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Palaeoflora Europaea: Notulae Systematicae ad Palaeofloram Europaeam spectantes III. New names of fossil magnoliophytes of the European Tertiary: *Ternstroemiaceae*, *Theaceae* and *Actinidiaceae*

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ABSTRACT

Doweld A.B. 2024. *Palaeoflora Europaea*: Notulae Systematicae ad Palaeofloram Europaeam spectantes III. New names of fossil magnoliophytes of the European Tertiary: *Ternstroemiaceae*, *Theaceae* and *Actinidiaceae.* Geophytology 54(2): 119–144.

The *Palaeoflora Europaea* Project received new valid names for 71 fossil taxa referable to three angiosperm families of the European Tertiary, *Actinidiaceae*, *Ternstroemiaceae*, and *Theaceae*. *Freziera salicina* nom. nov. is proposed instead of *Freziera salicifolia* Saporta (fossil) non *Freziera salicifolia* Choisy (extant). *Polyspora euroeocenica* nom. nov. is proposed to replace the later homonym *Polyspora europaea* (Jähnichen) Rüffle (fossil) non *Polyspora europaea* (Mai) Gregor (fossil). *Pentapetalotrigyne* nom. nov. is proposed to replace the illegitimate name, coinciding with a technical term, *Pentapetalum* Martínez-Millán, Crepet & Nixon. *Paraeurya knoblochii* sp. nov. is validated and renamed instead of the invalidly published *Eurya carpatica* Erv. Knobloch & Mai (lacking holotype designation when published). *Euschimoxylon miowallichii* sp. nov. is proposed to replace invalid *Schima protowallichii* K. Terada & Mits. Suzuki (lacking validating illustrations and repository of the holotype when published). 19 new fossil-genera were proposed: *Alloeurya* gen. nov., *Boreome* gen. nov., *Camellioxylon* gen. nov., *Capparispermum* gen. nov., *Euryites* gen. nov., *Euschimoxylon* gen. nov., *Gordonianthus* gen. nov., *Maiaspermum* gen. nov., *Paracadaba* gen. nov., *Paraeurya* gen. nov., *Parastroemia* gen. nov., *Pentaphylacoides* gen. nov., *Polysporoxylon* gen. nov., *Pseudoprunus* gen. nov., *Pseudosaurauia* gen. nov., *Pseudoternstroemiophyllum* gen. nov., *Pseudovisnea* gen. nov., *Stewartioxylon* gen. nov., *Weylandiella* gen. nov. Two fossil-genera were reinstated and amplified: *Clethraecarpum* Menzel emend. nov. and *Cyrtospermites* Bogner emend. nov. New 49 combinations are made: *Adinandra bockwitzensis* comb. nov., *Adinandra magdae* comb. nov., *Adinandra sokolovensis* comb. nov., *Alloeurya crassitesta* comb. nov., *Alloeurya holyi* comb. nov., *Boreome graveonella* comb. nov., *Boreome intermedia* comb. nov., *Boreome sibirica* comb. nov., *Camellioxylon japonoxylum* comb. nov., *Camellioxylon kueishanense* comb. nov., *Camellioxylon nanningense* comb. nov., *Capparispermum kireevskianum* comb. nov., *Capparispermum minimum* comb. nov., *Capparispermum nigrum* comb. nov., *Capparispermum omskiense* comb. nov., *Cyrtospermites becktonensis* comb. nov., *Eurya cooperi* comb. nov., *Euryites floersheimensis* comb. nov., *Euschimoxylon benderi* comb. nov., *Gordonianthus ternstroemioides* comb. nov., *Liquidambaroxylon altingioides* comb. nov., *Maiaspermum euryoides* comb. nov., *Paracadaba intermedia* comb. nov., *Parastroemia costata* comb. nov., *Pentapetalotrigyne trifasciculandrica* comb. nov., *Pentaphylacoides protogaea* comb. nov., *Polyspora emanuelii* comb. nov., *Polyspora hallensis* comb. nov., *Polyspora japonica* comb. nov., *Polyspora kunzii* comb. nov., *Polyspora oberdorfensis* comb. nov., *Polyspora pannonica* comb. nov., *Polyspora paulownia* comb. nov., *Polyspora pseudoknauensis* comb. nov., *Polyspora styriaca* comb. nov., *Polyspora warmanensis* comb. nov., *Polysporoxylon adendorfense* comb. nov., *Polysporoxylon gordonioides* comb. nov., *Pseudoprunus pereger* comb. nov., *Pseudosaurauia alenae* comb. nov., *Pseudosaurauia antiqua* comb. nov., *Pseudoternstroemiophyllum*

crassipes comb. nov., *Pseudovisnea minima* comb. nov., *Stewartia palaeorhodopensis* comb. nov., *Stewartia quinqueangularis* comb. nov., *Stewartioxylon notoense* comb. nov., *Stewartioxylon pseudocamellioxylon* comb. nov., *Weylandiella rhenana* comb. nov., *Weylandiella schilcheriana* comb. nov. Furthermore *Carpinus oblonga* Unger and *Crataegus orionis* Unger are lectotypified for the first time.

Keywords: *Palaeoflora Europaea*, new plant fossil names, *Magnoliophyta*, Tertiary, *Ternstroemiaceae*, *Theaceae*, *Actinidiaceae.*

INTRODUCTION

The third contribution series to the *Palaeoflora Europaea* Project is presented, which was initiated in 2012 as a comprehensive revision of the fossil plants discovered on what is known now as the European continent (from Pyrenean peninsula to the Urals, westernmost part of Eurasia) (Doweld 2018, 2022b). The aim of the *Palaeoflora Europaea* was to describe all the national palaeofloras of Europe in a single, authoritative publication to help readers identify any extinct plants in Europe to the species level. During the preparation of the basic checklist of the fossil plants a large number of changes have been found to be necessary as a consequence of typification studies and correct application of the current Code (Turland et al. 2018). It is hoped that these changes will bring us nearer to attaining a stable and correct nomenclature. Other changes are consequence of taxonomic revision and reassessment of the status of numerous fossil plants which have not previously been critically studied after their initial discovery in different parts of Europe.

The emphasis of the current study is on the problematic cases of the systematics and nomenclature of fossil-species from the European Tertiary referred to the families *Actinidiaceae*, *Ternstroemiaceae* and *Theaceae*. New replacement names are proposed here for 23 taxa of the European Tertiary. The revision of the European fossil taxa of *Ternstroemiaceae* and *Theaceae* also affected several related fossil forms previously described from the Asian region [Western Siberia (Russian Federation), China, Japan, Myanmar, India, Indonesia] and the American continent (USA).

New fossil plant names and nomenclatural adjustments (including typifications) were registered, through a registration system proposed before the XIX International Botanical Congress in Shenzhen in 2017, in the *International Fossil Plant Names Index* (IFPNI 2014–onwards) with unique persistent registration barcodes (LSIDs, Life Science Identifiers) (Doweld 2015, 2016, 2022a). The registration of plant taxa (Barkworth et al. 2016a–b) was accepted at the XIX International Botanical Congress in Shenzhen 2017 (Turland et al. 2017a, b).

Family: *Theaceae* Mirbel (1816: ad tab. 112), **nom. cons.**

Type: *Thea* Linnaeus (1753: 515)

Polyspora Sweet (1825: 205)

Polyspora emanuelii (Kovar-Eder) Doweld, **comb. nov.**

≡ *Gordonia emanuelii* Kovar-Eder (in Kovar-Eder & Hably 2006: 176, plate 2, figures 19, 20, plate 10, figure 1).

Type: [fossil leaves] Mataschen clay pit, 5 km SW of Fehring, district Feldbach, Styria, Austria (holotype, 2000B0015/241 A, Naturhistorisches Museum Wien, Geologisch-Paläontologische Abteilung, Vienna, Austria).

Occurrence: Upper Miocene (Tortonian); Europe.

IFPNI: A130FB20-410F-9585-9F23-3BD99FD35429.

Note: The fossil-species *Gordonia*

emanuelii Kovar-Eder was published on the basis of leaf remains with preserved cuticular structure from the Upper Miocene (Tortonian) sediments of Mataschen, Styria, Austria, as a fossil representative of *Gordonia* sensu lato. The transference of *Gordonia emanuelii* to *Polyspora* is based on its similar leaf morphology and stomata with tangentially more or less elongated and well-discernible subsidiary cells, which are mostly characteristic of *Gordonia*.

Polyspora euroeocenica Doweld, **nom. nov.**

≡ *Schisandra europaea* Jähnichen (1976: 151) ≡ *Polyspora europaea* (Jähnichen) Rüffle (1993: 117), nom. illeg. non *Polyspora europaea* (*Lagerstroemia europaea* Mai 1964: 39) Gregor (1978: 30).

Type: [fossil leaves] Profen, Sachsen-Anhalt, Germany (holotype, MB.Pb.2017/059, Museum für Naturkunde, Berlin, Germany).

Occurrence: Eocene; Europe.

Eponymy: From *Europe*, a continent and *Eocene*, a geological epoch.

IFPNI: 9796B058-8FCC-F76A-C09D-32BC879E9DA5.

Note: The fossil-species *Polyspora europaea* (Jähnichen) Rüffle (1993), based on leaf remains of the Eocene sediments from Profen, Sachsen-Anhalt, Germany, is a later homonym of the fossil-species *Polyspora europaea* (Mai) Gregor (1978), based on the fruit remains from the Miocene sediments of Wiesa near Kamenz, Saxony, Germany; since both fossils are unrelated, a new replacement is necessary.

Polyspora hallensis (Barthel, Z. Kvaček & Rüffle) Rüffle ex Doweld, **comb. nov.**

≡ *Symplocos hallensis* Barthel, Z. Kvaček & Rüffle (1966: 358) ≡ *Polyspora hallensis* (Barthel, Z. Kvaček & Rüffle) Rüffle (1993: 117), nom. inval. (ICN, Art. 40.1).

Type: [fossil leaves] Otto mine, Neumark-Süd mine, Geiseltal, Sachsen-Anhalt, Germany (holotype, MB.Pb.2004/0881 [53/4], Museum für Naturkunde, Berlin, Germany).

Occurrence: Eocene (Lutetian); Europe.

IFPNI: 13BBA297-0FE2-A372-2873-9A8185FDADD9.

Note: The fossil-species *Polyspora hallensis* (Barthel, Z. Kvaček & Rüffle) Rüffle (1993) was invalidly published due to the lack of the full and direct reference given to its author and place of valid publication, with page or plate reference and date not provided (ICN, Art. 40.1); therefore, the recombined fossil name is validated here.

