more advanced types of vessel elements having alternate intervessel pitting are associated either with simple perforations or multiple perforations having numerous isodiametric holes in the plates. Chalk (1933) suggested that the perforations in the more advanced type of vessel elements should be called reticulate when the alternate perforations are closely spaced with narrow bars and a general hexagonal arrangement. When the perforations are more widely spaced and rounded Chalk called these foraminate.

Proposals:

1. It is proposed that the term scalariform continue to be applied to the ladder-like arrangement of unbranched bars separating elongate perforations within the perforation plate.
2. The term reticulate should be applied to those systems in which the bars form a regular network with either thick or thin bars as shown in Figures 1, 2, 11, and 12.
3. These perforation types which form a continuous series ranging from scalariform on the one hand to reticulate on the other, should be named in a manner that reflects their nearest relationship. Therefore it is proposed that the scalariform types with a relatively small amount of branching and straight linear perforations (Figure 4) should be called scalariform-branched. Those types having irregular perforations as in Figures 3, 5, 6, 9, and 10 are essentially imperfect networks and for this reason it is proposed to classify them as irregular reticulate.
4. Finally it is proposed that the term foraminate replace the name Ephedroid in the Multilingual Glossary and be restricted to those cases in which there are a few rounded perforations in the plates (Figures 7 and 8). This suggestion is the same as that made by Chalk (1933) and is made

primarily because of the more widespread usage of this term in contrast to Ephedroid.

ACKNOWLEDGMENTS

The scanning electron micrographs prepared for this study were made with an ETEC Autoscan which was purchased through the generosity of the New York State College of Forestry Foundation, Inc. Without this thoughtful support, studies of this nature could not be undertaken at this Laboratory.

