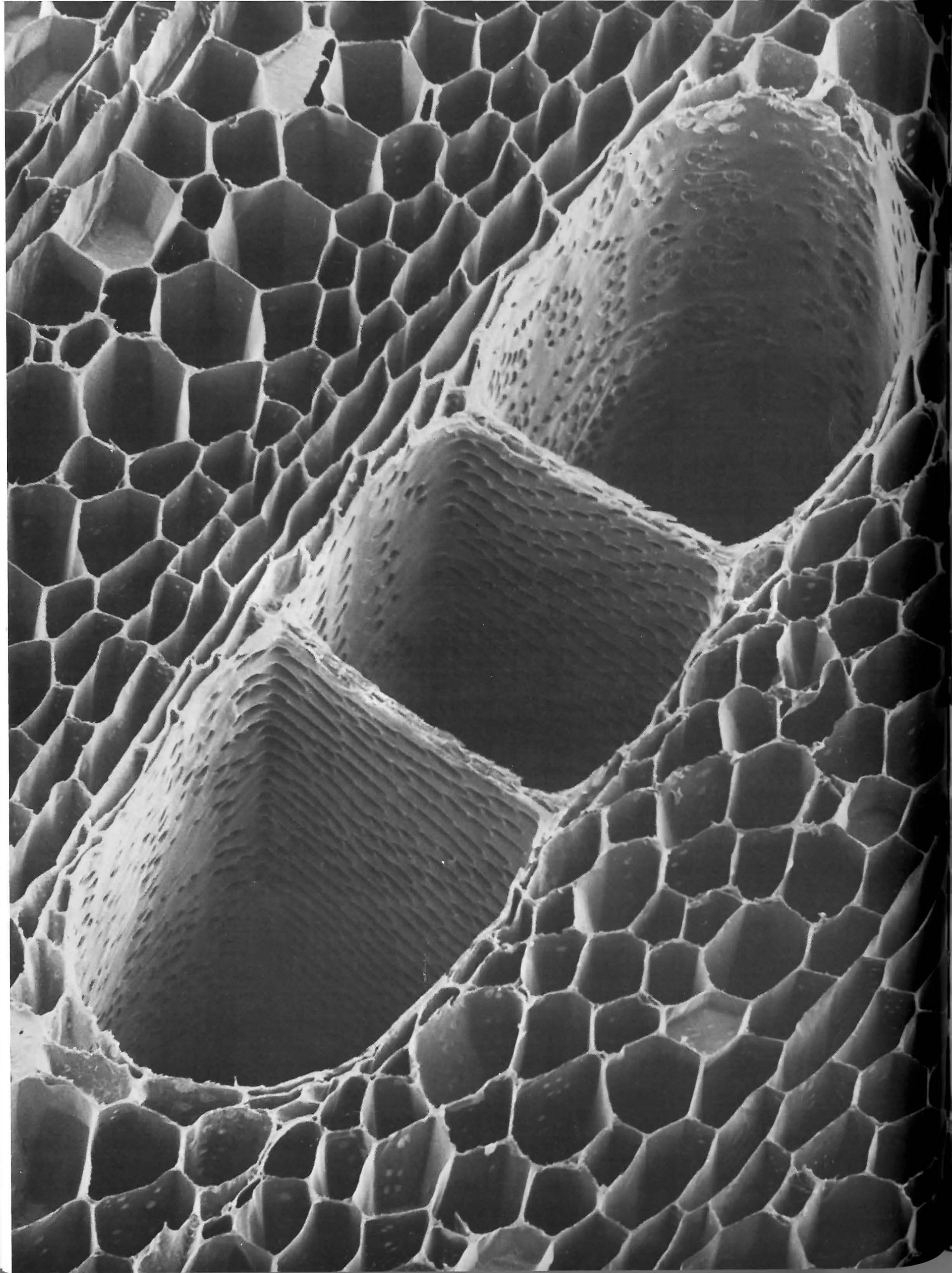

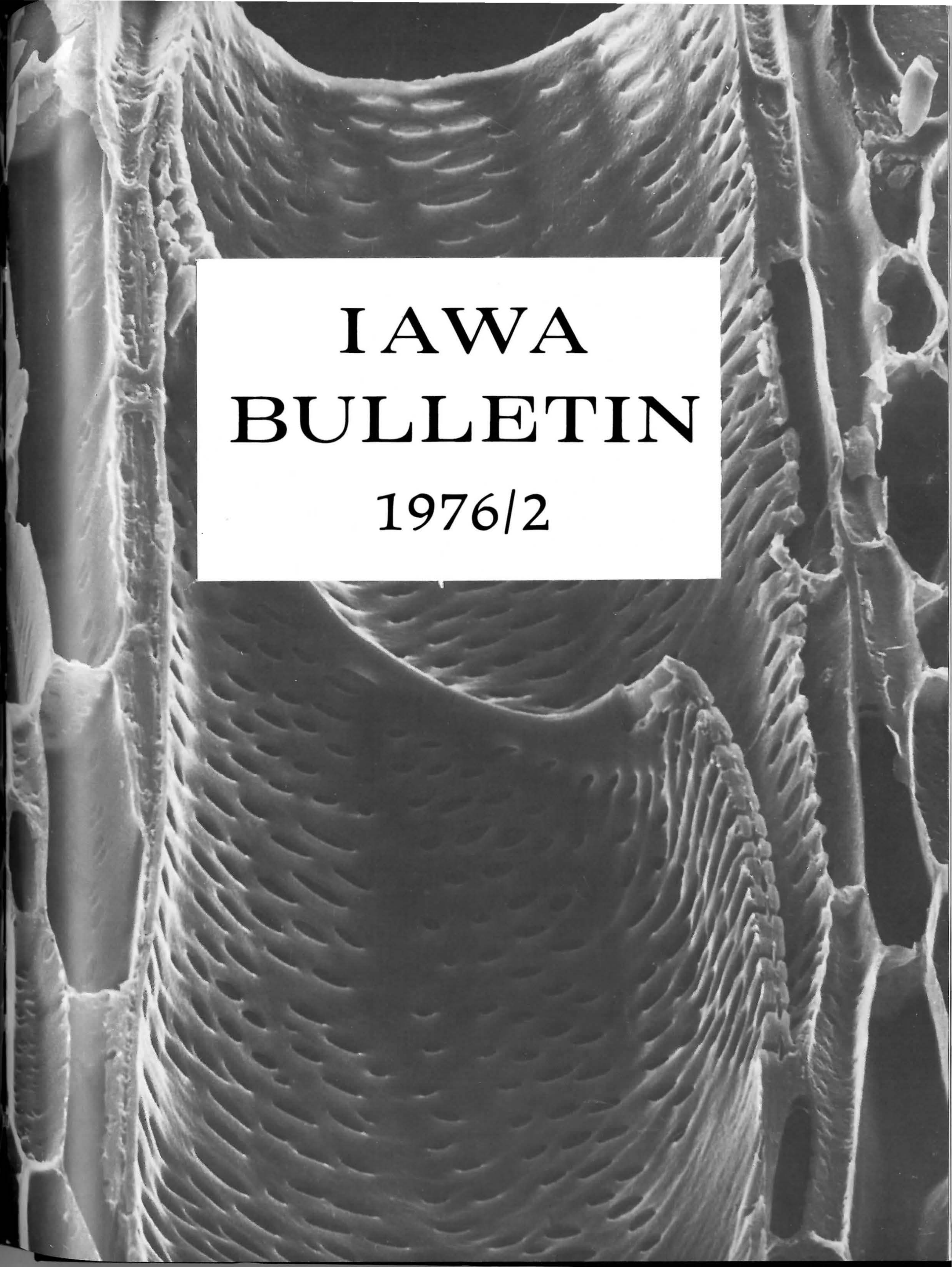

IAWA BULLETIN

1976/2

EDITORIAL

From the recent announcement sent to all members by letter, and with the notice under Association Affairs in this issue of the Bulletin, it will become apparent that our Association is gradually moving into a new era. Dr. Pieter Baas is now the official Executive Secretary of IAWA, as well as Editor of the Bulletin, although we are continuing to function in both capacities for a few more weeks.

Any operation of this kind inevitably reflects the personalities of the individuals involved. We have tried to keep long range goals of growth and of quality improvement for the Association and its quarterly publication. We are confident that in spite of any changes brought about by local conditions, Dr. Baas will also strive to make the International Association of Wood Anatomists a better organization and one that serves an ever-increasing membership.

To achieve these goals your new Executive Secretary will need the cooperation of all the members of IAWA. He will need papers for the Bulletin, ideas for activities of the Association, and time and effort by volunteers. We urge you to support him and the Council in the coming years. All of us will benefit if we share the responsibilities and the burdens.

W. A. Côté

C. H. de Zeeuw

OUR COVER

The *IAWA Bulletin* cover for 1976 consists of scanning electron micrographs of the wood of balsa, *Ochroma lagopus* Sw. The front cover emphasizes a longitudinal section through a vessel and is reproduced at a magnification of 700X. The back cover, a cross-section, is shown at 250X.

ON THE OCCURRENCE OF SILICA GRAINS IN THE SECONDARY XYLEM OF THE CHRYSOBALANACEAE

by

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Introduction

Cruger (1857) recorded for the first time the occurrence of silica grains in the ray cells of some species of the family Chrysobalanaceae. As a sequel to Cruger's work Kuster (1897) analyzed very extensively the presence of silica grains in this family, especially in the leaves.

In 1903, Petrucci recorded grains in the wood of *Parastemon urophyllum* A. DC. from Borneo. Gonggrijp, (1923) when analyzing some wood samples from Surinam, noticed the occurrence of silica grains (2 - 22 µm in diameter) in the ray cells of all Chrysobalanoideae, then considered as a subfamily of the Rosaceae. Silica grains were also found in species of Chrysobalanoideae from Indonesia (5 - 20 µm in diameter) investigated by him (Gonggrijp, 1932). For one sample the occurrence of silica grains in the axial parenchyma was recorded. Frison (1942) reported the occurrence of silica grains in three species of Parinari growing in the former Belgian Congo, which was confirmed by Besson (1946) for the same genus from Ivory Coast. Amos (1951) analyzed wood samples from Guyana which were reputed both to have a dulling effect on saws, to contain silica and to be resistant to some degree to marine borers. Among this material all species of Chrysobalanoideae contained silica grains. No particulars were given on the shape and distribution of the grains. These results were published (Amos, 1952) in a worldwide survey of timbers containing silica. For 37 species (6 genera) of Chrysobalanoideae the occurrence of silica grains in the ray cells and/or parenchyma cells was recorded.

