IAWA BULLETIN

1975/4

EDITORIAL

We were of the opinion that most of our readers would prefer to have the name of this publication changed to a more descriptive title. Previous editorials offered some reasons why a change might be desirable. One reason was that future issues could be numbered beginning with Volume 1, a procedure we could not initiate if the present name were to be retained.

Members of the Association have been polled on this name change and the returns to date have been overwhelmingly in favor of keeping the current name, IAWA Bulletin. It was surprising. There were, of course, other suggestions such as: "Wood Structure," "Wood Anatomy," "Xylem and Phloem," "Wood," "International Journal of Wood Structure," "Quarterly Review of Wood Structure," and several more which were rather similar. The main point, though, is the number who would prefer to keep the present name.

Perhaps the best argument put forth for at least delaying a name change was that we are not ready for it. We have not yet reached the stature of a top-ranked scientific publication, especially from the point of view of size. There are so few manuscripts available for publication that the Editors would be hard pressed to assemble enough papers to maintain continuity of the "journal."

It is our view that a change in format, name and size should be postponed until we can justify such a major step. Also, with a new Executive Secretary/Editor to be named before 1976, it would be easier to maintain our present status. As the Association grows, and we believe that it will continue to do so, more papers might be generated and the big step taken. The Council will make the decision, of course, but this is how your editors see it.

W. A. Côté
C. H. de Zeeuw

THE PRESENCE OF BISERIATE RAYS IN FIR (*Abies alba* MILL.)

by
Ladislav Kučera and Hans Heinrich Bosshard[1]

Introduction

It is often said in the literature that only uniseriate rays can be found in coniferous wood, except in *Juniperus*, *Sequoia*, and the resinous rays of the *Pinaceae*. Other authors state with more or less emphasis that biseriate rays may occur in most species of the Gymnosperms. The present paper considers biseriate rays in fir (*Abies alba* Mill.) and gives evidence for their occurrence.

Material

A fir tree was selected from the Research Forest of the Swiss Federal Institute of Technology (Zürich). A disc was taken from the trunk of the felled tree and cubes were sawn for preparation. The tangential sections (20 x 30 mm) were taken from the 76th annual ring (from the part oriented to the South). This annual ring was chosen due to its largeness and regular grain.

Methods

Tangential sections forming an area of 561 mm² were checked for biseriate rays. The number of biseriate rays within the areas was noted; at the borders of the areas the compensation method (L. Kučera 1968) was used to enumerate the coordinated rays. The following features were registered:

1. height of rays in number of vertically arranged cells
2. largeness of rays in total number of cells.

For comparison 10,000 uniseriate rays were also taken into consideration according to the compensation method.

Results

1029 biseriate rays were found in the 561 sections of 1 mm². None of these rays was larger than two cell rows. Table 1 contains the absolute and relative (%) frequencies of biseriate rays per 1 mm² tangential section. In Table 2 the frequencies of uniseriate and biseriate rays, measured in the same section, are compared.

The biseriate rays can be characterized as follows:

1. height of rays in number of cells
2. type of ray = height of ray + number of double cell rows.

For instance: a biseriate ray is of type N + 3; e.g., it is N cells high and contains 3 double cell rows (compare Fig. 1).

The frequency distribution of biseriate rays is displayed in the Figures 2—4: in Fig. 2 classified according to the height of the rays in number of cells; in Fig. 3 classified according to the type of ray; in Fig. 4 classified stereographically according to the height of the rays in number of cells and the type of ray. Furthermore, the frequency distribution of uniseriate rays, taken from the same tangential section and classified according to the same arguments, is presented for comparison in Fig. 2. Table 3 gives a statistical comparison of the frequency distributions of uniseriate rays and of biseriate rays, classified according to the height of the rays in number of cells. The difference was examined with the following test methods:

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Table 1. Absolute and Relative (%) Frequencies of Biseriate Rays Per MM² Tangential Section (TS)