Polyspora kunzii (Heer) Doweld, **comb. nov.**

≡ *Persoonia kunzii* Heer (1861: 415 [9], pl. 8: fig. 22).

Type: [fossil leaves] Schkopau, Sachsen-Anhalt, Germany (holotype, not located).

Occurrence: Eocene; Europe.

IFPNI: 917B96A6-7EA6-B094-36AC-AD72930C243A.

Note: The fossil-species *Persoonia kunzii* from the Eocene sediments of Schkopau, Sachsen-Anhalt, Germany is based on the leaf remains which are similar to *Polyspora*-type of foliage instead of superficial similarity with *Persoonia*, and therefore, a new combination is necessary and validated here.

Polyspora oberdorfensis (Kovar-Eder) Doweld, **comb. nov.**

≡ *Gordonia oberdorfensis* Kovar-Eder (in Kovar-Eder & Meller 2001: 79, pl. 2, fig. 2; pl. 5, figs. 1, 2).

Type: [fossil leaves] Oberdorf N Voitsberg, Styria, Austria (holotype, 1998B0007/77A, Naturhistorisches Museum Wien, Geologisch-Paläontologische Abteilung, Vienna, Austria).

Occurrence: Lower Miocene (Burdigalian/ Ottnangian / Köflach-Voitsberg Formation); Europe.

IFPNI: 6033F4F9-3DE1-1211-2B6B-7F78259C9492.

Note: The fossil-species *Gordonia oberdorfensis* Kovar-Eder shows similar leaf structure and the structure of the abaxial cuticle including stomata with extant Polyspora axilliaris, but differs in having larger, suborbicular to orbicular stomata, less distinct epidermal walls of the guard cells and anticlinal walls of the subsidiary cells, more concentric striation around the stomata, and more common trichome bases.

Polyspora pannonica (Kovar-Eder) Doweld, **comb. nov.**

≡ *Gordonia pannonica* Kovar-Eder (in Kovar-Eder & Hably 2006: 177, Pl. 9, fig. 5, Pl. 10, fig. 3).

Type: [fossil leaves] Mataschen clay pit, 5 km SW of Fehring, district Feldbach, Styria, Austria (holotype, 2000B0015/149, Naturhistorisches Museum Wien, Geologisch-Paläontologische Abteilung, Vienna, Austria).

Occurrence: Upper Miocene (Tortonian); Europe.

IFPNI: EBC62E0A-06A4-EE1B-9384-3E3CF33CB9D4.

Note: The fossil-species *Gordonia pannonica* Kovar-Eder was published on the basis of leaf remains from the Upper Miocene (Tortonian) sediments of Mataschen, Styria, Austria, as a fossil representative of *Gordonia* sensu lato. The recombination of *Gordonia pannonica* to *Polyspora* is confirmed by its similar leaf morphology, stomata and cuticular microstructure with the concentrically elongated subsidiary cells and almost concentrically wrinkles surrounding the stomata, the wrinkles are oriented in almost parallel bundles covering the areas between the stomatal complexes, and with the smooth adaxial cuticle with curved and slightly undulating anticlines.

Polyspora pseudoknauensis (Z. Kvaček) Doweld, **comb. nov.**

≡ *Gordonia pseudoknauensis* Z. Kvaček (2004: 14, pl. 8: fig. 4).

Type: [fossil leaves] Flörsheim am Main, Main-Taunus district, Hesse, Germany (holotype, SM.B 185c, Senckenberg Naturhistorische Sammlungen Frankfurt, Senckenberg Forschungsinstitut und Naturmuseum, Frankfurt am Main, Germany).

Occurrence: Lower Oligocene (Rupelian); Europe.

IFPNI: A53F16EF-66A7-E4A3-F1F4-8EC48192FABE.

Note: The fossil-species *Gordonia pseudoknauensis* Z. Kvaček was published on the basis of leaf remains from the Rupelian sediments of Flörsheim am Main, Hesse, Germany, who considered *Gordonia* sensu lato. The acceptance of the distinctness of *Polyspora* necessitates the transference of *Gordonia pseudoknauensis* on the basis of similarity of leaf morphology of the fossil-species with *Polyspora*.

Polyspora styriaca (Kovar-Eder) Doweld, **comb. nov.**

≡ *Gordonia styriaca* Kovar-Eder (in Kovar-Eder & Hably 2006: 178, Pl. 9, figs 3–4, Pl. 10, fig. 2).

Type: [fossil leaves] Mataschen clay pit, 5 km SW of Fehring, district Feldbach, Styria, Austria (holotype, 2000B0015/10 B, Naturhistorisches Museum Wien, Geologisch-Paläontologische Abteilung, Vienna, Austria).

Occurrence: Upper Miocene (Tortonian); Europe.

IFPNI: 607BDE8D-C444-88B9-4042-13901B562D48.

Note: The recombination of the fossil-species *Gordonia styriaca* Kovar-Eder to *Polyspora* is confirmed by its similar leaf structure, including stomata and cuticular ultrastructure; the distinctive

feature of *Polyspora styriaca* is the presence of the inner and incomplete outer circle of subsidiary cells, which have been observed in the modern *Polyspora axillaris*. In addition, the cuticular structure of *P. styriaca* closely resembles those of *P. emanuelii*.

Polysporoxylon Doweld, **gen. nov.**

Description: Growth zones quite narrow. Vessels thin-walled and narrow: 35-40(-50) μm, exclusively solitary or at the beginning of the growth zone sometimes in twos or threes in short radial rows; transverse walls inclined and perforated in the form of a ladder with up to 70 proliferations, at the ends the perforations merge into a fiber with bordered pits. The spots to the medullary rays and the parenchyma ladder-shaped or horizontal-elliptical; those to the fibers are round bordered pits. Axial parenchyma scanty paratracheal. Medullary rays one to two, very rarely up to three cells wide, homogeneous or heterogeneous. The single-row medullary rays formed either by standing or lying cells; the maximum height of the medullary rays is sixteen cells; the spots on the fibers rounded; the fibers thick-walled.

Type: *Polysporoxylon gordonioides* (K. Kramer) Doweld.

IFPNI: 88F6C5A0-832A-AB60-D3FA-D71CFDCCCDF7.

Polysporoxylon adendorfense (van der Burgh) Doweld, **comb. nov.**

≡ *Ternstroemioxylon adendorfense* van der Burgh (1973: 172).

Type: [fossil wood] Adendorf, district of Lüneburg, Lower Saxony, Germany (holotype, Nr. 1160, Utrecht University, Laboratory of Palaeobotany and Palynology, Utrecht, The Netherlands).

Occurrence: Miocene; Europe.

IFPNI: B312B3BE-4934-751D-F852-DAEB3FE210D9.

Note: The fossil-species *Ternstroemioxylon adendorfense*, based on wood remains from the Lower Miocene of Germany, resembles wood of extant *Polyspora* (Kvaček & Walther 1984). The type of the fossil wood genus *Ternstroemioxylon* Schönfeld (1930: 125), *T. kraeuselii* Schönfeld, was recently critically re-studied by Süss & Müller-Stoll (1982), who transferred the fossil-species to the Rosaceaous fossil-genus *Pruninium*, *P. kraeuselii* (Schönfeld) Süss & Müller-Stoll (1982: 1153). As a result, the remained fossil-species *Ternstroemioxylon adendorfense*, showing Thealean fossil wood structure, should be segregated in a distinct fossil wood genus, *Polysporoxylon* Doweld, gen. nov.

Polysporoxylon gordonioides (K. Kramer) Doweld, **comb. nov.**

≡ *Schimoxylon gordonioides* K. Kramer (1974: 25, 29).

Type: [fossil wood] Mandai River, W Borneo Island, Indonesia (holotype, Utrecht 193, Nr.: 9618, 9637, 9638, Utrecht University, Laboratory of Palaeobotany and Palynology, Utrecht, The Netherlands).

Occurrence: Cenozoic; Maritime Southeast Asia.

IFPNI: F01F939E-3B82-F894-4FB7-505220E51304.

Note: The fossil-species *Schimoxylon gordonioides*, based on wood remains from the Cenozoic of Borneo Island, Indonesia, resembles the wood of extant species *Polyspora excelsa* (Blume) Orel, Peter G.Wilson, Curry & Luu (Kramer 1974). The type of the fossil wood genus *Schimoxylon* K. Kramer (1974: 29), *S. dachelense* (Kräusel) K. Kramer (1974: 25) (≡ *Ternstroemioxylon dachelense* Kräusel (1940: 91), was instituted on the wood remains of the Cretaceous age (Senonian) from Nubian Desert, Egypt. The resemblance of this fossil wood with extant representatives of the genus *Schima* is very

superficial, and needing more revision; the overall generic diagnosis of *Schimoxylon* was mainly based on the different fossil wood type from Borneo, Indonesia (*Schimoxylon gordonioides*), and this mixture of palaeoxylological features of the Cretaceous and Cenozoic fossil wood types led to the creation of very artificial and unnatural fossil wood genus. Since the type species was originally based on the Cretaceous fossil wood type, the relationships of which is very obscure with extant genus *Schima*, it is proposed to restrict *Schimoxylon* to this ambiguous fossil wood remains [haud typo], but other fossil wood types from Tertiary sediments should be re-classified and excluded in the different fossil wood genera. See below additional commentaries under newly created fossil wood genus, *Euschimoxylon* Doweld, gen. nov.

Addendum: *Polyspora* Fossiles Extraeuropaeorum

Polyspora japonica (Tanai) Doweld, **comb. nov.**

≡ *Gordonia japonica* Tanai (1970: 494).

Type: [fossil leaves] Harutori pit, Harutori mine, Kushiro City, Hokkaido, Japan (holotype, HUMP-25998, Museum of Palaeontology, Hokkaido University, Sapporo, Japan).

Occurrence: Oligocene; Eurasia (Japan Archipelago).

IFPNI: 8B3CC2D4-EB62-3EA1-8FDB-F2B6127C0B0F.

Note: The fossil-species *Gordonia japonica*, established on the leaf imprints from the Oligocene sediments of Japanese Archipelago, is transferred to the genus *Polyspora* on account of the similarity of the leaf morphotype with that of *Polyspora axillaris* (Roxburgh ex Ker-Gawler) Sweet (1825: 205), a type of the genus.

Polyspora paulownia (Knowlton) Doweld, **comb. nov.**

≡ *Carpites paulownia* Knowlton (1926: 50, pl. 29, fig. 12)

= *Gordonia hesperia* Berry (1929: 430, figs. 1-2), syn. nov. ≡ *Carpites hesperia* (Berry) R.W. Brown ex Becker (1961: 89), comb. inval. (no basionym cited).

Type: [fossil fruit] Spokane, Washington, USA (holotype, USNM P 37014, National Museum of Natural History, Smithsonian Institution, Washington, USA).