Amos' extensive study was followed by articles on the same subject, restricted to geographical regions (Burgess, 1965; Murthy, 1965; Balan Menon, 1965; Sharma and Rao, 1970). For all species of Chrysobalanoideae the occurrence of silica grains was recorded. Except for Gonggrijp's (1923) and Amos' (1951) investigations mentioned above, an extensive study of the presence and distribution of silica grains in this taxon for the New World representatives was not yet made, although the family has its widest distribution in the Neotropics. Therefore, in the present paper, attention is focused on species of this region. Prance (1972[a]) refers in his treatment "A Monograph of Neotropical Chrysobalanaceae" to the literature related to the occurrence of silica grains in the secondary xylem. In another paper Prance (1972[b]) describes the use of the bark ash of various species of Chrysobalanaceae by Indian tribes of Amazonia to harden their clay.

Methods and Materials

116 samples comprising 12 genera and 62 species were analyzed. Most of the samples were taken from adult heartwood. In a few cases branchlets from herbarium specimens were analyzed, partly because of the absence of larger sized samples and partly in order to make comparisons with wood from trunks. To evaluate the distribution of the grains from the cambium to the pith, in some cases sapwood samples were studied as well.

All the wood samples are backed by herbarium vouchers which for the greater part were identified by Dr. G. T. Prance (New York Botanical Garden). Radial sections of 15 - 20 µm thick were studied. The sectioning was done without any pre-treatment, because other investigations in our department showed that boiling in water sometimes disintegrates silica grains. The sections were bleached, rinsed in water and enclosed using carbolic acid and clove oil as medium, which makes the grains stand out clearly.

The values for the dimensions of the silica grains recorded in Table 1, 2, 3 and 5 are averages of 25 random observations, covering the total area of the sections; minima and maxima are placed between brackets.

Results

Distribution, shape and dimension of the silica grains

Details about distribution and dimension of the grains are shown in Table 5. The most important result is that all species and all samples investigated contain silica grains in the ray cells. There is never more than one grain per ray cell. Ray cells without silica occur only sporadically. In 10 samples silica in the axial parenchyma was noticed, while the tyloses in the vessels of 8 samples also contain silica grains.

The grains are usually globular (Fig. 2), sometimes slightly oval or oblong (Fig. 3). Although in every sample a few cells with small grains and a few with large ones are always present, as noted between brackets in Tables 1, 2, 3 and 5, the main portion of the grains in a sample generally is of a uniform size. Exceptionally, in a few species, the size of the grains in the individual ray cells of a specimen is less uniform, and consequently the percentage of small- and large-sized silica grains is much greater.

For all samples investigated a variation in diameter of the globular grains from 3 to 28 µm has been observed. The average grain diameter within a given sample varies from 5 to 20 µm. In ca. 65% of the number of samples, the variation is from 10 to 15 µm. The size of the oblong grains shows a considerable variation and may reach a size of 35 × 18 µm (radially respectively axially).

Besides these general results the following data, not included in Table 5, were obtained:

Acioa: In *Acioa scabrifolia* Hua the shape of the grains varies from globular to oblong.

