

Ruhr-Universität Bochum, Lehrstuhl für Spezielle Botanik, Bochum

C. SCHULZ; P. KNOPF & TH. STÜTZEL

Identification key to the Cypress family (Cupressaceae)¹

With 11 Figures

Summary

The identification of Cupressaceae taxa, except for some local and easily distinguishable taxa, is difficult even for specialists. One reason for this is the lack of a complete key including all Cupressaceae taxa, another reason is that diagnoses and descriptions are spread over several hundred publications which are sometimes difficult to access. Based on morphological studies of about 3/4 of the species and a careful compilation of the most important descriptions of Cupressaceae, a first identification key for the entire Cypress family (Cupressaceae) could be set up. The key comprises any of the 30 genera, 134 species, 7 subspecies, 38 varieties, one form and thus all 180 taxa recognized by FARJON (2001). The key uses mainly features of adult leaves, female cones and other characters which are all relatively easy to be used.

Introduction

One of the first species to be published according to the “International Code of Botanical Nomenclature” was *Cupressus sempervirens* L. in 1753, the last was *Xanthocyparis vietnamensis* FARJON & HIEP in 2002. During this long time, several hundred descriptions for taxa of all ranks in Cupressaceae were published. Despite the fact that many species are cultivated world wide, only regional keys have been set up. There is neither a key for all genera of the family, nor a full key for all members of such

Zusammenfassung

Bestimmungsschlüssel für die Familie der Cupressaceae

Die Bestimmung von Cupressaceae-Taxa ist mit Ausnahme einiger lokaler und leicht bestimmbarer Taxa schwierig, selbst für Spezialisten. Ein Grund, warum es noch keinen vollständigen Bestimmungsschlüssel mit allen Cupressaceae-Taxa gibt ist, dass die Sippen-Beschreibungen sich auf mehrere hundert Publikationen verteilen, welche teilweise schwierig zu beschaffen sind. Etwa 3/4 der Cupressaceae-Arten wurden morphologisch untersucht und die wichtigsten Beschreibungen zusammengefasst, daraus wurde dann der erste vollständige Bestimmungsschlüssel für Cupressaceae erstellt. Der Bestimmungsschlüssel enthält 30 Gattungen, 134 Arten, 7 Unterarten, 38 Varietäten, eine Form und damit alle 180 Taxa nach FARJON (2001). Es werden vorwiegend Merkmale von adulten Blättern, weiblichen Zapfen und andere Merkmale verwendet, welche alle relativ leicht erkennbar sind.

important genera like *Callitris*, *Cupressus* and *Juniperus*. In many cases geographic information is used in keys, what makes them often inappropriate to determine material held in collections such as arboreta and botanical gardens. In their natural habitat, it is mostly quite simple to determine Cupressaceae, as there is usually only a limited number of Cupressaceae native to a region.

Materials and methods

Nomenclature and taxonomy are generally adopted from FARJON (2001). The key is based on morphological studies of about 3/4 of the species and a careful compilation of the relevant bibliography.

¹ Data matrix inclusive illustrations for interactive identification using DELTA/INTKEY available on <http://www.boga.ruhr-uni-bochum.de/spezbot/publikationen.htm>

Keys were performed using the DELTA-package (DALLWITZ 1974, 1980; DALLWITZ et al. 1993, 1995, 1999, 2000). All data collected from own examinations and the bibliography were entered into a DELTA matrix. These taxa studied can be grouped in three parts. The first group comprises those taxa which are frequently grown in Germany even outside botanical gardens. Access to material was not or hardly limited for this group, and morphological, especially morphometrical characters are supposed not to differ markedly from natural conditions. This was mostly proven by comparing data from the bibliography with ours. The data sets as well as the range for many characters were however emended markedly even for this group. A second list comprises the taxa which are usually only found in scientific collections such as botanic gardens and arboreta. It may be suspected that these taxa are grown under conditions more different from their natural environment. This might result in differences to material collected from natural sites, and we tried to get material from different sources and compared the results carefully with data from the bibliography. The third group comprises those taxa for which no material could be accessed and only data from the bibliography and herbarium samples could be included. Cultivars were excluded, it is however mostly possible to identify cultivars as well, if characters like size and habit are excluded. The identification of herbarium samples is conditionally possible, if character colour is not necessary.

List 1 (Species occurring in Germany also outside of botanical gardens and botanical collections; frequently cultivated taxa)

Chamaecyparis lawsoniana, *Chamaecyparis obtusa* var. *obtusa*, *Chamaecyparis pisifera*, *Cryptomeria japonica*, *Cunninghamia lanceolata*, *Cupressus arizonica* var. *glabra*, *Cupressus sempervirens*, *Juniperus chinensis* var. *chinensis*, *Juniperus communis* var. *communis*, *Juniperus horizontalis*, *Juniperus sabina* var. *sabina*, *Metasequoia glyptostroboides*, *Microbiota decussata*, *Platycladus orientalis*, *Sequoiadendron giganteum*, *Taxodium distichum* var. *distichum*, *Thuja occidentalis*, *Thuja plicata*, *Thujopsis dolabrata* var. *dolabrata*, *Xanthocyparis nootkatensis*.

List 2 (Species occurring in Germany only in botanical gardens or botanical collections; BG = botanical garden, A = arboretum, RBG = Royal Botanical Garden)

Actinostrobus pyramidalis: BG Halle (Saale), BG München; *Athrotaxis cupressoides*: BG

Bonn; *Athrotaxis laxifolia*: BG Bonn, BG Düsseldorf; *Athrotaxis selaginoides*: BG Bonn; *Austrocedrus chilensis*: BG Bonn, BG Düsseldorf, Palmengarten Frankfurt (Main); *Calocedrus decurrens*: BG Bochum, Essen Grugapark, Palmengarten Frankfurt (Main), BG Frankfurt(Main), BG Strasbourg; *Callitris canescens*: BG Halle (Saale); *Callitris columellaris*: BG Bonn; *Callitris drummondii*: BG Bochum; *Callitris endlicheri*: BG Berlin, BG Düsseldorf; *Callitris oblonga*: A Freiburg; *Callitris preissii*: BG Bochum, BG Bonn; *Callitris rhomboidea*: BG Bochum; *Callitris verrucosa*: BG Bochum; *Calocedrus formosana*: BG Düsseldorf, BG Bonn; *Calocedrus macrolepis*: Dortmund Rombergpark; *Chamaecyparis formosensis*: BG Düsseldorf; *Chamaecyparis obtusa* var. *formosana*: A Günstertal; *Chamaecyparis thyoides* var. *henryae*: BG Mainz; *Chamaecyparis thyoides* var. *thyoides*: BG Bochum, Dortmund Rombergpark; *Cunninghamia konishii*: Palmengarten Frankfurt (Main); *Cupressus arizonica* var. *arizonica*: BG Mainz, Flora Köln, Esveld, Dortmund Rombergpark; *Cupressus arizonica* var. *montana*: BG Bayreuth; *Cupressus arizonica* var. *nevadensis*: BG Bayreuth; *Cupressus bakeri*: Dortmund Rombergpark, Palmengarten Frankfurt (Main), A Freiburg, RBG Kew; *Cupressus cashmeriana*: BG Bochum, BG Bonn, BG Hamburg, BG Berlin, A Freiburg; *Cupressus chengiana* var. *chengiana*: RBG Kew, A Trompenburg; *Cupressus chengiana* var. *jiangensis*: private; *Cupressus duclouxiana*: BG München, BG Bochum; *Cupressus dupreziana* var. *atlantica*: BG Berlin, BG Bayreuth; *Cupressus dupreziana* var. *dupreziana*: BG Bochum, BG Bonn, BG Hamburg, BG Berlin, A Freiburg; *Cupressus funebris*: BG Frankfurt (Main), BG Bochum, BG Berlin, A Freiburg, BG Marburg, BG München; *Cupressus gigantea*: BG Marburg, BG Bochum, BG Bayreuth; *Cupressus goveniana* var. *abramsiana*: Flora Köln; *Cupressus goveniana* var. *goveniana*: BG Münster, BG Bochum, BG Bayreuth, A Freiburg; *Cupressus guadalupensis* var. *forbesii*: BG Bayreuth; *Cupressus guadalupensis* var. *guadalupensis*: BG Bayreuth; *Cupressus lusitanica* var. *bentharii*: BG Bochum; *Cupressus lusitanica* var. *lusitanica*: BG Bochum, BG Hamburg, BG Halle (Saale); *Cupressus macnabiana*: BG Hamburg, BG Mainz, RBG Kew;

Cupressus macrocarpa: BG Halle (Saale), BG Bochum, Dortmund Rombergpark, BG Marburg; *Cupressus sargentii*: BG Hamburg, BG Bayreuth; *Cupressus torulosa*: A Trompenburg, BG Berlin, BG Hamburg; *Diselma archeri*: BG Bonn; *Fitzroya cupressoides*: BG Düsseldorf, Palmengarten Frankfurt (Main), A Freiburg; *Fokienia hodginsii*: BG Düsseldorf, BG Bonn, Palmengarten Frankfurt (Main); *Glyptostrobus pensilis*: BG Bochum, BG Bonn; *Juniperus ashei*: BG Hamburg, BG Berlin; *Juniperus bermudiana*: Esveld; *Juniperus cedrus*: BG Bochum, BG Bonn, BG Marburg; *Juniperus chinensis* var. *sargentii*: BG Bochum, BG Berlin; *Juniperus communis* var. *depressa*: BG Bochum; *Juniperus communis* var. *saxatilis*: BG Berlin, BG Bochum, BG München; *Juniperus deppeana* var. *deppeana*: A Freiburg; *Juniperus drupacea*: BG Bochum, BG Hamburg, BG Düsseldorf, Esveld; *Juniperus excelsa* subsp. *excelsa*: BG Münster, BG Berlin; *Juniperus excelsa* subsp. *polycarpus*: BG Berlin; *Juniperus flaccida* var. *flaccida*: private; *Juniperus indica*: BG Berlin; *Juniperus monosperma*: BG Mainz, BG Berlin; *Juniperus occidentalis* var. *occidentalis*: BG Berlin; *Juniperus osteosperma*: BG Berlin, BG Mainz; *Juniperus oxycedrus* subsp. *badia*: BG Halle (Saale); *Juniperus oxycedrus* subsp. *macrocarpa*: BG Bochum, BG Halle (Saale); *Juniperus oxycedrus* subsp. *oxycedrus*: BG Bochum, BG Berlin; *Juniperus phoenicea* subsp. *phoenicea*: BG Bochum, BG Bonn, BG Berlin, BG Mainz, BG Münster; *Juniperus phoenicea* subsp. *turbinata*: BG Berlin; *Juniperus pinchotii*: BG Halle (Saale); *Juniperus pingii* var. *wilsonii*: Esveld; *Juniperus procera*: BG Bochum, BG Bonn; *Juniperus procumbens*: BG Bochum, BG Bonn; *Juniperus pseudosabina*: BG Berlin; *Juniperus recurva* var. *coxii*: private; *Juniperus recurva* var. *recurva*: BG Berlin; *Juniperus rigida* subsp. *conferta*: BG Bochum, BG Halle (Saale), BG Berlin, Dortmund Rombergpark; *Juniperus rigida* subsp. *rigida*: BG Bochum, BG Berlin, BG Halle (Saale), BG Leipzig; *Juniperus sabina* var. *davurica*: BG Berlin, BG Bochum; *Juniperus scopulorum*: BG Düsseldorf; *Juniperus semiglobosa*: BG Berlin; *Juniperus squamata*: BG Bochum, BG Berlin; *Juniperus thurifera*: BG Hamburg, BG Bochum, BG Berlin; *Juniperus virginiana* var. *silicicola*: A Freiburg; *Juniperus virginiana*

var. *virginiana*: BG Bochum, BG Mainz, BG Dortmund, Essen Grugapark, BG Berlin; *Libocedrus bidwillii*: Palmengarten Frankfurt (Main); *Libocedrus plumosa*: Palmengarten Frankfurt (Main); *Papuacedrus papuana* var. *papuana*: BG Bonn; *Papuacedrus papuana* var. *arfakensis*: BG Bonn; *Pilgerodendron uviferum*: Palmengarten Frankfurt (Main), A Günstertal; *Sequoia sempervirens*: BG Bochum, BG Düsseldorf; *Taiwania cryptomerioides*: BG Düsseldorf; *Taxodium distichum* var. *imbricatum*: BG Bochum, Palmengarten Frankfurt (Main); *Taxodium mucronatum*: BG Düsseldorf, BG Freiburg, A Günstertal; *Tetraclinis articulata*: BG Düsseldorf, BG Bonn, BG Bochum; *Thuja koraiensis*: BG Bochum, Dortmund Rombergpark; *Thuja standishii*: BG Bochum; *Thujopsis dolabrata* var. *hondai*: BG Mainz; *Widdringtonia cedarbergensis*: BG Bochum; *Widdringtonia nodiflora*: BG Bochum; *Widdringtonia schwarzii*: BG Bonn.

List 3 (Species which were not available in Germany and adjacent regions. Data are only from herbarium samples and literature)

Actinostrobus acuminatus, *Actinostrobus arenarius*, *Callitris baileyi*, *Callitris macleayana*, *Callitris monticola*, *Callitris muelleri*, *Callitris neocaledonica*, *Callitris roei*, *Callitris sulcata*, *Cupressus arizonica* var. *stephensonii*, *Juniperus angosturana*, *Juniperus barbadensis* var. *barbadensis*, *Juniperus barbadensis* var. *lucayana*, *Juniperus blancoi* var. *blancoi*, *Juniperus blancoi* var. *mucronata*, *Juniperus brevifolia*, *Juniperus californica*, *Juniperus chengii*, *Juniperus chinensis* var. *tsukusiensis*, *Juniperus coahuilensis* var. *arizonica*, *Juniperus coahuilensis* var. *coahuilensis*, *Juniperus comitana*, *Juniperus communis* var. *megistocarpa*, *Juniperus communis* var. *nipponica*, *Juniperus convallium* var. *convallium*, *Juniperus convallium* var. *microsperma*, *Juniperus deppeana* var. *pachyphlaea*, *Juniperus deppeana* var. *robusta*, *Juniperus deppeana* var. *sperry*, *Juniperus deppeana* var. *zacatecensis*, *Juniperus durangensis*, *Juniperus flaccida* var. *martinezii*, *Juniperus flaccida* var. *poblana*, *Juniperus foetidissima*, *Juniperus formosana* f. *formosana*, *Juniperus formosana* f. *tenella*, *Juniperus gamboana*, *Juniperus gracilior* var. *ekmanii*, *Juniperus gracilior* var. *gracilior*, *Juniperus*

gracilior var. *urbaniana*, *Juniperus jaliscana*, *Juniperus komarovii*, *Juniperus monticola*, *Juniperus occidentalis* var. *australis*, *Juniperus oxycedrus* subsp. *transtagana*, *Juniperus pingii* var. *pingii*, *Juniperus przewalskii*, *Juniperus sabina* var. *arenaria*, *Juniperus saltillensis*, *Juniperus saltuaria*, *Juniperus saxicola*, *Juniperus standleyi*, *Juniperus taxifolia*, *Juniperus tibetica*, *Libocedrus austrocaledonica*, *Libocedrus chevalieri*, *Libocedrus yateensis*, *Neocallitropsis pancheri*, *Thuja sutchuenensis*, *Widdringtonia whytei*.

The key uses mainly features of adult leaves and female cones. Male cones and juvenile leaves are accessible only a limited time in the year or even during the whole plant life. The data matrix is therefore not sufficiently complete. For this reason we tried to focus on characters which are available throughout the year. Many taxa start forming adult leaves not before they are three or four years old. Determination of Cupressaceae using only vegetative characters is sometimes not possible, but many species have typical leaves or even branchlets, and those characters are used in the key as well (Fig. 1). In the key only characters are used which distinctly separate two or more groups. The sole exceptions are two varieties (*Chamaecyparis thyoides* var. *henryana*/var. *thyoides*, *Juniperus occidentalis* var. *australis*/var. *occidentalis*) with only overlapping character ranges. For most key steps, several non-overlapping characters are offered either to facilitate correct decisions or to allow the identification in cases of incomplete material. Sometimes some overlapping features are added to the use of distinct characters, if such combinations with supplementary characters make decisions easier. Almost all features are illustrated. The illustrations in the key are regarded as examples for character states and do not show necessarily the taxon under consideration at this point of the key. The taxa are however always mentioned in the legend. For some taxa diagnostic characters are illustrated (numbers in brackets after the taxon name), which allow to recognize a taxon directly from the illustration.

Characters in the key are described in an abbreviated form to make it shorter and easier to read. The characters mean the following:

1. leaves = only adult leaves, except if juvenile leaves persist for decades (e.g. *Taiwania cryptomerioides*);
2. length/width/colour of leaves = only on ultimate branchlets, but not on the last leaf pair;
3. length/width of female cones = open as well as closed female cones;
4. length/width of seed = length is from hilum to the top of the micropyle, right-angled to it the width (measures at maximum extent);
5. margin of scale leaves only visible with strong lens (min. 20×);
6. seeds with tubercle only visible with lens (10×);
7. resin glands only on ultimate branchlets;
8. coating of female cones (*Juniperus*) only after maturity not in earlier stages;
9. investigate the white stripes on the adaxial side of needle leaves not in basal and terminal position but between.

The key is composed of a “key to the genera” including all accepted genera, and of several “keys to the species” for each genus with more than one single accepted taxon. Therefore identifications can also be started from the key to the species. We tried to make the keys short by dividing as symmetrically as possible, the use of several characters per step wherever possible is supposed to facilitate proper identification. The representation of intraspecific variability remains however problematic due to the unbalanced and sometimes restricted availability of material for the taxa under consideration. Furthermore, taxa with a very limited geographical range and ecological amplitude are usually less variable than those for which applies the contrary and collections often do not reflect this properly. We suppose to have a more or less even representation of the intraspecific variability within each of the three lists mentioned above. For the species of list 1 the variability is supposed to be relatively well represented. For those of list 3 this is more disputable as the data are sometimes from the published description of a single specimen or individual. List 2 represents a somewhat intermediate situation. As established floras show marked improvements even after many editions, we suppose that our key will need further improvements urgently. Additions, corrections and other comments are therefore highly welcome (Christian.Schulz-3@ruhr-uni-bochum.de).