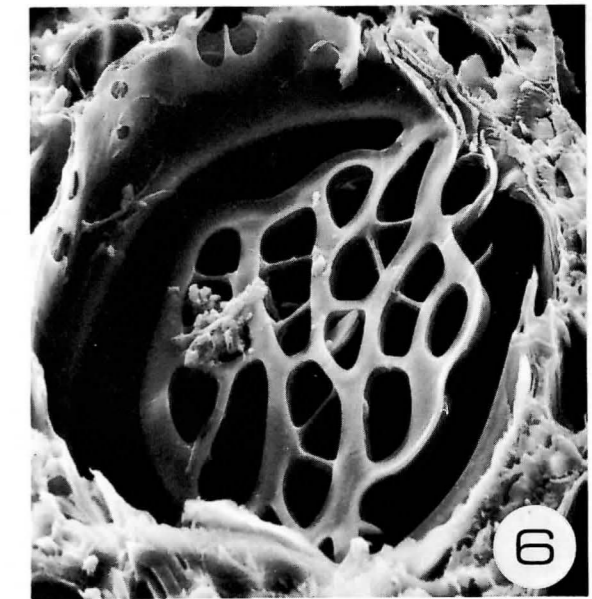
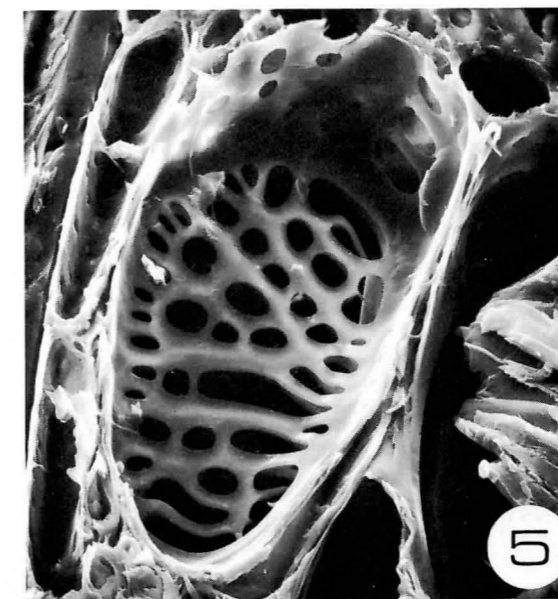
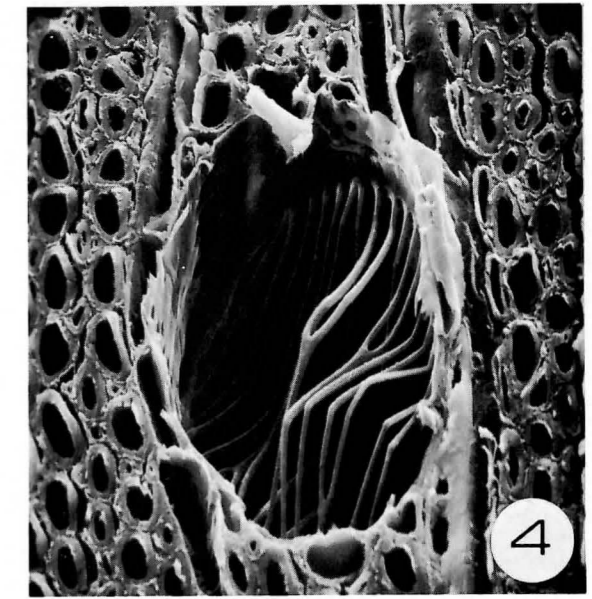
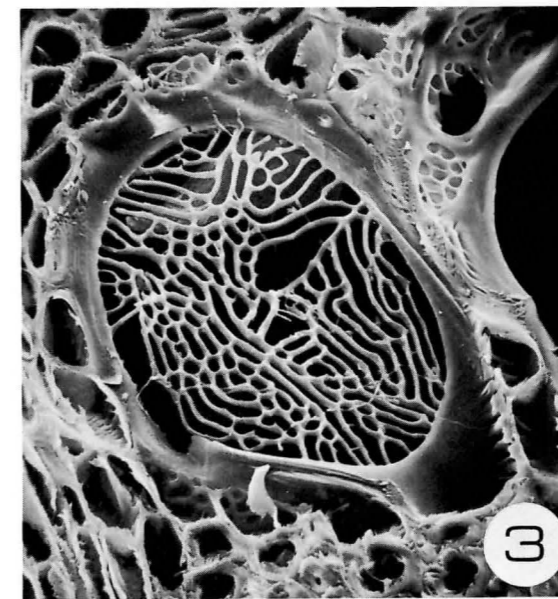
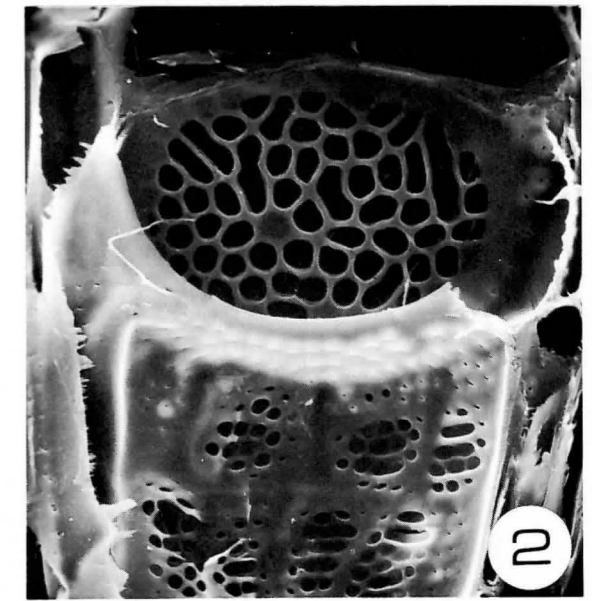
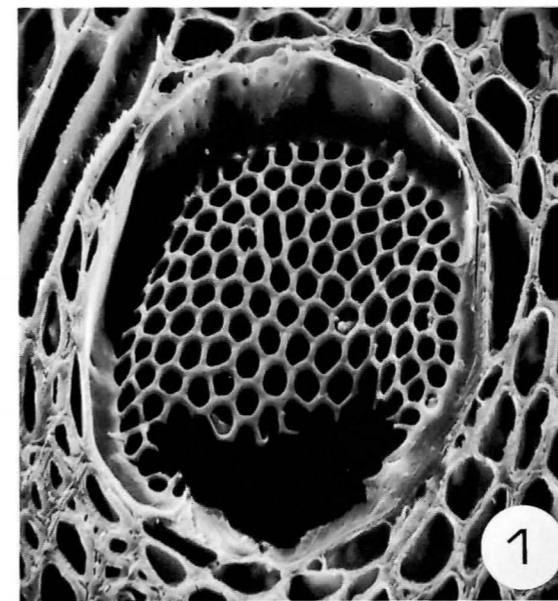
The helpful contributions of staff members A. C. Day and J. J. McKeon to this study are gratefully recognized.