Chrysobalanus: The grains in the axial parenchyma of *Chrysobalanus icaco* L. are slightly smaller than those in the ray cells.

Couepia: In *Couepia obovata* Ducke and *Couepia parillo* A.DC. globular and oblong shapes occur; in the other species the grains are globular.

Licania: In all samples investigated the silica grains are globular, except in one sample of *Licania apetala* (E. Mey.) Fritsch var. *apetala*, where they are oblong.

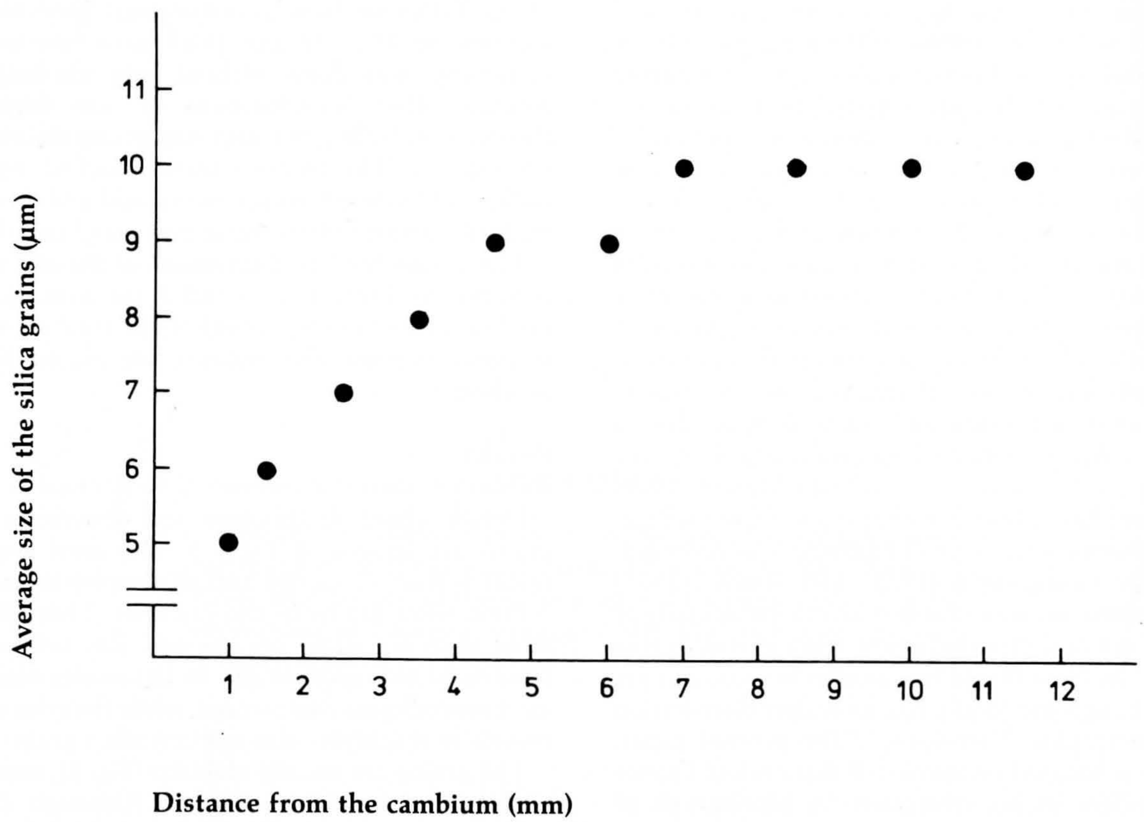
Maranthes: The silica grains in the samples from Zaïre are more or less oblong and, moreover, an important part of the grains is broken, a phenomenon which has never been noticed in other samples of Maranthes.

Parinari: The sample from Zaïre shows oblong and sometimes broken grains.

Variation in silica grain size correlated with the position in the tree

In order to get an idea about the variation in size, occurrence and shape of the silica grains in various places in the same tree, a few blocks of *Couepia multiflora* Benth. (A.C. Smith 2502) were investigated more extensively. For this purpose a series of radial sections at one level, from the cambium to the pith, was prepared. The sections were subdivided into parts of 0.8 - 1.5 mm. In each part the size of the grains was measured. The results are given in Fig. 1.

Fig. 1 Variation of the size of the silica grains from cambium to pith in *Couepia multiflora* Benth.



It is obvious that the size of the grains increases quickly and continuously from cambium to pith. They appear for the first time at a distance of about 0.7 mm from the cambium and reach their full size at about 8 mm from the cambium. For five other species, two or three sections cut at various distances from the cambium were investigated. Herbarium material was also analyzed. Results are shown in Table 1.

Table 1. Variation in Dimension of Silica Grains in Some Species of Chrysobalanaceae at Various Places in the Tree

Species	Distance from the Cambium (cm)	Average Diameter of the Silica Grains (µm)	
Couepia guianensis	1	10	
idem	15	11	
Hirtella bicornis var. *pubescens*	0.5	9	(7-13)
idem	4.5	9	(8-13)
Licania apetala var. *apetala*	0.1 (herb.)	10	(5-13)
idem	1.5	13	(10-18)
idem	4	14	(11-20)
idem	14	16	(10-25)
Licania macrophylla	0.1 (herb.)	11	(5-15)
idem	1	15	(11-24)
idem	7	14	(11-22)
idem	14	14	(11-22)
Licania ovalifolia	0.2 (herb.)	10	(8-15)
idem	2	14	(11-21)
idem	16	16	(10-25)

In two species there is still a 10-25% increase in grain size after a distance of 1 cm from the cambium, going towards the pith; in the remaining three species the size remains constant. Silica is already present in very small-sized branchlets with a diameter of about 2 mm. The diameter of the grains in the branchlets is about 60-80% of the maximum diameter of the grains in the corresponding wood samples. Between branchlets taken from herbarium vouchers and adult secondary xylem, no differences in the distribution pattern appear to exist.

Gottwald and Parameswaran (1967), in their study on Lacunaria (Quiinaceae), recorded a maximum diameter for the grains as near as 150 µm to the cambium. Bamber and Lanyon (1960), who investigated nine species from various families from New South Wales, reported the full diameter to be reached at distances from the cambium varying from 0.07 to 2.5 cm.

Locality and dimension of the silica grains

To study whether or not a variation in size possibly exists in correlation with geographical distribution, two groups of samples were investigated, one of the same species growing in various localities and the other of various species growing in the same locality.

The first group consisted of six samples of *Hirtella racemosa* Lam. var. *racemosa* and seven samples of *Licania heteromorpha* Benth. var. *heteromorpha*. Measurements were made on adult secondary xylem, situated at least 2 cm from the cambium. Results are shown in Table 2.