Key to the genera

1. Leaves: arranged spirally (one leaf per node) (Fig. 1B–K, M) 2
 Leaves: arranged decussately (two leaves per node) (Fig. 1L, N–3A) 15
 Leaves: arranged in whorls of 3 (Fig. 3B–F) 32
 Leaves: arranged in whorls of 4 (Fig. 7A) 36
- 2(1). Leaves: needle-like (awl-shaped: rounded in cross-section) (Fig. 1D, E, F, H) 3
 Leaves: needle-like (linear: flattened in cross-section) (Fig. 1G, I–M) 6
 Leaves: scale-like (Fig. 1A–C, N–Q; 2A–U; 3D–F) 10
- 3(2). Female cone scales: thin (less than 0.5 mm thick) (Fig. 7B); flexible.
 *Taiwania cryptomerioides* HAYATA (Fig. 1F; 4D)
 Female cone scales: thick (more than 0.5 mm thick) (Fig. 7C); rigid (woody or fleshy) 4
- 4(3). Female cones: disintegrating in several parts after maturity (Fig. 7D); seeds: thick
 (Fig. 7E) *Taxodium* RICH. (page 127)
 Female cones: not disintegrating after maturity (Fig. 4A–D, 4F–5H); seeds: thin
 (Fig. 7F) 5
- 5(4). Needle leaves: in 3 rows (Fig. 1D); tip acute (Fig. 1D); female cones: ovoid (Fig. 4G);
 35–80 mm long; more than 25 mm wide; female cone scales: tip blunt (Fig. 4G); seed
 wings: more than 0.7 mm wide
 *Sequoiadendron giganteum* (LINDL.) J.BUCHHOLZ (Fig. 1D; 4G; 6A; 7F)
 Needle leaves: in 5 rows (Fig. 1H); tip blunt (Fig. 1H); female cones: globose (Fig. 4C);
 9–30 mm long; up to 25 mm wide; female cone scales: tip acute (Fig. 4C); seed wings:
 up to 0.7 mm wide *Cryptomeria japonica* (THUNB. ex L.f.) D.DON (Fig. 1H; 4C)
- 6(2). Needle leaves: in 2 rows, exact in one plane (Fig. 1I–L) 7
 Needle leaves: in 2 rows, not exact in one plane (Fig. 1M) 8
 Needle leaves: in 3 rows (Fig. 1E) *Taxodium* RICH. (page 127)
 Needle leaves: in 5 rows (Fig. 1G) *Athrotaxis selaginoides* D.DON (Fig. 1G)
- 7(6). Female cones: disintegrating in several parts after maturity (Fig. 7D); seeds: thick
 (Fig. 7E); needle leaves without any white stripes (Fig. 1J); female cone scales: with
 small dorsal umbo (Fig. 4E; 7I: arrow); [seeds: 4–26 mm long; 3–23 mm wide; 6–16 per
 cone] *Taxodium* RICH. (page 127)
 Female cones: not disintegrating after maturity (Fig. 4H); seeds: thin (Fig. 7F); needle
 leaves with two white stripes (Fig. 1K; 10N); female cone scales: with dorsal depression
 (Fig. 4H; 7H: arrow); [seeds: 1–7 mm long; 1.5–5 mm wide; 30–140 per cone]
 *Sequoia sempervirens* (D.DON) ENDL. (Fig. 1K; 4H)
- 8(6). Needle leaves: with two white stripes (Fig. 1M; 10N); female cone scales: thin (up to
 0.5 mm thick) (Fig. 7B; 4B) *Cunninghamia* R.BR. ex RICH. & A.RICH. (page 112)
 Needle leaves: without any white stripes (Fig. 1I, L); female cone scales: thick (more
 than 0.5 mm thick) (Fig. 7C) 9
- 9(8). Female cone scales: arranged spirally (Fig. 4F); seed wings: unequal (Fig. 6H); branch-
 lets: up to 20 mm wide; arranged 3-dimensionally (Fig. 8D); [needle leaves: 2–12 mm
 long; 0.4–1.2 mm wide]
 *Glyptostrobus pensilis* (STAUNTON ex D.DON) K.KOCH (Fig. 1I; 4F; 6H)

- Female cone scales: arranged oppositely (Fig. 1L); seed wings: (almost) equal (Fig. 8I); branchlets: more than 20 mm wide; arranged in one plane (Fig. 8E); [needle leaves: 8–25 mm long; 1–3 mm wide]
 *Metasequoia glyptostroboides* HU & W.C.CHENG (Fig. 1L; 4I; 7H; 8I)
- 10(2). Female cone scales: arranged spirally (Fig. 4A, F, H); female cone scales: insert on different levels in mature cones (imbricat) (Fig. 4A, F, H; 8C); columella: absent (Fig. 7L) 11
 Female cone scales: arranged oppositely (Fig. 4Q); female cone scales: all insert on the same level in mature cones (valvat); female cone: bowl-shaped (Fig. 4Q; 8B, L); columella: present (Fig. 8A; 9K, L; 11L: arrow)
 *Widdringtonia nodiflora* (L.) POWRIE (Fig. 1A, P; 4Q; 5S)
- 11(10). Seed wings: (almost) equal (Fig. 5L–6G) 12
 Seed wings: unequal (Fig. 6H)
 *Glyptostrobus pensilis* (STAUNTON ex D.DON) K.KOCH (Fig. 1I; 4F; 6H)
- 12(11). Female cone scales: tip blunt (Fig. 4H) 13
 Female cone scales: tip acute (Fig. 4A) 14
- 13(12). Female cone scales: umbo more or less in the center (Fig. 4H; 7K: arrow); scale leaves: tip acute (Fig. 1K); branchlets: 20–40 mm wide; arranged in one plane (Fig. 8E) *Sequoia sempervirens* (D.DON) ENDL. (Fig. 1K; 4H)
 Female cone scales: umbo near the apex (Fig. 7I, J: arrow); scale leaves tip blunt (Fig. 1C); branchlets: 2–5 mm wide; arranged 3-dimensionally (Fig. 8D)
 *Athrotaxis cupressoides* D.DON (Fig. 1C)
- 14(12). Scale leaves: apically spreading or loosely spreading (Fig. 1B); scale leaves: with entire margin (Fig. 8F: arrow); [female cones: 12–21 mm long]
 *Athrotaxis laxifolia* HOOK. (Fig. 1B; 4A; 5L)
 Scale leaves: closely appressed (Fig. 1C); scale leaves: with serrate margin (Fig. 8G: arrows); [female cones: 8–15 mm long] *Athrotaxis cupressoides* D.DON (Fig. 1C)
- 15(1). Female cone scales: thin (cones flexible) (Fig. 7B) 16
 Female cone scales: thick (cones rigid) (Fig. 7C) 21
- 16(15). Scale leaves: one leaf type only = monomorphic (no differentiation in lateral and facial leaves) (Fig. 1Q, R) or needle leaves (Fig. 1R) 17
 Scale leaves: two leaf types = dimorphic (differentiation in lateral and facial leaves) (Fig. 2A–U) 18
- 17(16). Columella: present (Fig. 8A; 9K, L; 11L: arrow); female cones: dark (Fig. 5H); female cone scales: umbo or depression absent (Fig. 7G); seed wings: (almost) equal (Fig. 5L–6G); branchlets: up to 2 mm wide *Diselma archeri* HOOK.f. (Fig. 1Q)
 Columella: absent (Fig. 7L); female cones: light (Fig. 5D); female cone scales: umbo present (Fig. 7H–K: arrow); seed wings: unequal (Fig. 6H–M); branchlets: more than 2 mm wide *Pilgerodendron uviferum* (D.DON)
 FLORIN [= *Libocedrus tetragona* (HOOK.) ENDL.] (Fig. 1R; 5D; 7K)
- 18(16). Seeds: thin (Fig. 7F); seed wings: present (always membranous) (Fig. 5L–6P) 19
 Seeds: thick (Fig. 7E); seed wings: absent (sometimes with massive edges) (Fig. 5I–K)
 *Microbiota decussata* KOM. (Fig. 2A; 4N; 5I)

- 19(18). Seed wings: (almost) equal (Fig. 5U) *Thuja* L. (page 128)
Seed wings: unequal (Fig. 6I, L) 20
- 20(19). Female cone scales: with small dorsal umbo (Fig. 7I: arrow); female cone scales:
umbo near the apex (Fig. 5A; 7I, J: arrow) *Austrocedrus chilensis* (D.DON)
PIC.SERM & BIZZARRI [= *Libocedrus chilensis* (D.DON) ENDL.] (Fig. 2T; 5A; 6I)
Female cone scales: with very large dorsal umbo (Fig. 5C, D; 7K: arrow); female
cone scales: umbo more or less in the center (Fig. 7K: arrow) *Libocedrus* ENDL. (page 126)
- 21(15). Seed wings: present (always membranous) (Fig. 5L–6P) 22
Seed wings: absent (sometimes with massive edges) (Fig. 5I–K) 31
- 22(21). Seed wings: (almost) equal (Fig. 5L–6G) 23
Seed wings: unequal (Fig. 6H–M) 29
- 23(22). Female cone scales: all insert on the same level in mature cones (valvat), female
cones: bowl-shaped (Fig. 8B, L) 24
Female cone scales: insert on different levels in mature cones (imbricat) (Fig. 8C) 6
- 24(23). Scale leaves: one leaf type only = monomorphic (no differentiation in lateral and
facial leaves) (Fig. 1N–Q); columella: present (Fig. 8A; 9K, L; 11L: arrow)
. *Widdringtonia* ENDL. (page 128)
Scale leaves: two leaf types = dimorphic (differentiation in lateral and facial leaves)
(Fig. 2A–U); columella: absent (Fig. 7L) 25
- 25(24). Seed wings: up to 2.5 mm wide; branchlets: in one plane (Fig. 8E); in cross section
roundish or quadrangular; female cones: maturity after the second year
. *Chamaecyparis* SPACH, *Cupressus* L., *Xanthocyparis* FARJON & HIEP (page 106)
Seed wings: more than 2.5 mm wide; branchlets: 3-dimensionally arranged (Fig. 8D);
in cross section flattened; female cones: maturity after the first year
. *Tetraclinis articulata* (VAHL) MAST. (Fig. 2I; 5B; 6D; 7L; 8B)
- 26(23). Needle leaves: in 2 rows (Fig. 1L); plant: deciduous
. *Metasequoia glyptostroboides* HU & W.C.CHENG (Fig. 1L; 4I)
Needle leaves: in 4 or 8 rows (Fig. 1R; 3A) or scale leaves; plant: evergreen 27
- 27(26). Female cones: up to 12 mm wide.
. *Chamaecyparis* SPACH, *Cupressus* L., *Xanthocyparis* FARJON & HIEP (page 106)
Female cones: more than 12 mm wide 28
- 28(26). Branchlets: lower side with white or glaucous marking (Fig. 2N); scale leaves: more
than 2 mm wide; female cones: maturity after the first year.
. *Thujopsis dolabrata* (THUNB. ex L.f.) SIEBOLD & ZUCC. (Fig. 2N) (page 128)
Branchlets: lower side without white or glaucous marking (Fig. 1O; 2L, J); scale
leaves: up to 2 mm wide; female cones: maturity after the second year
. *Chamaecyparis* SPACH, *Cupressus* L., *Xanthocyparis* FARJON and HIEP (page 106)
- 29(22). Leaves: facial and lateral leaves more or less equal respectively the length (Fig. 2B,
C, Q) 30
Leaves: facial and lateral leaves conspicuous unequal respectively the length (Fig. 2P)
. *Papuacedrus* H.L.LI (page 127)

- 30(29). Female cone scales: umbo near the apex (Fig. 7I, J: arrow); female cones: with up to 6 cone scales; oblong (Fig. 4O); with up to 8 seeds *Calocedrus* KURZ (page 106)
 Female cone scales: umbo more or less in the center (Fig. 7K: arrow); female cones: with more than 6 cone scales; globose or ovoid (Fig. 4L); with more than 8 seeds
 *Fokienia hodginsii* (DUNN) A.HENRY & H.H.THOMAS (Fig. 2Q; 4L; 6M)
- 31(21). Scale leaves: one leaf type only = monomorphic (no differentiation in lateral and facial leaves) (Fig. 1O); female cone scales: with small dorsal umbo or without (Fig. 5E, F: arrow); female cones: berry-like (closed after maturity) (Fig. 5E, F); branchlets: arranged 3-dimensionally (Fig. 8D); not flattened in cross section
 *Juniperus* L. (page 112)
 Scale leaves: two leaf types = dimorphic (differentiation in lateral and facial leaves) (Fig. 2J); female cone scales: with large dorsal umbo (Fig. 7J: arrow); female cones: cone-like (open after maturity) (Fig. 4M); branchlets: arranged in one plane (Fig. 8E); flattened in cross section.
 *Platycladus orientalis* (L.) FRANCO [= *Thuja orientalis* L.](Fig. 2J; 4M; 5J; 7E, J)
- 32(1). Female cone scales: with several small additional cone scales at the base of the female cones (Fig. 5G: arrows) *Actinostrobus* MIQ. (page 103)
 Female cone scales: without several small additional cone scales at the base of the female cones (Fig. 5H). 33
- 33(32). Female cone scales: thin (Fig. 7B); flexible *Diselma archeri* HOOK.f. (Fig. 1Q)
 Female cone scales: thick (Fig. 7C); rigid (woody or fleshy) 34
- 34(33). Female cones: cone-like (opened after maturity), woody (Fig. 5H; 8H); columella: present (Fig. 8A; 9K, L; 11L: arrow) 35
 Female cones: berry-like (closed after maturity), fleshy or leathery (Fig. 5E, F); columella: absent (Fig. 7L). *Juniperus* L. (page 112)
- 35(34). Leaves: spreading (Fig. 3C); female cones: young ones green only
 *Fitzroya cupressoides* (MOLINA) I.M.JOHNST. (Fig. 3C; 6P; 8H)
 Leaves: appressed closely (Fig. 3D, E); female cones: young ones green with bluish coating *Callitris* VENT. (Fig. 3D, E; 5H) (page 104)
- 36(1). Leaves: spreading (Fig. 7A); [female cones: up to 9 mm wide]; female cone scales: thin (up to 0.5 mm thick) (Fig. 7B)
 *Neocallitropsis pancheri* (CARRIÈRE) DELAUB. (Fig. 7A)
 Leaves: closely appressed (Fig. 3D, E); [female cones: more than 6 mm wide]; female cone scales: thick (more than 0.5 mm thick) (Fig. 7C) *Callitris* VENT. (page 104)

***Actinostrobus* MIQ.**

(3 species; key after HILL 1998)

1. Female cones: apex rounded (Fig. 5G); [10–16 mm long]
 *Actinostrobus pyramidalis* MIQ. (Fig. 3F; 5G; 6O)
 Female cones: apex acute; [15–35 mm long] 2
- 2(1). Female cones: about as long as broad; tip of scales straight; up to 20 mm long
 *Actinostrobus arenarius* C.A.GARDNER
 Female cones: about 1.5 times as long as broad; tip of scales hooked; more than 20 mm long. *Actinostrobus acuminatus* PARL.

***Athrotaxis* D. DON**

(3 species)

1. Leaves: needle-like (Fig. 1G); branchlets with leaves: more than 7 mm wide
 *Athrotaxis selaginoides* D.DON (Fig. 1G)
 Leaves: scaly (Fig. 1B, C); branchlets: up to 7 mm wide 2
- 2(1). Scale leaves: loosely spreading (Fig. 1B); with entire margin (Fig. 8F: arrow)
 *Athrotaxis laxifolia* HOOK. (Fig. 1B; 4A; 5L)
 Scale leaves: closely appressed (Fig. 1C); with serrate margin (Fig. 8G: arrows)
 *Athrotaxis cupressoides* D.DON (Fig. 1C)

***Callitris* VENT.**

(15 species)

1. Female cone scales: almost equal (Fig. 5G) 2
 Female cone scales: unequal (Fig. 8L). 4
- 2(1). Leaves: adult plants with scale leaves only (Fig. 3D, E); female cone scales: with large dorsal umbo (Fig. 7J: arrow); the larger ones angled into a (broad) apex (Fig. 9A); female cones: with slender fruiting branchlets (Fig. 9C: arrow). 3
 Leaves: adult plants with scale and needle leaves (Fig. 9D); female cone scales: with small dorsal umbo (Fig. 7I: arrow); the larger ones tapering towards the apex (Fig. 9B); female cones: with stout fruiting branchlets (Fig. 5H; 8L).
 *Callitris macleayana* (F.MUELL.) F.MUELL.
- 3(2). Female cone scales: the smaller cone scales angled into a (broad) apex (Fig. 9A); without dorsal furrow below the apex; female cones: up to 9 mm wide
 *Callitris neocaledonica* DUMMER
 Female cone scales: the smaller cone scales tapering towards the apex (Fig. 9B); with dorsal furrow below the apex; female cones: more than 9 mm wide
 *Callitris sulcata* (PARL.) SCHLTR.
- 4(1). Female cone scales: spreading widely after opening (Fig. 9K) 5
 Female cone scales: not spreading widely after opening (Fig. 9L) 7
- 5(4). Female cone scales: the larger ones angled into a (broad) apex (Fig. 9A); seed wings: (almost) equal (Fig. 5L–6G); seeds: more than 10 per cone; female cone scales: without dorsal furrow below the apex 6
 Female cone scales: the larger ones tapering towards the apex (Fig. 9B); seed wings: unequal (Fig. 6I–M); seeds: up to 10 per cone; female cone scales: with dorsal furrow below the apex *Callitris baileyi* C.T.WHITE
- 6(5). Columella: simple (round or angled at the apex) (Fig. 9K, L; 11L: arrow); female cones: with slender fruiting branchlets (Fig. 9C: arrow); scale leaves: dorsal side rounded (branchlets: often roundish); female cones: shedding seeds and deciduous shortly after maturity *Callitris columellaris* F.MUELL.

- Columella: apart (2-/3-/4-lobed, 2-/3-/4-partite) (Fig. 8A); female cones: with stout fruiting branchlets (Fig. 5H; 8L); scale leaves: dorsal side keeled (branchlets: square-edged); female cones: persistent and holding seeds for several years after maturity
 *Callitris rhomboidea* R.BR. ex RICH. & A.RICH.
- 7(4). Seed wings: (almost) equal (Fig. 5L–6G); seeds: more than 10 per cone 8
 Seed wings: unequal (Fig. 6J); seeds: up to 10 per cone 21
- 8(7). Columella: simple (round or angled at the apex) (Fig. 9K, L; 11L: arrow) 9
 Columella: apart (2-/3-/4-lobed, 2-/3-/4-partite) (Fig. 8A). 15
- 9(8). Female cones: warty (Fig. 9J). 10
 Female cones: not warty (Fig. 5H; 8L; 9C). 11
- 10(9). Female cones: with some warts, but not dense *Callitris preissii* MIQ.
 Female cones: densely warty on the whole cone (Fig. 9J)
 *Callitris verrucosa* (A.CUNN. ex ENDL.) F.MUELL. (Fig. 9J)
- 11(9). Female cone scales: the larger ones angled into a (broad) apex (Fig. 9A). 12
 Female cone scales: the larger ones tapering towards the apex (Fig. 9B) 14
- 12(11). Scale leaves: dorsal side rounded (branchlets: often roundish) 13
 Scale leaves: dorsal side keeled (branchlets: square-edged).
 *Callitris muelleri* (PARL.) BENTH. & HOOK.f. ex F.MUELL.
- 13(12). Female cones: up to 17 mm long; columella: up to 2 mm long
 *Callitris canescens* (PARL.) S.T.BLAKE (Fig. 3E; 9C)
 Female cones: more than 17 mm long; columella: more than 2 mm long
 *Callitris preissii* MIQ. (Fig. 9E)
- 14(11). Scale leaves: tip blunt (Fig. 11C: arrow); female cone scales: tip blunt (Fig. 7I); united at the base and forming a thick cone base (Fig. 9E); female cones: depressed-globose or globose (Fig. 5H; 8L; 9C); [seed wings: 2–4 mm wide]
 *Callitris muelleri* (PARL.) BENTH. & HOOK.f. ex F.MUELL.
 Scale leaves: tip acute (Fig. 11D: arrow); female cone scales: tip acute (Fig. 7G); separating almost to the base (Fig. 9F); female cones: ovoid; [seed wings: 1–3 mm wide] *Callitris oblonga* RICH. & A.RICH.
- 15(8). Female cone scales: the larger ones angled into a (broad) apex (Fig. 9A). 16
 Female cone scales: the larger ones tapering towards the apex (Fig. 9B) 18
- 16(15). Female cones: with slender fruiting branchlets (Fig. 9C: arrow); female cones: shedding seeds and deciduous shortly after maturity
 *Callitris endlicheri* (PARL.) F.M.BAILEY (Fig. 8A; 9F; 11L)
 Female cones: with stout fruiting branchlets (Fig. 5H; 8L); female cones: persistent and holding seeds for several years after maturity. 17
- 17(16). Female cone scales: united at the base and forming a thick cone base (Fig. 9E); scale leaves: more than 4 mm long *Callitris muelleri* (PARL.) BENTH. & HOOK.f. ex F.MUELL.