Number of Biseriate Rays Per mm² TS	Frequency	
	Absolute	Relative (%)
0	69	12.2
1	172	30.7
2	162	28.9
3	109	19.4
4	39	7.0
5	10	1.8
Total	561	100

Table 2. Frequency of Uniseriate and Biseriate Rays Per MM² Tangential Section

Reference Number	Type of Ray	
	Uniseriate	Biseriate
Minimum value x_{min}	33	0
Maximum value x_{max}	56	5
Average value with confidence interval $\bar{x} \pm CL$	44.3 ± 0.5	1.8 ± 0.1
Coefficient of variability of the mean $v_{\bar{x}}$ (%)	0.6	2.7
Ratio of ray type (%)	96	4

Interpretation of signs:
CL = Limit of confidence of the mean at a probability level of P = 0.95
$CL = t_{n,\,95} \cdot s_{\bar{x}}$

Table 3. Statistical Comparison of Two Frequency Distributions (UR and BR, Compare Fig. 2)

	x^2-Test	Marshall - Test
Degree of freedom	23	11029
Test value	700.93	25.67
Significance level	***	***

Interpretation of signs:
*** The investigated random samples are of significant difference at a probability level of P = 0.999

Table 4. The Presence of Biseriate Rays in Gymnosperm Families (According to P. Greguss 1955)

Gymnosperm families*	Number of Investigated Species			
	Total	With Uniseriate Rays Only	Biseriate Rays Existing	
			Absolute	%
Ginkgoaceae	1	1	-	-
Araucariaceae	27	23	4	15
Podocarpaceae	44	25	19**	43
Taxales	17	12	5	29
Cupressaceae	94	60	34	36
Taxodiaceae	14	5	9	64
Pinaceae	154	81	73***	47
Abies sp.	32	22	10	31
GYMNOSPERMS	351	207	144	41

Interpretation of signs:
* without Cycadales
** in 2 species rays up to 3 rows large
***in 21 species rays up to 3 rows large, in 9 further species rays up to 4 rows large