Occurrence: Miocene; USA.

IFPNI: F696EEB8-B402-8449-E41F-59FD8F5527D3.

Note: The fossil-species *Carpites paulownia* Knowlton, established on the fruits from the Miocene sediments of Spokane, Washington, USA, and originally thought to be the fruit of *Paulownia* Siebold & Zuccarini (1835: 25) (*Scrophulariaceae*), is transferred to the genus *Polyspora* on account of the similarity of its fruit morphotype with *Polyspora*.

Polyspora warmanensis (Grote & Dilcher) Doweld, **comb. nov.**

≡ *Gordonia warmanensis* Grote & Dilcher (1992: 748, Figs. 7, 8, 30).

Type: [fossil fruits] Warman clay pit, Weakley County, Tennessee, USA (holotype, IU 15826-8173, Florida Museum of Natural History, Gainesville, USA).

Occurrence: Eocene; USA.

IFPNI: E34E7F84-38DD-2740-BC99-807BB7553057.

Note: The fossil-species *Gordonia warmanensis* Grote & Dilcher, established on the fruits with seeds from the Eocene sediments of Warman clay pit, Weakley County, Tennessee, USA, is transferred to the genus *Polyspora* on account of the similarity of the fruit morphotype with *Polyspora obtusa* (Wall. ex Wight & Arn.) Niissalo & L.M.Choo (in Choo et al. 2020: 164). The seeds of *G. warmanensis* lack the "warty sculpturing" seen in *G. lasianthus*, so this character supports the exclusion of the fossil-species

from *Gordonia* and its placement in *Polyspora* (Gunathilake et al. 2014).

Stewartia I. Lawson (in Linnaeus 1753: 698)

Stewartia palaeorhodopensis (Bozukov & Palamarev) Doweld, **comb. nov.**

≡ *Hartia palaeorhodopensis* Bozukov & Palamarev (1996: 185).

Type: [fossil leaves] Satovcha village, Goce Delchev district, southwestern Bulgaria (holotype, CAT-2171, Institute of Biodiversity and Ecosystems Research, Bulgarian Academy of Sciences, Sofia, Bulgaria).

Occurrence: Miocene; Europe.

IFPNI: 3B53286D-2CCB-6AF9-9319-986A99FBC9B7.

Note: The fossil-species *Hartia palaeorhodopensis*, based on the leaf remains from the Miocene sediments of Bulgaria, shows a certain resemblance with respect to the leaf shape and venation of extant *Stewartia s.l.* (incl. *Hartia* Dunn).

Stewartia quinqueangularis (Menzel) Doweld, **comb. nov.**

≡ *Carpolithes quinqueangularis* Menzel (1913: 63) ≡ *Hartia quinqueangularis* (Menzel) Mai (1975: 464).

Type: [fossil fruits] Maria Theresia mine, near Herzogenrath, Aachen, North Rhine-Westphalia, Germany (lectotype [designated by Mai 1975: 464 (originally incorrectly designated as a 'holotypus')], MB.Pb.2004/1183 [formerly # 372], Museum für Naturkunde, Berlin, Germany).

Occurrence: Miocene; Europe.

IFPNI: 22F3B356-839F-2D73-A630-F498E86B9696.

Note: The unattributed doubtful fossil-species *Carpolithes quinqueangularis*, once referred to the extant genus *Hartia* Dunn (Mai 1975), shows a certain resemblance with respect to the fruits of extant *Stewartia s.l.* (incl. *Hartia*), but the fossil capsules had the maximum width in the upper half, were markedly striated and often asymmetric, with two carpels decidedly broader than the remaining three, all these features are lacking in the capsules of the living species of *Hartia* Dunn.

Family: *Ternstroemiaceae* De Candolle (1816: 203), **nom. cons. prop.**

Type: *Ternstroemia* Mutis *ex* Linnaeus f. (1782: 39, 264), nom. cons.

Adinandra W. Jack (1822: 49)

Adinandra sokolovensis (Z. Kvaček & Walther) Doweld, **comb. nov.**

≡ *Ternstroemites sokolovensis* Z. Kvaček & Walther (1984: 339).

Type: [fossil leaves] borehole H 42, near Královské Poříčí and Nové Sedlo, Sokolov District, Karlovy Vary Region, Czech Republic (holotype, 36 H 120, Czech Geological Survey, Prague, Czech Republic).

Occurrence: Eocene; Europe.

IFPNI: 986227F8-C8BD-AD51-AD2E-60C41DFACE3C.

Note: The fossil-species *Ternstroemites sokolovensis* Z. Kvaček & Walther, once referred to the heterogeneous fossil-genus *Ternstroemites*, shows a certain resemblance with respect to the leaf shape and venation of extant *Adinandra*.

Adinandra bockwitzensis (Walther) Doweld, **comb. nov.**

≡ *Ternstroemites bockwitzensis* Walther (in Mai & Walther 1992: 77, pl. 38: figs 4-6).

Type: [fossil leaves] Bockwitz mine, near Borna, Saxony, Germany (holotype, MMG BOB 2147: 1a, prep. BOB 168-172/88, BOB 213-218/88, Senckenberg Naturhistorische Sammlungen Dresden, Abteilung Museum für Mineralogie und Geologie, Dresden, Germany).

Occurrence: Upper Oligocene (Chattian); Europe.

IFPNI: CEF80334-40E0-4D35-5D75-D5F024F5256E.

Note: The fossil-species *Ternstroemites bockwitzensis* shows a leaf micromophology of the extant *Adinandra*-type, once considered to be related with *Adinandra sokolovensis* (Kvaček & Walther) Doweld, comb. nov. (Mai & Walther 1992: 77).

Adinandra magdae (Z. Kvaček) Doweld, **comb. nov.**

≡ *Ternstroemites magdae* Z. Kvaček (2015: 211, pl. 17, fig. 8 in Knobloch & al. 1996).

Type: [fossil leaves] Královské Poříčí, drill-core 40-H, depth 85.5 m, Czech Republic (holotype, NM G 6628, Národní Muzeum, Prague, Czech Republic).

Occurrence: Eocene (Priabonian); Europe.

IFPNI: B558B677-490B-9D4C-8695-9122597CE 9C.

Note: The fossil-species *Ternstroemites magdae* Z. Kvaček shows a great similarity to *Ternstroemites sokolovensis* Z. Kvaček & Walther in cyclocytic stomata.

Freziera Willdenow (1799: 1179), **nom. cons.**

Freziera salicina Doweld, **nom. nov.**

≡ *Freziera salicifolia* Saporta (1865: 176), nom. illeg. non *Freziera salicifolia* Choisy (1855: 124).

Type: [fossil leaves] Armissan, near Narbonne, France (holotype, not located, Muséum National d'Histoire Naturelle, Paris, France).

Occurrence: Upper Oligocene (Chattian); Europe.

IFPNI: C3DE6A2C-BA3E-E2EB-5BED-6D9825EB734C.

Note: The fossil-species *Freziera salicifolia* Saporta is a rare type of leaf remains found in the fossil record, which is perhaps not properly attributed to *Freziera*; new findings are needed to resolve the taxonomic position of the fossil, however, in anticipation of a new findings the revealed homonymy is resolved by the proposal of a new replacement name.

Pseudoprunus Doweld, **gen. nov.**

Description: Leaves lanceolate, long petiolate, petiole up to 1.4 cm long, base slightly asymmetrical, cuneate, apex missing, (?) acute. Margin densely, regularly crenulate, entire at base, with more or less distinct apical glands.Teeth small, apical side of teeth shorter than basal side. Venation semicraspedodromous.

Type: *Pseudoprunus pereger* (Unger) Doweld.

IFPNI: E8588647-0380-6EE9-ED54-3706BACB8210.

Pseudoprunus pereger (Unger) Doweld, **comb. nov.**

≡ *Amygdalus pereger* Unger (1850: 483) ≡ *Prunus pereger* (Unger) Unger (1869: 65) ≡ *Pruniphyllum pereger* (Unger) Weyland (1948: 129, 155) ≡ *Ternstroemites pereger* (Unger) Kovar-Eder & Z. Kvaček (2004: 63).

Synonym: *Crataegus orionis* Unger (1850: 481). Type: [fossil leaves] Parschlug, Styria, Austria (lectotype, designated here, LMJ 76593, Landesmuseum Joanneum, Graz, Austria – illustrated by Unger (1866: pl. 18, fig. 15).

Type: [fossil leaves] Parschlug, Styria, Austria [neotype (designated by Kovar-Eder & Z. Kvaček 2004: 63)], NHMW 1878/6/8169, Naturhistorisches Museum Wien, Geologisch-Paläontologische Abteilung, Vienna, Austria – illustrated by Kovar-Eder & Z. Kvaček (2004: pl. 6, fig. 1).

Occurrence: Miocene; Europe.

IFPNI: 2B27DCE7-EA88-EE70-8842-FF55E54C49FD.

Note: The fossil-species *Amygdalus pereger*, once recently recombined *Ternstroemites pereger* (Unger) Kovar-Eder & Z. Kvaček, is a very anomalous fossil-species of European palaeoflora. Kovar-Eder & Kvaček (2004) referred this fossil-species to *Ternstroemites* in assumption that the fossil-genus *Ternstroemites*, as emended by Hickey (1977: 141), comprises the fossil

leaves which are characterised by having the combination of several simple glandular teeth on the margin and eucamptodromous venation. Since the epidermal structure could not be used to confirm the affinity with *Ternstroemites*, and the difference in leaf venation (semicraspedodromous vs. eucamptodromous in *Ternstroemites*) precludes the putative relationships with *Ternstroemites*, therefore it is difficult to make comparisons with the previously described *Theaceae* or *Rosaceae* leaves, which are mostly based on both macromorphology and epidermal anatomy. In this connection, a new endemic fossil-generic name *Pseudoprunus* Doweld gen. nov. is proposed to accommodate the anomalous leaf fossils of the European palaeofloral endemic.

Engelhardia macroptera (Brongniart 1828: 48) Saporta (1863: 39).

Synonym: *Carpinus oblonga* Unger (1850: 409), syn. nov. Type: [fossil fruit involucres] Parschlug, Styria, Austria [lectotype, designated here, LMJ 76493, Landesmuseum Joanneum, Graz, Austria – illustrated by Unger (1852: pl. 20, fig. 17)].