- Female cone scales: separating almost to the base (Fig. 9F); scale leaves: up to 4 mm long *Callitris monticola* J.GARDEN
- 18(15). Scale leaves: tip blunt (Fig. 11C: arrow) 19
 Scale leaves: tip acute (Fig. 11D: arrow) 20
- 19(18). Female cones: with slender fruiting branchlets (Fig. 9C: arrow); shedding seeds and deciduous shortly after maturity; up to 16 mm long; female cone scales: separating almost to the base (Fig. 9F); scale leaves: up to 4 mm long
 *Callitris endlicheri* (PARL.) F.M.BAILEY (Fig. 8A; 9F, K; 11L)
 Female cones: with stout fruiting branchlets (Fig. 5H; 8L); persistent and holding seeds for several years after maturity; more than 16 mm long; female cone scales: united at the base and forming a thick cone base (Fig. 9E); scale leaves: more than 4 mm long *Callitris muelleri* (PARL.) BENTH. & HOOK.f. ex F.MUELL.
- 20(18). Female cones: with slender fruiting branchlets (Fig. 9C: arrow); shedding seeds and deciduous shortly after maturity; [10–16 mm long; scale leaves: 1–4 mm long]
 *Callitris endlicheri* (PARL.) F.M.BAILEY (Fig. 8A; 9F; 11L)
 Female cones: with stout fruiting branchlets (Fig. 5H; 8L); persistent and holding seeds for several years after maturity; [12–25 mm long; 3–5 mm long]
 *Callitris oblonga* RICH. & A.RICH.
- 21(7). Female cone scales: with dorsal furrow below the apex; [female cones: 10–20 mm wide] *Callitris roei* (ENDL.) F.MUELL.
 Female cone scales: without dorsal furrow below the apex; [female cones: 10–15 mm wide] *Callitris drummondii* (PARL.) F.MUELL. (Fig. 3D; 5H; 6J; 8L; 9A, B, L; 10E)

***Calocedrus* KURZ**

(3 species; key after FLORIN 1930, changed)

1. Cone-bearing-branchlets (peduncle): terete or 4-angled and not like the branchlets without female cones 2
 Cone-bearing-branchlets (peduncle): flattened and like the branchlets without female cones (Fig. 10A). 3
- 2(1). Seeds: up to 4 mm wide *Calocedrus macrolepis* KURZ [= *Libocedrus macrolepis* (KURZ) BENTH & HOOK.f.]
 Seeds: more than 4 mm wide *Calocedrus decurrens* (TORR.) FLORIN [= *Libocedrus decurrens* TORR.] (Fig. 2B; 4O; 6K)
- 3(1). Seeds: up to 4 mm wide *Calocedrus formosana* (FLORIN) FLORIN [= *Libocedrus formosana* FLORIN] (Fig. 2C; 10A)
 Seeds: more than 4 mm wide *Calocedrus decurrens* (TORR.) FLORIN [= *Libocedrus decurrens* TORR.] (Fig. 2B; 4O; 6K)

***Chamaecyparis* SPACH and *Cupressus* L. and *Xanthocyparis* FARJON & HIEP**

(*Chamaecyparis*: 8 taxa = 6 species + 2 varieties; *Cupressus*: 25 taxa = 17 species + 8 varieties; *Xanthocyparis*: 2 species)

1. Scale leaves: one leaf type only = monomorphic (no differentiation in lateral and facial leaves) (Fig. 1A–C, N–Q). 2

- Scale leaves: two leaf types = dimorphic (differentiation in lateral and facial leaves) (Fig. 2A–U) 38
- 2(1). Branchlets: arranged 3-dimensionally (Fig. 8D) 3
 Branchlets: arranged in one plane (Fig. 8E) 32
- 3(2). Female cone scales: umbo more or less in the center (Fig. 7K: arrow) 4
 Female cone scales: umbo near the apex (Fig. 7I, J: arrow) 30
- 4(3). Scale leaves: with white resin (Fig. 8J: arrows) 5
 Scale leaves: without white resin (Fig. 1A–C; 1P–2U) but sometimes resinous 8
- 5(4). Seeds: thin (Fig. 7F) 6
 Seeds: thick (Fig. 7E). *Cupressus guadalupensis* S.WATSON var. *forbesii* (JEPS.)
 LITTLE [= *Cupressus forbesii* JEPS.]
- 6(5). Seeds: light – medium brown (Fig. 5I; N–Q); up to 80 per cone; [3–4 mm long];
 [branchlets: 8–20 mm long]; bark: furrowed *Cupressus arizonica*
 GREENE var. *montana* (WIGGINS) LITTLE [= *Cupressus montana* WIGGINS]
 Seeds: dark brown – black (Fig. 5J, S; 6B); more than 80 per cone; [4–7 mm long];
 [branchlets: 15–30 mm long]; bark: smooth – scaly (Fig. 9G) or divided in plates
 (Fig. 9H) 7
- 7(6). Branchlets: up to 20 mm long; stout (Fig. 11E); seed wings: more than 1.3 mm wide;
 female cones: up to 20 mm wide; crown: dense *Cupressus arizonica*
 GREENE var. *glabra* (SUDW.) LITTLE [= *Cupressus glabra* SUDW.] (Fig. 1N; 8D, G)
 Branchlets: more than 20 mm long; slender (Fig. 11F); seed wings: up to 1.3 mm
 wide; female cones: more than 20 mm wide; crown: rather open.
 *Cupressus guadalupensis* S.WATSON var. *guadalupensis*
- 8(4). Seeds: with conspicuous hilum (Fig. 5I, S; 6M: arrow) 9
 Seeds: without conspicuous hilum (Fig. 5M, N). 26
- 9(8). Seeds: tubercled (Fig. 8K: arrows) 10
 Seeds: not tubercled (Fig. 11K). 22
- 10(9). Seeds: thin (Fig. 7F) 11
 Seeds: thick (Fig. 7E). *Cupressus guadalupensis* S.WATSON var. *forbesii* (JEPS.)
 LITTLE [= *Cupressus forbesii* JEPS.]
- 11(10). Branchlets: up to 10 mm long 12
 Branchlets: between 10–15 mm long 16
 Branchlets: between 15–20 mm long 21
 Branchlets: up to 20 mm long *Cupressus guadalupensis* S.WATSON var. *guadalupensis*
- 12(11). Scale leaves: tip blunt (Fig. 11C: arrow) 13
 Scale leaves: tip acute (Fig. 11D: arrow) 14
- 13(12). Scale leaves: tip curved outwards (Fig. 11I: arrow); up to 0.8 mm wide; seeds: up to
 120 per cone; up to 5 mm long; up to 4 mm wide; branchlets: long (Fig. 11F); up to 1
 mm wide; crown: dense *Cupressus duclouxiana* HICKEL

- Scale leaves: tip incurved (Fig. 11J: arrows); more than 0.8 mm wide; seeds: more than 120 per cone; more than 5 mm long; more than 4 mm wide; branchlets: short (Fig. 11E); more than 1 mm wide; crown: rather open
 *Cupressus macrocarpa* HARTW. ex GORDON (Fig. 8J)
- 14(12). Scale leaves: up to 0.5 mm wide *Cupressus duclouxiana* HICKEL
 Scale leaves: between 0.5–1 mm wide 15
 Scale leaves: between 1–1.5 mm wide *Cupressus arizonica*
 GREENE var. *stephensonii* (C.B.WOLF) LITTLE [= *Cupressus stephensoni* C.B.WOLF.]
 Scale leaves: more than 1.5 mm wide *Cupressus sargentii* JEPS.
- 15(14). Branchlets: up to 1 mm wide; slender (Fig. 11F); seed wings: up to 2.3 mm wide;
 seeds: up to 4 mm wide; [10–28 seeds per female cone scale]; scale leaves: up to
 1 mm wide; branches: horizontal or drooping; bark: furrowed or peeling of in strands
 (Fig. 9I) *Cupressus duclouxiana* HICKEL
 Branchlets: more than 1 mm wide; stout (Fig. 11E); seed wings: more than 2.3 mm
 wide; seeds: more than 4 mm wide; [8–10 seeds per female cone scale]; scale leaves:
 more than 1 mm wide; branches: ascending; bark: smooth-scaly (Fig. 9G) or divided
 in plates (Fig. 9H)
 *Cupressus arizonica* GREENE var. *stephensonii* (C.B.WOLF) LITTLE
 [= *Cupressus stephensoni* C.B.WOLF.]
- 16(11). Scale leaves: tip curved outwards (Fig. 11I: arrow) 17
 Scale leaves: tip incurved (Fig. 11J: arrows) 18
- 17(16). Branchlets: up to 1 mm wide; slender (Fig. 11F); seed wings: up to 2.3 mm wide;
 seeds: up to 4 mm wide; [10–28 seeds per female cone scale]; scale leaves: up to
 1 mm wide; branches: horizontal or drooping; bark: furrowed or peeling of in strands
 (Fig. 9I) *Cupressus duclouxiana* HICKEL
 Branchlets: more than 1 mm wide; stout (Fig. 11E); seed wings: more than 2.3 mm
 wide; seeds: more than 4 mm wide; [8–10 seeds per female cone scale]; scale leaves:
 more than 1 mm wide; branches: ascending; bark: smooth-scaly (Fig. 9G) or divided
 in plates (Fig. 9H) *Cupressus arizonica* GREENE var. *stephensonii* (C.B.WOLF)
 LITTLE [= *Cupressus stephensoni* C.B.WOLF.]
- 18(16). Scale leaves: tip blunt (Fig. 11C: arrow) 19
 Scale leaves: tip acute (Fig. 11D: arrow) 20
- 19(18). Seeds: up to 5 mm long; up to 14 seeds per female cone scale; up to 125 per cone;
 seed wings: up to 1 mm wide; female cones: up to 20 mm wide; branchlets: long
 (Fig. 11F); crown: dense *Cupressus goveniana* GORDON var.
abramsiana (C.B.WOLF) LITTLE [= *Cupressus abramsiana* C.B.WOLF.]
 Seeds: more than 5 mm long; more than 14 seeds per female cone scale; more than
 125 per cone; seed wings: more than 1 mm wide; female cones: more than 20 mm
 wide; branchlets: short (Fig. 11E); crown: rather open
 *Cupressus macrocarpa* HARTW. ex GORDON
- 20(18). Female cones: up 20 mm wide; seed wings: up to 1.5 mm wide; seeds: up to 85 per
 cone; branchlets: slender (Fig. 11F); bark: furrowed *Cupressus goveniana* GORDON
 var. *abramsiana* (C.B.WOLF) LITTLE [= *Cupressus abramsiana* C.B.WOLF.]

- Female cones: more than 20 mm wide; seed wings: more than 1.5 mm wide; seeds: more than 85 per cone; branchlets: stout (Fig. 11E); bark: smooth–scaly (Fig. 9G) or divided in plates (Fig. 9H). *Cupressus arizonica* GREENE var. *stephensonii* (C.B.WOLF) LITTLE [= *Cupressus stephensoni* C.B.WOLF]
- 21(11). Scale leaves: up to 1.5 mm long; seed wings: more than 1.5 mm wide; seeds: more than 5 mm wide; [female cones: 6–12 scales per cone], [branchlets: 1.5–2.1 mm wide]; branches: horizontal *Cupressus arizonica* GREENE var. *stephensonii* (C.B.WOLF) LITTLE [= *Cupressus stephensoni* C.B.WOLF]
Scale leaves: more than 1.5 mm long; seed wings: up to 1.5 mm wide; seeds: up to 5 mm wide; [female cones: 6–8 scales per cone], [branchlets: 1.1–1.7 mm wide]; branches: ascending. *Cupressus arizonica* GREENE var. *arizonica* (Fig. 6F)
- 22(9). Scale leaves: tip blunt (Fig. 11C: arrow) 23
Scale leaves: tip acute (Fig. 11D: arrow) 24
- 23(22). Scale leaves: bright green [seeds: 50–70 per cone]; female cones: up to 22 mm wide *Cupressus goveniana* GORDON var. *abramsiana* (C.B.WOLF) LITTLE [= *Cupressus abramsiana* C.B.WOLF]
Scale leaves: dark green; [seeds: 64–240 per cone]; female cones: more than 22 mm wide *Cupressus sempervirens* L. (Fig. 4K)
- 24(22). Seeds: light – medium brown (Fig. 5I, N, Q); [2–4 mm wide; scale leaves: 0.4–1.3 mm wide] *Cupressus bakeri* JEPS.
Seeds: dark brown – black (Fig. 5J, S; 6B); [3–6 mm wide; scale leaves: 1–2.1 mm wide] 25
- 25(24). Branchlets: up to 10 mm long; more than 1.5 mm wide; stout (Fig. 11E); short (Fig. 11E); female cones: young ones reddish; [scale leaves: 1.6–2.1 mm wide] *Cupressus sargentii* JEPS.
Branchlets: more than 10 mm long; up to 1.5 mm wide; slender (Fig. 11F); long (Fig. 11F); female cones: young ones only green; [scale leaves: 1–1.7 mm wide] *Cupressus goveniana* GORDON var. *abramsiana* (C.B.WOLF) LITTLE [= *Cupressus abramsiana* C.B.WOLF]
- 26(8). Scale leaves: with conspicuous glands (Fig. 10P: arrow) *Cupressus bakeri* JEPS.
Scale leaves: with inconspicuous or without glands (Fig. 11A). 27
- 27(26). Female cone scales: with small dorsal umbo (Fig. 4K; 7I: arrow) 28
Female cone scales: with large dorsal umbo (Fig. 4M; 7J: arrow) 29
- 28(27). Scale leaves: tip curved outwards (Fig. 11I: arrow); female cones: solitary; branchlets: stout (Fig. 11E); branches: drooping. *Cupressus lusitanica* MILL. var. *lusitanica*
Scale leaves: tip incurved (Fig. 11J: arrows); female cones: several together; branchlets: slender (Fig. 11F); branches: ascending or horizontal *Cupressus goveniana* GORDON var. *goveniana*
- 29(27). Scale leaves: up to 1.5 mm long; seeds: up to 85 per cone; [female cones: 12–16 mm long]; branchlets: long (Fig. 11F); branches: drooping. *Cupressus lusitanica* MILL. var. *lusitanica*

- Scale leaves: more than 1.5 mm long; seeds: more than 85 per cone; [female cones: 12–26 mm long]; branchlets: short (Fig. 11E); branches: horizontal
 *Cupressus arizonica* GREENE var. *arizonica* (Fig. 6F)
- 30(3). Scale leaves: tip blunt (Fig. 11C: arrow); female cones: 5–6 cone scale whorls per cone; reddish or bluish or dark (Fig. 4J, M, C); up to 20 mm wide and long 31
 Scale leaves: tip acute (Fig. 11D: arrow); female cones: 3–4 cone scale whorls per cone; light (Fig. 4K); more than 20 mm wide and long *Cupressus arizonica* GREENE var. *nevadensis* (ABRAMS) LITTLE [= *Cupressus nevadensis* ABRAMS]
- 31(30). Female cone scales: with small dorsal umbo (Fig. 7I: arrow); scale leaves: without white resin (Fig. 11A); female cones: reddish or dark (Fig. 4J, C); young ones green with bluish coating; up to 12 mm wide and long
 *Cupressus chengiana* S.Y.HU var. *jiangensis* (N.ZHAO) SILBA
 Female cone scales: with large dorsal umbo (Fig. 7J: arrow); scale leaves: with white resin (Fig. 1N; 8J: arrows); female cones: bluish (Fig. 4M; 5B); young ones only green; more than 12 mm wide and long.
 *Cupressus gigantea* W.C.CHENG & L.K.FU (Fig. 11A, F)
- 32(2). Branchlets: flattened in cross section 33
 Branchlets: roundish in cross section 36
 Branchlets: quadrangular in cross section. *Cupressus torulosa* D.DON (Fig. 6E)
- 33(32). Female cones: 3–4 whorls per cone 34
 Female cones: 5–6 whorls per cone 35
- 34(33). Female cone scales: with small dorsal umbo (Fig. 4K; 7I: arrow); scale leaves: tip curved outwards (Fig. 11I: arrow); dorsal side keeled (branchlets: square-edged); seed wings: more than 1 mm wide; female cones: dark (Fig. 4C, H); young ones only green or reddish; branchlets: long (Fig. 11F) *Cupressus dupreziana* A.CAMUS var. *atlantica* (GAUSSEN) SILBA (Fig. 6G) [= *Cupressus atlantica* GAUSSEN]
 Female cone scales: with large dorsal umbo (Fig. 4M; 7J: arrow); scale leaves: tip incurved (Fig. 11J: arrows); dorsal side rounded (branchlets: often roundish); seed wings: up to 1 mm wide; female cones: reddish (Fig. 4J) or light (Fig. 4K) or bluish (Fig. 4M; 5B); young ones green with bluish coating; branchlets: short (Fig. 11E) *Cupressus macnabiana* A.MURRAY BIS
- 35(33). Scale leaves: tip blunt (Fig. 11C: arrow); female cones: light (Fig. 4K); branches: horizontal or drooping; crown: dense; bark: furrowed
 *Cupressus dupreziana* A.CAMUS var. *dupreziana* (Fig. 11C)
 Scale leaves: tip acute (Fig. 11D: arrow); female cones: reddish (Fig. 4J) or dark (Fig. 4C, H); branches: ascending; crown: rather open; bark: peeling off in strands (Fig. 9I) *Cupressus cashmeriana* ROYLE ex CARRIÈRE (Fig. 8F)
- 36(32). Scale leaves: with white resin (Fig. 1N; 8J: arrows); [female cones: 15–25 mm long]; [branches: horizontal or drooping] *Cupressus chengiana* S.Y.HU var. *chengiana*
 Scale leaves: without white resin (Fig. 11A); [female cones: 10–20 mm long]; [branches: horizontal or ascending] 37
- 37(36). Female cone scales: umbo more or less in the center (Fig. 7K: arrow); female cones: several together; more than 12 mm long; branchlets: slender (Fig. 11F)
 *Cupressus torulosa* D.DON (Fig. 6E)

- Female cone scales: umbo near the apex (Fig. 7I, J: arrow); female cones: solitary; up to 12 mm long; branchlets: stout (Fig. 11E)
 *Cupressus chengiana* S.Y.HU var. *jiangensis* (N.ZHAO) SILBA
- 38(1). Branchlets: flattened in cross section 39
 Branchlets: roundish in cross section *Xanthocyparis vietnamensis* FARJON & HIEP
 Branchlets: quadrangular in cross section. 47
- 39(38). Branchlets: lower side with white or glaucous marking (Fig. 2F, G, K, M–U) 40
 Branchlets: lower side without white or glaucous marking (Fig. 2B, H, J) 44
- 40(39). Leaves: facial and lateral leaves more or less equal respectively the length (Fig. 2D, E, G); branchlets: lower side with indistinct white marking (Fig. 2D, E, G) 41
 Leaves: facial and lateral leaves conspicuous unequal respectively the length (Fig. 2F); branchlets: lower side with distinct white marking (Fig. 2F) 43
- 41(40). Scale leaves: on leading shoots with resin glands (Fig. 10P: arrow); [female cones: 7–12 mm wide]; lateral leaves: without acute translucent tip.
 *Chamaecyparis lawsoniana* (A.MURRAY BIS) PARL. (Fig. 2E; 4J; 5N)
 Scale leaves: on leading shoot without resin glands (Fig. 1P); [female cones: 5–10 mm wide]; lateral leaves: with acute translucent tip. 42
- 42(41). Female cones: globose (Fig. 4L); dark (Fig. 4C, H); seed wings: more than 2 mm wide; [seeds: 1–2 seeds per female cone scale; 8–24 per cone]; lateral leaves: more than 2.2 mm long
 *Chamaecyparis pisifera* (SIEBOLD & ZUCC.) ENDL. (Fig. 2G; 5O; 9G)
 Female cones: ovoid (Fig. 4G–I); reddish (Fig. 4J) or light (Fig. 4K); seed wings: up to 2 mm wide; [seeds: 2–6 seeds per female cone scale; 20–40 per cone]; lateral leaves: up to 2.2 mm long *Chamaecyparis formosensis* MATSUM. (Fig. 5Q; 8C)
- after FU 1999
- 43(40). Lateral leaves up to 2 mm long; [scale leaves: thin]; tip subacute; seeds: obovoid . . .
 . . . *Chamaecyparis obtusa* (SIEBOLD & ZUCC.) ENDL. var. *formosana* (HAYATA) HAYATA
 Lateral leaves: more than 2 mm long; [scale leaves: thick]; tip obtuse; seeds: suborbicular. *Chamaecyparis obtusa* (SIEBOLD & ZUCC.) ENDL. var. *obtusa* (Fig. 2F; 5M)
- 44(39). Columella: present (Fig. 8A; 9K, L; 11L: arrow) 45
 Columella: absent (or only reduced fused cone scales) (Fig. 8B; 7L) 46
- after LI 1962
- 45(44). [Scale leaves: much lighter colored yellowish green foliage, especially pronounced on younger plants; 2–3 mm long; more closely appressed; on the leading shoots prominently glandular while the others are mostly eglandular; facial leaves: generally distinctly keeled; bark smoother; branchlets: less flattened].
Chamaecyparis thyoides (L.) BRITTON, STERNS & POGGENB. var. *henryae* (H.L.LI) LITTLE
 [Scale leaves: 1.5–2.5 mm long; slightly spreading (Fig. 10O); generally glandular throughout; facial leaves: less keeled]. *Chamaecyparis thyoides* (L.)
 BRITTON, STERNS & POGGENB. var. *thyoides* (Fig. 2H; 5P)