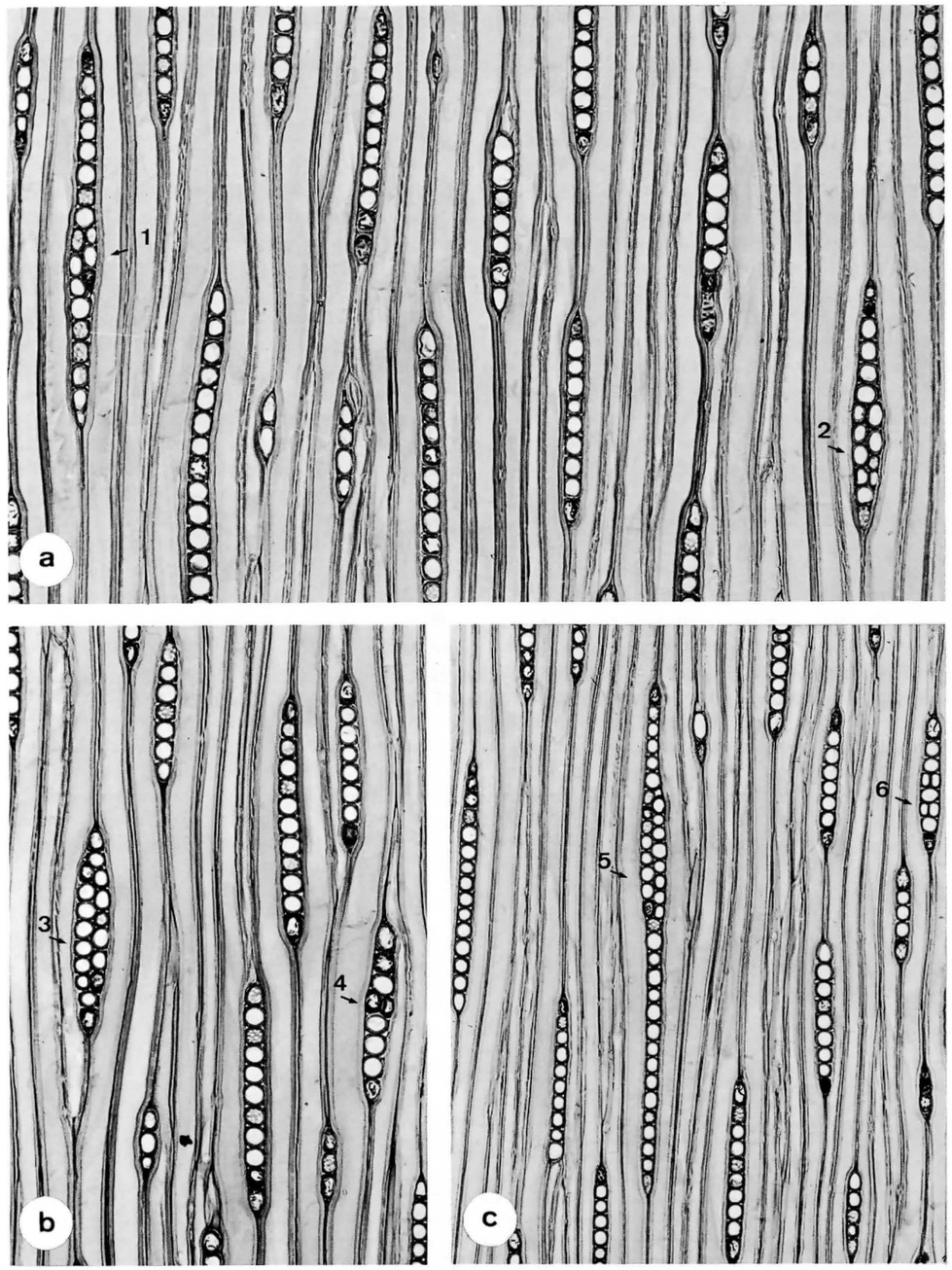

Figure 1. Fir (*Abies alba* Mill.): Tangential sections a, b and c. Biseriate rays marked with arrow. Type of ray = height of ray + number of double cell rows: (1) type of ray N + 3; (2) type of ray N + 4; (3) type of ray N + 6; (4) type of ray N + 1; (5) type of ray N + 8; (6) type of ray N + 2. Scale—a = 200: 1; b = 175: 1; c = 140: 1.

