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| **Author(s):** | Pieter Baas and Elisabeth Wheeler |
| **Title:** | **Editorial — On the 40th Jubilee of the IAWA Journal** |
| **Source:** | IAWA Journal, Volume 40, Issue 1 |
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| **Author(s):** | Anna L. Jacobsen, R. Brandon Pratt, Martin D. Venturas and Uwe G. Hacke |
| **Title:** | **Large volume vessels are vulnerable to water-stress-induced embolism in stems of poplar** |
| **Source:** | IAWA Journal, Volume 40, Issue 1 |
| **Publication Year:** | 2019 |
| **Pages:** | 4–S4 |
| **Keywords:** | Cavitation; cavitation resistance; embolism; HRCT; safety-efficiency tradeoff; vessel diameter; vessel length; vulnerability to cavitation |
| **Abstract:** | Xylem vessels interconnect to form the vessel network that is responsible for long-distance water transport through the plant. As plants dehydrate, the water column within vessels cavitates and gas emboli form, which block transport through embolized vessels. The impact of vessel blockages on transport through the xylem tissue depends upon vessel size and the arrangement and connections between vessels in the network. We examined if there was a correlation between vessel length and diameter within poplar stem xylem tissue using both silicone-injection and analysis of tissue volumes scanned using high-resolution computed tomography (microCT). We then used microCT to scan intact stems sampled over varying water potentials to examine if larger vessels, which would have the greatest impact on hydraulic transport, were more vulnerable to cavitation and embolism than smaller vessels. Within the xylem tissue, larger diameter vessels tended to be longer than narrow diameter vessels. Vessel size distributions indicated that most vessels were narrow and short, with fewer large vessels. Larger volume vessels tended to embolize at higher water potentials and the mean vessel volume of embolized vessels declined as water potentials declined. Hydraulic transport through the xylem tissue was near zero when about 40% of the vessels within the xylem tissue volume were embolized, suggesting important vessel network effects occur as water moves through a three-dimensional (3D) tissue. The structure of the vessel network is important in understanding the impact of emboli within vessels on the overall hydraulic function of xylem tissue. |
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| **Author(s):** | Bei Luo, Tomoya Imai, Junji Sugiyama and Jian Qiu |
| **Title:** | **The occurrence and development of intraxylary phloem in young *Aquilaria sinensis* shoots** |
| **Source:** | IAWA Journal, Volume 40, Issue 1 |
| **Publication Year:** | 2019 |
| **Pages:** | 23–42 |
| **Keywords:** | Thymelaeaceae; callose; sieve tubes; interxylary phloem; external phloem; photosynthate transport; agarwood |
| **Abstract:** | Agarwoods such as Aquilaria spp. and Gyrinops spp. (Thymelaeaceae) produce interxylary phloem in their secondary xylem and intraxylary phloem at the periphery of the pith, facing the primary xylem. We studied young shoots of Aquilaria sinensis and characterized the development of its intraxylary phloem. It was initiated by the division of parenchyma cells localized in the outer parts of the ground meristem immediately following the maturation of first-formed primary xylem. Its nascent sieve plates bore donut-like structures, the individual pores of which were so small (less than 0.1 μm) that they were hardly visible under FE-SEM. Intraxylary phloem developed into mature tissue by means of the division and proliferation of parenchyma cells. During the shoots’ active growth period, the sieve pore sizes were 0.1–0.5 μm, with tubular elements passing through them. In the maturation stage, large clusters of sieve tubes continued to be differentiated in the intraxylary phloem. In the partial senescence stage observed in a three-centimeter-diameter branch, intraxylary phloem cells in the adaxial part became crushed, and sieve plates had pores over 1–2 μm in diameter without any callose deposition. Before and after the differentiation of interxylary phloem in the first and second internodes, callose staining detected more than twice as many sieve tubes in intraxylary phloem than in external phloem. However, after differentiation of interxylary phloem in the eleventh internode, more sieve tubes were found in interxylary phloem than in intraxylary and external phloem. This suggests that prior to the initiation of interxylary phloem intraxylary phloem acts as the principal phloem. After its differentiation, however, interxylary phloem takes over the role of principal phloem. Interxylary phloem thus acts as the predominant phloem in the translocation of photosynthates in Aquilaria sinensis. |