In *Hirtella racemosa* Lam. var. *racemosa* the average size of the grains varies by 3 µm (± 20%). One sample from Surinam contains marginal ray cells with smaller grains than those in the other ray cells. In *Licania heteromorpha* Benth. var *heteromorpha* the variation is 7 µm (± 65%). In six out of the seven samples investigated, silica also occurs in the axial parenchyma. Only one sample (from Brasil, Rio Jurua) contains marginal ray cells in which the grains are smaller than those in the other ray cells.

In the second group, three species of *Licania* from the same locality (Peninica, Surinam) were investigated. Here, too, adult secondary xylem at a distance of at least 2 cm from the cambium was used.

Only a slight variation of 2 µm (± 10%) exists between the average dimensions of the grains of the six samples. If we consider all samples of these three

Table 2. Variation in Diameter of Silica Grains in *Hirtella racemosa* Lam. var. *racemosa* and *Licania heteromorpha* Benth. var. *heteromorpha* from Various Localities

Species	Locality	Silica Grains Diam. (μm)	Distribution	Dimensions of the Ray Cells Rad. × Axial (μm)
Hirtella racemosa var. *racemosa*	Guyana	17 (8-23)	rr	53 × 30
idem	Surinam (Wia Wia)	16 (10-20)	rr	39 × 35
idem	Surinam (Wayombo)	16 (13-23)	rr	38 × 40
idem	Surinam (Tafelberg)	14 (8-20)	rr^{+}	41 × 35
idem	B. Rio Madeira	17 (8-25)	rr	33 × 28
idem	Venezuela	15 (10-20)	rr	42 × 39
Licania heteromorpha var. *heteromorpha*	Guyana	9 (6-20)	rr,p	60 × 25
idem	Surinam (Zandery)	8 (5-28)	rr	48 × 26
idem	Surinam (Parariver)	13 (7-18)	rr, $p.v^{t}$	48 × 30
idem	Surinam (Sarramacca)	11 (8-15)	rr,p	56 × 24
idem	B. Rio Madeira	11 (5-15)	rr,p,v^{t}	61 × 25
idem	B. Rio Purus	14 (10-20)	rr,p	57 × 26
idem	B. Rio Jurua	15 (5-20)	rr^{+},p	60 × 26

Table 3. Variation in Diameter of the Silica Grains of Three Species of *Licania* Growing in Peninica, Surinam

Species	Silica Grains Diam. (μm)	Distribution	Dimensions of the Ray Cells Radial × Axial (μm)
Licania apetala var. *apetala*	16 (10-25)	rr°	53 × 22
idem	16 (10-25)	rr°	50 × 20
macrophylla	16 (10-25)	rr	69 × 25
idem	15 (11-24)	rr	65 × 25
idem	17 (10-23)	rr,v^{t}	62 × 28
ovalifolia	16 (10-25)	rr	58 × 25

Table 4. Occurrence of Silica Grains in the Axial Parenchyma of *Parinari*-Species

References	Species Investigated	Silica Present in the Ray Cells	Silica Present in the Axial Parenchyma
Amos (1952)	6	6	6
Balan Menon (1965)	6	6	-
Gonggrijp (1932)	6	6	1
Murthy (1965)	2	2	2
Sharma and Rao (1970)	1	1	1
Present investigations	7	7	

Table 5. Distribution of Silica Grains in the Secondary Xylem of Chrysobalanaceae

Species	Collection	Silica Distribution	Silica ∅ of the Grains	Locality
Acioa barteri (Hook.f.ex Oliv.) Engl.	Ver/Out. 702	rr	11 (8-15)	Ivory Coast
dinklagei Engl.	Ver/Out. 630	rr	11 (5-15)	Ivory Coast
scabrifolia Hua	Breteler 932	rr	9 (5-13)	Cameroun
somnolens Maguire	Maguire 50490	rr	14 (7-20)	Amazonia
Chrysobalanus icaco L.	Maguire 55915	rr^{+},p	13 (8-15)	Surinam
icaco L.	Ver/Out. 143	rr^{+},v^{t}	9 (5-18)	Ivory Coast
Couepia caryophylloides R. Benoist	Lindeman 6743	rr	12 (8-18)	Surinam
cognata (Steud.) Fritsch	Lindeman 4193	rr	12 (8-15)	Surinam
edulis (Prance) Prance	Pr/Ms. 14015	rr	13 (5-18)	Amazonia
glandulosa Miquel	Stahel 353	rr	13 (8-18)	Surinam
guianensis Aublet	Stahel 54	rr	14 (8-18)	Surinam
guianensis Aublet	BBS 10880	rr,v^{t}	16 (12-20)	Surinam
multiflora Benth.	A.C. Smith 2502	rr	10 (5-13)	Guyana
obovata Ducke	Maguire 54802	rr	12 (5-18)	Surinam
parillo A. DC.	Maguire 24782	rr	14 (8-18)	Surinam
Cyclandrophora excelsa (Jack) Kostermans*	Kostermans 7044	rr,v^{t}	8 (5-13)	Borneo
spec.	BW 8099	rr^{+}	18 (10-28)	New Guinea
Exellodendron barbatum (Ducke) Prance	A. C. Smith 2609	rr^{+}	18 (10-23)	Guyana
barbatum (Ducke) Prance	Lindeman 5888	rr^{+}	9 (3-13)	Surinam
barbatum (Ducke) Prance	Lindeman 6795	rr^{+}	12 (8-15)	Surinam
barbatum (Ducke) Prance	Maguire 55976	rr^{+}	14 (8-23)	Surinam
Hirtella bicornis Mart. & Zucc. var. *pubescens* Ducke	Stahel 206	rr	14 (8-21)	Surinam
bicornis Mart. & Zucc. var. *pubescens* Ducke	Heyligers 448	rr	12 (8-15)	Surinam
bicornis Mart. & Zucc. var. *pubescens* Ducke	BW 6243	rr	13 (9-20)	Surinam
bicornis Mart. & Zucc. var. *pubescens* Ducke	Lindeman 3662	rr	9 (8-13)	Surinam
bicornis Mart. & Zucc. var. *pubescens* Ducke	Lindeman 4573	rr	12 (9-16)	Surinam
duckei Huber	A. C. Smith 2999	rr	14 (8-20)	Guyana
duckei Huber	Krukoff 6834	rr	13 (8-18)	Amazonia
duckei Huber	Pr/Ms. 13849	rr	11 (8-15)	Amazonia
glandulosa Sprengel	Schulz 8034	rr	10 (5-15)	Surinam
glandulosa Sprengel	Maguire 51232	rr	10 (5-13)	Brasil
glandulosa Sprengel	Maguire 56100	rr	10 (5-18)	Brasil
glandulosa Sprengel	Maguire 56357	rr	15 (8-20)	Brasil
Hirtella hispidula Miquel	Schulz 8032	rr	15 (8-23)	Surinam
mucronata Prance	A. C. Smith 2718	rr	15 (5-20)	Guyana
obidensis Ducke	Lindeman 5014	rr	9 (3-15)	Surinam
paniculata Swartz	L & L 810	rr	10 (8-15)	Surinam
paniculata Swartz	L & L 3048	rr	12 (8-15)	Surinam
physophora Mart. & Zucc.	W. Boer 1284	rr	10 (5-13)	Surinam
racemosa Lam. var. *racemosa*	A. C. Smith 3625	rr	17 (8-23)	Guyana