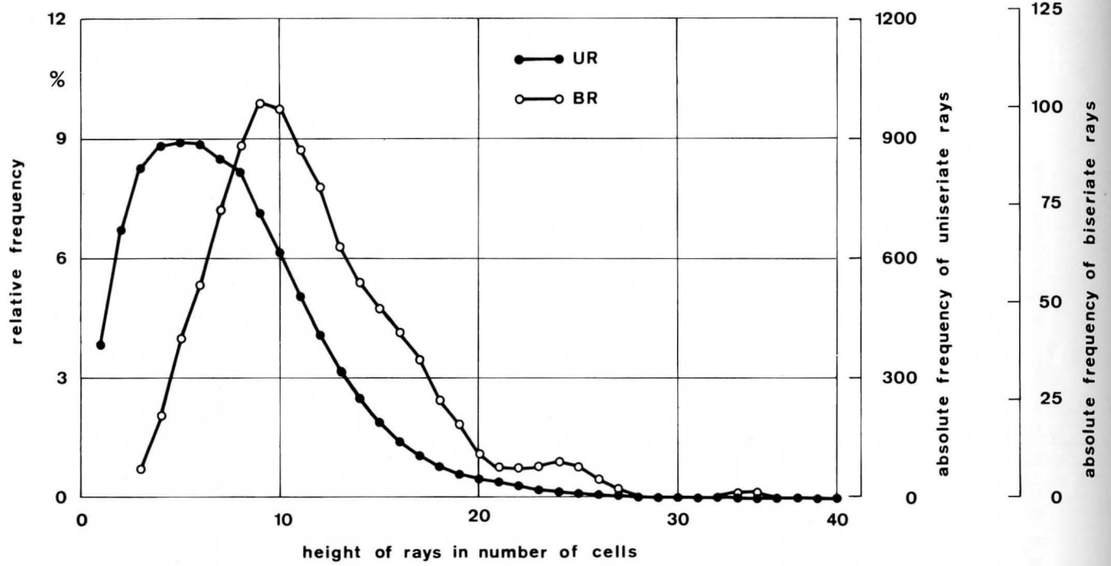

Figure 2. Distribution of absolute and relative (%) frequencies of uniseriate (UR) and biseriate (BR) rays, classified according to height of rays in number of cells (N_{UR} = 10,000; N_{BR} = 1029).

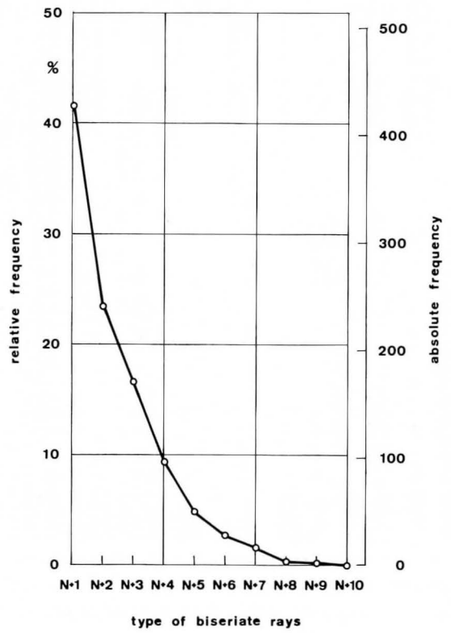

Figure 3. Distribution of absolute and relative (%) frequencies of biseriate rays, classified according to type of ray (N = 1029).

1. x^2-test to compare two independent random samples
2. Marshall-test to compare two independent and not normally distributed random samples.

Discussion

The occasional presence of biseriate rays in several Gymnosperms has often been stated but probably never been examined thoroughly. Table 4 was compiled according to results by P. Greguss (1955) and shows that biseriate rays can be found in all Gymnosperm families, except *Ginkgoaceae*. Gray (1973) has shown multiseriate rays in *Sequoia sempervirens* (D. Don) Endl. In spite of the fact that according to this investigation the relative figures seem to be without correlation to phylogenetic evidences, we think that systematic measurements would show a clear dependence. Several species of *Abies* show biseriate rays (compare Table 4), for instance regularly in *Abies grandis* Lindley (P. Greguss 1955) and occasionally in *Abies magnifica* A. Murray (A. J. Panshin and C. de Zeeuw 1970) and in other *Abies* species (P. Greguss 1955). Biseriate rays can also be found in the sample of *Abies alba* Mill. under investigation. In this sample we have found that biseriate rays obviously occur regularly, i.e., according to a law; they can be characterized statistically (compare Tables 1 and 2). There are two types of frequency distributions of uniseriate and biseriate rays, classified according to the height of rays in number of cells. Obviously biseriate rays are formed more frequently in higher rays than in lower ones (compare Fig. 2). From statistical test methods (x^2-test, Marshall-test, compare Table 3) it can be traced that the two frequency distributions are of a significant difference (with a probability of p = 0.999). The cross-sections of rays exhibit varying numbers of rows of biseriate cells ranging from one to nine rows of biseriates. The most frequent type of biseriate ray is that in which a single row of biseriate cells occurs (N + 1). As the numbers of rows of biseriate cells within the ray increases the frequency of occurrence of that class decreases until there is a minimum number for rays with the largest number of rows of biseriate cells (see Fig. 3). The distribution form of biseriate rays, classified according to the type of ray, can be compared with the form of frequency distribution in beech vessels, in accordance to the size of groups (L. Kučera and H. H. Bosshard 1973, Fig. 1a). The stereographic frequency distribution of biseriate rays classified according to the height of rays in number of cells (1. abscissa) and type of ray (2. abscissa) reveals a maximum with height of ray = 8 and type of ray = N + 1, as well as a rather regular distribution of the other values around this maximum.