- 46(44). Scale leaves: tip blunt (Fig. 11C: arrow); seeds: 8–20 per cone scale; scale leaves: dorsal side rounded; with conspicuous glands (Fig. 10P: arrow); blunt (Fig. 11C: arrow); leaves: adult plants with scale leaves only (Fig. 8D, E) 48
 Scale leaves: tip acute (Fig. 11D: arrow); seeds: 6–7 per cone scale; scale leaves: dorsal side keeled; with inconspicuous or without glands (Fig. 11A); acute (Fig. 11D: arrow); leaves: adult plants with scale and needle leaves (Fig. 9D)
 *Cupressus funebris* ENDL. [= *Chamaecyparis funebris* (ENDL.) FRANCO] (Fig. 11I)
- 47(38). Female cone scales: all insert on the same level in mature cones (valvat); female cone: bowl-shaped (Fig. 8B, L); seeds: not tubercled (Fig. 11K); 1–3 seeds per female cone scales; 4–9 per cone; female cones: depressed globose; young ones only green; branchlets: roundish in cross section; leaves: adult plants with scale and needle leaves (Fig. 9D) . . . *Xanthocyparis nootkatensis* (D.DON) FARJON & HARDER [= *Chamaecyparis nootkatensis* (D.DON) SPACH, *Cupressus nootkatensis* D.DON] (Fig. 2U; 9H)
 Female cone scales: insert on different levels in mature cones (imbricat) (Fig. 8C); Seeds: tubercled (Fig. 8K: arrows); 8–10 seeds per female cone scales; 65–85 per cone; female cones: globose; young ones green with bluish coating; branchlets: quadrangular in cross section; leaves: adult plants with scale leaves only (Fig. 8D, E)
 *Cupressus lusitanica* MILL.
 var. *benthamii* (ENDL.) CARRIÈRE [= *Cupressus benthamii* ENDL.] (Fig. 11E)
- 48(46). Female cone scales: 6–8 per cone; with large dorsal umbo; branchlets: up to 1 mm wide; short (Fig. 11E) *Cupressus macnabiana* A.MURRAY BIS
 Female cone scales: 10–12 per cone; with small dorsal umbo; branchlets: more than 1 mm wide; long (Fig. 11F)
 *Cupressus dupreziana* A.CAMUS var. *dupreziana* (Fig. 11C)

***Cunninghamia* R.BR. ex RICH. & A.RICH.**

(2 species)

1. Needle leaves: 7–15 rows of stomata per white stripe on the abaxial side; [8–35 mm long]; female cones: up to 25 mm wide; [18–30 mm long]
 *Cunninghamia konishii* HAYATA
 Needle leaves: 16–28 rows of stomata per white stripe on the abaxial side (Fig. 10B); [8–70 mm long]; female cones: more than 25 mm wide; [25–45 mm long]
 *Cunninghamia lanceolata* (LAMB.) HOOK. (Fig. 1M; 4B; 5R; 7B, G; 10B)

***Juniperus* L.**

(85 taxa = 53 species + 6 subspecies + 25 varieties + 1 form)

1. Leaves: needle-like only group A (page 112)
 Leaves: scaly with or without needle leaves group B (page 116)

***Juniperus* group A: taxa with needle leaves**

1. Female cones: without coating (Fig. 5F) 2
 Female cones: with coating (Fig. 5E) 15

- 2(1). Needle leaves: spreading (Fig. 3B). 3
 Needle leaves: slightly spreading (Fig. 1D; 10C) 11
 Needle leaves: appressed (Fig. 1E). 14
- 3(2). Female cone scales: umbo present (Fig. 5E, F: arrow) 4
 Female cone scales: umbo absent (Fig. 7G) 7
- 4(3). Needle leaves: up to 5 mm long . . . *Juniperus oxycedrus* L. subsp. *trastagana* FRANCO
 Needle leaves: between 5–10 mm long 5
 Needle leaves: between 10–12 mm long
 *Juniperus oxycedrus* L. subsp. *trastagana* FRANCO
 Needle leaves: between 12–19 mm long 6
 Needle leaves: more than 19 mm long. *Juniperus oxycedrus* L. subsp. *macrocarpa*
 (SIBTH. & SM.) NEILR. [= *Juniperus macrocarpa* SIBTH. & SM.] (Fig. 10N)
- 5(4). Female cone scales: umbo more or less in the center (Fig. 7K: arrow); branchlets:
 roundish in cross section; stout (Fig. 11E); needle leaves: rounded (Fig. 10F); crown:
 widely conical or globose-irregular *Juniperus brevifolia* (SEUB.) ANTOINE
 Female cone scales: umbo near the apex (Fig. 7I, J: arrow); branchlets: triangular in
 cross section (Fig. 10E); slender (Fig. 11F); needle leaves: keeled (Fig. 10G); crown:
 columnar narrowly conical *Juniperus oxycedrus* L. subsp. *trastagana* FRANCO
- 6(4). Needle leaves: rounded (Fig. 10F); [seeds: 2–5 mm wide]
 *Juniperus oxycedrus* L. subsp. *oxycedrus* (Fig. 5F)
 Needle leaves: keeled (Fig. 10G); [seeds: 1.5–3 mm wide].
 *Juniperus oxycedrus* L. subsp. *badia* (H.GRAY) DEBEAUX
- 7(3). Needle leaves: tip blunt (Fig. 10H). 8
 Needle leaves: tip acute (Fig. 10I) 9
- 8(7). Needle leaves: rounded (Fig. 10F); [6–9 mm long]; branchlets: stout (Fig. 11E); short
 (Fig. 11E); roundish in cross section. *Juniperus brevifolia* (SEUB.) ANTOINE
 Needle leaves: keeled (Fig. 10G); [7–20 mm long]; branchlets: slender (Fig. 11F);
 long (Fig. 11F); triangular (Fig. 10E) or quadrangular in cross section
 *Juniperus taxifolia* HOOK. & ARN.
- 9(7). Needle leaves: up to 10 mm long; rounded (Fig. 10F); branchlets: roundish in cross
 section; seeds: thick (Fig. 7E); seed wings: absent (Fig. 5I, K)
 *Juniperus brevifolia* (SEUB.) ANTOINE
 Needle leaves: more than 10 mm long; keeled (Fig. 10G); branchlets: triangular in
 cross section (Fig. 10E); seeds: thin (Fig. 7F); seed wings: present (Fig. 5M–6M). . . 10
- 10(9). Needle leaves: up to 8 mm long; up to 1.2 mm wide
 *Juniperus formosana* HAYATA f. *tenella* HAND.-MAZZ.
 Needle leaves: more than 8 mm long; more than 1.2 mm wide
 *Juniperus formosana* HAYATA f. *formosana*
- 11(2). Seeds: tubercled (Fig. 8K: arrows). 12
 Seeds: not tubercled (Fig. 11K). 13
- 12(11). Female cones: 3–4 cone scales per cone; more than 5 mm wide; female cone scales:
 umbo absent (Fig. 7G); needle leaves: [6–10 mm long]; branchlets: roundish in cross

- section; stout (Fig. 11E); bark: peeling off in strands (Fig. 9I); crown: rather open. . .
 *Juniperus recurva* BUCH.-HAM. ex D.DON var. *coxii* (A.B.JACKS.) MELVILLE
 Female cones: 5–6 cone scales per cone; up to 5 mm wide; female cone scales: umbo
 present (Fig. 5E, F: arrow); needle leaves [3–7 mm long]; branchlets: triangular in
 cross section (Fig. 10E); slender (Fig. 11F); bark: furrowed; crown: dense
 *Juniperus pingii* W.C.CHENG ex FERRÉ var. *pingii*
- 13(11). Female cone scales: umbo more or less in the center (Fig. 7K: arrow); female cones:
 more than 7 mm long; needle leaves: rounded (Fig. 10F); branchlets: slender (Fig.
 11F); bark: peeling off in strands (Fig. 9I)
 *Juniperus recurva* BUCH.-HAM. ex D.DON var. *recurva* (Fig. 5K)
 Female cone scales: umbo near the apex (Fig. 7I, J: arrow); female cones: up to 7 mm
 long; needle leaves: keeled (Fig. 10G); branchlets: stout (Fig. 11E); bark: furrowed. . .
 *Juniperus pingii* W.C.CHENG ex FERRÉ var. *wilsonii* (REHDER) SILBA
 [= *Juniperus squamata* BUCH.-HAM. ex D.DON f. *wilsonii* REHDER]
- 14(2). Seeds: tubercled (Fig. 8K: arrows); female cones: 5–6 cone scales per cone; more
 than 7 mm long; up to 5 mm wide; branchlets: slender (Fig. 11F); long (Fig. 11F);
 [plant: erect; up to 30 m high] *Juniperus pingii* W.C.CHENG ex FERRÉ var. *pingii*
 Seeds: not tubercled (Fig. 11K); female cones: 3–4 cone scales per cone; up to 7 mm
 long; more than 5 mm wide; branchlets: stout (Fig. 11E); short (Fig. 11E); [plant:
 erect or procumbent; up to 6 m high]
 *Juniperus pingii* W.C.CHENG ex FERRÉ var. *wilsonii* (REHDER) SILBA
 [= *Juniperus squamata* BUCH.-HAM. ex D.DON f. *wilsonii* REHDER]
- 15(1). Female cones: up to 6 mm long. 16
 Female cones: between 6–9 mm long. 21
 Female cones: between 9–15 mm long 27
 Female cones: up to 15 mm long *Juniperus drupacea* LABILL. (Fig. 10G)
- 16(15). Needle leaves: leaves decurrent and not jointed at the base (Fig. 10J). 17
 Needle leaves: leaves not decurrent and jointed at the base (Fig. 10K) 19
- 17(16). Leaves: adult plants with needle leaves only (Fig. 8D, E); female cones: up to 6 mm
 long; crown: columnar–widely conical or globose-irregular 18
 Leaves: adult plants with scale and needle leaves (Fig. 9D); female cones: more than
 5 mm long; crown: procumbent *Juniperus horizontalis* MOENCH (Fig. 3A)
- 18(17). Needle leaves: arranged oppositely (Fig. 3A); female cones: 2–4 mm wide; seeds:
 2 per cone. *Juniperus saxicola* BRITTON & P.WILSON
 Needle leaves: arranged in whorls of 3 (Fig. 3B); female cones: more than 4 mm
 wide; seeds: 1 per cone. *Juniperus squamata* BUCH.-HAM. ex D.DON (Fig. 9I; 10F, J)
- 19(16). Needle leaves: with one narrow white stripe in a furrow (Fig. 10L); keeled (Fig. 10G);
 [seeds: 3 per cone] *Juniperus communis* L. var. *nipponica* (MAXIM.) E.H.WILSON
 Needle leaves: with one wide white stripe without furrow (Fig. 10M); keeled
 (Fig. 10G); [seeds: 3 per cone] 20
 Needle leaves: with two white stripes (Fig. 10N); rounded (Fig. 10F); [seeds: 1 per
 cone]. *Juniperus squamata* BUCH.-HAM. ex D.DON (Fig. 9I; 10F, J)

- 20(19). Seeds: up to 4 mm long; branchlets: stout (Fig. 11E); more than 1.5 mm wide; plant: procumbent; [up to 1 m high] . . . *Juniperus communis* L. var. *saxatilis* PALL. (Fig. 10I, M)
 Seeds: more than 4 mm long; branchlets: slender (Fig. 11F); up to 1.5 mm wide; plant: erect; [up to 15.3 m high] *Juniperus communis* L. var. *communis* (Fig. 5E)
- 21(15). Needle leaves: with one narrow white stripe in a furrow (Fig. 10L) 22
 Needle leaves: with one wide white stripe without furrow (Fig. 10M) 23
 Needle leaves: with two white stripes (Fig. 10N) 25
 Needle leaves: without any white stripes *Juniperus horizontalis* MOENCH
- 22(21). Seeds: with conspicuous hilum (Fig. 5I, S; 6M: arrow); [female cones: 8–13 mm long and wide]; crown: procumbent; [plant: up to 0.6 m high] *Juniperus rigida* SIEBOLD & ZUCC. subsp. *conferta* (PARL.) KITAM. [= *Juniperus conferta* PARL.]
 Seeds: without conspicuous hilum (Fig. 5M, N); [female cones: 6–9 mm long and wide]; crown: columnar-widely conical; [plant: up to 12 m high]
 *Juniperus rigida* SIEBOLD & ZUCC. subsp. *rigida* [= *Juniperus rigida* SIEBOLD & ZUCC.] (Fig. 3B; 8K; 10K, L)
- 23(21). Seeds: up to 4 mm long; branchlets: more than 1.5 mm wide
 *Juniperus communis* L. var. *saxatilis* PALL. (Fig. 10I, M)
 Seeds: more than 4 mm long; branchlets: up to 1.5 mm wide 24
- 24(23). Leaves: only needle leaves on adult plants (Fig. 3A, B); jointed at the base (Fig. 10K); female cone scales: umbo near the apex (Fig. 7I, J: arrow); seeds: 3 per cone; female cones: arranged in whorls of 3 (Fig. 3B); [6–9 mm long]; needle leaves: spreading (Fig. 3B); with one wide white stripe (Fig. 10M); keeled (Fig. 10G); [7–15 mm long]; [1–2 mm wide]; branchlets: slender (Fig. 11F); [5–60 mm long]
 *Juniperus communis* L. var. *depressa* PURSH
 Leaves: adult plants with scale and needle leaves (Fig. 9D); female cone scales: umbo more or less in the center (Fig. 7K: arrow); seeds: 1–2 per cone; female cones: arranged oppositely; [5–7 mm long]; needle leaves slightly spreading (Fig. 1D; 10C); leaves decurrent and not jointed at the base (Fig. 10J); without any white stripes; rounded (Fig. 10F); [2–8 mm long]; [0.7–1.2 mm wide]; branchlets: stout (Fig. 11E); [4–15 mm long]. *Juniperus horizontalis* MOENCH
- 25(21). Leaves: only needle leaves on adult plants (Fig. 3B); needle leaves: with two white stripes (Fig. 10N); [1–3 mm wide] 26
 Leaves: adult plants with scale and needle leaves (Fig. 9D); needle leaves: [0.7–1.2 mm wide] *Juniperus horizontalis* MOENCH
- 26(25). Female cones: up to 6 mm width; seeds: 1 per cone; [female cones: 4–9 mm long]; crown: columnar-narrowly conical – globose-irregular; [plant: up to 20 m high]
 *Juniperus squamata* BUCH.-HAM. ex D.DON (Fig. 9I; 10F, J)
 Female cones: more than 6 mm width; seeds: 2–3 per cone; [female cones: 8–9 mm long]; crown: procumbent; [plant: up to 0.8 m high]
 *Juniperus procumbens* (SIEBOLD ex ENDL.) MIQ.
- 27(15). Needle leaves: with one narrow white stripe in a furrow (Fig. 10L); [plant: procumbent; crown: dense] *Juniperus rigida* SIEBOLD & ZUCC. subsp. *conferta* (PARL.) KITAM. [= *Juniperus conferta* PARL.]
 Needle leaves: with one wide white stripe without furrow (Fig. 10M); [plant: procumbent; crown: dense] *Juniperus communis* L. var. *megistocarpa* FERNALD & H.ST.JOHN

Needle leaves: with two white stripes (Fig. 10N); [plant: erect; crown: rather open] . . .
 *Juniperus cedrus* WEBB & BERTHEL. (Fig. 10H)

***Juniperus* group B: taxa with scale leaves**

- | | | |
|---------|---|----|
| 1. | Scale leaves: with entire margin (Fig. 8F: arrow) | 2 |
| | Scale leaves: with serrate margin (Fig. 8G: arrows) | 62 |
| 2(1). | Scale leaves: dorsal side rounded (branchlets: often roundish) | 3 |
| | Scale leaves: dorsal side keeled (branchlets: square-edged) | 55 |
| 3(2). | Leaves: adult plants with scale leaves only (Fig. 8D, E) | 4 |
| | Leaves: adult plants with scale and needle leaves (Fig. 9D) | 38 |
| 4(3). | Female cones: without coating (Fig. 5F) | 5 |
| | Female cones: with coating (Fig. 5E) | 7 |
| 5(4). | Scale leaves: apically spreading or loosely spreading (Fig. 10O); branchlets: stout
(Fig. 11E) <i>Juniperus komarovii</i> FLORIN | |
| | Scale leaves: closely appressed (Fig. 1A, C, O); branchlets: slender (Fig. 11F) | 6 |
| 6(5). | Seeds: up to 6 mm wide; up to 7 mm long; [female cones: 6–10 mm long]; bark:
smooth-scaly (Fig. 9G) . . . <i>Juniperus convallium</i> REHDER & E.H.WILSON var. <i>convallium</i> | |
| | Seeds: more than 6 mm wide; more than 7 mm long; [female cones: 8–16 mm long];
bark: divided in plates (Fig. 9H) <i>Juniperus tibetica</i> KOM. | |
| 7(4). | Seeds: thin (Fig. 7F) <i>Juniperus semiglobosa</i> REGEL | |
| | Seeds: thick (Fig. 7E) | 8 |
| 8(7). | Female cones: fleshy after maturity | 9 |
| | Female cones: leathery after maturity | 33 |
| 9(8). | Branchlets: arranged 3-dimensionally (Fig. 8D) | 10 |
| | Branchlets: arranged in one plane (Fig. 8E) | 32 |
| 10(9). | Scale leaves: with conspicuous glands (Fig. 10P: arrow) | 11 |
| | Scale leaves: with inconspicuous or without glands (Fig. 11A) | 27 |
| 11(10). | Scale leaves: apically spreading or loosely spreading (Fig. 10O) | 12 |
| | Scale leaves: closely appressed (Fig. 1A, C, O) | 14 |
| 12(11). | Seeds: tubercled (Fig. 8K: arrows) | 13 |
| | Seeds: not tubercled (Fig. 11K) <i>Juniperus procera</i> HOCHST. ex ENDL. (Fig. 10C) | |
| 13(12). | Seeds: up to 6 mm long; 2 per cone; up to 4 mm wide; [female cones: 4–9 mm long];
[2-lobed or depressed globose or globose]; branchlets: slender (Fig. 11F); crown:
rather open; plant: dioecious <i>Juniperus scopulorum</i> SARG. | |
| | Seeds: more than 6 mm long; 1 per cone; more than 4 mm wide; [female cones:
8–12 mm long]; [globose or ovoid]; branchlets: stout (Fig. 11E); crown: dense; plant:
monoecious <i>Juniperus komarovii</i> FLORIN | |

- 14(11). Female cone scales: umbo present (Fig. 5E, F: arrow) 15
 Female cone scales: umbo absent (Fig. 7G) 19
- 15(14). Scale leaves: tip blunt (Fig. 11C: arrow) *Juniperus bermudiana* L.
 Scale leaves: tip acute (Fig. 11D: arrow) 16
- 16(15). Seeds: with conspicuous hilum (Fig. 5I, S; 6M: arrow) 17
 Seeds: without conspicuous hilum (Fig. 5M, N). 18
- 17(16). Female cones: light blue – blue-green beneath glaucous coating; [5–8 mm long];
 scale leaves: up to 1.5 mm long; branchlets: short (Fig. 11E); crown: dense
 *Juniperus barbadensis* L. var. *barbadensis*
 Female cones: dark blue – black beneath glaucous coating; [3–6 mm long]; scale
 leaves: more than 1.5 mm long; branchlets: long (Fig. 11F); crown: rather open
 *Juniperus blancoi* MARTÍNEZ var. *blancoi*
- 18(16). Female cones: 2-lobed or depressed-lobose; scale leaves: more than 1.5 mm long;
 closely appressed (Fig. 1A, C; O); crown: dense *Juniperus barbadensis* L. var. *barbadensis*
 Female cones: globose; scale leaves: up to 1.5 mm long; apically spreading or loosely
 spreading (Fig. 10O); crown: rather open. *Juniperus procera* HOCHST. ex ENDL.
- 19(14). Female cones: whitish beneath whitish-glaucous coating
 *Juniperus sabina* L. var. *sabina* (Fig. 11H)
 Female cones: light blue – blue-green beneath glaucous coating 20
 Female cones: reddish-yellow – reddish-brown beneath glaucous coating 22
 Female cones: dark blue – black beneath glaucous coating 23
- 20(19). Scale leaves: tip blunt (Fig. 11C: arrow); female cones: more than 5 mm long; bark:
 divided in plates (Fig. 9H); branchlets: up to 0.5 mm wide; up to 20 mm long; slender
 (Fig. 11F); short (Fig. 11E) *Juniperus sabina* L. var. *sabina* (Fig. 11H)
 Scale leaves: tip acute (Fig. 11D: arrow); female cones: more than 5 mm long; bark:
 peeling off in strands (Fig. 9I); branchlets: 0.5–1 mm wide; up to 20 mm long; slender
 (Fig. 11F); short (Fig. 11E). 21
 Scale leaves: tip blunt (Fig. 11C: arrow); female cones: up to 5 mm long; bark:
 smooth-scaly (Fig. 9G); branchlets: more than 1 mm wide; more than 20 mm long;
 stout (Fig. 11E); long (Fig. 11F) *Juniperus bermudiana* L.
- 21(20). Female cones: 2-lobed or depressed-globose; bark: peeling off in strands (Fig. 9I);
 crown: columnar-narrowly or widely conical *Juniperus barbadensis* L. var. *barbadensis*
 Female cones: globose or ovoid; bark: divided in plates (Fig. 9H); crown: globose-
 irregular. *Juniperus sabina* L. var. *sabina* (Fig. 11H)
- 22(19). Seeds: up to 5 mm long; [2–4.5 mm wide]; [female cones: 5–8 mm long]; branchlets:
 up to 1 mm wide; bark: divided in plates (Fig. 9H)
 *Juniperus sabina* L. var. *sabina* (Fig. 11H)
 Seeds: more than 5 mm long; [4–6 mm wide]; [female cones: 6–10 mm long];
 branchlets: more than 1 mm wide; bark: smooth-scaly (Fig. 9G).
 *Juniperus convallium* REHDER & E.H.WILSON var. *convallium*
- 23(19). Seeds: with conspicuous hilum (Fig. 5I, S; 6M: arrow) 24
 Seeds: without conspicuous hilum (Fig. 5M, N).
 *Juniperus sabina* L. var. *sabina* (Fig. 11H)