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| **Author(s):** | Kelly Cristina Moreira dos Santos, Gabriel Uriel Cruz Araújo dos Santos, Claudia Franca Barros, Haroldo Cavalcante de Lima and Cátia Henriques Callado |
| **Title:** | **Wood anatomy of seven *Stryphnodendron* species (Mimosoid clade - Caesalpinioideae - Leguminosae)** |
| **Source:** | IAWA Journal, Volume 40, Issue 1 |
| **Publication Year:** | 2019 |
| **Pages:** | 43–57 |
| **Keywords:** | Systematic wood anatomy; Fabaceae; Neotropics |
| **Abstract:** | Stryphnodendron Mart. is a widespread genus in the Neotropics and its species are widely used for their timber, in popular medicine, and for tanning. The similarities in their external morphology make species identification difficult in this genus. This study describes and compares the wood anatomy of the seven species of Stryphnodendron most frequently found in Brazilian forest remnants, in order to identify which anatomical features can be used in their segregation. From seven species 31 samples of Stryphnodendron were studied. Principal Component Analysis was used to evaluate wood anatomical characters. The species were separated into two main groups, congruent with the division into multifoliolate and paucifoliolate species, due to the presence of diffuse, lozenge-aliform and confluent axial parenchyma. In the multifoliolate group, although two subgroups were formed due to ray width in number of cells, none of the species were individualised, which corroborates previous findings of high morphological and anatomical similarities of the multifoliolate species. |
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| **Author(s):** | Maomao Zhang, Guang Jie Zhao, Bo Liu, Tuo He, Juan Guo, Xiaomei Jiang and Yafang Yin |
| **Title:** | **Wood discrimination analyses of *Pterocarpus tinctorius* and endangered *Pterocarpus santalinus* using DART-FTICR-MS coupled with multivariate statistics** |
| **Source:** | IAWA Journal, Volume 40, Issue 1 |
| **Publication Year:** | 2019 |
| **Pages:** | 58–74 |
| **Keywords:** | Mass spectrometry; wood identification; xylarium; wood extract; OPLS-DA models; machine learning methods |
| **Abstract:** | Pterocarpus santalinus, listed in CITES Appendix II, is an endangered timber species as a result of illegal harvesting due to its high value and commercial demand. The growing demand for P. santalinus and timbers with the morphologically similar Pterocarpus tinctorius has resulted in confusion as well as identification problems. Therefore, it is of vital importance to explore reliable ways to accurately discriminate between P. santalinus and P. tinctorius. In this study, the method of direct analysis in real time and fourier transform ion cyclotron resonance mass spectrometry (DART-FTICR-MS), combined with multivariate statistical analysis, was used to extract chemical information from xylarium wood specimens and to explore the feasibility of distinguishing these two species. Significant differences were observed in their DART-FTICR-MS spectra. Orthogonal partial least square-discriminant analysis (OPLS-DA) showed the highest prediction, with an accuracy of 100%. These findings demonstrate the feasibility of authenticating wood types using DART-FTICR-MS coupled with multivariate statistical analysis. |
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| **Author(s):** | Stéphanie C. Bodin, Rita Scheel-Ybert, Jacques Beauchêne, Jean-François Molino and Laurent Bremond |
| **Title:** | **CharKey: An electronic identification key for wood charcoals of French Guiana** |
| **Source:** | IAWA Journal, Volume 40, Issue 1 |
| **Publication Year:** | 2019 |
| **Pages:** | 75–S20 |
| **Keywords:** | Charcoal anatomy; anthracology; Xper2; tropical flora; computeraided identification |