From preliminary investigations it can be said that there are fewer or even no biseriate rays in annual rings derived from younger cambium. From this observation, supported by the fact that higher rays are more frequently biseriate, a positive correlation can be assumed between age of cambium and occurrence of biseriate rays. In other words, biseriate rays can be expected mostly in peripheral annual rings and in the lower part of the stem. It is particularly remarkable that the wood of fir roots shows biseriate rays, too. The authors, therefore, cannot agree with the statement of H. J. Braun, F. Wolkinger and H.

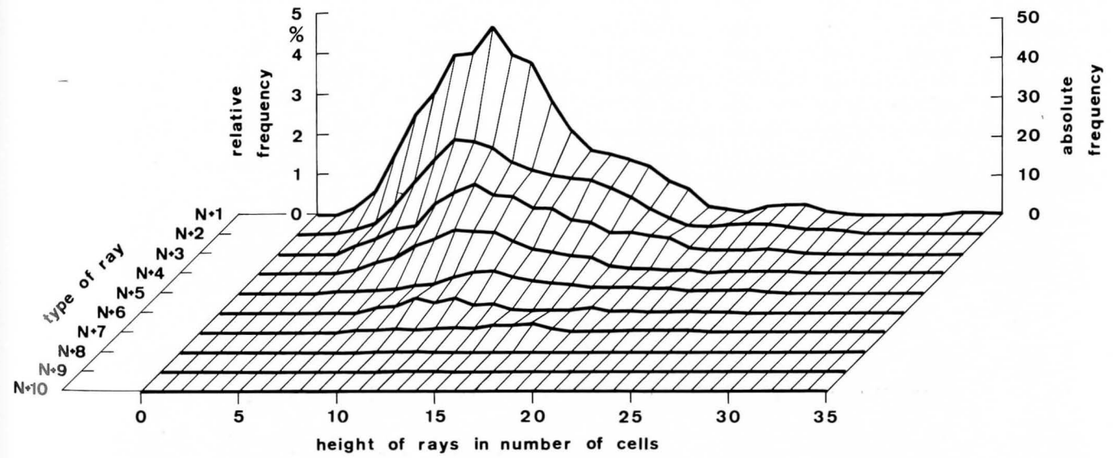

Figure 4. Distribution of absolute and relative (%) frequencies of biseriate rays, classified according to height of rays in number of cells (1. abscissa) and type of ray (2. abscissa) (N = 1029).

Boehme 1967; H. J. Braun 1970, mentioning that the rays of *Abies alba* Mill. as building type of coniferous rays are "always uniseriate." Based on the present investigations as well as on already published results they find, on the contrary, that biseriate rays belong to the building principle of the ray system in Gymnosperms.

The increase of the axial ray-dimensions has been shown before (H. H. Bosshard 1961; L. Kučera 1968). It is conceivable to think that a species might be able to form rays of limited height only. On the other hand one knows about the accentuated formation of storage tissue in slowly grown wooden tissues, as for instance in the so-called latewood portions of the annual rings, in the lower parts of the stems and in the peripheral ones. The conformity of reduplication of ray cells in *Abies* with ray height leads to the same functional origin; as soon as maximum ray height is reached, the storage tissue is strengthened by addition of lateral cells. Biseriation of coniferous rays has, in addition to its quantitative aspect, a qualitative one. It shall be described in a further contribution.