- 24(23). Seeds: up to 3 mm wide 25
 Seeds: more than 3 mm wide 26
- 25(24). Seeds: up to 4 mm long; branchlets: long (Fig. 11F); female cones: maturity after the first year *Juniperus blancoi* MARTÍNEZ var. *mucronata* (R.P.ADAMS) FARJON
 Seeds: more than 4 mm long; branchlets: short (Fig. 11E); female cones: maturity after the second year *Juniperus scopulorum* SARG.
- 26(24). Branchlets: short (Fig. 11E); female cones: maturity after the second year
 *Juniperus scopulorum* SARG.
 Branchlets: long (Fig. 11F); female cones: maturity after the first year
 *Juniperus blancoi* MARTÍNEZ var. *blancoi*
- 27(10). Female cones: whitish beneath whitish-glaucous coating
 *Juniperus sabina* L. var. *sabina* (Fig. 11H)
 Female cones: light blue – blue-green beneath glaucous coating 28
 Female cones: reddish-yellow – reddish-brown beneath glaucous coating 29
 Female cones: dark blue – black beneath glaucous coating 31
- 28(27). Female cones: 2-lobed or depressed-globose; bark: peeling off in strands (Fig. 9I);
 crown: columnar-narrowly or widely conical
 *Juniperus barbadensis* L. var. *barbadensis*
 Female cones: globose or ovoid; bark: divided in plates (Fig. 9H); crown: globose-irregular
 *Juniperus sabina* L. var. *sabina* (Fig. 11H)
- 29(27). Scale leaves: bright green 30
 Scale leaves: dark green *Juniperus sabina* L. var. *sabina* (Fig. 11H)
 Scale leaves: bluish *Juniperus gracilior* PILG. var. *ekmanii* (FLORIN) R.P.ADAMS
- 30(29). Female cones: peduncle straight (Fig. 11G); up to 5 mm long; [2-lobed – depressed globose – globose]; scale leaves: tip curved outwards (Fig. 11I: arrow); branchlets: long (Fig. 11F); branches: drooping; crown: rather open
 *Juniperus gracilior* PILG. var. *gracilior*
 Female cones: peduncle curved (Fig. 11H); more than 5 mm long; [globose or ovoid]; scale leaves: tip incurved (Fig. 11J: arrows); branchlets: short (Fig. 11E); branches: horizontal; crown: dense
 *Juniperus sabina* L. var. *sabina* (Fig. 11H)
- 31(27). Seeds: with conspicuous hilum (Fig. 5I, S; 6M: arrow); [female cones: 2-lobed or depressed globose or globose]; crown: rather open *Juniperus scopulorum* SARG.
 Seeds: without conspicuous hilum (Fig. 5M, N); [female cones: globose or ovoid]; crown: dense *Juniperus sabina* L. var. *sabina* (Fig. 11H)
- 32(9). Scale leaves: bright green; female cones: up to 7 mm wide and long; crown: rather open
 *Juniperus procera* HOCHST. ex ENDL.
 Scale leaves: dark green; female cones: more than 7 mm wide and long; crown: dense
 *Juniperus thurifera* L. (Fig. 10O; 11G)
- 33(8). Female cones: whitish beneath whitish-glaucous coating
 *Juniperus sabina* L. var. *sabina* (Fig. 11H)
 Female cones: light blue – blue-green beneath glaucous coating 34
 Female cones: reddish-yellow – reddish-brown beneath glaucous coating 35
 Female cones: dark blue – black beneath glaucous coating 37

- 34(33). Female cones: young ones only green; globose or ovoid; [scale leaves: 1–2.5 mm long]; bark: divided in plates (Fig. 9H); crown: dense
Juniperus sabina L. var. *sabina* (Fig. 11H)
 Female cones: young ones green with bluish coating; 2-lobed or depressed globose; [scale leaves: 0.7–1.3 mm long]; bark: peeling off in strands (Fig. 9I); crown: rather open
Juniperus barbadensis L. var. *lucayana* (BRITTON) R.P.ADAMS
- 35(33). Scale leaves: tip curved outwards (Fig. 11I: arrow); [0.8–1.5 mm long]; crown: rather open 36
 Scale leaves: tip incurved (Fig. 11J: arrows); [1–2.5 mm long]; crown: dense
Juniperus sabina L. var. *sabina* (Fig. 11H)
- 36(35). Scale leaves: with conspicuous glands (Fig. 10P: arrow); [female cones: globose]; [4–7 mm long]; crown: procumbent.
Juniperus gracilior PILG. var. *urbaniana* (PILG. & EKMAN) R.P.ADAMS
 Scale leaves: with inconspicuous or without glands (Fig. 11A); [female cones: 2-lobed – depressed globose – globose]; [4–5 mm long]; crown: columnar-narrowly – widely conical – globose-irregular
Juniperus gracilior PILG. var. *gracilior*
- 37(33). Seeds: with conspicuous hilum (Fig. 5I, S; 6M: arrow); [female cones: 2-lobed or depressed globose or globose]; crown: rather open
Juniperus scopulorum SARG.
 Seeds: without conspicuous hilum (Fig. 5M, N); [female cones: globose or ovoid]; crown: dense
Juniperus sabina L. var. *sabina* (Fig. 11H)
- 38(3). Female cone scales: umbo present (Fig. 5E, F: arrow) 39
 Female cone scales: umbo absent (Fig. 7G) 47
- 39(38). Scale leaves: bright green 40
 Scale leaves: dark green 44
 Scale leaves: bluish 46
- 40(39). Seeds: thin (Fig. 7F) *Juniperus semiglobosa* REGEL
 Seeds: thick (Fig. 7E). 41
- 41(40). Female cones: fleshy after maturity 42
 Female cones: leathery after maturity
Juniperus excelsa M.-BIEB. subsp. *polycarpus* (K.KOCH) TAKHT.
- 42(41). Seeds: up to 5 mm wide; branchlets: up to 1 mm wide; slender (Fig. 11F); scale leaves: up to 2 mm long 43
 Seeds: more than 5 mm wide; branchlets: more than 1 mm wide; stout (Fig. 11E); scale leaves: more than 2 mm long
Juniperus foetidissima WILLD.
- 43(42). Seeds: tubercled (Fig. 8K: arrows); female cones: more than 8 mm long
Juniperus excelsa M.-BIEB. subsp. *excelsa*
 Seeds: not tubercled (Fig. 11K); female cones: up to 8 mm long
Juniperus procera HOCHST. ex ENDL.
- 44(39). Scale leaves: tip blunt (Fig. 11C: arrow) *Juniperus chinensis* L. var. *chinensis*
 Scale leaves: tip acute (Fig. 11D: arrow) 45

- 45(44). Branchlets: arranged 3-dimensionally (Fig. 8D); short (Fig. 11E); stout (Fig. 11E); female cones: up to 7 mm long; plant: procumbent shrub *Juniperus horizontalis* MOENCH
 Branchlets: arranged in one plane (Fig. 8E); long (Fig. 11F); slender (Fig. 11F); female cones: more than 7 mm long; plant: erect tree. *Juniperus thurifera* L. (Fig. 100; 11G)
- 46(39). Seeds: thin (Fig. 7F); female cone scales: umbo near the apex (Fig. 7I, J: arrow); [seeds: 3–7 mm long]; plant: erect tree *Juniperus semiglobosa* REGEL
 Seeds: thick (Fig. 7E); female cone scales: umbo more or less in the center (Fig. 7K: arrow); [seeds: 4–5 mm long]; plant: procumbent shrub *Juniperus horizontalis* MOENCH
- 47(38). Scale leaves: tip blunt (Fig. 11C: arrow) 48
 Scale leaves: tip acute (Fig. 11D: arrow) 50
- 48(47). Female cones: peduncle straight (Fig. 11G); branchlets: stout (Fig. 11E).
 *Juniperus chinensis* L. var. *sargentii* A.HENRY [= *Juniperus sargentii* (A.HENRY) TAKEDA ex NAKAI] (Fig. 11J)
 Female cones: peduncle curved (Fig. 11H); branchlets: slender (Fig. 11F). 49
- 49(48). Branchlets: up to 1 mm wide; crown: globose-irregular; dense plant: procumbent
 *Juniperus sabina* L. var. *sabina* (Fig. 11H)
 Branchlets: more than 1 mm wide; crown: columnar–narrowly/widely conical; rather open *Juniperus sabina* L. var. *arenaria* (E.H.WILSON) FARJON
- 50(47). Seeds: tubercled (Fig. 8K: arrows). 51
 Seeds: not tubercled (Fig. 11K). 54
- 51(50). Scale leaves: tip curved outwards (Fig. 11I: arrow). 52
 Scale leaves: tip incurved (Fig. 11J: arrows). 53
- 52(51). Seeds: up to 7 mm long; female cones: up to 8 mm long; crown: dense; plant: procumbent shrub; dioecious *Juniperus horizontalis* MOENCH
 Seeds: more than 7 mm long; female cones: more than 8 mm long; crown: rather open; plant: erect tree; monoecious *Juniperus przewalskii* KOM.
- 53(51). Branchlets: slender (Fig. 11F); bark: divided in plates (Fig. 9H).
 *Juniperus sabina* L. var. *sabina* (Fig. 11H)
 Branchlets: stout (Fig. 11E); bark: smooth–scaly (Fig. 9G).
 *Juniperus horizontalis* MOENCH
- 54(50). Branchlets: short (Fig. 11E); stout (Fig. 11E) *Juniperus horizontalis* MOENCH
 Branchlets: long (Fig. 11F); slender (Fig. 11F)
 *Juniperus sabina* L. var. *davurica* (PALL.) FARJON (Fig. 10P)
- 55(2). Branchlets: up to 0.5 mm wide *Juniperus scopulorum* SARG.
 Branchlets: between 0.5 and 1 mm wide 56
 Branchlets: between 1 and 1.5 mm wide 58
 Branchlets: more than 1.5 wide 61

- 56(55). Female cones: light blue – blue-green beneath glaucous coating; [3–6 mm wide]; branchlets: long (Fig. 11F) 57
 Female cones: dark blue – black beneath glaucous coating; [4–9 mm wide]; branchlets: short (Fig. 11E) *Juniperus scopulorum* SARG.
- 57(56). Scale leaves: bright green; female cones: up to 4.5 mm wide; crown: rather open
 *Juniperus virginiana* L. var. *silicicola* (SMALL) E.MURRAY [= *Juniperus silicicola* (SMALL) L.H.BAILEY]
 Scale leaves: dark green or bluish; female cones: more than 4.5 mm wide; crown: dense *Juniperus virginiana* L. var. *virginiana*
- 58(55). Leaves: adult plants with scale leaves only (Fig. 8D, E) 59
 Leaves: adult plants with scale and needle leaves (Fig. 9D) 60
- 59(58). Female cones: up to 9 mm long; 2-lobed – depressed globose – globose; seeds: up to 5 mm wide and long *Juniperus scopulorum* SARG.
 Female cones: more than 9 mm long; ovoid – oblong; seeds: more than 5 mm wide and long *Juniperus chengii* L.K.FU & Y.F.YU
- 60(58). Scale leaves: tip blunt (Fig. 11C: arrow); tip incurved (Fig. 11J: arrows); seeds: 2–5 per cone; up to 5 mm wide; up to 6 mm long; plant: procumbent shrub; dioecious
 *Juniperus chinensis* L. var. *tsukusiensis* (MASAM.) MASAM.
 Scale leaves: tip acute (Fig. 11D: arrow); tip curved outwards (Fig. 11I: arrow); seeds: 1 per cone; more than 5 mm wide; more than 6 mm long; plant: erect tree; monoecious *Juniperus przewalskii* KOM.
- 61(55). Female cones: up to 9 mm long; 2-lobed – depressed globose – globose; seeds: up to 5 mm wide and long *Juniperus scopulorum* SARG.
 Female cones: more than 9 mm long; ovoid – oblong; seeds: more than 5 mm wide and long *Juniperus chengii* L.K.FU & Y.F.YU
- 62(1). Scale leaves: dorsal side rounded (branchlets: often roundish) 63
 Scale leaves: dorsal side keeled (branchlets: square-edged) 94
- 63(62). Scale leaves: with white resin (Fig. 1N; 8J: arrows) 64
 Scale leaves: without white resin (Fig. 1A, C, P) but sometimes resinous 70
- 64(63). Leaves: adult plants with scale leaves only (Fig. 8D, E) 65
 Leaves: adult plants with scale and needle leaves (Fig. 9D)
 *Juniperus flaccida* SCHLTDL. var. *martinezii* (PÉREZ DE LA ROSA) SILBA
- 65(64). Female cones: reddish-yellow – reddish-brown beneath glaucous coating
 *Juniperus monosperma* (ENGELM.) SARG.
 Female cones: dark blue – black beneath glaucous coating 66
- 66(65). Female cones: peduncle straight (Fig. 11G) 67
 Female cones: peduncle curved (Fig. 11H) 69
- 67(66). Female cones: ovoid – oblong; branchlets: short (Fig. 11E); stout (Fig. 11E); [0.5–2 mm wide] 68
 Female cones: globose; branchlets: long (Fig. 11F); slender (Fig. 11F); [0.5–1 mm wide] *Juniperus comitana* MARTÍNEZ

after HOLMGREN 1972 and BARTEL & GRIFFIN 1993

- 68(67). [Female cones: 5–9 mm long and wide; scale leaves: arranged generally in whorls of 3, 6-ranked; plants: generally dioecious; bark: red-brown; cotyledons: 2–4]
 *Juniperus occidentalis* HOOK. var. *australis* (VASEK) A.H. & N.H.HOLMGREN
 [Female cones: 7–12 mm long and wide; scale leaves: arranged oppositely, 4-ranked or in whorls of 3, 6-ranked; plants: generally monoecious; bark: brown; cotyledons: generally 2]. *Juniperus occidentalis* HOOK. var. *occidentalis*
- 69(66). Scale leaves: tip blunt (Fig. 11C: arrow); 0.6–1 mm wide; seeds: dark brown – black; 3–6 per cone; [2.5–3.7 mm wide]; branchlets: short (Fig. 11E); stout (Fig. 11E); more than 1 mm wide *Juniperus standleyi* STEYERM.
 Scale leaves: tip acute (Fig. 11D: arrow); 1.1–1.5 mm wide; seeds: light – medium brown; 1–2 per cone; [3–5 mm wide]; branchlets: long (Fig. 11F); slender (Fig. 11F); up to 1 mm wide *Juniperus comitana* MARTÍNEZ
- 70(63). Female cones: without coating (Fig. 5F) 71
 Female cones: with coating (Fig. 5E) 75
- 71(70). Scale leaves: with conspicuous glands (Fig. 10P: arrow) 72
 Scale leaves: with inconspicuous or without glands (Fig. 11A).
 *Juniperus saltuaria* REHDER & E.H.WILSON
- 72(71). Seeds: more than 2 per cone; [branchlets: 0.8–1.2 mm wide]; branches: horizontal; bark: furrowed; brown 73
 Seeds: up to 2 per cone; [branchlets: 1–1.5 mm wide]; branches: ascending; bark: smooth-scaly (Fig. 9G); grey 74
- 73(72). Scale leaves: tip blunt (Fig. 11C: arrow); [female cones: ovoid–oblong]; [6–10 mm wide]; plant: erect *Juniperus phoenicea* L. subsp. *phoenicea* (Fig. 10)
 Scale leaves: tip acute (Fig. 11D: arrow); [female cones: ovoid]; [7–14 mm wide]; plant: procumbent . . . *Juniperus phoenicea* L. subsp. *turbinata* (GUSS.) NYMAN (Fig. 9D)
- 74(72). Seeds: up to 5 mm long; up to 4 mm wide; [female cones: 5–7 mm long]; branchlets: long (Fig. 11F). *Juniperus convallium* REHDER & E.H.WILSON var. *microsperma* (W.C.CHENG & L.K.FU) SILBA
 Seeds: more than 5 mm long; more than 4 mm wide; [female cones: 6–10 mm long]; branchlets: short (Fig. 11E)
 *Juniperus convallium* REHDER & E.H.WILSON var. *convallium*
- 75(70). Leaves: adult plants with scale leaves only (Fig. 8D, E) 76
 Leaves: adult plants with scale and needle leaves (Fig. 9D). 92
- 76(75). Female cones: arranged oppositely. 77
 Female cones: arranged in whorls of 3 *Juniperus californica* CARRIÈRE
- 77(76). Scale leaves: up to 0.5 mm wide *Juniperus gamboana* MARTÍNEZ
 Scale leaves: between 0.5 and 1 mm wide 78
 Scale leaves: between 1 and 1.5 mm wide 89
 Scale leaves: more than 1.5 mm wide *Juniperus saltillensis* M.T.HALL

- 78(77). Scale leaves: with conspicuous white resin (Fig. 1N; 8J: arrows) *Juniperus standleyi* STEYERM.

 Scale leaves: with conspicuous glands (Fig. 10P: arrow) 79
 Scale leaves: with inconspicuous or without glands (Fig. 11A). 88
- 79(78). Female cones: whitish beneath whitish-glaucous coating *Juniperus indica* BERTOL.
 Female cones: light blue – blue-green beneath glaucous coating
 *Juniperus indica* BERTOL.
 Female cones: reddish-yellow – reddish-brown beneath glaucous coating 80
 Female cones: dark blue – black beneath glaucous coating 86
- 80(79). Seeds: up to 2 mm wide *Juniperus jaliscana* MARTÍNEZ
 Seeds: between 2 and 3 mm wide 81
 Seeds: between 3 and 4 mm wide 83
 Seeds: between 4 and 5 mm wide 85
 Seeds: more than 5 mm wide
 *Juniperus convallium* REHDER & E.H.WILSON var. *convallium*
- 81(80). Seeds: with conspicuous hilum (Fig. 5I, S; 6M: arrow); [1–11 per cone]; branchlets:
 long (Fig. 11F); bark: furrowed or peeling off in strands (Fig. 9I) 82
 Seeds: without conspicuous hilum (Fig. 5M, N); [1 per cone]; branchlets: short (Fig.
 11E); bark: smooth-scaly (Fig. 9G) *Juniperus convallium*
 REHDER & E.H.WILSON var. *microsperma* (W.C.CHENG & L.K.FU) SILBA
- 82(81). Female cones: up to 6 mm wide; [seeds: 1–4 per cone]; [6–7 mm long]; [scale
 leaves: 0.7–2 mm long]; branchlets: stout (Fig. 11E); crown: rather open
 *Juniperus durangensis* MARTÍNEZ
 Female cones: more than 6 mm wide; [seeds: 2–11 per cone]; [6–10 mm long]; [scale
 leaves: 0.7–1 mm long]; branchlets: slender (Fig. 11F); crown: dense
 *Juniperus jaliscana* MARTÍNEZ
- 83(80). Seeds: with conspicuous hilum (Fig. 5I, S; 6M: arrow)
 *Juniperus gamboana* MARTÍNEZ
 Seeds: without conspicuous hilum (Fig. 5M, N). 84
- 84(83). Seeds: thin (Fig. 7F); more than 5 mm long; [female cones: 6–13 mm long];
 [5–9 mm wide]; branchlets: stout (Fig. 11E); short (Fig. 11E); bark: brown.
 *Juniperus indica* BERTOL.
 Seeds: thick (Fig. 7E); up to 5 mm long; [female cones: 5–7 mm long]; [4–6 mm
 wide]; branchlets: slender (Fig. 11F); long (Fig. 11F); bark: grey *Juniperus*
convallium REHDER & E.H.WILSON var. *microsperma* (W.C.CHENG & L.K.FU) SILBA
- 85(80). Seeds: thin (Fig. 7F); not tubercled (Fig. 11K). *Juniperus indica* BERTOL.
 Seeds: thick (Fig. 7E); tubercled (Fig. 8K: arrows)
 *Juniperus convallium* REHDER & E.H.WILSON var. *convallium*
- 86(79). Seeds: thin (Fig. 7F); [1–2 per cone]; more than 5 mm long *Juniperus indica* BERTOL.
 Seeds: thick (Fig. 7E); [2–9 per cone]; up to 5 mm long 87
- 87(86). Seeds: light – medium brown; female cones: 8 cone scales per cone; branchlets: long
 (Fig. 11F). *Juniperus monticola* MARTÍNEZ
 Seeds: dark brown–black; female cones: 2–6 cone scales per cone; branchlets: short
 (Fig. 11E). *Juniperus standleyi* STEYERM.