| **Abstract:** | Tropical tree floras are highly diverse and many genera and species share similar anatomical patterns, making the identification of tropical wood charcoal very difficult. Appropriate tools to characterize charcoal anatomy are thus needed to facilitate and improve identification in such species-rich areas.  This paper presents the first computer-aided identification key designed for charcoals from French Guiana, based on the wood anatomy of 507 species belonging to 274 genera and 71 families, which covers respectively 28%, 67% and 86% of the tree species, genera and families currently listed in this part of Amazonia. Species of the same genus are recorded together except those described under a synonym genus in Détienne et al. (1982) that were kept separately. As a result, the key contains 289 ‘items’ and mostly aims to identify charcoals at the genus level. It records 26 anatomical features leading to 112 feature states, almost all of which are illustrated by SEM photographs of charcoal. The descriptions were mostly taken from Détienne et al.’s guidebook on tropical woods of French Guiana (1982) and follow the IAWA list of microscopic features for hardwood identification (Wheeler et al. 1989). Some adjustments were made to a few features and those that are unrelated to charcoal identification were excluded. The whole tool, named CharKey, contains the key itself and the associated database including photographs. It can be downloaded on Figshare at https://figshare.com/s/d7d40060b53d2ad60389 (doi: 10.6084/m9.figshare.6396005). CharKey is accessible using the free software Xper2, specifically conceived for taxonomic description and computer aided-identification. |
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| **Author(s):** | Tomáš Kolář, Vladimír Gryc, Konrad Mayer, Michal Rybníček, Hanuš Vavrčík, Andrea Weber and Michael Grabner |
| **Title:** | **Wood species analysis of traditional hand-operated spinning wheels from Central Europe** |
| **Source:** | IAWA Journal, Volume 40, Issue 1 |
| **Publication Year:** | 2019 |
| **Pages:** | 92–105 |
| **Keywords:** | Cultural heritage; historical wood utilisation; open-air museum; wood identification; wood properties; wooden handicraft |
| **Abstract:** | Hand spinning has become increasingly popular as a recovery of the traditional techniques of natural fibre processing and cultural heritage protection. Modern spinning wheels are usually made of easily available wood species, particularly hardwoods, and one spinning wheel usually consists of one or two species. However, the wood species that were used for the individual parts of old spinning wheels in Central Europe are still unknown. To improve our understanding of traditional craftsmen and their skills, we investigated old spinning wheels that originated from Central Europe in the 19th and the 20th century. In this study, we present a collection of 643 samples from 54 artefacts representing the region between the European Alps and the Western Carpathians. Spinning wheels were usually made of 3 to 5 wood species, and the species selection varied among regions. Generally, high wood density (> 600 kg.m−3) species prevailed in Austria and Western Slovakia, but lower wood density (< 600 kg.m−3) species were preferred in the south-eastern Czech Republic. Easily workable species were used for the production of the spinning wheels, primarily Tilia, Fagus sylvatica, Picea abies, and Acer. In addition to these species, a high proportion of fruit-bearing trees and three shrubs were identified. Wood anatomy, as an important scientific method, contributed to understanding the reasons for species selection and the suitability of their properties which will enable the conservation of sustainable folk traditions and crafts, as well as the knowledge of traditional craftsmen. |
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| **Author(s):** | Patrik Ahvenainen |
| **Title:** | **Anatomy and mechanical properties of woods used in electric guitars** |
| **Source:** | IAWA Journal, Volume 40, Issue 1 |
| **Publication Year:** | 2019 |
| **Pages:** | 106–S6 |
| **Keywords:** | Tropical hardwoods; electric guitar; tonewoods; CITES; principal component analysis; wood anatomy |
| **Abstract:** | Many endangered tropical hardwoods are commonly used in electric guitars. In order to find alternative woods, the current electric guitar woods need to be studied and classified as most research in this field has focused on acoustic instruments. Classification was done based on luthier literature, woods used in commercially available electric guitars, commercially available tonewoods and by interviewing Finnish luthiers. Here, the electric guitar woods are divided into three distinct classes based on how they are used in the guitar: low-density wood used in the body only (alder, poplar, basswood, ash), medium-density wood used in the body and neck (maple and mahogany), and high-density wood used in the fretboard only (rosewood and ebony). Together, these three classes span a wide range of anatomical and mechanical properties, but each