Summary

In the present study biseriate rays in *Abies alba* Mill. are examined quantitatively. The ray height in number of cells as well as the ray type (ray height + number of biseriate cell rows) are used as classification. Based on the results it is supposed that the biseriate rays are part of the building principle of the ray system of Gymnosperms.

Zusammenfassung

In der vorliegenden Arbeit werden die zweireihigen Markstrahlen bei der Tanne (*Abies alba* Mill.) quantitativ untersucht. Als Ordnungsprinzipien werden dabei die Markstrahlhöhe in Anzahl Zellen sowie der Markstrahltypus (= Markstrahlhöhe + Anzahl doppelter Zellreihen) verwendet. Auf Grund der Ergebnisse wird vermutet, dass die zweireihigen Markstrahlen zum Bauprinzip des Markstrahlsystems der Gymnospermen gehören.

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ON THE POLYLAMELLATE STRUCTURE OF PARENCHYMA WALL IN *PHYLLOSTACHYS EDULIS* RIV.

by
N. Parameswaran and W. Liese*

During studies on the fine structure of the cell walls of some bamboo species, a special construction of the parenchyma wall was noted in *Phyllostachys edulis* Riv.

The parenchyma, constituting the ground tissue to ca. 50% of the culm, consists of two types of cells: elongated cells which become lignified already in early stages of internodial development and short cells characterized by dense cytoplasm and thin non-lignified walls even in mature culms (cf. Grosser and Liese 1971). The elongated parenchyma cells possess walls with a crossed polylamellate structure, which resembles the type recently established for an array of cells: vessels (Yamanaka and Harada 1968), collenchyma (Chafe 1970), sieve elements (Chafe and Doohan 1972), epidermis (Chafe and Wardrop 1972), xylem parenchyma (Chafe 1974, Chafe and Chauret 1974), sclereids (Parameswaran 1975).

The parenchyma wall in *Phyllostachys* exhibits a typical polylamellate structure consisting of about 15 successive lamellae arranged in an alternating manner (Fig. 1). All the lamellae are continuous around the wall except at places of simple pit formation. The broader lamellae (0.2 μ m) are characterized by the orientation of cellulose fibrils perpendicular to the middle lamella, making a curvature in their run

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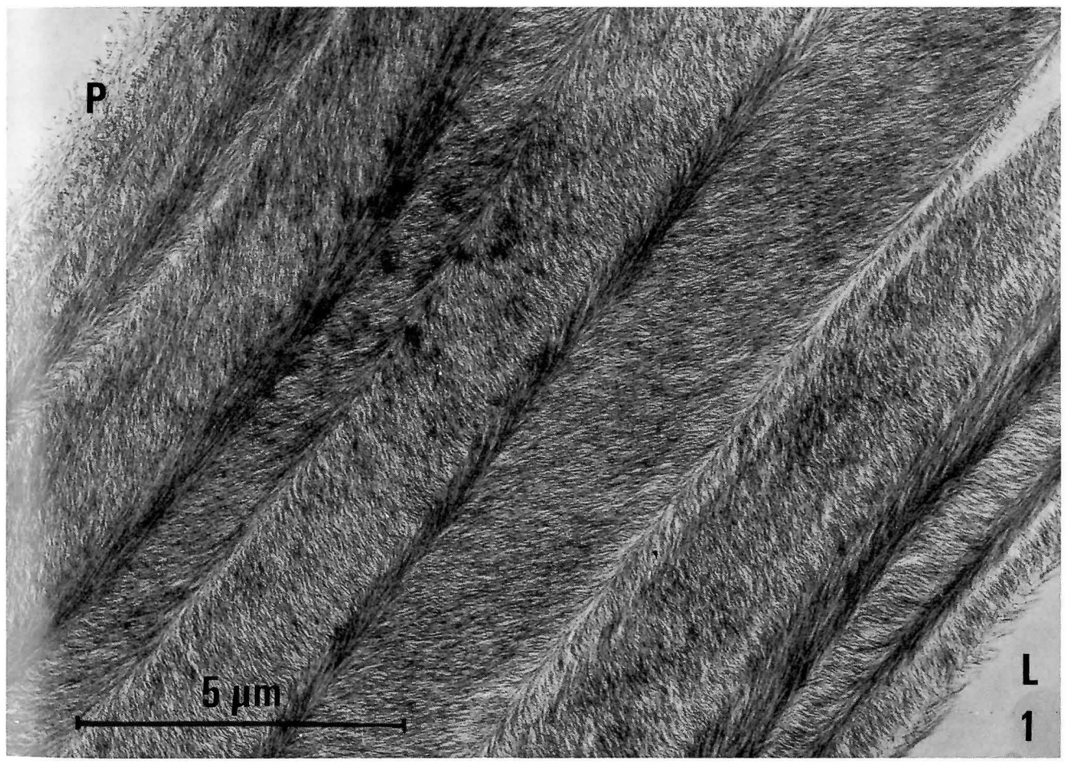