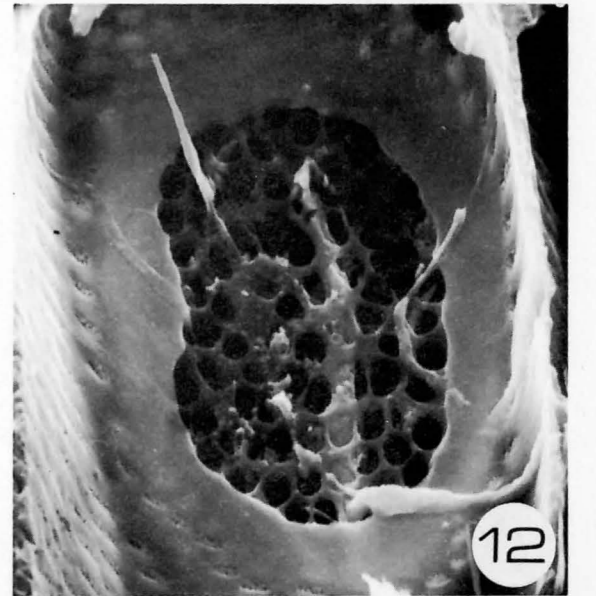
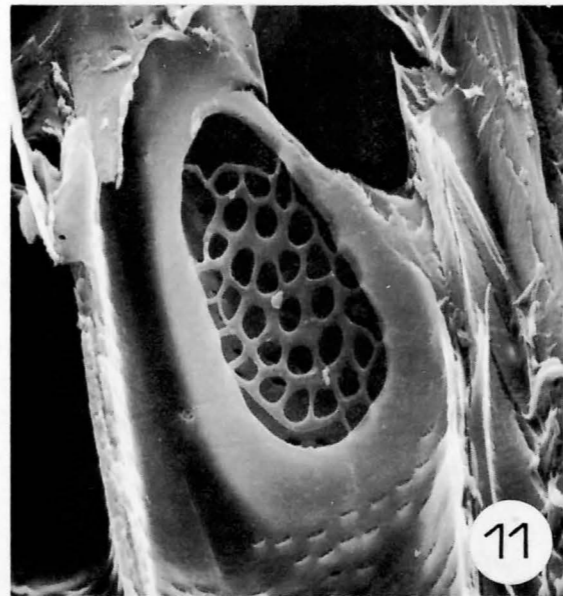
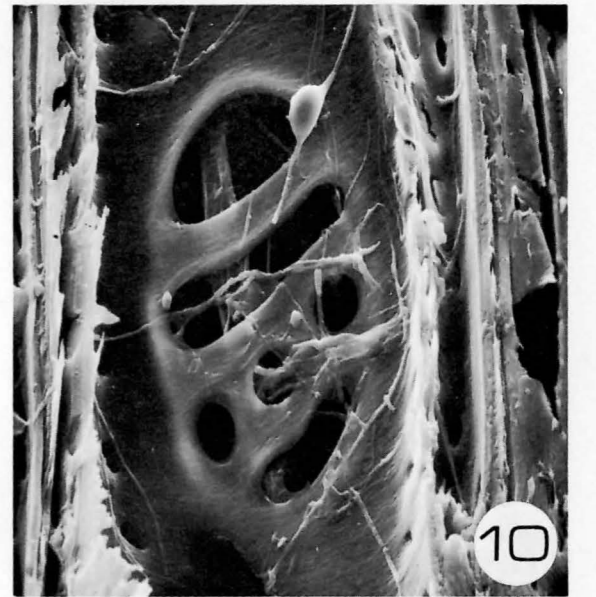
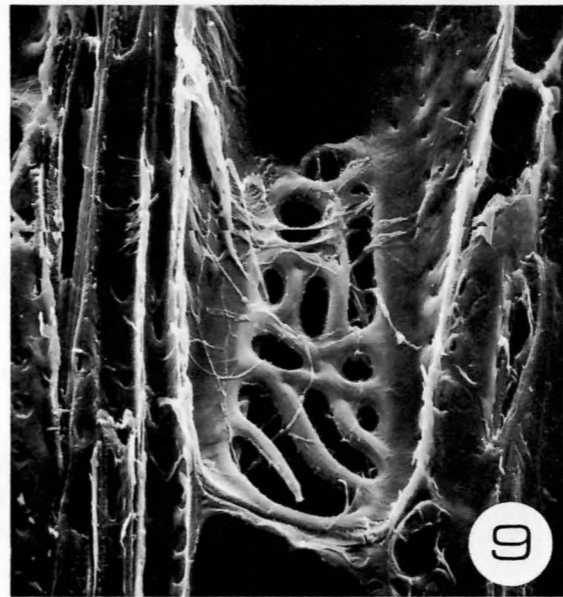
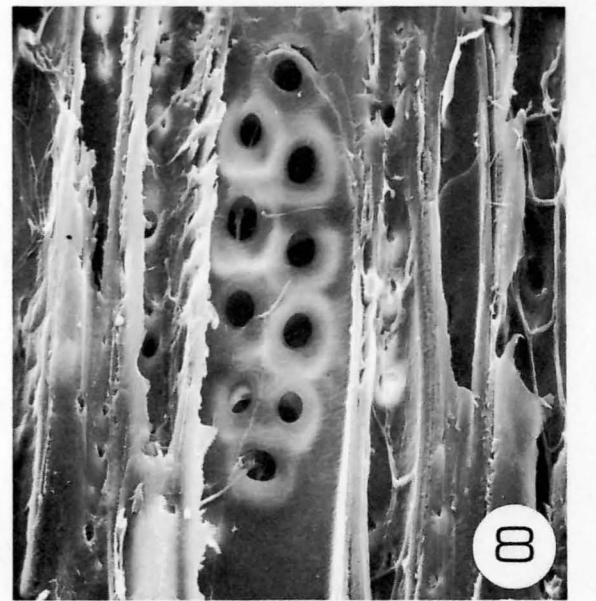
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FIGURES