Note: Kovar-Eder & Kvaček (2004) referred fossil-species *Carpinus oblonga* Unger, *pro parte* to synonymy of *Ternstroemites pereger* (Unger) Kovar-Eder & Z. Kvaček in assumption that the illustrated imperfect leaves by Unger (1852: pl. 20, fig. 16, not fig. 17) could be referred to this theaceous fossil taxon. This specimen was not found in Unger's collections of fossil plants, and hence we were unable to re-study the original material. On contrary, the fruit involucres, illustrated by Unger (1852: pl. 20, fig. 17) and originally ascribed to the protologue of the fossil-species in 1850, were available for study that revealed that they should be referred to a quite different fossil-species, *Engelhardia macroptera.* Therefore, a lectotypification of *Carpinus oblonga* Unger was done on the basis of only survived specimen.

Eurya Thunberg (1783: 67)

Eurya cooperi (M. Chandler) Doweld, **comb. nov.**

≡ *Myrtospermum cooperi* M. Chandler (1961b: 106, pl. 11: figs. 13-15).

Type: [fossil seeds] Bishopstone, Herne Bay, Kent, U.K. (holotype, V.29701, Natural History Museum, London, U.K.).

Occurrence: Eocene (Ypresian); Europe.

IFPNI: 4795D8E1-5207-0F93-5D56-9B6BBD529A4F.

Note: The fossil-species *Myrtospermum cooperi* M. Chandler, based on the fossil seeds of the Ypresian age of England, shows a resemblance to the seeds of *Eurya*.

Euryites Doweld, **gen. nov.**

Description: Leaves lanceolate to narrow elliptic, petiolate, apex acute, base narrowly cuneate, margin subentire to glandular crenulate, venation semicraspedodromous, midrib thin, secondaries steep, widely spaced, bent along margin, sending abmedial side veinlets into teeth. Texture coriaceous, adaxial cuticle thinner, granulate to slightly striate, ordinary cells polygonal-lobate, anticlines undulate, with slight thickenings in sinuses, abaxial cuticle thick, strongly striate to wrinkled all over intercostal arcas, ordinary cells lobate-polygonal, anticlines strongly, partially finely undulate. Stomata widely spaced, anisocytic-cyclocytic, guard cell pairs elliptic, rarely actinocytic with radial striation, solitary star-like heavily cutinized trichome bases.

Type: *Euryites floersheimensis* (Kvaček & Walther) Doweld.

IFPNI: 23E61771-9085-1B31-D1C7-51B3BE10E692.

Euryites floersheimensis (Kvaček & Walther) Doweld, **comb. nov.**

≡ *Ternstroemites floersheimensis* Kvaček & Walther (1984: 338, pl. 62: fig. 1).

Type: [fossil leaves] Flörsheim, Main-Taunus district, Hesse, Germany (holotype, SM.B. 344, Senckenberg Naturhistorische Sammlungen Frankfurt, Senckenberg Forschungsinstitut und Naturmuseum, Frankfurt am Main, Germany).

Occurrence: Lower Oligocene (Rupelian); Europe.

IFPNI: 23A58BED-90E3-F625-0789-952BF5ACD1CD.

Note: The fossil-species *Ternstroemites floersheimensis* is an endemic fossil-species of Flörsheim, Hesse, Germany. According to Kvaček & Walther (1984) similar leaves occur in extant *Eurya*, but the leaf micromorphology is distinct. In this connection, a new endemic fossil-generic name *Euryites* Doweld gen. nov. is proposed to accommodate the anomalous leaf fossils.

Weylandiella Doweld, **gen. nov.**

Description: Leaves simple, lanceolate, entire-margined, 23 mm wide, much more than 80 mm long, apex not known, base narrow cuneate (incompletely known), venation pinnate, poorly preserved, midrib straight and strong, secondaries very thin, faintly visible, dense, moderately steep, higher-order venation reticulate, tertiaries forming elongate meshes subparallel with secondaries. Adaxial cuticle thick, finely granulate, not striated, ordinary cells polygonal-lobate, 20-35 μm across, anticlines deeply coarsely wavy, no trichome or trichome bases observed; abaxial cuticle distinctly striate, concentrically around stomata, irregularly over non-stomatal cells, ordinary cells polygonal, about 18-30 μm across, anticlines wavy; stomata broadly elliptical to rounded, anisocytic to cyclocytic, guard cells 27-30 μm long, surrounded by usually 3 narrow subsidiary cells covered heavily by striation, distinct cutin ring about 3 μm thick completely surrounding broadly elliptic front cavity, pore narrow, slit-like, very thin polar T-pieces.

Type: *Weylandiella rhenana* (Kräusel & Weyland) Doweld.

Eponymy: In honor of Hermann Gerhard Weyland (1888–1974), explorer of Rhenish palaeofloras.

IFPNI: 67C56318-D2C2-74CB-36AB-B7199727D69A.

Weylandiella rhenana (Kräusel & Weyland) Doweld, **comb. nov.**

≡ *Pandanus rhenanus* Kräusel & Weyland (1950: 33, 36, pl. 3, figs 1-7, text-fig. 5) ≡ *Cleyera rhenana* (Kräusel & Weyland) Z. Kvaček & V. Wilde (2006: 149).

Type: [fossil leaves] Josefsberg, Roddergrube near Brühl, Rhein-Erft-Kreis, North Rhine-Westphalia, Germany (holotype, SM. B 6280/1 and two additional cuticle preparations SM. B 6280/8, SM. B 6280/9, Senckenberg Naturhistorische Sammlungen Frankfurt, Senckenberg Forschungsinstitut und Naturmuseum, Frankfurt am Main, Germany).

Occurrence: Oligocene; Europe.

IFPNI: 92C502D9-4526-85EB-0D9D-C798D3254000.

Note: The fossil-species *Pandanus rhenanus* Kräusel & Weyland is a problematic fossil-species from the Oligocene sediments of Josefsberg, North Rhine-Westphalia, Germany, with no reliable relationships with extant *Pandanus* S. Parkinson (1773: 46). Kvaček & Wilde (2006) suggested similarity with the leaves occurring in extant Theaceous genus *Cleyera* Thunberg (1783: 68), however, the leaf cuticle patterns are distinct, and therefore the generic affinity is not fully certain. In this connection, a new fossil-generic name *Weylandiella* Doweld gen. nov. is proposed to accommodate the endemic leaf fossils.

Weylandiella schilcheriana (Kovar-Eder) Doweld, **comb. nov.**

≡ *Cleyera schilcheriana* Kovar-Eder (in Kovar-Eder & Meller 2001: 80, pl. 5, figs. 5-7, 9, 10).

Type: [fossil leaves] Oberdorf N Voitsberg, Styria, Austria (holotype, Sample 50: 1993/0028/114B, Naturhistorisches Museum Wien, Geologisch-Paläontologische Abteilung, Vienna, Austria).

Occurrence: Lower Miocene (Burdigalian); Europe.

IFPNI: 92C502D9-4526-85EB-0D9D-C798D3254000.

Note: The fossil-species ?*Cleyera schilcheriana*, based on leaf imprints preserving cuticular ultrastructure, from the Lower Miocene sediments of Styria, Austria, was attributed to extant *Cleyera* with a query since no solid arguments were provided. Kvaček & Wilde (2006) suggested similarity with the leaves of fossil-species *Cleyera rhenana*, but the leaf cuticle patterns of ?*Cleyera schilcheriana* differ in having larger non-modified epidermal cells on both leaf surfaces [abaxially (31) 36±60 (70) mm, adaxially 37±60 mm] and larger stomata [stomatal length 24±31 mm]. The fragmentary character of the Styrian material does not allow a comprehensive comparison. Nevertheless, this fossil-species, anomalous in *Cleyera*, is transferred to *Weylandiella* in anticipation of new findings and studies.

Re-classification of the fossils attributed to extant *Visnea*

Menzel (1913) advanced a hypothesis that Miocene sediments of Maria Theresia mine, near Herzogenrath, Aachen, North Rhine-Westphalia, Germany, contain the fossil fruits that might be attributed to extant genus *Visnea* Linnaeus fil. (1782: 36, 251). He described a new fossil-species *Visnea germanica* Menzel (1913: 48). In addition, from the same Miocene sediments he also described a distinct monotypic fossil-genus *Clethraecarpum* Menzel (1913: 55), *Clethraecarpum asepalum* Menzel, based on the similar type of fossil fruits, and similar looking fruits named *Commiphora europaea* Menzel (1913: 38). Kirchheimer (1956) criticized Menzel's determinations, since they were not supported by anatomical studies allowing their precise attribution. The Menzel's attribution of the same fossil fruits to different families, viz. *Burseraceae* (*Commiphora*), *Theaceae* (*Visnea*) and *incertae sedis* (*Clethraecarpum*) should not be treated as proved affinity of these fossils. Mai (1971), in revising of Menzel's fossils, synonymized all of them in a single fossil taxon named *Visnea germanica* Menzel. While we could agree that these fruit fossils could be seen as a single fossil taxon, the attribution of them either to *Visnea* or even *Commiphora* is seen unequivocally untenable in spite of superficial similarity in half-inferior ovary, capsular dehiscent fruits and exotestal seeds. The combination of characters (half-inferior 3-locular ovary, spindle-shaped, mostly 1-2-locular capsular dehiscent stalked fruits with a persistent style and exotestal seeds) can neither come from *Clethra* or *Commiphora* nor belong to *Visnea*; the specific relationship could not be established at all without additional microstructural characters.

The fruits of extinct *V. germanica* contain 6 crescently shaped seeds of ca. 2.1 mm length, 1.1 mm thickness and 1.7 mm width, almost reaching the length of the locule. The testa smooth to slightly foveate and contains elongate cells with thickened cell walls; raphe r-shaped; embryos J-shaped. In contrast, extant *Visnea mocanera* is characterized by a half-inferior, three-locular ovary with three free persistent styles and two to three anatropous ovules per locule, with only one to four developed seeds; the fruit is a dehiscent capsule coated by the persistent fleshy calyx. Seeds exotestal, exotesta comprises a lignified and thickened inner wall and strongly thickened anticlinal walls. Thus, the hypothesis of the relationships with extant *Visnea* or *Clethra* is untenable.

Visnea Linnaeus fil. (1782: 36, 251)

Visnea germanica Menzel ≡ ***Clethraecarpum asepalum*** Menzel

Visnea hordwellensis (M. Chandler) Mai ≡ ***Cyrtospermites hordwellensis*** (M. Chandler) Bogner

Visnea minima Erv. Knobloch & Mai ≡ ***Pseudovisnea minima*** (Erv. Knobloch & Mai) Doweld, comb. nov.

Clethraecarpum Menzel (1913: 55) emend. Doweld, **emend. nov.**

Type: *Clethraecarpum asepalum* Menzel (1913: 55, pl. 5: figs. 27-28)

Holotype: [fossil fruits] Maria Theresia mine, near Herzogenrath, Aachen, North Rhine-Westphalia, Germany (MB.Pb.2004/1111, Museum für Naturkunde, Berlin, Germany).