class itself is limited to a relatively narrow parameter space. Statistically significant differences between these classes and the average hardwoods exist in the wood anatomy (size and organization of vessels, fibres, rays and axial parenchyma), in the mechanical properties (density, elastic modulus, Janka hardness, etc.) and in the average price per volume. In order to find substitute woods for a certain guitar wood class, density and elastic modulus can already be used to rule out most wood species. Based on principal component analysis of the elastomechanical and anatomical properties of commercially available hardwoods, few species are similar to the low- and high-density class woods. However, for all of the three electric guitar wood classes, non-endangered wood species are already commercially available from tonewood retailers that match the class characteristics presented here. |
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| **Author(s):** | Oliver Dünisch |
| **Title:** | **Frequencies in vibrating wood – Does cell organization matter?** |
| **Source:** | IAWA Journal, Volume 40, Issue 1 |
| **Publication Year:** | 2019 |
| **Pages:** | 124–142 |
| **Keywords:** | Wood structure; cell arrangement; storied rays; tree rings; laser measurements; frequency spectra; resonance wood |
| **Abstract:** | The relationship between the spatial organization of different cell types, of the xylem rays, and of the tree rings and the frequencies in vibrating softwoods and hardwoods was studied under controlled conditions. In total, the frequencies in 1007 standardized vibrating plates from 16 softwoods and 74 hardwoods were analysed using high resolution laser sensors (accuracy ± 0.02 μm, sampling frequency 30 kHz) for vibration measurements. Overlapping frequencies within the frequency spectra were identified by means of Fast Fourier Transformation analysis. With regard to the number of distinct frequencies within the spectra, four different vibration types were identified: type 1–one dominant frequency within the frequency spectra; type 2-two dominant frequencies within the frequency spectra; type 3-three dominant frequencies within the frequency spectra; type 4-no dominant frequencies within the frequency spectra. The presence of distinct frequencies was correlated with a highly organized spatial arrangement of tracheids in softwoods, with a storied arrangement of the xylem rays in hardwoods, and with low variation in tree-ring width in both softwoods and hardwoods. The grid size for repetition in these xylem structures influenced the frequencies of the vibrating wood in absolute numbers. The results indicate that the analysis of the anatomical structure of the wood can contribute to the grading of timber for its vibration characteristics, which is of special interest for the selection of resonance wood for musical instruments. |
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| **Author(s):** | Jugo Ilic |
| **Title:** | **Australian Forest Woods. Characteristics, Uses and Identification. Morris Lake. x + 218 pp., colour illustrations, 2019. CSIRO Publishing. ISBN 978-1-4863-0778-4. Price AUD 69.95 (hardback).** |
| **Source:** | IAWA Journal, Volume 40, Issue 1 |
| **Publication Year:** | 2019 |
| **Pages:** | 143–144 |
| **Keywords:** |  |
| **Abstract:** |  |
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| **Author(s):** | Fritz H. Schweingruber |
| **Title:** | **Visual guide to plant anatomy. Alexander Lux, Milan Baláž, Marie Kummerová, Aleš Soukup, Olga Votrubová, Jun Abe, Shigenori Morita, Thomas Rost, 325 pp., illus., 2017. Academia Praha. ISBN 978-80-200-2620-0. Price: EUR 20.09 or CZK (Kč) 360 (hardback).** |
| **Source:** | IAWA Journal, Volume 40, Issue 1 |
| **Publication Year:** | 2019 |
| **Pages:** | 144 |
| **Keywords:** |  |
| **Abstract:** |  |
| **DOI:** | 10.1163/22941932-04001011 |

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| **Author(s):** | Regis B. Miller |
| **Title:** | **Ben J.H. ter Welle (1946–2019)** |
| **Source:** | IAWA Journal, Volume 40, Issue 1 |
| **Publication Year:** | 2019 |
| **Pages:** | 145–146 |
| **Keywords:** |  |
| **Abstract:** |  |
| **DOI:** | 10.1163/22941932-20170242 |

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| **Author(s):** | Editors IAWA List of Microscopic Bark Features |
| **Title:** | **Acknowledgement of Reviewers** |
| **Source:** | IAWA Journal, Volume 40, Issue 1 |
| **Publication Year:** | 2019 |
| **Pages:** | 147 |
| **Keywords:** |  |
| **Abstract:** |  |
| **DOI:** | 10.1163/22941932-04001013 |