racemosa Lam. var. *racemosa*	L & L 1124	rr	16	(10-20)	Surinam
racemosa Lam. var. *racemosa*	Schulz 7403	rr	16	(13-23)	Surinam
racemosa Lam. var. *racemosa*	Krukoff 6688	rr	17	(8-25)	Amazonia
racemosa Lam. var. *racemosa*	Breteler 3872	rr	15	(10-20)	Venezuela
racemosa Lam. var. *racemosa*	Maguire 55169	rr^{+}	14	(8-20)	Surinam
silicea Grisebach*	Broadway 3577	rr	7	(3-10)	Tobago
triandra Swartz subsp. *triandra*	Maguire 54904	rr	12	(8-15)	Surinam
Kostermanthus heteropetala (Scort.) Prance*	Kostermans 13630	rr	13	(8-18)	E-Borneo
Licania apetala (E. Mey.) Fritsch var. *apetala*	L & L 418	rr	13	(10-19)	Surinam
apetala (E. Mey.) Fritsch var. *apetala*	BBS 1032	rr°	16	(10-25)	Surinam
apetala (E. Mey.) Fritsch var. *apetala*	BBS 1033	rr°	16	(10-25)	Surinam
apetala (E. Mey.) Fritsch var. *apetala*	BBS 51	rr°	15	(8-22)	Surinam
canescens R. Benoist	L & L 357	rr	8	(5-13)	Surinam
canescens R. Benoist	Schulz 8359	rr	12	(8-18)	Surinam
canescens R. Benoist	Pr/Ms. 14320	rr	13	(8-18)	Amazonia
couepifolia Prance	O.N.S. 1256	rr^{+}	15	(10-20)	Surinam
densiflora Kleinhoonte	F. D. 1181	rr	16	(10-20)	Guyana
densiflora Kleinhoonte	BBS 10830	rr	10	(5-15)	Surinam
divaricata Benth.	Stahel 158	r	8	(5-15)	Surinam
divaricata Benth.	L & L 1833	rr	8	(5-15)	Surinam
elaeosperma (Mildbr.) Prance & White	Zenker 472	rr	10	(5-13)	Cameroun
elliptica Standley	Stahel 281	r	9	(5-15)	Surinam
elliptica Standley	Krukoff 5014	rr	15	(8-20)	Amazonia
heteromorpha Benth. var. *heteromorpha*	Stahel 41	rr	8	(5-28)	Surinam
heteromorpha Benth. var. *heteromorpha*	BBS 79	rr,p,v^{t}	13	(7-18)	Surinam
heteromorpha Benth. var. *heteromorpha*	F.D. 3343	rr,p	9	(6-20)	Guyana
heteromorpha Benth. var. *heteromorpha*	BBS 49	rr,p	11	(8-15)	Surinam
heteromorpha Benth. var. *heteromorpha*	Krukoff 6898	rr,p,v^{t}	11	(5-15)	Brasil
heteromorpha Benth. var. *heteromorpha*	Pr/Ms. 13975	rr,p	14	(10-20)	Amazonia
heteromorpha Benth. var. *heteromorpha*	Krukoff 4796	rr^{+},p	15	(5-20)	Amazonia
hypoleuca Benth. var. *hypoleuca*	Stahel 150	rr	12	(8-15)	Surinam
incana Aublet	Stahel 141	r	5	(3-10)	Surinam
incana Aublet	F.D. 3369	r	6	(4-12)	Guyana
incana Aublet	Maguire 24345	r	6	(4-10)	Surinam
irwinii Prance	L & L 454	rr	13	(5-18)	Surinam
cf. laxiflora Fritsch	L & L 2472	rr	14	(8-18)	Surinam
laxiflora Fritsch	L & L 2805	rr	13	(10-15)	Surinam
laxiflora Fritsch	O.N.S. 1179	rr	14	(8-20)	Surinam
leptostachya Benth.	L & L 895	rr	10	(8-15)	Surinam
leptostachya Benth.	Maguire 24862	rr^{+},p	15	(10-20)	Surinam
licaniaeflora (Sagot) Blake	L & L 2663	rr°	9	(5-13)	Surinam
macrophylla Benth.	BBS 1029	rr,v^{t}	16	(8-25)	Surinam

macrophylla Benth.	BBS 1030	rr	15	(10-23)	Surinam
macrophylla Benth.	BBS 1031	rr,v^{t}	17	(10-23)	Surinam
macrophylla Benth.	Dan/Jonk. 1093	rr	12	(8-15)	Surinam
macrophylla Benth.	Stahel 143	rr	13	(8-17)	Surinam
majuscula Sagot	Schulz 10343	rr	15	(12-20)	Surinam
majuscula Sagot	Maguire 54937	rr	20	(8-28)	Surinam
micrantha Miquel	Stahel 86	rr	14	(10-20)	Surinam
octandra (Hoffm. ex R.&S.) Kuntze	Stahel 61[a]	rr	16	(10-25)	Surinam
octandra (Hoffm.ex R.&S.) Kuntze	Heyligers 595	rr	9	(5-13)	Surinam
ovalifolia Kleinhoonte	Burger 21	rr	18	(12-23)	Surinam
ovalifolia Kleinhoonte	BBS 1027	rr	16	(10-25)	Surinam
polita Spruce ex Hooker f.	Stahel 257	rr	17	(10-20)	Surinam
robusta Sagot	Stahel 80[a]	rr	13	(10-20)	Surinam
rufescens Klotzsch ex Fritsch	Maguire 24795	rr	13	(8-15)	Surinam
splendens (Korthals) Prance	SAN 75144	rr	14	(8-18)	Malaya
stricta Kleinhoonte	BBS 10811	rr^{+},p	13	(5-18)	Surinam
Maranthes corymbosa Blume	F.P.R.I. 326	rr^{+}	15	(10-20)	Philippines
corymbosa Blume	Dutton 69	rr	11	(5-15)	Caroline Isl.
corymbosa Blume	Sch/Cr. 4000	rr^{+},p	16	(8-23)	Solomon Isl.
corymbosa Blume	Jacobs 7754	rr^{+}	9	(5-15)	Philippines
glabra (Oliv.) Prance	Cauwe 3015	rr^{+}	17	(10-20)	Zaïre
glabra (Oliv.) Prance	Corbisier s.n.	rr^{+}	19	(13-25)	Zaïre
Parastemon versteeghii Merr. & Perry	BW 12274	rr^{+}	12	(5-15)	New Guinea
Parinari campestris Aublet	Stahel 84[a]	rr°	13	(8-15)	Surinam
campestris Aublet	BBS 1001	rr°	10	(5-15)	Surinam
campestris Aublet	Schulz 8355	rr°	12	(10-15)	Surinam
curatellifolia Planch. ex Benth.	Schlieben 457	rr	12	(5-20)	East Africa
excelsa Sabine	Corbisier s.n.	rr^{+}	18	(13-25)	Zaïre
excelsa Sabine	Leeuwenberg 2623	rr	14	(8-18)	Ivory Coast
nonda F.v.M. ex Benth.	BW 12462	rr°	9	(5-13)	New Guinea
nonda F.v.M. ex Benth.	v. Royen 4843	rr°	12	(5-15)	New Guinea
oblongifolia Hook.f.	SAN 20443	rr°	14	(10-18)	N-Borneo
parilis Macbride	Williams 1113	rr°	15	(8-18)	Peru
rodolphii Huber	A.C. Smith 3320	rr	5	(3-8)	Guyana