Figure 1. Polylamellate wall of parenchyma showing a herringbone pattern (L = lumen; P = primary wall).

(longitudinal), and the narrow ones (0.04 μ m) by fibrils oriented parallel to the middle lamella (tangential-transverse). This arrangement evokes the impression of a herringbone pattern. The broad lamellae are reduced in thickness both towards the lumen and the middle lamella. The narrow lamellae with transversely oriented fibrils possess a higher electron density than the broad lamellae with longitudinal fibrils. However, it could often be observed that these transitional lamellae did not show the same contrast as the ones in the neighborhood. This might be related to the failure of a distinct transition from longitudinal to transverse orientation of the fibrils and thus to the absence of a conglomeration of fibrils.

The fiber cells in the peripheral zones of the culm also have walls with a lamellate structure; this, however, appears different in terms of lamella distribution and the gamut of fibrillar orientation. These results will be reported elsewhere.

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Deceased Member

Word has been received from the widow of Professor Joseph A. G. Fouarge that he passed away in 1974. No other details were mentioned. Professor Fouarge was a member of the Faculté des Sciences Agronomiques at Gembloux, Belgium. He had been associated with our organization since 1964. We join his widow, friends and colleagues in noting his passing with regret.

Address Changes for Directory

Voting members were asked to submit address changes with their election ballots and dues payments. Because these are still being received as the Bulletin goes to press, all of the corrections will be held for publication in the 1976/1 issue. This will update the membership directory which was published in the 1975/2 issue.

Membership Recruiting

As an aid in promoting the recruitment of new members for the Association, application forms have been enclosed with this issue of the Bulletin. Additional copies may be obtained with this issue of the Bulletin. Additional copies may be obtained on request from the Office of the Executive Secretary. All members will benefit from a larger Association as services can be improved and dues kept at the lowest possible level. It is hoped that the Bulletin can be enlarged in spite of increased postage costs and printing expenses by selling more subscriptions to libraries and by an increase in the membership.

Regional Groups

In the last issue of the Bulletin (1975/3) there was a report of the business meeting of the Association which took place during the International Botanical Congress at Leningrad. One of the items on the agenda was the proposal to establish regional groups within IAWA.

At this time the current members of the Council are considering that proposal, and it is anticipated that recommendations will be announced in the 1976/1 issue. There appears to be no opposition to the idea, but the procedures to be followed in holding meetings and working within the present Association must be agreed upon. It may also be the recommendation of the current Council that the decision be made by the new Council which begins its tenure on January 1, 1976.

Election Results

This issue of the Bulletin has been delayed deliberately in order to announce the results of the election of Council Members for 1976-1978. Although there may be additional ballots received after this October 31 deadline, it is unlikely that the voting results would be changed if they were counted. The twelve (12) candidates proposed by the nominating committee received an overwhelming majority of the votes. There were many write-in candidates, but each received no more than two votes. It was interesting to note that five (5) of the write-in candidates are not members of the Association!