Synonym: *Visnea germanica* Menzel (1913: 48, pl. 5: fig. 4), syn. nov. Lectotype (here designated): [fossil fruits] Maria Theresia mine, near Herzogenrath, Aachen, North Rhine-Westphalia, Germany (holotype, MB.Pb.2004/1109/1 [pl. 5: fig. 4a], Museum für Naturkunde, Berlin, Germany).

Synonym: *Commiphora europaea* Menzel (1913: 38, pl. 4: fig. 21), syn. nov. Holotype: [fossil fruits] Maria Theresia mine, near Herzogenrath, Aachen, North Rhine-Westphalia, Germany (holotype, MB.Pb.2004/1110, Museum für Naturkunde, Berlin, Germany).

Occurrence: Miocene; Europe.

Cyrtospermites Bogner (1973: 321) emend. Doweld, **emend. nov.**

≡ *Campylospermum* M. Chandler (1925: 16), nom. illeg. non *Campylospermum* van Tieghem (1902: 35, 40) (*Magnoliophyta — Ochnaceae).*

Type: *Cyrtospermites hordwellensis* (M. Chandler) Bogner (1973: 321) ≡ *Campylospermum hordwellense* M. Chandler (1925: 16) ≡ *Visnea hordwellensis* (M. Chandler) Mai (1971: 335).

Cyrtospermites becktonensis (M. Chandler) Doweld, **comb. nov.**

≡ *Eurya becktonensis* M. Chandler (1961a: 136, pl. 28: fig. 103).

Type: [fossil seeds] Hordle [Hordwell] Cliffs, South Hampshire, U.K. (holotype, V. 42168, Natural History Museum, London, U.K.).

Occurrence: Upper Eocene (Priabonian/ Headon Hill Formation); Europe.

IFPNI: 7DF74D5B-FB7F-AE4D-FC8B-D2179D851D79.

Note: The fossil-species *Eurya becktonensis* was based on the dispersed fossil seeds which are similar to the seeds of the extant genus *Visnea*. Mai (1971) pointed out that if such seeds could be found in fossil fruits, then he hypothesized that "die Art als Synonym zu *Visnea hordwellensis* (M. Chandler) Mai aufzufassen ware". Since the relationships with extant genus *Visnea* was rejected as superficial, the fossil-species is transferred to the newly re-instated fossil-genus *Cyrtospermites* [previously validly published fossil-genus *Campylospermum* M. Chandler (1925: 16), nom. illeg. was preoccupied by *Campylospermum* van Tieghem (1902: 35, 40)].

Pseudovisnea Doweld, **gen. nov.**

Description: Fruits capsular, half-inferior, 3-locular, columellate, with persistent style remains; placentation submedian, locules horseshoe-shaped, unequal; 2-3 mm in longitudinal diameter. Calyx reaching into the first third of the fruit, with veining sepals (calyx tips abraded); pedicel plump, with some bracts, some of which severely crippled. Seeds small, 1.3 mm in diameter, 5-8, up to 2 per a locule, one above the other or diagonally next to each other, one seed often aborted, bean-shaped to triangular-rounded, irregularly squeezed, with a condyle in the locule through which the raphe canal is bent pulls. Micropyle directed upwards outwards. Surface with deep, sharp-edged pits.

Type: *Pseudovisnea minima* (Erv. Knobloch & Mai) Doweld.

IFPNI: 9A42B039-F6A9-186C-D043-3A1A26A98302.

Pseudovisnea minima (Erv. Knobloch & Mai) Doweld, **comb. nov.**

≡ *Visnea minima* Erv. Knobloch & Mai (1986: 84, pl. 17, figs. 26, 27).

Type: [fossil seeds] Walbeck, Saxony-Anhalt, Germany (holotype, 9262, Senckenberg Naturhistorische Sammlungen Dresden, Abteilung Museum für Mineralogie und Geologie, Dresden, Germany).

Occurrence: Upper Cretaceous (Maastrichtian); Europe.

IFPNI: 13DD728F-67E2-2905-CD0F-8EB2E2D67319.

Note: The fossil-species *Visnea minima* iss based on the fossil fruits from the Upper Cretaceous (Maastrichtian) sediments of Walbeck, Saxony-Anhalt, Germany.

Parastroemia Doweld, **gen. nov.**

Description: Seeds oboval to narrow-oboval, compressed, with a median slightly curved ridge with rounded inner end over the condyle and a curved rounded ridge over the curved seed cavity beyond which is a marginal rim. Micropyle a small pit near the hilum at the end of one limb of the cavity. Testa fine-celled, unpitted.

Type: *Parastroemia costata* (M. Chandler) Doweld.

IFPNI: 11314282-249A-48EE-E384-BFC74A4CCC86.

Parastroemia costata (M. Chandler) Doweld, **comb. nov.**

≡ *Anneslea costata* M. Chandler (1961a: 139, pl. 29, fig. 113).

Type: [fossil seeds] Hordle [Hordwell] Cliffs, South Hampshire, U.K. (holotype, V. 42177, Natural History Museum, London, U.K.).

Occurrence: Upper Eocene (Priabonian); Europe.

IFPNI: 5017AB4C-3B92-7A71-0D6D-CEF5B5B3560B.

Note: The fossil-species *Anneslea costata* was based on the fossil seeds from the Upper Eocene (Priabonian: Headon Hill Formation) sediments of Hordle [Hordwell] Cliffs, South Hampshire, U.K. The peculiar U-shaped cavity and raphe canal in the condyle are characteristic of the ternstroemiacean family. The fine (unpitted) sculpturing of the testa is somewhat suggestive of *Ternstroemia* (Corner 1976). Chandler (1961a) thought that "bearing in mind that few species of these genera are available for study and that other genera have not been seen at all the species is referred tentatively only to *Anneslea*". However, the peculiar rounded ridges of the surface appear to be distinctive for the British fossils and distance its affinities from the extant representatives of Indomalayan *Anneslea*. Therefore, a new name is given for the unrelated to *Anneslea* fossils.

Pentaphylacoides Doweld, **gen. nov.**

Description: Fruits capsular, five-valved, fruit dehiscence loculicidal-septifragal, leaves a central column, pericarpium thick, woody, with a persistent, leathery calyx. Calyx of five lobes of unequal length that are fused basally to a shallow cup. Seeds two per locule, anatropous.

Type: *Pentaphylacoides protogaea* (Erv. Knobloch & Mai) Doweld.

IFPNI: A954C899-CEE3-477C-21D2-FF48FDFA0D86.

Pentaphylacoides protogaea (Erv. Knobloch & Mai) Doweld, **comb. nov.**

≡ *Pentaphylax protogaea* Erv. Knobloch & Mai (1986: 47, pl. 22, fig. 15).

Type: [fossil fruits] Walbeck, Saxony-Anhalt, Germany (holotype, 9252, Senckenberg Naturhistorische Sammlungen Dresden, Abteilung Museum für Mineralogie und Geologie, Dresden, Germany).

Occurrence: Upper Cretaceous (Mastrichtian); Europe.

IFPNI: 2FD837C2-9823-982E-F2EF-2A1B69F6EECB.

Note: The fossil-species *Pentaphylax protogaea* is a problematic fossil-species from the Upper Cretaceous (Maastrichtian) sediments of Walbeck, Saxony-Anhalt, Germany, with superficial relationships with extant *Pentaphylax* G. Gardner & Champion (1849: 244), precluded by the difference of ovular type (anatropous in fossil, campylotropous in extant). In addition, differences in fruits morphology (pericarpium thinner, calyx lobes are of equal length, etc.) fully debunked any idea of the inclusion of the fossils in extant genus. Hence, a new fossil-generic name is proposed for peculiar fruits remains of Upper Cretaceous age.

Paraeurya Doweld, **gen. nov.**

Description: Seeds rounded, bilaterally flattened, 1,2-1,9 mm long, 0,8-1,9 mm wide, campylotropous. Locule U-shaped with a stout condyle reaching the middle of the locule. Hilar scar and micropyle situated basally close together. Surface ornamented wlth concentric rings of large round cellular warts.

Type: *Paraeurya knoblochii* Doweld.

IFPNI: 8B404AB6-259A-C223-ED80-C7F6A8DEB34D.

Paraeurya knoblochii Doweld, **sp. nov.**

≡ *Eurya carpatica* Erv. Knobloch & Mai (1983: 309, pl. 3, figs. 8, 9), nom. inval.

Type: [fossil seeds] Staré Hamry village, Frýdek-Místek District, Moravian-Silesian Region, Czech Republic (holotype, EK 39718, Národní Muzeum, Prague, Czech Republic – illustrated by Knobloch & Mai (1983: pl. 3, fig. 8).

Occurrence: Upper Cretaceous (Istebna Formation); Europe.

IFPNI: C5B3CC33-DD2B-E5EE-C2DF-162F357E4C5D.

Note: The fossil-species *Eurya carpatica*, nom. inval. [holotype was designated on two specimens and two type localities given] was based on the fossil seeds from the Upper Cretaceous sediments of Staré Hamry village, Frýdek-Místek District, Moravian-Silesian Region, and Horní Bečva, Vsetín district, Zlín Region, Czech Republic [formerly Czechoslovakia]. Knobloch & Mai (1983, 1986) attributed the seeds to extant genus *Eurya* in spite of the very peculiar verrucate seed surface, a character not observed in seeds of the extant genus. This character precludes the putative relationships with extant genus, and therefore the fossil-species is excluded in the fossil-genus of its own.

Alloeurya Doweld, **gen. nov.**

≡ *Eurya* subgen. *Palaeocleyera* Knobloch & Mai (1985: 74) — Type: *Eurya crassitesta* Erv. Knobloch (1977: 87).

≡ *Eurya* subgen. *Palaeocleyera* Knobloch & Mai (1986: 78), nom. inval. [no type designated, Art. 40.1, ICN]

Description: Seeds semicircular, spherical, broadly elliptic, rarely rounded to kidney-shaped, campylotropous, small, 0.8-1.4 mm long and 0.7-1.8 mm, with a large basal hilar scar. Seed surface ornamented with concentric to eccentric rings of large equally sized, rounded and annular thickened exotesta polygons.

Type: *Alloeurya holyi* (Erv. Knobloch) Doweld.

IFPNI: 35955F91-4FD7-06A5-653D-9368E297A67E.