- Figure 1. Scanning electron micrograph (SEM) of *Vitex micrantha* Guerke (SJRw 13720) showing a reticulate perforation plate with a well marked hexagonal pattern. (400X)
- Figure 2. SEM of *Vitex chrysocarpa* Planch. (FH0w 4042) showing a reticulate perforation plate. (500X)
- Figure 3. SEM of *Vitex madiensis* Oliver (TERVw 10208) showing an irregular reticulate perforation plate. (400X)
- Figure 4. SEM of *Vitex pubescens* Vahl. (BWCw 5839) showing a branched scalariform perforation plate. (500X)
- Figure 5. SEM of *Grias fendleri* Seeman (S. J. Record and H. Kuylen G48, SJRw 8879) showing an irregular reticulate perforation plate. (500X)
- Figure 6. SEM of *Grias fendleri* Seeman (S. J. Record and H. Kuylen G48, SJRw 8879) showing an irregular reticulate perforation plate. (600X)
- Figure 7. SEM of *Ephedra trifurca* Torr. SJRw 14793 showing a typical foraminiate perforation plate. (400X)
- Figure 8. SEM of *Gnetum gnemon* L. BWCw 6480 showing a foraminiate perforation plate. (500X)
- Figure 9. SEM of *Gnetum gnemon* L. BWCw 17037 showing an irregular reticulate perforation plate. (400X)
- Figure 10. SEM of *Gnetum gnemon* L. BWCw 6480 showing an irregular reticulate perforation plate. Note mismatching of the adjoining perforation plate. (600X)
- Figures 11 and 12. SEM of *Byrsonima lucida* DC. BWCw 8750 showing reticulate perforation plates. (1000X and 1200X)