Abbreviations used in Table 5

A. Distribution of the grains.

p — parenchyma
r — ray parenchyma
rr — ray parenchyma, abundant
t — tyloses
v — vessels
\+ — silica grains in the marginal ray cells smaller
° — horizontal rows of ray cells without silica grains present
* — twigs of herbarium material

B. Collections.

BBS — Bos Beheer Suriname
BW — Boschwezen
Dan/Jonk. — Daniels & Jonker
F. D. — Forest Department, Guyana
L & L — Lanjouw & Lindeman
O. N. S. — Oldenburger, Norde & Schulze
Pr/Ms. — Prance & Maas
SAN — Sandakan, Sabah
Sch/Cr. — Schodde & Craven
Ver/Out. — Versteegh & den Outer

species investigated, the average variation in size is much greater, namely 6 µm (± 50%); see Table 5.

Although the silica grain takes up only a relatively small part of the ray cells, there is, however, a possibility of a relationship between the dimensions of the ray cells and the silica grains. Therefore, a survey was made of the dimensions of the ray cells of all samples included in Tables 2 and 3. The ray cells of *Hirtella* are more or less square while those in *Licania* are more or less procumbent. In spite of a considerable variation in size of both ray cells and silica grains, no correlation could be established (Spearman-Rank correlation r_s = 0.12).

For example, grains with a diameter of 17 µm are found in ray cells with the following radial, respectively axial dimensions: 53 × 30, 33× 28 and 62 × 28 µm; on the contrary, in cells measuring about 60 × 25 µm, grains with a diameter of 9, 11, 15 and 16 µm, respectively, are observed. Evidence from Tables 2 and 3 seems to indicate that the size of the silica grains is influenced mainly by environmental conditions of the locality and to a lesser extent by genetic factors.

According to Lewin and Reimann (1969), there is a clear correlation between the amount of silica in the soil (as monosilicic acid) and the amount of silica present in the plants (as percentage of dry weight). Scurfield, Anderson and Signet (1974) mentioned that there seems to have been no attempt to relate the uptake of monosilicic acid by trees either with its concentration in the soil or with transpiration by the trees.

Discussion

Although the presence of silica in the Chrysobalanaceae has been known for a long time, and even was one of the reasons for transforming this former subfamily of the Rosaceae into a separate family (Prance, 1972[a]), there are some exceptions to the rule (Metcalfe and Chalk, 1950; Amos, 1952).

In the present investigations of 68 species (12 genera) the secondary xylem of all samples is characterized by the occurrence of silica grains especially in the ray cells. Consequently this feature may be considered as an important taxonomic character of the family.

Three types of distribution of the silica grains in the ray cells are recognized:

Type 1: Every cell containing a silica grain and all grains having about the same diameter;

Type 2: Every cell containing a silica grain, those in the marginal ray cells smaller than in the other ray cells;

Type 3: Ray cells normally with silica, but alternating with horizontal rows of cells without silica (Fig. 4). The ray cells without silica also lack the brown deposits present in the other ray cells.

Type 1 occurs in all genera except *Chrysobalanus, Exellodendron* and *Parastemon*. Type 2 was observed for all species of *Chrysobalanus, Exellodendron*, and *Parastemon*, and in a few samples of *Cyclandrophora, Hirtella, Licania, Maranthes*, and *Parinari*. Type 3 is limited to a few species of *Licania* and *Parinari*.

Occasionally silica also occurs in the axial parenchyma (Fig. 3). It was noticed in some samples of *Chrysobalanus, Licania* and *Maranthes*. However, here the occurrence is less constant, as in some samples of a particular species silica may be absent from the parenchyma cells. For *Maranthes corymbosa* Blume from New Guinea, Amos (1952) recorded the occurrence of silica in the axial parenchyma while a sample from Malaysia (Balan Menon, 1965) lacked silica in the parenchyma. In my own investigations of four samples from various localities, only one of them, collected in the Solomon Islands, contains silica in the parenchyma. This phenomenon was also recorded for *Parastemon urophyllum* A. DC. A sample from Indonesia or Malaysia contained silica in the axial parenchyma (Amos, 1952), while samples from the same region studied by Balan Menon (1965) and Gonggrijp (1932) lacked silica.

In Parinari we find the same inconsistency as is shown by Table 4 where data from the pertaining literature and from my own investigations are listed.

Perhaps this may be related to some extent to environmental conditions. Further investigations are needed to elucidate the role of the habitat. For such an investigation *Parinari* seems the most suitable genus because, besides the occasional occurrence of silica grains in the axial parenchyma, the three types of silica distribution in the ray cells described above are present. *Parinari* furthermore has a worldwide distribution.

Occasionally we find silica grains included in tyloses of the vessels, but as the presence of tyloses is not a constant character in Chrysobalanoideae (Lindeman and Mennega, 1963), the included grains are not of taxonomic value either.

The grains are mostly circular in shape and the surface is granular (Fig. 2). Smooth surfaces as recorded by Gonggrijp (1923) were not noticed. Sometimes oval or oblong shapes are present (Fig. 3), the oblong more frequently with increasing diameter of the grains. The grains are very compact and stable except in the samples from Zaïre where they seem to be less stable because part of them are broken. The SEM photograph (Fig. 6) clearly shows the more dense inner side of the grains. Hirata, Saiki and Harada (1972) recorded the same structure for the silica grains of Anisoptera.

Summary

The distribution of silica grains in the secondary xylem of 62 species representing 12 genera of Chrysobalanaceae was investigated. Special attention was given to species from the Neotropics. The following conclusions are drawn:

1. All species of Chrysobalanaceae contain silica grains in the ray cells.
2. One ray cell never contains more than one grain.
3. In every ray cell one grain is present, with the exception of a few species of *Parinari* and *Licania*.
4. Three types of distribution of silica in the rays can be distinguished.
5. The grains are generally globular, sometimes oval or oblong; their surface is granular.
6. The grains reach their maximum dimension at a distance of about 2 cm from the cambium, but even in small twigs silica grains are already present.
7. The environmental conditions seem to be an important factor influencing the diameter of the grains.
8. The occasional occurrence of silica grains in the axial parenchyma seems to be of little taxonomic value, while silica grains in the tyloses are of no taxonomic value at all.