The new Council will consist of the following members:

Dr. P. Baas
Mr. R. K. Bamber
Dr. D. F. Cutler
Dr. C. H. de Zeeuw

Eng. M. P. Ferreirinha
Dr. H. Gottwald
Dr. S. M. Jutte
Dr. R. W. Kennedy
Mr. A. Mariaux
Dr. K. Shimaji
Prof. Dr. L. Susmel
Prof. A. A. Yatsenko-Khmelevsky

The Council now has the responsibility of naming a new Executive Secretary for the next three-year term. His term will begin January 1, 1976, and his duties will include Editorship of the IAWA Bulletin. The results of this Council decision will be announced.

Message from Retiring Executive Secretary

This issue of the Bulletin is my last opportunity for sending a personal message to members of the International Association of Wood Anatomists. It was at the 1969 International Botanical Congress in Seattle, Washington that I took on the responsibility of looking after the procedural details of our Association from Professor Frey-Wyssling and his associate, Professor Bosshard. Much has happened in the interim, but there is no need to recite the various problems, challenges, changes and failures.

Still, I must not miss this chance to offer my thanks to those many dedicated members who have served at my request, without compensation and often without their service being recognized by the membership at large. Without their help the organization might no longer be in existence. One person must be singled out because she is not a member, yet she knows the organization better than most and has done more than anyone to keep it running efficiently: Miss Judy Barton. Her contributions to IAWA, to the Bulletin, and to the success of the entire operation have made it all possible.

Because membership happens to be one of our major concerns at the present time, I want to dwell on that point for a moment. In the 1970/2 issue of the Bulletin, we announced that membership had grown to 160. Today, in spite of the loss of many members through retirement, death, or resignation, there are 239 members, a net gain of 79. In addition, there are several applications in process and numerous inquiries and nominations which may bring 20 or more members by the end of 1975.

Numbers are not everything, as we well know. However, I sense that these new members are dedicated to action and service to IAWA and that our older members are exhibiting a revitalization and new interest in wood anatomy and the Association.

It has been a privilege to serve in this position. The goals of the organization are worth the effort. I am confident that the new Executive Secretary and the Members of the Council will proceed with vigor in bringing IAWA to the prestigious level it deserves.

W. A. Côté

LETTERS TO THE EDITOR

Before the ballot request for suggested name changes for the Bulletin were mailed, we had received two letters on the subject. Excerpts are included here to supplement the comments made in the Editorial:

Dr. Susan M. Jutte wrote: ". . . . Couldn't we just say "Stem & Root" perhaps with "studies" added? The bulletin could be named "Journal of Stem and Root" . . . or "The Tree Gazette."

Dr. Irving B. Sachs wrote: ". . . . I wish to suggest that we adopt the name, "Wood Morphology, Bulletin of the IAWA." If the prefix, Wood Morphology is not appealing, perhaps Wood Facts would be more to the Association's predilection."

These letters were appreciated as were the comments added to the ballots by some of the members, but not mentioned in the Editorial. In a future issue, if the discussion of the name change continues, a complete listing of names suggested by members will be published and perhaps a vote taken on the final choice. In the meantime, the Bulletin can be improved and enlarged as manuscripts and other materials are submitted for publication. (Editors.)

WOOD ANATOMY ACTIVITIES AROUND THE WORLD

The Royal Microscopical Society is sponsoring the "Anglo-Dutch Wood Anatomy Meeting" to be held at St. Anne's College, Oxford and the Jodrell Laboratory, Kew, April 5-8, 1976. The list of speakers includes a large number of IAWA members. If possible, a complete program will be published in the IAWA Bulletin for 1976/1.

Anyone interested in attending these meetings is invited to write to the Administrator, Royal Microscopical Society, 37/38 St. Clements, Oxford, England OX4 1AJ for the registration and booking form.