- 88(78). Scale leaves: tip blunt (Fig. 11C: arrow); female cones: peduncle curved (Fig. 11H); dark blue – black beneath glaucous coating; more than 6 mm wide; [seeds: 3–6 per cone]; branchlets: stout (Fig. 11E) *Juniperus standleyi* STEYERM.
Scale leaves: tip acute (Fig. 11D: arrow); female cones: peduncle straight (Fig. 11G); reddish-yellow – reddish-brown beneath glaucous coating; up to 6 mm wide; [seeds: 1–3 per cone]; branchlets: slender (Fig. 11F) *Juniperus angosturana* R.P.ADAMS
- 89(77). Seeds: tubercled (Fig. 8K: arrows) 90
Seeds: not tubercled (Fig. 11K) 91
- 90(89). Scale leaves: tip blunt (Fig. 11C: arrow); seeds: dark brown – black; [4–5 mm long]; branchlets: stout (Fig. 11E); short (Fig. 11E) *Juniperus saltillensis* M.T.HALL
Scale leaves: tip acute (Fig. 11D: arrow); seeds: light – medium brown; [4–7 mm long]; branchlets: slender (Fig. 11F); long (Fig. 11F) *Juniperus comitana* MARTÍNEZ
- 91(89). Seeds: thin (Fig. 7F); without conspicuous hilum (Fig. 5M, N); more than 5 mm long; more than 3 mm wide; [1–2 per cone]; female cones: 3–5 cone scales per cone; branchlets: short (Fig. 11E) *Juniperus indica* BERTOL.
Seeds: thick (Fig. 7E); with conspicuous hilum (Fig. 5I, S; 6M: arrow); up to 5 mm long; up to 3 mm wide; [2–9 per cone]; female cones: 8 cone scales per cone; branchlets: long (Fig. 11F) *Juniperus monticola* MARTÍNEZ
- 92(75). Female cone scales: umbo present (Fig. 5E, F: arrow); seeds: thick (Fig. 7E); 4–13 per cone; scale leaves: apex curved outwards (Fig. 11I: arrow); female cones: reddish or light; [8–20 mm wide]; branchlets: slender (Fig. 11F); long (Fig. 11F); branches: horizontal or drooping 93
Female cone scales: umbo absent (Fig. 7G); seeds: thin (Fig. 7F); 1–2 per cone; scale leaves: apex incurved (Fig. 11J: arrows); female cones: bluish or dark; [5–9 mm wide]; branchlets: stout (Fig. 11E); short (Fig. 11E); branches: ascending
. *Juniperus indica* BERTOL.
- 93(92). Seeds: up to 5 mm wide *Juniperus flaccida* SCHLTDL. var. *poblana* MARTÍNEZ
Seeds: more than 5 mm wide *Juniperus flaccida* SCHLTDL. var. *flaccida*
- 94(62). Female cones: fleshy after maturity 95
Female cones: leathery after maturity 113
- 95(94). Scale leaves: tip curved outwards (Fig. 11I: arrow) 96
Scale leaves: tip incurved (Fig. 11J: arrows) 103
- 96(95). Seeds: tubercled (Fig. 8K: arrows) 97
Seeds: not tubercled (Fig. 11K) 99
- 97(96). Female cones: without coating (Fig. 5F) *Juniperus pinchotii* SUDW.
Female cones: with coating (Fig. 5E) 98
- 98(97). Seeds: up to 3 mm wide *Juniperus monosperma* (ENGELM.) SARG.
Seeds: more than 3 mm wide *Juniperus coahuilensis*
(MARTÍNEZ) GAUSSEN ex R.P.ADAMS var. *arizonica* R.P.ADAMS
- 99(96). Female cones: peduncle straight (Fig. 11G); seeds: thick (Fig. 7E) 100
Female cones: peduncle curved (Fig. 11H); seeds: thin (Fig. 7F)
. *Juniperus pseudosabina* FISCH. & C.A.MEY.

- 100(99). Scale leaves: with white resin (Fig. 1N; 8J: arrows); branchlets: stout (Fig. 11E) . . . 101
 Scale leaves: without white resin (Fig. 1A, C, P); branchlets: slender (Fig. 11F) . . .
 102
- (101 after ADAMS 1994, changed)
- 101(100). Needle leaf (whip leaf) glands about half as long as the sheath; [female cones:
 6–7 mm wide] *Juniperus coahuilensis* (MARTÍNEZ)
 GAUSSEN ex R.P.ADAMS var. *arizonica* R. P. ADAMS
 Needle leaf (whip leaf) glands two-thirds as long as the sheath; [female cones:
 4–7 mm wide] *Juniperus coahuilensis* (MARTÍNEZ)
 GAUSSEN ex R.P.ADAMS var. *coahuilensis*
- 102(100). Female cones: up to 2 cone scale whorls per cone; up to 8 mm long; up to 7 mm
 wide seeds: up to 5 mm long; up to 3 mm wide
 *Juniperus angosturana* R.P.ADAMS
 Female cones: 3–4 cone scale whorls per cone; more than 8 mm long; more than
 7 mm wide seeds: more than 5 mm long; more than 3 mm wide
 *Juniperus deppeana* STEUD. var. *pachyphlaea* (TORR.) MARTÍNEZ
- 103(95). Seeds: thin (Fig. 7F). 104
 Seeds: thick (Fig. 7E). 105
- 104(103). Female cones: peduncle straight (Fig. 11G); [6–10 mm long]; branchlets: slender
 (Fig. 11F); long (Fig. 11F); bark: peeling off in strands (Fig. 9I); crown: rather
 open *Juniperus ashei* J.BUCHHOLZ (Fig. 11D)
 Female cones: peduncle curved (Fig. 11H); [7–17 mm long]; branchlets: stout
 (Fig. 11E); short (Fig. 11E); bark: smooth or scaly (Fig. 9G); crown: dense
 *Juniperus pseudosabina* FISCH. & C.A.MEY.
- 105(103). Female cones: depressed-globose. 106
 Female cones: globose 108
 Female cones: ovoid 112
 Female cones: oblong. *Juniperus chengii* L.K.FU & Y.F.YU
- 106(105). Female cones: whitish beneath whitish-glaucous coating; [13–20 mm wide]
 *Juniperus deppeana* STEUD. var. *zacatecensis* MARTÍNEZ
 Female cones: reddish-yellow – reddish-brown beneath glaucous coating;
 [8–15 mm wide]. 107
- 107(106). Branches: ascending or horizontal; [female cones: 10–15 mm long]
 *Juniperus deppeana* STEUD. var. *robusta* MARTÍNEZ
 Branches: drooping; [female cones: 8–13 mm long]
 *Juniperus deppeana* STEUD. var. *sperry* CORRELL
- 108(105). Female cone scales: umbo more or less in the center (Fig. 7K: arrow). 109
 Female cone scales: umbo near the apex (Fig. 7I, J: arrow) 111
- 109(108). Female cones: whitish beneath whitish-glaucous coating; [13–20 mm wide]
 *Juniperus deppeana* STEUD. var. *zacatecensis* MARTÍNEZ
 Female cones: reddish-yellow – reddish-brown beneath glaucous coating; [2–15 mm
 wide]. 110

- 110(109). Female cones: up to 2 cone scale whorls per cone; up to 9 mm long; up to 7 mm wide; seeds: up to 5 mm wide and long; branchlets: short (Fig. 11E)
 *Juniperus angosturana* R.P.ADAMS
 Female cones: 3–4 cone scale whorls per cone; more than 9 mm long; more than 7 mm wide; seeds: more than 5 mm wide and long; branchlets: long (Fig. 11F)
 *Juniperus deppeana* STEUD. var. *robusta* MARTÍNEZ
- 111(108). Seeds: up to 3 mm wide; [3.5–4.5 mm long]; [female cones: 2–6 mm wide]; scale leaves: up to 0.9 mm wide; branchlets: short (Fig. 11E); crown: dense
 *Juniperus angosturana* R.P.ADAMS
 Seeds: more than 3 mm wide; [4–6 mm long]; [female cones: 5–10 mm wide]; scale leaves: more than 0.9 mm wide; branchlets: long (Fig. 11F); crown: rather open
 *Juniperus ashei* J.BUCHHOLZ
- 112(105). Seeds: up to 3 mm wide; [3.5–4.5 mm long]; [female cones: 3–8 mm long]; [scale leaves: 0.6–0.8 mm wide] *Juniperus angosturana* R.P.ADAMS
 Seeds: between 3 and 6 mm wide; [4–6 mm long]; [female cones: 6–10 mm long]; [scale leaves: 1–1.5 mm wide] *Juniperus ashei* J.BUCHHOLZ
 Seeds: more than 6 mm wide; [8–10 mm long]; [female cones: 9–11 mm long]; [scale leaves: 0.5–1.2 mm wide] *Juniperus chengii* L.K.FU & Y.F.YU
- 113(94). Scale leaves: with white resin (Fig. 1N; 8J: arrows). 114
 Scale leaves: without white resin (Fig. 1A, C, P) but sometimes resinous. 115
- 114(113). Female cones: depressed-globose – globose; seeds: up to 6 mm wide; up to 7 mm long; branchlets: stout (Fig. 11E) *Juniperus osteosperma* (TORR.) LITTLE
 Female cones: ovoid – oblong; seeds: more than 6 mm wide; more than 7 mm long; branchlets: slender (Fig. 11F) *Juniperus chengii* L.K.FU & Y.F.YU
- 115(113). Female cones: depressed-globose. *Juniperus deppeana* STEUD. var. *deppeana*
 Female cones: globose 116
 Female cones: ovoid 117
 Female cones: oblong. *Juniperus chengii* L.K.FU & Y.F.YU
- 116(115). Seeds: up to 6 mm long; [female cones: 5–10 mm wide]; scale leaves: more than 0.9 mm wide; branchlets: short (Fig. 11E); bark: peeling off in strands (Fig. 9I)
 *Juniperus ashei* J.BUCHHOLZ
 Seeds: more than 6 mm long; [female cones: 8–15 mm wide]; scale leaves: up to 0.9 mm wide; branchlets: long (Fig. 11F); bark: smooth or scaly (Fig. 9G) or furrowed or divided in plates (Fig. 9H) *Juniperus deppeana* STEUD. var. *deppeana*
- 117(115). Seeds: up to 7 mm long; up to 5 mm wide *Juniperus ashei* J.BUCHHOLZ
 Seeds: more than 7 mm long; more than 5 mm wide
 *Juniperus chengii* L.K.FU & Y.F.YU

***Libocedrus* ENDL.**

(5 species)

1. Leaves: facial and lateral leaves more or less equal respectively the length (Fig. 2S) 2
 Leaves: facial and lateral leaves conspicuous unequal respectively the length (Fig. 2T) 5

- 2(1). Branchlets: upper side and lower side different 3
 Branchlets: no difference between upper side and lower side 4
- 3(2). Lateral leaves: up to 3 mm long; [scale leaves: 0.5–3.5 mm long]
 *Libocedrus bidwillii* HOOK.f. (Fig. 2S; 5C; 6L)
 Lateral leaves: more than 3 mm long; [scale leaves: 2–10 mm long]
 *Libocedrus yateensis* GUILLAUMIN
- 4(2). Seed wings: up to 2.5 mm wide; [scale leaves: 2–9 mm long; female cones: 10–17 mm
 long] *Libocedrus chevalieri* J.BUCHHOLZ
 Seed wings: more than 2.5 mm wide; [scale leaves: 0.5–3.5 mm long; female cones:
 5–12 mm long] *Libocedrus bidwillii* HOOK.f. (Fig. 2S; 5C; 6L)
- 5(1). Facial leaves: dorsal surface conspicuous keeled
 *Libocedrus austrocaledonica* BRONGN. & GRIS.
 Facial leaves: dorsal surface not keeled 6
- 6(5). Lateral leaves: touch each other (Fig. 2T); [scale leaves: 1–7 mm wide]
 *Libocedrus plumosa* (D.DON) SARG. (Fig. 2R)
 Lateral leaves: not touch each other (Fig. 2U); [scale leaves: 0.5–2 mm wide].
 *Libocedrus yateensis* GUILLAUMIN

***Papuacedrus* H.L.LI**

(2 taxa = 1 species + 1 variety, key after JOHNS 1995): Two varieties are recognized, differing strongly in their juvenile leaves; some intermediates exist, especially at higher altitudes. Collections from older plants cannot be distinguished.

1. Lateral leaves: up to 3 mm long if the plant has not a considerable age. (Apex of lateral leaves first spreading but soon constricted to the base of the following facial leaves. Leaves expanded outwards by up to 3 mm the base and the tips of lateral leaves)
 *Papuacedrus papuana* (F.MUELL.) H.L.LI var. *arfakensis* (GIBBS)
 R.J.JOHNS [= *Libocedrus arfakensis* GIBBS] (Fig. 2P)
 Lateral leaves: more than 3 mm long if the plant has not a considerable age. (Apex of lateral leaves becoming widely spreading on young plants up to 6 mm from stem, often falcately bent outwards but the tip always turned upwards, up to 13 mm from the base to the tip) *Papuacedrus papuana* (F.MUELL.) H.L.LI
 var. *papuana* [= *Libocedrus papuana* F.MUELL.] (Fig. 2O)

***Taxodium* RICH.**

(3 taxa = 2 species + 1 variety; key after LUNDELL 1955 modified)

1. Leaves: needle-like (awl-shaped: rounded in cross-section) (Fig. 1E); needle leaves: in 3 rows (Fig. 1E); appressed (Fig. 1E)
 *Taxodium distichum* (L.) RICH. var. *imbricatum* (NUTT.) CROOM
 [= *Taxodium ascendens* BRONGN.] (Fig. 1E; 10D)
 Leaves: needle-like (linear: flattened in cross-section) (Fig. 1J); needle leaves: in 2 rows, exact in one plane (Fig. 1J); spreading (Fig. 1J) 2

- 2(1). Plant: essentially evergreen; branches of male cones long and slender, open, composed of single cones or tight cluster of several cones (Fig. 11B); plant without knees
 *Taxodium mucronatum* TEN. (Fig. 11B)
 Plant: deciduous; branches with male cones short and crowded, the cones commonly in short compact secondary branches (Fig. 10D); plant with knees.
 *Taxodium distichum* (L.) RICH. var. *distichum* (Fig. 1J; 4E; 6N; 7D; 10D)

***Thuja* L.**

(5 species)

1. Female cones: up to 4 mm wide; scale leaves up to 1.5 mm wide; facial leaves: with furrow on dorsal side *Thuja sutchuenensis* FRANCH.
 Female cones: more than 4 mm wide; scale leaves: more than 1.5 mm wide; facial leaves: without furrow on dorsal side. 2
- 2(1). Branchlets: lower side without white or glaucous marking (Fig. 2L)
 *Thuja occidentalis* L. (Fig. 2L; 5U; 8E)
 Branchlets: lower side with white or glaucous marking (Fig. 2K; M) 3
- 3(2). Branchlets: with snow-white marking about the whole lower face (Fig. 2K)
 *Thuja koraiensis* NAKAI (Fig. 2K; 4P; 5T; 7I)
 Branchlets: with pale-white marking of the lower face only on some spots (Fig. 2M) 4
- 4(3). Scale leaves: tip on leading shoot acuminate; facial leaves: with oval resin glands or without *Thuja plicata* DONN ex D.DON (Fig. 2M, 5V)
 Scale leaves: tip on leading shoots blunt or acute; facial leaves: with oblong resin glands
 *Thuja standishii* (GORDON) CARRIÈRE

***Thujopsis* SIEBOLD & ZUCC. ex ENDL.**

(2 taxa = 1 species + 1 variety)

1. Lateral leaves: tip blunt; female cone scales: not thickened at the apex
 *Thujopsis dolabrata* (THUNB. ex L.f.) SIEBOLD & ZUCC. var. *hondai* MAKINO
 Lateral leaves: tip acute; female cone scales: thickened at the apex.
 *Thujopsis dolabrata* (THUNB. ex L.f.) SIEBOLD & ZUCC. var. *dolabrata* (Fig. 2N; 6C)

***Widdringtonia* ENDL.**

(4 species)

1. Female cones: edge of female cone scales warty and rough 2
 Female cones: edge of female cone scales smooth or slightly wrinkled, not warty. 3
- 2(1). Seeds: 3-cornered; up to 8 per cone; seeds wings: absent, only small ribs
 *Widdringtonia cedarbergensis* J.A.MARSH
 Seeds: rather flattened; more than 8 per cone; seeds wings: conspicuous
 *Widdringtonia schwarzii* (MARLOTH) MAST. (Fig. 6B; 7C)

- 3(1). Length of ultimate branchlets from tip to first node: more than 11 mm; [female cones: up to 8 per cluster; 9–16 mm wide (closed cone); 9–18 mm long; seeds: 2–19 per cone] *Widdringtonia whytei* RENDLE
 Length of ultimate branchlets from tip to first node: up to 11 mm; [female cones: up to 48 per cluster; 14–24 mm wide (closed cone); 14–24 mm long; seeds: 2–32 per cone] *Widdringtonia nodiflora* (L.) POWRIE (Fig. 1A, P; 4Q; 5S)

Acknowledgements

We wish to thank the directors and the staffs of botanical gardens in Bayreuth, Berlin, Bochum, Dortmund, Düsseldorf, Bonn, Frankfurt (Main), Halle (Saale), Hamburg, Kew, Leipzig, Mainz, Marburg, München, Münster, Strasbourg and other botanical collects like Essen Grugapark, Palmengarten Frankfurt (Main), Dortmund Rombergpark, Arboretum Güntertal, Arboretum Freiburg, Arboretum Trompenburg, Flora Köln for their kind support in collecting material for the investigation. We also thank Armin Jagel for the informed advice and Sabine Adler for the linguistic support and Nicole Hille, Heike Diekmann, Sabine Adler, Meike Tetzlaff, Veit Dörken, Julia Obermann, Markus Streckenbach, Armin Jagel, Nina Minkley, Thorsten Marx, Michael Markowski, Iris and Marcus Mundry for testing the identification key.