Acknowledgments

I am grateful to Dr. A.M.W. Mennega for her interest and aid throughout this investigation and for reading the manuscript. Dr. L.Y. Th. Westra is acknowledged for his helpful comments on the manuscript and for correction of the English version. Mr. A. Kuiper and Mr. T. Schipper prepared the photographs. I should like to thank Dr. P. Baas (Rijksherbarium, Leiden) and Dr. ir. R. W. den Outer (Algemene Plantkunde, Wageningen) for loan of wood samples and Dr. R. B. Miller (Center for Wood Anatomy Research, Madison) for data on wood samples. Sincere gratitude is due to Dr. G. T. Prance (New York Botanical Garden) and Dr. F. White (C.F.I. Oxford) for giving me the opportunity for perusal of Dr. Prance's manuscript "A Generic Monograph of Chrysobalanaceae."

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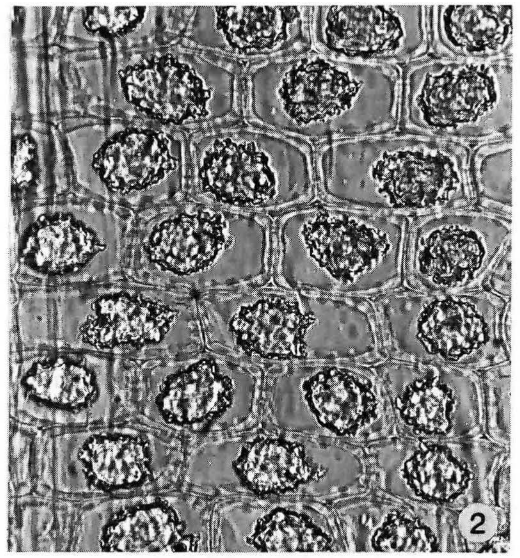
Figure 2. Radial section of *Licania majuscula* Sagot showing globular silica grains. X320

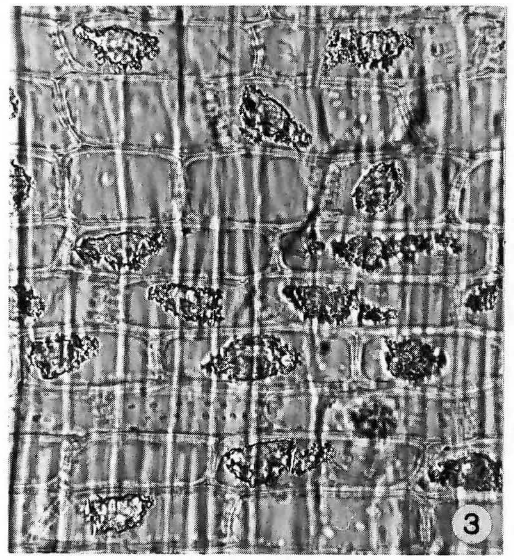
Figure 3. Radial section of *Licania apetala* (E.Mey.) Fritsch var. apetala showing oblong silica grains. X320

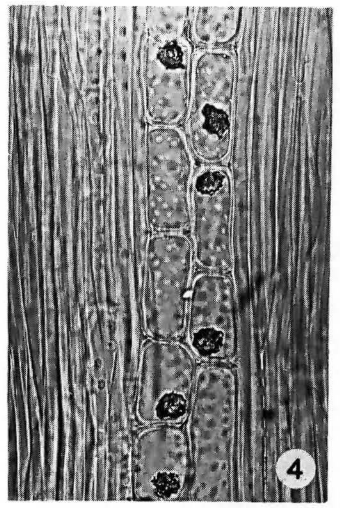
Figure 4. Radial section of *Maranthes corymbosa* Blume. Silica grains in the axial parenchyma. X220

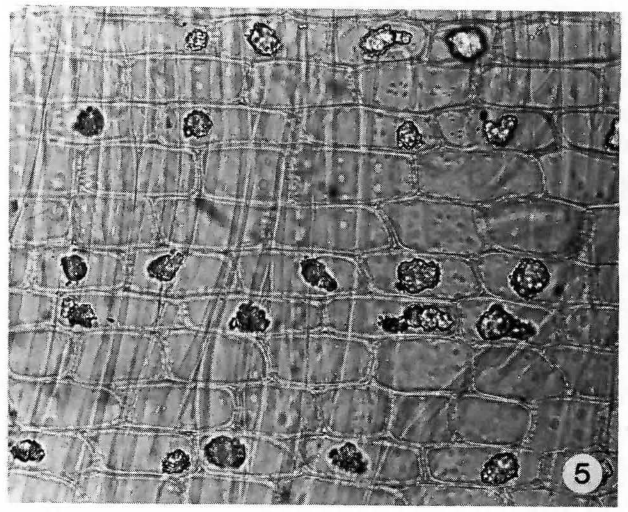
Figure 5. Radial section of *Parinari excelsa* Sabine. Ray cells with silica grains alternating with horizontal rows of cells without silica grains. X220

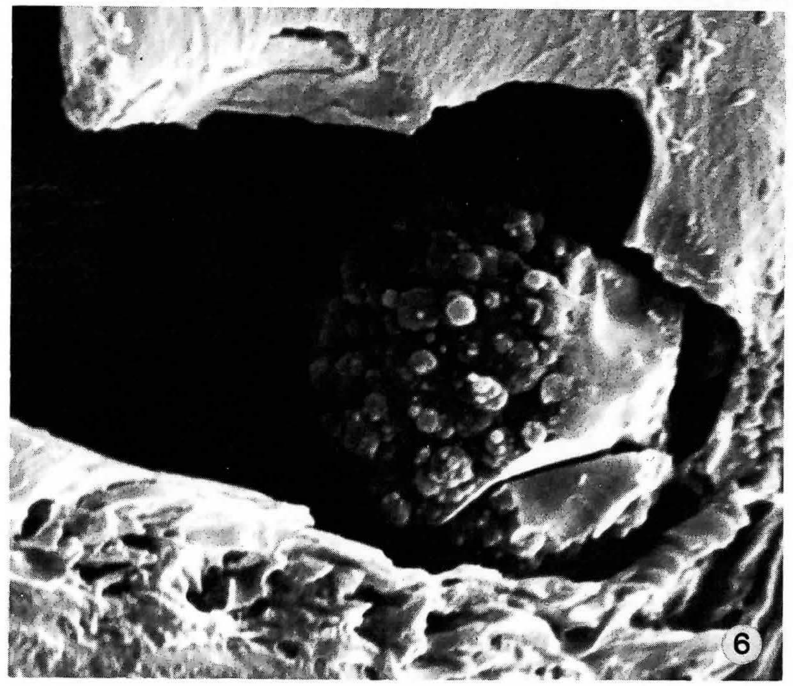
Figure 6. SEM photograph of a radial section of *Hirtella duckei* Huber showing the more dense inside of the silica grains. X3800











ASSOCIATION AFFAIRS

Transfer of Office of IAWA

On or about June 1, all of the membership and business functions of the International Association of Wood Anatomists will be transferred to the new office in the Netherlands. A preliminary announcement of this action was sent by letter to each member of IAWA, and some functions have already been started under the direction of the new Executive Secretary, Dr. Pieter Baas.