Note: Two fossil-species *Eurya holyi* Erv. Knobloch (1977: 89) and *Eurya crassitesta* Erv. Knobloch (1977: 87) were based on the fossil seeds from the Upper Cretaceous sediments of Staré Hamry village, Frýdek-Místek District, Moravian-Silesian Region, and Horní Bečva, Vsetín district, Zlín Region, Czech Republic [formerly Czechoslovakia]. Later Knobloch & Mai (1986)

segregated these fossils to a distinct subgenus of extant *Eurya*, subgen. *Palaeocleyera* Knobloch & Mai (1986: 78), nom. inval. [no type designated, Art. 40.1, ICN]; the subgenus was validated in a different paper [*Eurya* subgen. *Palaeocleyera* Knobloch & Mai (1985: 74)]. However, in extant genus *Eurya* the exotesta is thin and brittle in spite of the greatly thickened exotesta in fossils with a peculiar irregularly eccentric or eccentric seed surface and sickle-shaped curvature, these characters not observed in seeds of the extant genus. Therefore, these characters debunked the suggested relationships with extant genus, and therefore these fossil-species are excluded in the fossil-genus of its own.

Alloeurya holyi (Erv. Knobloch) Doweld, **comb. nov.**

≡ *Eurya holyi* Erv. Knobloch (1977: 89, pl. 4, fig. 10).

Type: [fossil seeds] Staré Hamry 1, Frýdek-Místek District, Moravian-Silesian Region, Czech Republic (holotype, EK 25642, Národní Muzeum, Prague, Czech Republic).

Occurrence: Upper Cretaceous (Istebna Formation); Europe.

IFPNI: 1AFE83CD-063F-BC92-E88D-77DDCA53D901.

Alloeurya crassitesta (Erv. Knobloch) Doweld, **comb. nov.**

≡ *Eurya crassitesta* Erv. Knobloch (1977: 87, pl. 2, fig. 16).

Type: [fossil seeds] Horní Bečva, Vsetín District, Zlín Region, Czech Republic (holotype, EK 27333, Národní Muzeum, Prague, Czech Republic).

Occurrence: Upper Cretaceous (Istebna Formation); Europe.

IFPNI: 7ED0D1CC-BD95-2B2B-3EB4-FA05E4C0CC9E.

Family: *Actinidiaceae* Engl. & Gilg (1924, Syllabus ed. 9 & 10: 279), **nom. cons**

Type: *Actinidia* Lindl. (1836, Intr. Nat. Syst. Bot., ed. 2: 439).

Pseudosaurauia Doweld, **gen. nov.**

Description: Seeds wedge-shaped or elongated-oval, apically not inflated; testa with medium-sized rectangular fields, 10-20 fields in a long series of the dorsal side. Micropyle and hilum basal on the edge or in a pit, approximated to each other. Raphe long, terminated immediately at the truncated end.

Type: *Pseudosaurauia antiqua* (Erv. Knobloch & Mai) Doweld.

IFPNI: C78F8CBA-A69B-684F-AC3B-74A8589E45DB.

Note: The fossil-species *Saurauia antiqua* Erv. Knobloch & Mai and *Saurauia alenae* Erv. Knobloch & Mai were instituted on the fossil seeds of the Upper Cretaceous in contrast to the previous findings restricted to the Tertiary sediments. The time gap between findings questioned the validity of the opinion to relate both groups of fossils, and especially their superficial relationships with extant *Saurauia* Willdenow (1811: 407). In addition, differences in seed morphology (wedge-shaped or elongated-oval, apically not inflated form, testa with medium-sized rectangular fields in 10-20 long series, long raphe, etc.) fully precluded any idea of the inclusion of the fossils in extant genus. Hence, a new fossil-generic name is proposed for peculiar seeds remains of Upper Cretaceous age.

Pseudosaurauia antiqua (Erv. Knobloch & Mai) Doweld, **comb. nov.**

≡ *Saurauia antiqua* Erv. Knobloch & Mai (1986: 88, pl. 22, figs. 23, 24).

Type: [fossil seeds] Eisleben, Saxony-Anhalt, Germany (holotype, 8518, Museum für Naturkunde, Berlin, Germany).

Occurrence: Upper Cretaceous (Mastrichtian); Europe.

IFPNI: 51CF448C-FED8-4E12-9768-15ADB603FB97.

Pseudosaurauia alenae (Erv. Knobloch & Mai) Doweld, **comb. nov.**

≡ *Saurauia alenae* Erv. Knobloch & Mai (1983: 314, pl. 4, fig. 3).

Type: [fossil seeds] Branná, borehole Sch 2, Olomoucký kraj, Czech Republic (holotype, EK 39366, Národní Muzeum, Prague, Czech Republic).

Occurrence: Upper Cretaceous (Santonian); Europe.

IFPNI: 9E6367F7-690F-2148-BBEF-3B2055007C41.

Addendum: Taxa Theaceorum Fossiles Extraeuropaeorum

Pseudoternstroemiophyllum Doweld, **gen. nov.**

≡ *Ternstroemiphyllum* Velenovský (1889: 51, 54), **nom. nud.**

Description: Leaves large, petiole is quite long, very thick, straight, broadly lanceolate, wedge-shaped at the base, shortly pointed at the front, with large, blunt, somewhat irregular teeth on the edge, having a symmetrical rounded shape. Venation pinnate; the primary veinlet very strong and thick, finely thinned at the tip of the leaf; the secondary veins arise at acute angles, numerous, fine, dissolving into a network of veinlets in front of the leaf edge, the network of veinlets weakly prominent, composed of irregular fields.

Type: ***Pseudoternstroemiophyllum crassipes*** (Velenovský) Doweld.

IFPNI: DC83E89A-8D8E-CF9C-E14C-EB4159F95B89.

Pseudoternstroemiophyllum crassipes (Velenovský) Doweld, **comb. nov.**

≡ *Ternstroemia crassipes* Velenovský (1884: 20). ≡ *Ternstroemiphyllum crassipes* (Velenovský) Velenovský (1889: 51, 54), **nom. inval.**

Type: [fossil leaves] Vyšehořovice (Vyšerovice), Středočeský kraj, Czech Republic (lectotype [here designated], F s.n. [pl. 3 [18], fig. 3], Národní Muzeum, Prague, Czech Republic).

Occurrence: Upper Cretaceous (Cenomanian); Europe.

IFPNI: 827039EC-B939-A86D-D39F-6B6DC9F2D545.

Note: Velenovský (1884) originally described two specimens of fossil leaves from the Cenomanian of then Bohemia (now Czech Republic) and placed them in the extant genus *Ternstroemia*, pointing to the resemblance in leaf venation to extant *Ternstroemia dentata* Sw. and even *Camellia japonica* L. However, later he realized (Velenovský, 1889) that the generic affinity is provisional and superficial, and proposed to segregate the fossils into a distinct fossil-genus *Ternstroemiphyllum* Velenovský (1889: 51, 54), but failed to supply the new genus with a separate generic description or diagnosis. As a result, a new generic name and a proposed new combination were both invalidly published. The generic name, although being in use, was not validated since that times. Since the fossil leaf type is distinctive among Cenomanian fossil foliage of Europe, it is proposed to validate the fossil-generic name under a new generic name *Pseudoternstroemiophyllum* Doweld, gen. nov., in order to discard the previously suggested, but superficial affinity with the extant representatives of *Ternstroemia*.

Pentapetalotrigyne Doweld, **nom. nov.**

≡ *Pentapetalum* Martínez-Millán, Crepet & Nixon, Amer. J. Bot. 96: 935. 2009, nom. inval. [technical term, prohibited]

IFPNI: 4ABCFABA-1DC1-833A-725C-1CD4B4A7B669.

Type: *Pentapetalotrigyne trifasciculandrica* (Martínez-Millán, Crepet & Nixon) Doweld, comb. nov.

Pentapetalotrigyne trifasciculandrica (Martínez-Millán, Crepet & Nixon) Doweld, **comb. nov.**

≡ *Pentapetalum trifasciculandricum* Martínez-Millán, Crepet & Nixon, Amer. J. Bot. 96: 935. 2009.

Type: [fossil flowers] Old Crossman Clay Pit, Sayreville, New Jersey, USA (holotype, part CUPC579 and counterpart CUPC591, Cornell University, lthaca, New York, USA – illustrated by Martínez-Millán & al.: Figs. 2, 3, 4, 8, 13, 14, 17. 2009).

Occurrence: Upper Cretaceous (Turonian); North America.

IFPNI: 151A4203-CAA4-B3A5-2A6D-99764C87F285.

Note: A new replacement name is proposed for the fossil-genus bearing a name coinciding with a technical term 'pentapetalum'. The Code prohibited the use of such names (ICN, Art. 20.2).

Gordonianthus Doweld, **gen. nov.**

Description: Flowers polypetalous, with 5 large obovate petals, 2.5 cm long, delicately veined, with reticulated, much elongated, narrow meshes. The sepals (unknown in number) about 1/3 the length the petals. The stamens (?) and pistil (?).

Type: *Gordonianthus ternstroemioides* (Berry) Doweld.

IFPNI: 339C85C1-60D0-EA6D-3B68-24A9C91B0F17.

Gordonianthus ternstroemioides (Berry) Doweld, **comb. nov.**

≡ *Antholithes ternstroemioides* Berry (1930: 140).

Type: [fossil flowers] Puryear, Henry County, Tennessee, USA (syntypes not found).

Occurrence: Eocene; North America.

IFPNI: 226B327D-5D87-11F7-A9A8-1AB725772359.

Note: The fossil-species *Antholithes ternstroemioides* Berry, once hypothesized to be a *Gordonia* flower, is an anomalous fossil-species of the Tertiary American palaeoflora, revealing various relationships with extant members of the theaceous alliance. Berry (1930) referred this fossil-species to artificial fossil-genus *Antholithes*, thereby doubted its exact affinity with now living forms. Since the floral structure could not be used to confirm the affinity with precise theaceous genus, in this connection, a new endemic fossil-generic name *Gordonianthus* gen. nov. is proposed to accommodate the anomalous endemic floral fossils.

Camellioxylon Doweld, **gen. nov.**

Description: Wood diffuse-porous with evenly distributed, mostly solitary, small vessels; scalariform perforation plates (exclusively) with 9–19 bars; scalariform pitting on vessel walls; diffuse-in-aggregates and diffuse axial parenchyma; narrow heterocellular rays; solitary crystals in swollen ray cells.

Type: *Camellioxylon japonoxylum* (Mits. Suzuki & K. Terada) Doweld.

IFPNI: E4397B80-3B98-5209-71A4-E2E8E07CB1C4.