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Member Deceased

We were saddened to receive the notice of the recent passing of Dr. Eberhard Schmidt in Sulzburg, Germany. Dr. Schmidt had been a member of the Institut für Holzforschung und Holztechnik in Munich for many years until his recent retirement. He had been a member of IAWA since 1939 and an active wood anatomist who collected in the tropical forests as well as carrying out anatomical research in the laboratory.

WOOD ANATOMY ACTIVITIES AROUND THE WORLDU.S.S.R. -- XII International Botanical Congress (1975)

It has come to our attention that individuals planning to attend the Leningrad meetings from 3 July to 10 July 1975 should communicate with the Organizing Committee office of the Congress at this address: XII International Botanical Congress, 2, Prof. Popov Str., Leningrad, 197022, U. S. S. R. In this way, if new Circulars are distributed, there will be no delay in obtaining the very latest information about the program. You will likely not receive the Second Circular to be mailed during 1974, including the schedule of payments and the final application forms, unless you have completed the preliminary registration through the above address. If there is any chance that you might attend the Congress, you are urged to communicate immediately.

England -- IAWA/Linnean Society of London Joint Meeting

Dr. D. F. Cutler of the Jodrell Laboratory announces the successful completion of preliminary arrangements for a joint meeting between IAWA and the Linnean Society of London. Tentatively, a symposium entitled "Applied Plant Anatomy" will be held on June 26-27, 1975, presumably in London although the exact location has not been fixed.

Dr. Cutler is soliciting papers for this two-day meeting which has been timed to allow for a visit to the wood anatomy centers in England before continuing on to Leningrad for the International Botanical Congress. Papers of anatomical/taxonomic subjects, as well as those of technological

importance, may be submitted. This symposium should provide an additional opportunity for IAWA members to become acquainted or to renew old acquaintances as well as to meet members of the Linnean Society. You are urged to contact Dr. Cutler directly at Jodrell Laboratory, Royal Botanic Gardens, Kew, Richmond, Surrey TW9 3DS, England, or to submit titles through the Office of the Executive Secretary if you prefer. As additional information becomes available, it will be published in these pages of future Bulletins.

U. S. A. -- "Tropical Woods" Back Issues Available

Dr. R. C. Koeppen of the Center for Wood Anatomy Research at the U. S. Forest Products Laboratory has informed us that a limited number of back issues of "Tropical Woods" has been made available. Members desiring individual copies of the following numbers, free of charge, may obtain them by submitting a request to the Center in Madison, Wisconsin 53705:

Nos. 9, 10, 28, 29, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42,
43, 44, 45, 46, 82, 96, 98, 100, 101, 102, 103, 104,
105, 106, 107, 108, 109, 110, 111, 112, 113.

These issues became available when the Walter J. Johnson book supply house determined that their storage was costing them more than their actual value and they were offered to the Forest Products Laboratory.

(Editorial Cont'd.)

item needs to be increased by more than 20 percent. Now we wish that we had followed former Council Member John Brazier's sage advice when he recommended raising annual dues to a level higher than \$5.00 because it was inevitable that even an increase to \$7.00 would soon be wiped out by inflation. IAWA can barely manage financially for the remainder of this year, but with the very great increases in costs of paper and printing as well as postage, 1975 will have to be the year of reckoning.

W. A. Côté

C. H. de Zeeuw