References

- ABRAMS L. R. 1919: A new California cypress. – *Torrey* **19**: 92.
- ADAMS, P. A. 1993: Cupressaceae. – In: P. A. ADAMS, *Flora of North America*, vol. 2: pteridophytes and gymnosperms. – New York.
- ADAMS, R. P. 1994: Geographic variation and systematics of monospermous *Juniperus* (Cupressaceae) from the Chihuahuah Desert based on RAPDs and terpenes. – *Biochem. Syst. Ecol.* **22**(7): 699–710.
- ALLAN, H. H. 1961: Cupressaceae. – In: H. H. ALLAN, *Flora of New Zealand*, vol. I: Indigenous Tracheophyta: Psilopsida, Lycopsida, Filicopsida, Gymnospermae, Dicotyledones. – Wellington.
- ALLAN, H. H. 1982: Cupressaceae. – In: H. H. ALLAN, *Flora of New Zealand*, vol. I: Indigenous Tracheophyta: Psilopsida, Lycopsida, Filicopsida, Gymnospermae, Dicotyledones, 2nd. ed. – Wellington.
- ALVIN, L.; DALBY, D. H. & OLADELE, F. A. 1982: Numerical analysis of cuticular characters in Cupressaceae: 379–396. – In: D. F. CUTLER; K. L. ALVIN & C. E. PRICE (eds.), *The plant cuticle*. – London a. o.
- ANTOINE, F. & KOTSCHY, T. 1854: *Arceuthos* ANTOINE & KOTSCHY. – *Bot. Wochenbl.* **4**(31): 249–250.
- BARTEL, J. A. & GRIFFIN, J. R. 1993: Cupressaceae and Taxodiaceae: 111–114, 122. – In: C. J. HICKMAN (ed.), *The Jepson manual, higher plants of California*. – Berkeley, Los Angeles, London.
- BEADLE, N. C. W.; EVANS, O. D. & CAROLINE, R. C. 1972: *Flora of the Sydney region*. – Sydney.
- BENTHAM, G. & MUELLER, B. F. V. 1967: Coniferae: *Frenela, Actinostrobus, Diselma, Athrotaxis*. – In: G. BENTHAM & B. F. V. MUELLER, *Flora Australiensis: a description of the plants of the Australian territory*, vol. VI. – Amsterdam.
- BERG, O. 1860: Beschreibung einiger neuer Drogen vom Cap. – *Bonplandia* **8**(12): 190–192.
- BLACK, J. M. 1960: Gymnosperms. – In: J. M. BLACK, *Flora of South Australia*, part I: Cyathaceae – Orchidaceae, 2 ed. – Adelaide.
- BOISSIER, P. E. 1863: Cupressineae. – In: P. E. BOISSIER, *Flora Orientalis*, vol. V: Monocotyledonae (Gymnospermae, Acotyledoneae, Vasculares). – Geneve.
- BORATYNSKY, A. & BROWICZ, K. 1983: *Juniperus drupacea* LABILL. in Greece. – *Arbor. Kórnická* **27**: 3–16.
- BORG, J. 1976: Cupressaceae. – In: J. BORG, *Descriptive flora of the Maltese Islands including the ferns and flowering plants*. – Koenigstein.
- BÖCHER, T. W.; FREDSKILD, B.; HOLMEN, K. & JAKOBSEN, K. 1978: Cupressaceae. – In: T. W. BÖCHER, *Grönlands flora*, 3. rev. ed. – København.
- BRITTON, N. L. 1923: Studies of West Indian plants XI. – *Bull. Torrey Bot. Club* **50**: 35–56.
- CAMUS, A. 1926: Un Cyprès nouveau du Tassili. – *Bull. Mus. Hist. Nat. (Paris)* **32**: 101.
- CHAPMAN, J. D. 1961: Some notes on the taxonomy, distribution, ecology and economic importance of *Widdringtonia*, with particular reference to *W. whytei*. – *Kirkia* **1**: 138–154.
- CHENG & FU, L. K. 1975: *Cupressus gigantea*. – *Acta Phytotax. Sin.* **13**(4): 85–86.
- CHOWDHURY, C. R. 1962: The embryogeny of conifers: a review. – *Phytomorphology* **12**: 313–338.
- CHRISTENSEN, K. I. 1986: Cupressaceae. – In: A. STRID (ed.), *Mountain flora of Greece*. – Cambridge, London, New York, New Rochelle, Melbourne, Sydney.

- COATES PALGRAVE, K.; DRUMMOND, R. B.; MOLL, E. J.; COATES PALGRAVE, M.; COATES PALGRAVE, P. & DUGGANT, T. 1983: Cupressaceae (The cypress family). – In: K. COATES PALGRAVE, Trees of Southern Africa, 2. rev. ed. – Cape Town.
- COLLETT, H. 1971: Cupressaceae. – In: H. COLLETT, Flora Simlensis, a handbook of the flowering plants of Simla and the neighbourhood, 3. ed. – Dehra Dun.
- COODE, M. J. E. & CULLEN, J. 1965: Cupressaceae: 76–84. – In: H. P. DAVIS (ed.), Flora of Turkey and the East Aegean Islands. – Edinburgh.
- CORY, V. L. 1936: Three junipers of Western Texas. – *Rhodora* **38**: 182–187.
- CRONIN, L. 1997: Cupressaceae. – In: Australian flora. – Kew, Victoria.
- DALE, I. R. & GREENWAY, P. J. 1961: Cupressaceae. – In: I. R. DALE & P. J. GREENWAY, Kenya trees and shrubs. – Nairobi.
- DALLIMORE, W. 1931: The cypresses. – *Empire Forest J.* **10**: 37–47.
- DALLIMORE, W. & JACKSON, B. A. 1966: A handbook of Coniferae and Ginkgoaceae. – London.
- DALLWITZ, M. J. 1974: A flexible computer program for generating identification keys. – *Syst. Zool.* **23**: 7–50.
- DALLWITZ, M. J. 1980: A general system for coding taxonomic descriptions. – *Taxon* **29**: 6–41.
- DALLWITZ, M. J.; PAINE, T. A. & ZURCHER, E. J. 1993: User's guide to the DELTA System: a general system for processing taxonomic descriptions. – Australia, Division of Entomology, Commonwealth Scientific and Industrial Research Organisation.
- DALLWITZ, M. J.; PAINE, T. A. & ZURCHER, E. J. 1995: User's guide to intkey: a program for interactive identification and information retrieval. – Australia, Division of Entomology, Commonwealth Scientific and Industrial Research Organisation.
- DALLWITZ, M. J.; PAINE, T. A. & ZURCHER, E. J. 1999: User's guide to the DELTA Editor. – Australia, Division of Entomology, Commonwealth Scientific and Industrial Research Organisation.
- DALLWITZ, M. J.; PAINE, T. A. & ZURCHER, E. J. 2000: Principles of interactive keys. – Australia, Division of Entomology, Commonwealth Scientific and Industrial Research Organisation.
- DÜMMER, R. A. 1914: Three conifers. – *J. Bot.* **52**: 236–241.
- EICHLER, A. W.; ENGLER, A. & PRANTL, K. 1889: Coniferae: 84–102. – In: A. ENGLER & K. PRANTL (eds.), Die natürlichen Pflanzenfamilien nebst ihren Gattungen und wichtigeren Arten insbesondere den Nutzpflanzen. – Leipzig.
- ELLIOTT, W. R. & JONES, D. L. 1985: *Callitris*. – In: W. R. ELLIOTT & D. L. JONES, Encyclopaedia of Australian plants suitable for cultivation. – Melbourne, Sydney, Auckland.
- ENGELMANN, G. 1878: The American junipers of the section *Sabina*. – *Trans. Acad. Sci. St. Louis* **3**: 583–592.
- FARJON, A. 1992: The taxonomy of multiseed junipers (*Juniperus* sect. *Sabina*) in Southwest Asia and East Africa (Taxonomic notes on Cupressaceae I). – *Edinb. J. Bot.* **49**(3): 251–283.
- FARJON, A. 2001: Cupressaceae. – In: A. FARJON, World checklist and bibliography of conifers, 2 ed. – Kew.
- FARJON, A. & GARCIA, S. O. 2002: Towards the minimal conifer ontogeny and trends in *Cupressus*, *Juniperus* and *Microbiota* (Cupressaceae s. str.). – *Bot. Jahrb. Syst.* **124**(2): 129–147.
- FARJON, A.; HIEP, N. T.; HARDER, D. K.; LOC, P. K. & AVERYANOW, L. 2002: A new genus and species in Cupressaceae (Coniferales) from Northern Vietnam, *Xanthocyparis vietnamensis*. – *Novon* **12**: 179–189.
- FASSETT, N. C. 1945: *Juniperus virginiana*, *J. horizontalis*, and *J. scopulorum*, V: taxonomic treatment. – *Bull. Torrey Bot. Club* **72**(5): 480–482.
- FLORIN, R. 1930: Die Koniferengattung *Libocedrus* ENDL. in Ostasien. – *Svensk Bot. Tidskr.* **24**(1): 117–131 + Taf. I, II.
- FLORIN, R. 1934: Die von E. L. Ekman in Westindien gesammelten Koniferen. – *Ark. Bot. (Stockholm)* **25A**(5): 1–22 + Taf. I–III.
- FLORIN, R. & BOUTELJE, J. B. 1954: External morphology and epidermal structure of leaves in the genus *Libocedrus*, s. lat. – *Acta Horti Berg.* **17**(2): 7–37 + pl. I–X.
- FRANCO, J. D. A. 1963: Taxonomic notes on *Juniperus oxycedrus* L. and *J. macrocarpa* SM. – *Feddes Repert.* **68**(2): 163–167.
- FRANCO, J. D. A. 1968: On Himalayan-chinese cypresses. – *Portugaliae Acta Biol., Sér. B, Sist.* **9**: 183–195.
- FU, L.; YU, Y. & MILL, R. R. 1999: Taxodiaceae and Cupressaceae. – In: Z.-Y. WU & P.-H. RAVEN (ed.), Flora of China, vol. 4, Cycadaceae through Fagaceae. – Beijing, St. Louis.
- GALBRAITH, J. 1977: Cupressaceae. – In: J. GALBRAITH, A field guide to the wild flowers of South-East Australia. – Sydney, London.
- GARDEN, J. 1957: A revision of the genus *Callitris* VENT. – *Contr. New South Wales Natl. Herb.* **2**: 363–392.
- GARDNER, M. F.; THOMAS, P.; LARA, A. & BENARDO, E. 1999: *Fitzroya cupressoides*. – *Bot. Mag.* **16**(3): 229–240.
- GORDON, G. 1880: The Pinetum: being a synopsis of all the coniferous plants at present known, with

- descriptions, history and synonyms, and a comprehensive systematic index. – London.
- GROSSER, D.; FENGEL, D. & SCHMIDT, H. 1974: Tamrit-Zypresse (*Cupressus dupreziana* A. CAMUS). Beitrag zur Ökologie, Anatomie und Chemie. – Forstwiss. Zbl. **93**(4): 191–207.
- HALL, N.; JOHNSTON, R. D. & CHIPPENDALE, G. M. 1970: *Athrotaxis selaginoides*, *Callitris glauca*, *Callitris intratropica*. – In: N. HALL; R. D. JOHNSTON & G. M. CHIPPENDALE, Forest trees of Australia. – Canberra.
- HALL, M. T. 1971: A new species of *Juniperus* from Mexico. – Fieldiana, Bot. **34**(4): 45–53.
- HANDEL-MAZZETTI, H. 1929: Symbolae sinicae. Botanische Ergebnisse der Expedition der Akademie der Wissenschaften in Wien nach Südwest-China 1914/1918. T. VII Anthophyta, Lief. 1, Gymnospermae: 1–18. – Wien.
- HARDEN, G. J. (ed.) 1990: Cupressaceae: 84–86. – In: G. J. HARDEN, Flora of New South Wales. – Kensington, NSW.
- HEGI, G. 1908: *Juniperus*. – In: G. HEGI, Illustrierte Flora von Mittel-Europa. Mit besonderer Berücksichtigung von Deutschland, Oesterreich und der Schweiz. Zum Gebrauch in den Schulen und zum Selbstunterricht, Band I. – München.
- HENRY, A. 1911: New or noteworthy plants, a new genus of Coniferae. – Gard. Chron. **49**: 66–68.
- HEYWOOD, V. H. & FRANCO, J. A. 1964: XXVII: Taxodiaceae, XXVIII: Cupressaceae: 36–39. – In: T. G. TUTIN; V. H. HEYWOOD; N. A. BURGESS; D. H. VALENTINE. & S. M. WALTERS (eds.), Flora Europaea. Vol. I: Lycopodiaceae-Platanaceae. – Cambridge.
- HIEKE, K. 1989: *Juniperus*. – In: K. HIEKE, Praktische Dendrologie 1. – Berlin.
- HILL, K. D. 1998: Cupressaceae. – In: K. D. HILL, Flora of Australia. Vol. 48: ferns, Gymnosperms and allied groups. – Canberra.
- HOFFMANN, A. E. 1982: Cupressaceae. – In: A. E. HOFFMANN, Flora silvestre de Chile zona australiana. – Santiago.
- HOLLIDAY, I. & HILL, R. 1974: *Callitris columellaris*. – In: I. HOLLIDAY & R. HILL, A field guide to Australian trees, rev. ed. – Adelaide.
- HOLMGREN, A. H. 1972: Cupressaceae: 237–243. – In: A. CRONQUIST, A. H. HOLMGREN; N. H. HOLMGREN & L. L. REVEAL (eds.), Intermountain flora, vascular plants of the Intermountain West, U.S.A., vol. I. – New York, London.
- HORA, F. B. 1981: Cupressaceae. – In: F. B. HORA, Bäume der Welt. – Stuttgart.
- HU S.-Y. 1951: Notes on the flora of China, I. – J. Arnold Arbor. **32**: 390–402 + pl. I.
- HU S. Y. 1964: Notes on the flora of China, IV. – Taiwania **10**: 57.
- JEPSON, W. L. 1922: A new species of cypress. – Madroño **1**(4): 75.
- JESSOP, J. P. 1986: Pinaceae: 105–108. – In: J. P. JESSOP (ed.), Flora of South Australia. – Adelaide.
- JOHNS, R. J. 1983: Cupressaceae. – In: R. J. JOHNS, Common forest trees of Papua New Guinea, part one: the gymnosperms, rev. ed. – Lae.
- JOHNS, R. J. 1995: *Papuacedrus papuana* var. *papuana*. – Bot. Mag. **12**: 66–72.
- JONSELL, B.; KARLSSON, T.; AGESTAM, M.; BYGREN, N.; HULTGARD, U.-M. & PERSSON, E. 2000: Cupressaceae. – In: B. JONSELL, Flora Nordica. Vol. 1: Lycopodiaceae to Polygonaceae. – Stockholm.
- KEARNEY, T. H. & PEEBLES, R. H. 1960: Cupressaceae. – In: T. H. KEARNEY & R. H. PEEBLES, Arizona flora. – Berkeley.
- KERFOOT, O. & LAVRANOS, J. J. 1984: Studies in the flora of Arabia X: *Juniperus phoenicea* L. and *J. excelsa* M.BIEB. – Notes Roy. Bot. Gard. Edinburgh **41**(3): 483–489.
- KOMAROV, V. L.; BOBROV, E. G.; FEDCHENKO, B. A.; FOMIN, A. V.; IL'IN, M. M.; KRISHTOFVICH, A. N. & YUZEPCHUK, S. V. 1968: Flora of U.S.S.R., vol. I: Taxodiaceae and Cupressaceae: 136–164. – Jerusalem.
- KONAR, R. N. 1962: Investigations on the development of the male cones in *Fitzroya cupressoides* (MOL.) JOHNST. and *Pilgerodendron uviferum* (DOM.) FLOR. – Phytomorphology **12**: 190–195.
- KONAR, R. N. & BANERJEE, S. K. 1963: The morphology and embryology of *Cupressus funebris* ENDL. – Phytomorphology **13**: 321–338.
- KRÜSSMANN, G. & WARDA, H.-D. 1983: Handbuch der Nadelgehölze, 2. Aufl. – Berlin, Hamburg.
- KÜRSCHNER, H.; RAUS, T. & VENTER, J. 1995: Cupressaceae. – In: H. KÜRSCHNER; T. RAUS; & J. VENTER, Pflanzen der Türkei. Ägäis – Taurus – Inneranatolien. – Wiesbaden.
- LAUBENFELS, D. J. D. 1969: Cupressaceae: 144–163. – In: A. AUBRÉVILLE (ed.), Flore de la Nouvelle-Calédonie et Dépendances, vol. 4: Gymnospermes. – Paris.
- LAUTERBACH, C. 1914: Beiträge zu Flora von Papuasien, II, Neue Pinaceae Papuasien. – Bot. Jahrb. Syst. **50**: 46–53 + pl. I, II.
- LI, H.-L. 1962: A new species of *Chamaecyparis*. – Morris Arbor. Bull. **13**(3): 43–46.
- LI, H. & KENG, H. 1994: Flora of Taiwan, 2. ed., vol. I. – Taipei, Taiwan, Roc.
- LITTLE, E. L. 1966: Varietal transfers in *Cupressus* and *Chamaecyparis*. – Madroño **18**: 161–167.
- LITTLE, E. L. 1970: Names of New World cypresses (*Cupressus*). – Phytologia **20**(7): 429–445.
- LÜCKHOFF, H. A. 1971: The Clanwilliam cedar (*Widdringtonia cedarbergensis* MARSH): its past history and present status. – J. Bot. Soc. South Africa **57**: 17–23.

- MAIRE, R. 1952: Cupressaceae: 105–125. – In: P. LECHEVALIER, (ed.), *Encyclopédie Biologique*. XXXIII: Flore de L’Afrique du Nord. Vol. I. – Paris.
- MALEJEFF, W. 1928: Schema einer natürlichen Klassifikation der *Cupressus*-Arten. – Mitt. Deutsch. Dendrol. Ges. **40**: 57–61.
- MARTÍNEZ, M. 1948: Los *Cupressus* Mexicanos. – Bol. Soc. Bot. México **6**: 1–6.
- MARTÍNEZ, M. 1963: Las Pináceas Mexicanas. – México.
- MELVILLE, R. 1939: *Callitris oblonga*. – Bot. Mag. **161**.
- MERRILL, E. D. 1922: Notes on the flora of South-eastern China. – Philipp. J. Sci. **21**: 491–492.
- MITCHELL, A. F. 1972: Conifers in the British Isles, a descriptive handbook. – Forestry Commission Booklet (London) **33**.
- MOGGRIDGE, J. T. 1874: Plate LXV: *Juniperus oxycedrus*, LINN. var. *macrocarpa*; *J. communis*, LINN.; *J. phoenicea*, LINN. – In: Contributions of the flora of Mentone and to a winter flora of the Ribiera including the coast from Marseilles-Genoa, 3. ed. – London.
- MOLYNEUX, B. & FORRESTER, S. 1997: The Australflora A–Z of Australian plants. – Kew.
- MOSELEY, M. F. 1942: Contributions to the life history, morphology and phylogeny of *Widdringtonia cupressoides*. – Lloydia **6**(2): 109–132.
- MUNZ, P. A. & KECK, D. D. 1968: Taxodiaceae, Cupressaceae. – In: P. A. MUNZ & D. D. KECK, A California flora. – Berkeley, Los Angeles.
- MURRAY, E. 1983: Notae Spermatophytæ No. 2. Unum minutum monographum generis *Pinus*. – Kalmia **13**: 3–24.
- NIMSCH, H. 2000: *Neocallitropsis pancheri* (CARRIÈRE) DE LAUBENFELS: 1–6. – In: H. WEISGERBER; H.-J. SCHUCK; U. LANG; A. ROLOFF & P. SCHÜTT (eds.), *Enzyklopädie der Holzgewächse, Handbuch und Atlas der Dendrologie*. – Landsberg am Lech.
- OHWI, J.; MEYER, F. G. & WALKER, E. H. 1965: Taxodiaceae, Cupressaceae. – In: J. OHWI; F. G. MEYER & E. H. WALKER, *Flora of Japan* (in English). – Washington, DC.
- PAPST, G. (ed.) 1887: *Callitris quadrivalvis* VENTENAT: 129–131. – In: G. PABST, Köhler’s Medizinal-Pflanzen in naturgetreuen Abbildungen mit kurz erläuternden Texte, vol. 2. – Gera.
- PAUW, C. A. & LINDER, H. P. 1997: Tropical African cedars (*Widdringtonia*, Cupressaceae): systematics, ecology and conservation status. – Bot. J. Linn. Soc. **123**: 297–319.
- PILGER, C. R. 1926: Pinaceae. – In: *Plantae Haitiensis*. – Ark. Bot. (Stockholm) **20A**(15): 9–10.
- PILGER, R. 1926: Coniferae: 121–166, 199–403. – In: A. ENGLER & K. PRANTL (eds.), *Die natürlichen Pflanzenfamilien nebst ihren Gattungen und wichtigeren Arten insbesondere den Nutzpflanzen*, 2. Aufl. (unveränd. Nachdr. 1960). – Berlin.
- PILGER, R. 1964: IX. *Juniperi* species antillanae: 478–481. – In: I. URBAN (ed.), *Symbolae antillanae seu fundamenta florae indiae occidentalis*. – Amsterdam.
- POST, G. E. & DINSMORE, J. E. 1932: CXXXVI. Cupressaceae. Cypress Family. – In: G. E. POST, *Flora of Syria, Palestina and Sinai, a handbook of the flowering plants and ferns, native and naturalized from the Taurus to ras Muhammad and from Mediterranean Sea to the Syrian desert*, vol. II. – Beirut.
- PRESS, J. R. 1994: Cupressaceae: 54, 55. – In: J. R. PRESS & M. J. SHORT (eds.), *Flora of Madeira*. – London.
- QUÉZEL, P. & SANTA, S. 1962: Cupressacées. – In: P. QUEZEL & S. SANTA *Nouvelle flore de L’Algérie et des régions désertiques méridionales*. – Paris.
- RIEDL, H. 1968: Cupressaceae: 1–10. – In: K. H. RECHINGER, *Flora des iranischen Hochlandes und der umrahmenden Gebirge: Persien, Afghanistan; Teile von West-Pakistan, Nord-Iraq, Azerbaïdjan, Turkmenistan*. – Wien.
- ROBYNS, W. 1948: Cupressaceae: 446. – In: W. ROBYNS (ed.), *Flore du Congo belge et du Ruanda-Urundi*, vol. I: Spermatophytes. – Bruxelles.
- RODRÍGUEZ, R. R.; MATTHEI, S. O. & QUEZADA, M. M. 1983: Cupressaceae. – In: RODRÍGUEZ, R. R.; S. O. MATTHEI & M. M. QUEZADA, *Flora arborea de Chile*. – Concepcion.
- RODRÍGUEZ, R. R. & M. M. 1995: Gymnospermae: 310–337. – In: C. MARTICORENA & R. R. RODRÍGUEZ (eds.), *Flora de Chile*. Vol. I. Pteridophyta to Gymnospermae. – Chile.
- ROLOFF, A. & BÄRTELS, A. 1996: Gehölze: Bestimmung, Herkunft und Lebensbereiche, Eigenschaften und Verwendung. *Gartenflora*, Bd.1. – Stuttgart.
- ROYEN, P. V. 1979: Cupressaceae. – In: P. V. ROYEN, *The alpine flora of New Guinea*, vol. 2, taxonomic part: Cupressaceae to Poaceae. – Vaduz.
- RYDBERG, P. A. 1969: Family 2, Juniperaceae, juniper family. – In: P. A. RYDBERG, *Flora of the Rocky Mountains and adjacent plains: Colorado, Utah, Wyoming, Idaho, Montana, Saskatchewan, Alberta and neighboring parts of Nebraska, South Dakota, North Dakota, and British Columbia*, 2. ed. – New York, London.
- SCHMID, W. 1937: Ergebnisse der Reise von Dr. A. U. Däniker nach Neu-Kaledonien und den Loyalty-Inseln (1924/26). Beitrag zur Kenntnis von *Callitropsis araucarioides* COMPTON. – Ber. Schweiz. Bot. Ges. **47**: 124–159.