Note: The fossil-species of *Camellia*, *C. japanoxyla* Suzuki & Terada (1996), *Camellia kueishanensis* C.-Y. Li, C.-M. Wang, J.-Y. Hsiao & C.-H. Yang (2003), and *Camellia nanningensis* Huang, Jin, Quan & Oskolski (2016), based on wood Tertiary remains, resembles wood of extant *Camellia* (Huang & al. 2016). However, the preservation of wood types never allows its relationships with extant species of *Camellia*, the systematics of which is based on the reproductive and vegetative characters. In this connection, all fossil-species showing fossil wood structure of *Camellia*-type, should be segregated in a distinct fossil wood genus, *Camellioxylon* Doweld, gen. nov.

Camellioxylon kueishanense (C.-Y. Li, C.-M. Wang, J.-Y. Hsiao & C.-H. Yang) Doweld, **comb. nov.**

≡ *Camellia kueishanensis* C.-Y. Li, C.-M. Wang, J.-Y. Hsiao & C.-H. Yang (2003: 74, fig. 9).

Type: [fossil wood] Kungkuan Tuff, Shantzechiao Anticline, Kweishan, Taoyuan County, northern Taiwan (holotype, NMNS004104-F003831, National Museum of Natural Science (TNM), Taichung City, Taiwan).

Occurrence: Lower Miocene (Mushan/Taliao Formation); Taiwan Island.

IFPNI: 88EC672A-411E-B8F2-9A0E-B13497363F17.

Camellioxylon japonoxylum (Mits. Suzuki & K. Terada) Doweld, **comb. nov.**

≡ *Camellia japonoxyla* Mits. Suzuki & K. Terada (1996: 375, figs. 13-17).

Type: [fossil wood] Uchiura, Noto Peninsula, central Japan (holotype, 80030, Herbarium, Faculty of Science, Tohoku University, Sendai, Japan).

Occurrence: Lower Miocene (Aquitanian = Yanagida Formation); Japanese Archipelago.

IFPNI: 0F50A4C9-70A6-5C1C-F096-2C0E69844575.

Camellioxylon nanningense (Huang, Jin, Quan & Oskolski) Doweld, **comb. nov.**

≡ *Camellia nanningensis* Huang, Jin, Quan & Oskolski (2016: 825, figs. 3 A-H).

Type: [fossil wood] Nanning Basin, Guangxi Province, southern P.R. China (holotype, NNW006, Museum of Biology, Sun Yat-Sen University, Guangzhou, China).

Occurrence: Upper Oligocene (Chattian = Yongning Formation); China.

IFPNI: C5A88A63-8DE0-88C2-276D-3156C2136812.

Euschimoxylon Doweld, **gen. nov.**

Description: Wood diffuse-porous, consisting of medium-sized vessels, almost exclusively solitary, scalariform perforation plates, with 7–12 bars, paratracheal parenchyma scanty, with a rare diffuse apotracheal parenchyma, rays heterocellular, 2- to 4-seriate.

Type: *Euschimoxylon miowallichii* Doweld.

IFPNI: 3893FBB1-AA76-B503-5BE8-EE2F7C91C7AB.

Note: The fossil-species of *Schima*, *Schima protowallichii* K. Terada & Mits. Suzuki (in Choi & al. 2010), nom. inval., from Japanese Archipelago, and its nearly related fossils *Schimoxylon*, *S. altingioides* H. Gottwald (1992) from Europe, and *S. benderi* Licht, Boura & Franceschi (2013) from Indochina, based on wood Tertiary remains, represent a mixture of fossil wood types articially united in a single fossil-genus. The European fossil-species *S. altingioides* H. Gottwald was originally described from the Middle Eocene (Lutetian) of Lower Saxony, Germany. However, the arguments of the inclusion of this fossil wood type in the fossil-genus *Schimoxylon* were weak: (exclusively solitary vessels with significantly larger diameters and finer medullary rays). Therefore, the resemblance with altingioid wood type (Wheeler & al. 2010) is more reliable in this case, the fossil-species should be transferred to the valid fossil-genus of woods relating to *Liquidambar* L. sensu lato (incl. *Altingia* Noronha) (Ickert-Bond & Wen 2013), *Liquidambaroxylon altingioides* (H. Gottwald) Doweld, comb. nov.

The preservation of the rest fossil wood types, *Schima protowallichii* K. Terada & Mits. Suzuki, nom. inval., and *S. benderi* Licht, Boura & Franceschi, allows its relationships with the extant species of *Schima* (Deng & Baas 1991). However, the type species of the fossil wood genus *Schimoxylon* is unfortunately based on the poorly preserved Cretaceous wood type from Egypt, *Ternstroemioxylon dachelense* Kräusel (1940: 91), with the ambiguous combination of wood anatomical characters allowing its relationships with quite different angiosperm families, but not with extant genus *Schima*. This circumstance dictated the necessity to restrict the fossil-genus *Schimoxylon* to the Cretaceous wood types with a distant relationship to *Schima*, but the fossil wood

types of the Tertiary is rationale to segregate in distinct fossil wood genus *Euschimoxylon* Doweld, gen. nov.

Euschimoxylon benderi (Licht, Boura & Franceschi) Doweld, **comb. nov.**

≡ *Schimoxylon benderi* Licht, Boura & Franceschi (in Licht & al. 2013: 41, fig. 9).

Type: [fossil wood] Paukkaung locality, central Myanmar (holotype, MNHN.F.40132. L1/3, L2/3 & L3/3 (field number: PK3), Muséum National d'Histoire Naturelle, Paris, France).

Occurrence: Middle Eocene (Pondaung Formation); Eurasia (Indochina).

IFPNI: 8E5F406A-3FD5-F3B1-A2F0-B07EC08CE7EF.

Euschimoxylon miowallichii Doweld, **sp. nov.**

≡ *Schima protowallichii* K. Terada & Mits. Suzuki (in Choi & al. 2010: 106, figs. 26–31), nom. inval.

Type: [fossil wood] Odani, Yamagata Prefecture, Japan (holotype, TO 18 [illustrated l.c.: figs. 26–31. 2010], Fossil Collection, Herbarium, Chonbuk National University, South Korea).

Occurrence: Middle Miocene (Oyama Formation); Eurasia (Japanese Archipelago).

IFPNI: 53D02FD7-8491-5593-ED15-2CE2F1F549D1.

Note: The fossil-species of *Schima*, *Schima protowallichii* K. Terada & Mits. Suzuki (in Choi & al. 2010), nom. inval., was invalidly published due to the lack of repository indication for a holotype and the lack of validating illustrations of the holotype. The fossil-species is validated here as a fossil-species of the fossil-genus *Schimoxylon* with a new species epithet, *Euschimoxylon miowallichii* Doweld, sp. nov.

Species excluded:

Liquidambaroxylon altingioides (H. Gottwald) Doweld, **comb. nov.**

≡ *Schimoxylon altingioides* H. Gottwald (1992: 73, pl. 19: figs. 194-196).

Type: [fossil wood] Braunkohlen-Tagebau "Treue", Helmstedt, Lower Saxony, Germany (holotype, 1279/126, Staatliches Museum für Naturkunde, Stuttgart, Germany).

Occurrence: Middle Eocene (Lutetian = Helmstedt Formation); Eurasia (Europe).

IFPNI: 0B8255A3-B084-D9A8-6B8B-C3C3AE41503B.

Stewartioxylon Doweld, **gen. nov.**

Description: Wood diffuse-porous with almost exclusively solitary small vessels; exclusively scalariform perforation plates and scalariform pitting of vessel walls; diffuse and diffuse-in-aggregates axial parenchyma; narrow heterocellular rays; crystals in axial parenchyma strands.

Type: *Stewartioxylon notoense* (Mits. Suzuki & K. Terada) Doweld.

IFPNI: 3982D57C-006C-84B8-CDE6-7E91E8AECEDF.

Note: The fossil-species of *Stewartia*, *S. notoensis* Suzuki & Terada (1996) and *S. pseudocamellioxylon* E.K. Jeong & K. Kim (in Jeong & al. 2009), based on wood Tertiary remains from Japanese Archipelago and Korean Peninsula, have the wood type resembling extant genus *Stewartia*, although the combination of the characters of diffuse-porous with almost exclusively solitary small vessels wood with exclusively scalariform perforation plates and scalariform pitting of vessel walls, diffuse and diffuse-in-aggregates axial parenchyma and narrow heterocellular rays is found also in the families *Cornaceae* and *Hamamelidaceae*. The lack of knowledge of their reproductive organs and even full vegetative ones necessitates their segregation in the distinct morpho-genus, based solely on woods. Therefore, all these fossil-species showing the fossil wood structure of *Stewartia*-

type, are segregated in a distinct fossil wood genus, *Stewartioxylon* Doweld, gen. nov.

Stewartioxylon notoense (Mits. Suzuki & K. Terada) Doweld, **comb. nov.**

≡ *Stewartia notoensis* Mits. Suzuki & K. Terada (1996: 377, figs. 18-22).

Type: [fossil wood] Mawaki, Noto Peninsula, central Japan (holotype, 53970, Herbarium, Faculty of Science, Tohoku University, Sendai, Japan).

Occurrence: Lower Miocene (Aquitanian = Yanagida Formation); Japanese Archipelago.

IFPNI: C0DC8EA9-B1E6-FFFC-957C-8FFE845F0B72.

Stewartioxylon pseudocamellioxylon (E.K. Jeong, K. Kim in E.K. Jeong, K. Kim, Mits. Suzuki & J.W. Kim) Doweld, **comb. nov.**

≡ *Stewartia pseudocamellioxylon* E.K. Jeong, K. Kim in E.K. Jeong, K. Kim, Mits. Suzuki & J.W. Kim (2009: 132, pl. 5: figs. 1-6) ("*pseudo-camellioxylon*").

Type: [fossil wood] Shinjeong-ri, Donghae-myeon, Pohang City, Korea (South) [holotype, JNU 21062, Microscopic slides 21062-1-3, Herbarium, Division of Biological Sciences, Chonbuk National University, Jeonju, Korea (South)].

Occurrence: Lower Miocene; Korean Peninsula (Eurasia, Far East).

IFPNI: ED1E1BCB-4F2C-873E-B529-8A2F6CD0A77E.

Fossils excluded from *Theaceae*

***Capparidispermum* as a theaceous taxon: a revision of misunderstood fossil-genus:**

Mai (1971) established that the type species of *Capparidispermum* M. Chandler (1957: 98), *C. boveyanum* (Heer) M. Chandler (1957: 98), is in reality the fossil-species of theaceous extant genus *Eurya*, *E. boveyana* (Heer) Mai (1971: 330). However, this discovery was overlooked by Russian palaeobotanists (Balueva and V.P. Nikitin in Arbuzova 2005) who continued to use the inappropriate fossil-generic name for the new capparidaceous seed fossils of Western Siberia. This nomenclatural mistake is rectified here by re-classification of the Siberian seed fossils in the new fossil-genera depending on the structure of its seed-coats.