Members are urged to save time and confusion by writing to Dr. Baas at the following address:

Rijksherbarium
Schelpenkade 6
Leiden, Netherlands

Dr. Baas has agreed that the *IAWA Bulletin* should be published in Syracuse for the remainder of 1976. However, as much of the editorial function as possible will be handled through his office for the two remaining issues of this year. Incidentally, there is a need for papers for these and later issues.

NEW MEMBERS

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Prof. F. Raposo

Anyone having a current address for this member is requested to submit it to the Office of the Executive Secretary.

THE FUTURE OF THE IAWA

The present interim period with its delayed transfer of the office of the IAWA from Syracuse to Leiden is perhaps a blessing in disguise in spite of the extra burden it must imply for Dr. Côté and Dr. De Zeeuw at Syracuse. It means that the membership at large can still exert an effective influence on the course to be taken once the affairs have to be directed from Holland.

During the Leningrad meeting some desiderata were already formulated, such as the establishment of Regional Groups, the name change of the Bulletin, and the abolition of all formalities concerning the admission of new members. It is only a matter of procedure to effectuate these proposals. However, there are more urgent practical matters on which I would appreciate the advice and active help from the membership.

Although only 2 years ago the annual membership dues were doubled, rising costs and inflation, together with the decreasing readiness of research institutions to pay for activities of scientific societies administered by their staff members, will bring the IAWA once more in a financially precarious situation. There is only one way to secure our current activities or even to expand them without a rise in annual dues: viz. a vast increase of library subscriptions to our Bulletin. There must be at least 200 libraries in the world in which the *IAWA Bulletin* would be a useful periodical for present and future reference. Thanks to the efforts of Dr. Côté and Dr. De Zeeuw the *IAWA Bulletin* has grown in quantity and quality, and its original scientific papers are regularly quoted in other journals. It would only be fair to the authors that their contributions become and remain accessible to all those interested in wood structure, and at present the danger is too great that these papers are only available to IAWA members, in spite of the fact that Forestry Abstracts pays full attention to publications in the Bulletin. The increase in subscriptions to libraries will take time and work. During the Anglo-Dutch wood anatomy meeting in Oxford and Kew last April, some members agreed to provide addresses of libraries or institutions in their countries which might be interested. Similar help from other members would be highly appreciated. However, the most efficient way to effectuate a substantial increase in subscriptions at this stage is for each member to see to it that her or his research establishment subscribes to the Bulletin. The price to be charged to libraries should, I think, be the same as the annual dues for the members. In 1977 this will be 30 Dutch guilders, which is only slightly more than the 10 US dollars we have grown accustomed to. If we succeed in the future to increase the number of original scientific publications even further, it may become possible to charge libraries a higher price. This is quite customary for a number of scientific societies publishing their own journal.

For the time being it will, however, be a great enough effort and challenge to Mr. P. B. Laming and myself to maintain the high standards set out by our predecessors at Syracuse. As long as we are in this stage, a name change of our periodical would still be too early in my opinion. We should only change the name if we can rightfully pretend to offer more to the membership and libraries than we did before. And, after all, *IAWA Bulletin* is not such a parochial name and may well establish itself as a guarantee for a worthwhile scientific periodical, which at the same time is a vehicle for efficient exchange of notes and requests.

The success of our ambitious plans depends, however, entirely on your collaboration. Without your contributions, the Bulletin will become a mere news letter of very meagre dimensions. And, finally, without your collaboration in adding subscribers and new members to our mailing list we will eventually have to raise the annual dues. Although these final sentences very much remind me of blackmail, I cannot think of other words to define the alternative futures of our International Association of Wood Anatomists more clearly.

Pieter Baas

BOOK NOTICE

Journal of Microscopy 104, part 1, 106 pp. Blackwell Scientific Publication Ltd, Osney Mead, Oxford OX2 OEL. £ 5 or US$17.50.

This special issue of the *Journal of Microscopy* is entirely devoted to papers dealing with wood structure and properties. It has been published to mark the formation of an active "Wood Anatomy Group" within the Materials Section of the Royal Microscopical Society. There are seven papers on a variety of subjects:

J. M. Dinwoodie.
Timber—a review of the structure-mechanical property relationship.

A.J. Bolton and J. A. Petty.
Structural components influencing the permeability of ponded and unponded Sitka spruce.

I.D. Cave.
Wood substance as a water-reactive fibre-reinforced composite.

J.D. Brazier.
The changing pattern of research in wood anatomy.

G.J.C.M. van Vliet.
Wood anatomy of the *Crypteroniaceae sensu lato*.

P. Baas.
Interference microscopic studies on wood plastic and cell wall—liquid interactions in beech.

J.F. Hughes and R.M. de Albuquerque Sardinha.
The application of optical densitometry in the study of wood structure and properties.

Letters To The Editor

. . . In defense of the *IAWA Bulletin*. I was surprised, but also pleased, when I read your Editorial in the 1975/4 issue of the *IAWA Bulletin*, concerning the proposal of a name change. I was surprised because I would have expected the name change to be more popular, and I was pleased because I had voted for keeping the old name.

I am a member of many scientific societies, but I have always liked the IAWA because it has a minimal organization and does what it is supposed to do: to exchange information of mutual interest. The bulletin has served this purpose very well; you may remember that many years ago it consisted merely of a few mimeographed pages, stapled together. Later, it was printed offset which permitted the use of illustrations. At the same time, of course, it became more expensive.

A good deal of thought will be necessary if we want to upgrade our bulletin to make it a regular scientific journal, and we have to be aware of the burden we acquire with such a move. We would have to establish and finance a regular editorial office, set up a system of reviewing papers, embark upon a never-ending membership drive just to increase income, and try to sell subscriptions to libraries (which are hard up for money these days!).

The final irony could be that in a few years we might decide that we really need, in addition to the journal, a bulletin to exchange information of mutual interest. The question then is: Do we want or need a new wood journal? The small number of articles in the *IAWA Bulletin* indicates that, at least at this time, it is not necessary. It might perhaps be useful if authors who have published books or papers of interest elsewhere give us a brief report about them in the *IAWA Bulletin*. A column, "News in Wood Research", might offer a quarterly summary. It would be of interest to have comments along this line from the members.

In conclusion, I would like to thank you for your work, which was well done and appreciated by all of us.

Martin H. Zimmermann
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U.S.A.