Capparispermum Doweld, **gen. nov.**

Description: Seeds rounded, campylotropous, small, with flattened or concave lateral sides. Chalazal limb equal in length to the micropylar limb. Surface foveolate, foveolae arranged in 6-9 concentric rows. Seed-coats exotestal-exotegmic, exotesta thin, consisting of tangentially elongated and flattened cells forming foveolae; exotegmen of a single palisade layer of longitudinally elongated sclereids with porous cells; endotegmen 1-layered, thin-walled.

Type: *Capparispermum kireevskianum* (Balueva) Doweld.

IFPNI: FE76214C-BAF5-00F4-42A6-3EF3D67A75F0.

Note: The seeds of *Capparispermum* fossil-species is similar to the general construction of the seed-coats and seed morphology of the subfamily *Cleomoideae*. Their distinctive 2-layered exo-endotegmen in the seed-coats relates the fossil-genus to the genera of extant subfamily *Cleomoideae* with a similar seed construction (vide Rodionova 1992).

Capparispermum kireevskianum (Balueva) Doweld, **comb. nov.**

≡ *Capparidispermum kireevskianum* Balueva in Arbuzova 2005: 58, pl. 125: fig. 4.

Type: [fossil seeds] Tomsk, borehole 153, Tomsk region, Russian Federation (holotype, 24/1-Лев.63-153-62.7-19, Komarov Botanical Institute, Russian Academy of Sciences, St.-Petersburg, Russian Federation).

Occurrence: Oligocene; Western Siberia.

IFPNI: C8E9272D-78F3-3C4E-1486-3EA09D3E6BC7.

Capparispermum minimum (Balueva) Doweld, **comb. nov.**

≡ *Capparidispermum minimum* Balueva in Arbuzova 2005: 57, pl. 124: fig. 15.

Type: [fossil seeds] Paletskoe, Novosibirsk region, Russian Federation (holotype, 32/1-Ст. 1954-IIB-312.2-315.2-19, Komarov Botanical Institute, Russian Academy of Sciences, St.-Petersburg, Russian Federation).

Occurrence: Oligocene; Western Siberia.

IFPNI: FC5849D0-9A04-3D4F-3222-BD433954BF9E.

Capparispermum nigrum (Balueva) Doweld, **comb. nov.**

≡ *Capparidispermum nigrum* Balueva in Arbuzova 2005: 58, pl. 123: fig. 1.

Type: [fossil seeds] Barmashevo, Novosibirisk region, Russian Federation (holotype, 50/Кчн.59-1-114.2-12, Komarov Botanical Institute, Russian Academy of Sciences, St.-Petersburg, Russian Federation).

Occurrence: Miocene; Western Siberia.

IFPNI: 38B0AAE1-A5D1-75C0-6B16-CC6DE7CC99A5.

Capparispermum omskiense (V.P. Nikitin) Doweld, **comb. nov.**

≡ *Capparidispermum omskiense* V.P. Nikitin in Arbuzova 2005: 59, pl. 126: fig. 1.

Type: [fossil seeds] Juzhnoe, Novosibirsk region, Russian Federation (holotype, 43/1-Yuzh 81-4-67, Komarov Botanical Institute, Russian Academy of Sciences, St.-Petersburg, Russian Federation).

Occurrence: Miocene; Western Siberia.

IFPNI: 38B0AAE1-A5D1-75C0-6B16-CC6DE7CC99A5.

Paracadaba Doweld, **gen. nov.**

Description: Seeds rounded to transversely oval, campylotropous, bilaterally flattened, Limbs equal, micropylar limb narrower thanchalazal limb. Surface foveolate, foveolae pentagonal to hexagonal, shallow, radially elongate, arranged in 20 concentric rows. Seed-coats exomesotegmic with testal flattened cells forming the foveolate surface sculpturing; exomesotegmen 2-layered, exotegmen with heavily thickened and porous internal periclinal cell walls; mesotegmen consisting of longitudinally elongate cells with thickened porous cells; endotegmen of flattened 1-layered cells.

Type: *Paracadaba intermedia* (Balueva & V.P. Nikitin) Doweld.

IFPNI: 6F9E44E3-C500-0228-3200-8B2C1637BF15.

Monotypic.

Note: Two fossil-species is very archaic and does not reveal any clear analogues among extant forms. The peculiar 2-layered exomesotegmen in the seed-coats clearly differentiate the fossil-genus from the genera of extant subfamily *Cleomoideae* having mostly 1-laered exotegmic seeds. The 2-layered exomesotegmic construction is characteristic for the extant representatives of the subfamily *Capparidoideae* (like *Cadaba* Forsskål (1775: 67); vide Rodionova 1992).

Paracadaba intermedia (Balueva & V.P. Nikitin) Doweld, **comb. nov.**

≡ *Capparidispermum intermedium* Balueva & V.P. Nikitin in Arbuzova 2005: 57, pl. 123: fig. 3.

Type: [fossil seeds] Tym, borehole 1, Tomsk region, Russian Federation (holotype, 21/1-T.-1-74-4, Komarov Botanical Institute, Russian Academy of Sciences, St.-Petersburg, Russian Federation).

Occurrence: Eocene; Western Siberia.

IFPNI: EDCB1EA1-E50D-0C11-2159-532853AD37C5.

Boreome Doweld, **gen. nov.**

Description: Seeds obovoid to rounded, campylotropous, small, with a large chalazal limb, micropylar limb narrower and elongated. Surface foveolate, foveolae 4-6-angular, arranged in 8-10 concentric rows. Seed-coats consisting of thin-walled testa and 3-layered tegmen, differentiated in a single thick-walled exotegmen, and thin-walled meso-endotegmen.

Type: *Boreome sibirica* (P.A. Nikitin) Doweld.

IFPNI: F7320663-8D83-BAE5-0DBB-1FE436FAECC0.

Note: Initially Dorofeev (1963) and then V.P. Nikitin (1976, 2007) advanced a hypothesis that these peculiar Siberian seeds are related to the extant genus *Polanisia*, noticing the superficial seed morphology of both fossils and *Polanisia*. However, Arbuzova (2005) demonstrated the similarity of the Siberian fossil seeds with the seeds of extant *Cleome suffruticosa* Schinz (Africa) and *Gynandropsis pentaphylla* DC. (Afghanistan and Ceylon); therefore, she debunked the inclusion of the fossil forms to the extant genus, noticing additional differences in seed sculpturing.

Boreome sibirica (P.A. Nikitin) Doweld, **comb. nov.**

≡ *Polanisia sibirica* P.A. Nikitin (1966: 73, pl. 11, figs. 3–4) ≡ *Polanisia sibirica* P.A. Nikitin ex Dorofeev 1963: 190, pl. 32, figs. 1–9), nom. inval. [type not designated, ICN, Art. 40.1] ≡ *Polanisia sibirica* P.A. Nikitin (1948: 1104), nom. nud.

Type: [fossil seeds] Lagernyj Sad, Tomsk region, Russian Federation (holotype, 40/1-Lag II, Komarov Botanical Institute, Russian Academy of Sciences, St.-Petersburg, Russian Federation).

Occurrence: Miocene (Aquitanian); Western Siberia.

IFPNI: FE0E488B-0369-3527-3702-DB83FEB2217B.

Boreome graveonella (V.P. Nikitin) Doweld, **comb. nov.**

≡ *Polanisia graveonella* P.A. Nikitin ex V.P. Nikitin (1976: 181, pl. 69, fig. 14) ≡ *Polanisia graveonella* P.A. Nikitin (1948: 1104), nom. nud. ≡ *Capparidispermum graveonellum* (P.A. Nikitin ex V.P. Nikitin) Arbuzova (2005: 60).

Type: [fossil seeds] Kolyvan', Ob' River, Novosibirsk region, Russian Federation (holotype, [V.P. Nikitin *s.n.*], Komarov Botanical Institute, Russian Academy of Sciences, St.-Petersburg, Russian Federation).

Occurrence: Miocene; Western Siberia.

IFPNI: 9E7B800C-5366-A2E4-5473-C4CD3C2C116A.

Boreome intermedia (V.P. Nikitin) Doweld, **comb. nov.**

≡ *Polanisia intermedia* V.P. Nikitin (2007: 86, pl. 9, fig. 48).

Type: [fossil seeds] Kompasskij Bor, right bank of Tym River, Tomsk region, Russian Federation (holotype, 1/1, T.1-72, Komarov Botanical Institute, Russian Academy of Sciences, St.-Petersburg, Russian Federation).

Occurrence: Eocene (Bartonian); Eurasia (Western Siberia).

IFPNI: 3A7826A5-54F1-A7D8-6B93-CC0C30F9C04F.

Schima euryoides **as a non-theaceous taxon**

Mai (in Mai & Walther 1985) described fossil seeds from the Eocene sediments of Nobitz (Germany), *Schima euryoides* Mai. The exotestal seeds with some Eurya-like seed sculpturing were referred by him to the extant genus Schima. However, a very important feature, contradicting such an affinity, was neglected: exotestal seed with curved horseshoe-shaped embryos were never noticed in *Schima* or even *Theaceae* (Corner 1976). Although the fossil seeds were not well

preserved, and needs a re-study with the assistance of SEM, its relationships might be with the order *Caryophyllales* (former *Centrospermae*). Since the affinity of the fossil seeds with Eury weas not proved or even precluded by embryo type, a new fossil seed genus is segregated, *Maiaspermum* Doweld, gen. nov., in honour of its discoverer, Dieter Hans Mai (1934–2013).

Maiaspermum Doweld, **gen. nov.**

Description: Seeds flattened lenticular, with remnants of a circumferential wing margin, 2-3 mm in diameter, basally obliquely stepped or slightly recessed, wingless around the pit of the hilum, hilum and microphyle very strongly approximated, embryos horseshoe-shaped curved; seed surface with eccentrically arranged dimples, which extend from the inside to becoming more voluminous on the outside.

Type: *Maiaspermum euryoides* (Mai) Doweld.

IFPNI: 5E85B653-08EE-BCD2-65CB-10CDB117D7A1.

Maiaspermum euryoides (Mai) Doweld, **comb. nov.**

≡ *Schima euryoides* Mai (in Mai & Walther 1985: 79, pl. 20, fig. 18).

Type: [fossil seeds] Nobitz near Altenburg, Thuringia, Germany (holotype, MMG 8254, Senckenberg Naturhistorische Sammlungen Dresden, Abteilung Museum für Mineralogie und Geologie, Dresden, Germany).

Occurrence: Eocene; Europe.

IFPNI: AD87A447-AB19-5BD7-2766-589344DE1B55.

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