- SCHULZ, C.; JAGEL, A. & STÜTZEL, T. 2003: Cone morphology in *Juniperus* in the light of cone evolution in Cupressaceae s.l. – *Flora* **198**(3): 161–177.
- SILBA, J. 1981: Statistics of *Cupressus* cultivation. – *Phytologia* **19**(9): 416–420.
- SILBA, J. 1982: Distribution of *Chamaecyparis funebris* (ENDL.) CARR. and *Cupressus chengiana* HU. (Cupressaceae). – *Phytologia* **51**(2): 157–160.
- SILBA, J. 1983: Addendum to a revision of *Cupressus* L. (Cupressaceae). – *Phytologia* **52**: 349–361.
- SILBA, J. 1988: A new species of *Cupressus* L. from Tibet (Cupressaceae). – *Phytologia* **65**(5): 333–336.
- STAPF, O. 1924: *Cupressus duclouxiana*. – *Bot. Mag.* **150**: Tab. 9049.
- STAPF, O. 1933: Cupressaceae: 15–24. – In: A. W. HILL (ed.), *Flora Capensis: Being a systematic description of the plants of the Cape Colony, Caffraria, and Port Natal (and neighbouring territories)*. – Cape Town.
- THROWER, S. L. 1988: Cupressaceae. – In: S. L. THROWER, *Hong Kong trees. Omnibus volume.* – Hong Kong.
- TYLOR 1976: *Chamaecyparis nootkatensis* (D. DON) SPACH. – *Davidsonia* **7**(4): 56–62.
- VALDÉS, B.; TALAVERA, S. & FERNÁNDEZ-GALIANO, E. (eds.) 1987: Cupressaceae: 84–86. – In: B. VALDES; TALAVERA, S. & FERNÁNDEZ-GALIANO, E. (eds.), *Flora vascular de Andalucía Occidental*. Vol. I. – Barcelona.
- WALTER, S. M.; BRADY, A.; BRICKELL, C. D.; CULLEN, J.; GREEN, P. S.; LEWIS, J.; MATTHEWS, V. A.; WEBB, D. A.; YEO, P. F. & ALEXANDER, J. C. M. (eds.) 1986: *The European garden flora, a manual for the identification of plants cultivated in Europe, both under-out-doors and under glass, vol. I: Pteridophyten, Gymnospermae, Angiospermae to Monocotyledons (part I): Taxodiaceae and Cupressaceae: 77–87.* – Cambridge, London, New York, New Rochelle, Melbourne, Sydney.
- WEBB, C. J. & SIMPSON, M. J. A. 2001: Cupressaceae. – In: C. J. WEBB & M. J. A. SIMPSON, *Seeds of New Zealand gymnosperms and dicotyledons.* – Christchurch.
- WHITE, F. & ANGUS, A. 1962: Cupressaceae. – In: F. WHITE, *Forest flora of Northern Rhodesia.* – London.
- WOOTON, E. O. & STANDLEY, P. C. 1972: Juniperaceae. – In: E. O. WOOTON & P. C. STANDLEY, *Flora of New Mexico.* – New York.
- WUNDERLIN, P. R. & HANSEN, F. B. 2000: Cupressaceae. – In: P. R. WUNDERLIN & F. B. HANSEN, *Flora of Florida, pteridophytes and gymnosperms.* – Florida.
- YAMAZAKI, T. 1995: Cryptomeriaceae, Cupressaceae: 264, 278–283. – In: K. IWATSUKI; T. YAMAZAKI; D. E. BOUFFORD & H. OHBA (eds.), *Flora of Japan.* – Tokyo.
- ZANONI, T. A. & ADAMS, R. P. 1979: The genus *Juniperus* (Cupressaceae) in Mexico and Guatemala: synonymy, key and distributions of the taxa. – *Bol. Soc. Bot. Mexico* **38**: 83–121.
- ZOHARY, M. 1966: Cupressaceae. – In: M. ZOHARY, *Flora Palaestina. Equisetaceae to Moringaceae.* – Jerusalem.

Address of the authors:

Christian Schulz (corresponding author); Patrick Knopf, Prof. Dr. Thomas Stützel, Ruhr-Universität Bochum, Lehrstuhl für Spezielle Botanik, Universitätsstraße 150, D-44780 Bochum, Germany.
e-mail: Thomas.Stuetzel@ruhr-uni-bochum.de
Christian.Schulz-3@ruhr-uni-bochum.de

Manuscript received: October 28th, 2004/revised version: December 23rd, 2004.

Index

<i>Actinostrobus</i>	103
<i>Athrotaxis</i>	104
<i>Austrocedrus chilensis</i>	102
<i>Callitris</i>	104
<i>Calocedrus</i>	106
<i>Chamaecyparis</i>	106
<i>Cryptomeria japonica</i>	100
<i>Cunninghamia</i>	112
<i>Cupressus</i>	106
<i>Diselma archeri</i>	101
<i>Fitzroya cupressoides</i>	103
<i>Fokienia hodginsii</i>	103
<i>Glyptostrobus pensilis</i>	100
<i>Juniperus</i>	112
<i>Juniperus</i> group A: taxa with needle leaves	112
<i>Juniperus</i> group B: taxa with scale leaves	116
<i>Libocedrus</i>	126
<i>Metasequoia glyptostroboides</i>	101
<i>Microbiota decussata</i>	101
<i>Neocallitropsis pancheri</i>	103
<i>Papuacedrus</i>	127
<i>Pilgerodendron uviferum</i>	101
<i>Platycladus orientalis</i>	103
<i>Sequoia sempervirens</i>	100
<i>Sequoiadendron giganteum</i>	100
<i>Taiwania cryptomerioides</i>	100
<i>Taxodium</i>	127
<i>Tetraclinis articulata</i>	102
<i>Thuja</i>	128
<i>Thujopsis</i>	128
<i>Widdringtonia</i>	128
<i>Xanthocyparis</i>	106

Fig. 1

Ultimate branchlets of different Cupressaceae-taxa

A: *Widdringtonia nodiflora*, arranged decussately but it looks like arranged spirally because the scale are a little bit shifted; **B:** *Athrotaxis laxifolia*; **C:** *Athrotaxis cupressoides*; **D:** *Sequoiadendron giganteum*; **E:** *Taxodium distichum* var. *imbricatum*; **F:** *Taiwania cryptomerioides*; **G:** *Athrotaxis selaginoides*; **H:** *Cryptomeria japonica*; **I:** *Glyptostrobus pensilis*; **J:** *Taxodium distichum* var. *distichum*, **K:** *Sequoia sempervirens*; **L:** *Metasequoia glyptostroboides*; **M:** *Cunninghamia lanceolata*; **N:** *Cupressus arizonica* var. *glabra*; **O:** *Juniperus phoenicea* subsp. *phoenicea*; **P:** *Widdringtonia nodiflora*: usually arranged decussately; **Q:** *Diselma archeri*; **R:** *Pilgerodendron uviferum*. **A–K, M:** leaves arranged spirally. **L, N–R:** leaves arranged decussately

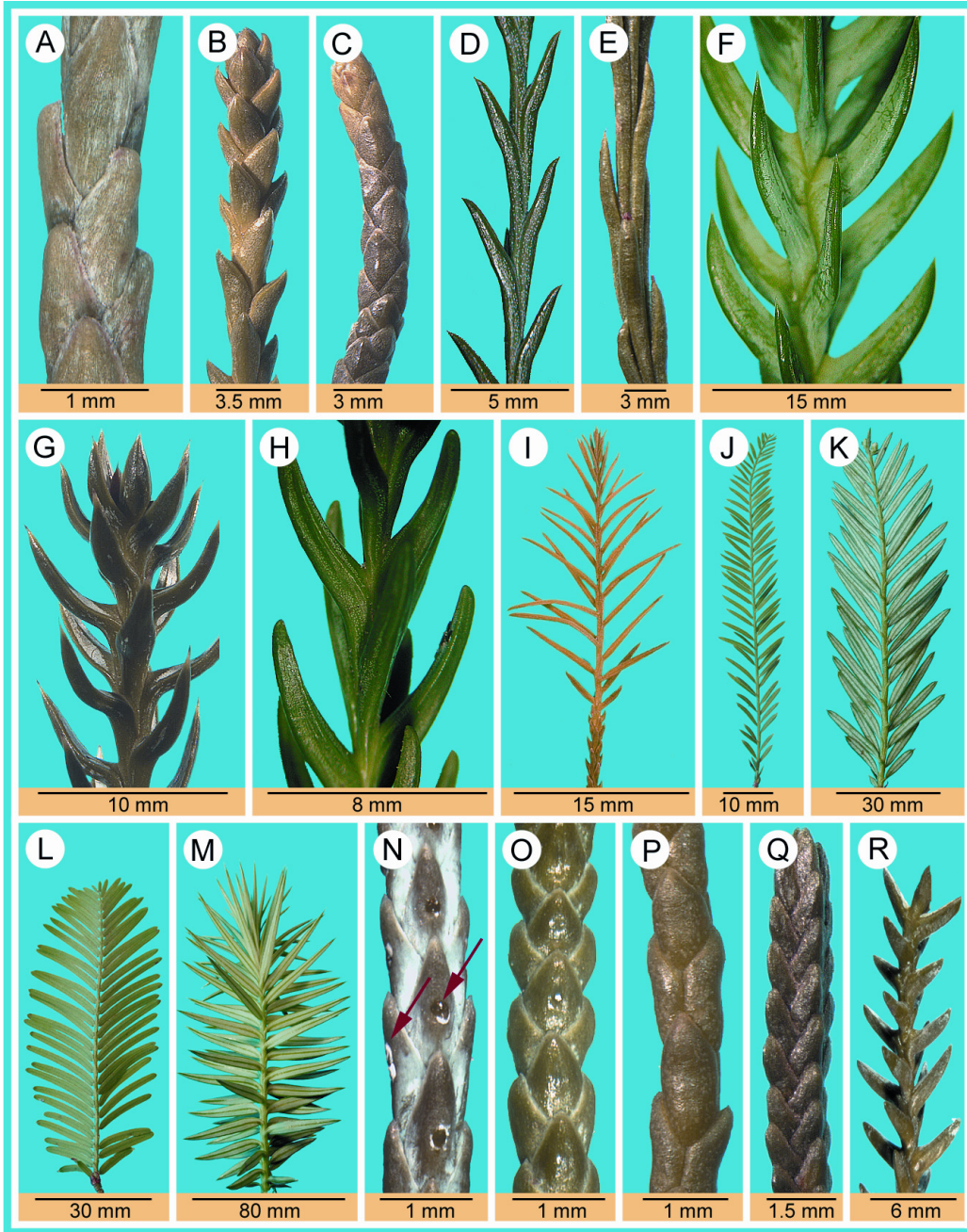


Fig. 1

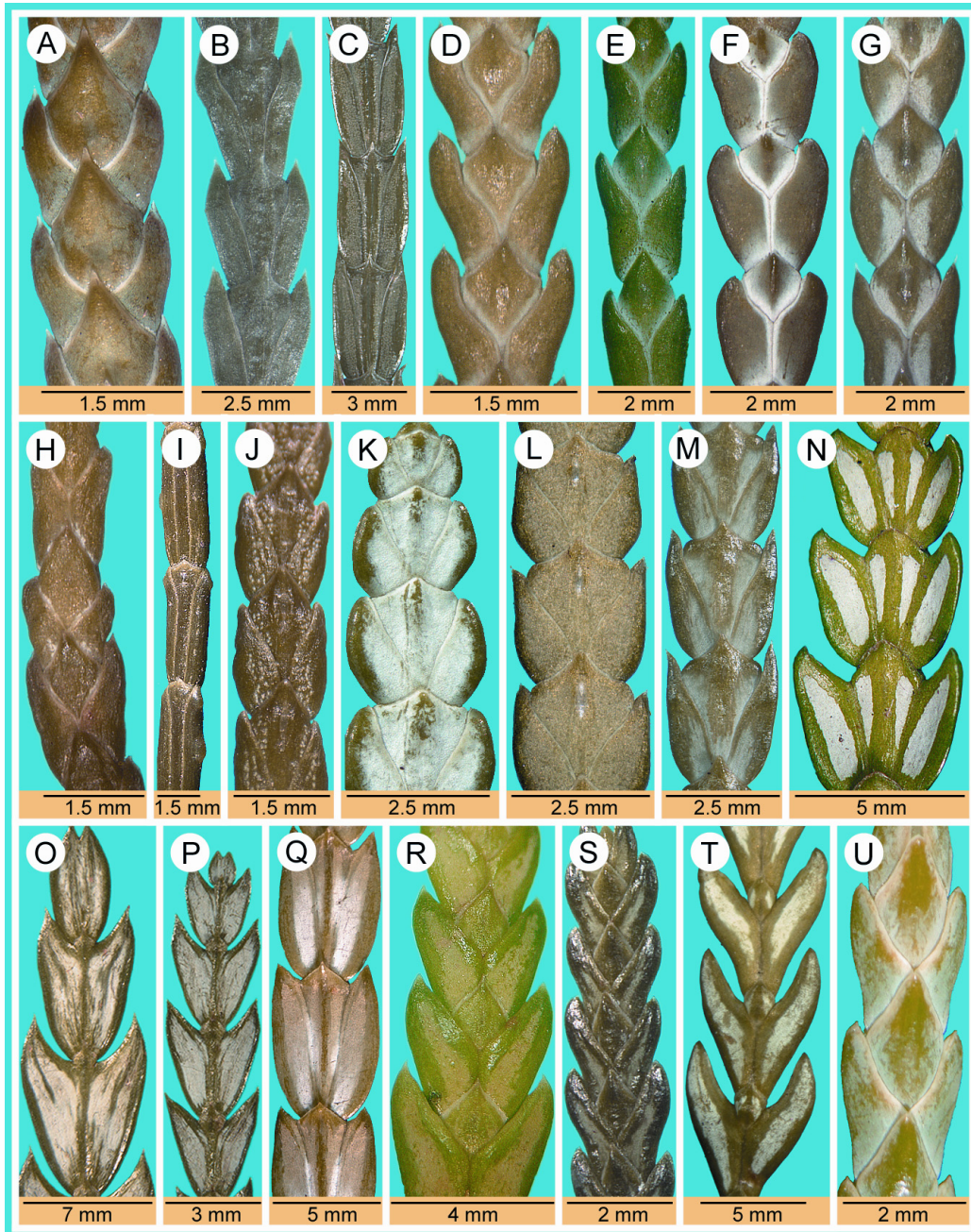


Fig. 2

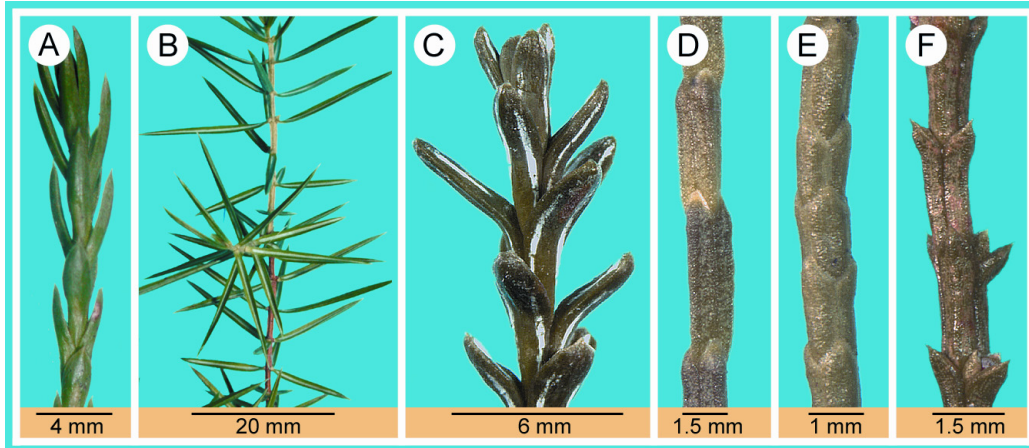


Fig. 3

Ultimate branchlets of different Cupressaceae-taxa

A: *Juniperus horizontalis*, leaves arranged decussately; **B–F:** leaves arranged in whorls of 3. **B:** *Juniperus rigida* subsp. *rigida*; **C:** *Fitzroya cupressoides*; **D:** *Callitris drummondii*; **E:** *Callitris canescens*; **F:** *Actinostrobus pyramidalis*

◀ Fig. 2

Ultimate branchlets of different Cupressaceae-taxa

A: *Microbiota decussata*; **B:** *Calocedrus decurrens*; **C:** *Calocedrus formosana*; **D:** *Chamaecyparis formosensis*; **E:** *Chamaecyparis lawsoniana*; **F:** *Chamaecyparis obtusa* var. *obtusa*; **G:** *Chamaecyparis pisifera*; **H:** *Chamaecyparis thyoides* var. *thyoides*; **I:** *Tetraclinis articulata*; **J:** *Platycladus orientalis*; **K:** *Thuja koraiensis*; **L:** *Thuja occidentalis*; **M:** *Thuja plicata*; **N:** *Thujopsis dolabrata* var. *dolabrata*; **O:** *Papuacedrus papuana* var. *papuana*; **P:** *Papuacedrus papuana* var. *arfakensis*; **Q:** *Fokienia hodginsii*; **R:** *Libocedrus plumosa*; **S:** *Libocedrus bidwillii*; **T:** *Austrocedrus chilensis*; **U:** *Xanthocyparis nootkatensis*. **A–U:** leaves arranged decussately



Fig. 4

Female cones of different Cupressaceae-taxa

A: *Athrotaxis laxifolia*; **B:** *Cunninghamia lanceolata*; **C:** *Cryptomeria japonica*; **D:** *Taiwania cryptomerioides*; **E:** *Taxodium distichum* var. *distichum*; **F:** *Glyptostrobus pensilis*; **G:** *Sequoiadendron giganteum*; **H:** *Sequoia sempervirens*; **I:** *Metasequoia glyptostroboides*; **J:** *Chamaecyparis lawsoniana*; **K:** *Cupressus sempervirens*; **L:** *Fokienia hodginsii*; **M:** *Platycladus orientalis*; **N:** *Microbiota decussata*; **O:** *Calocedrus decurrens*; **P:** *Thuja koraiensis*; **Q:** *Widdringtonia nodiflora*

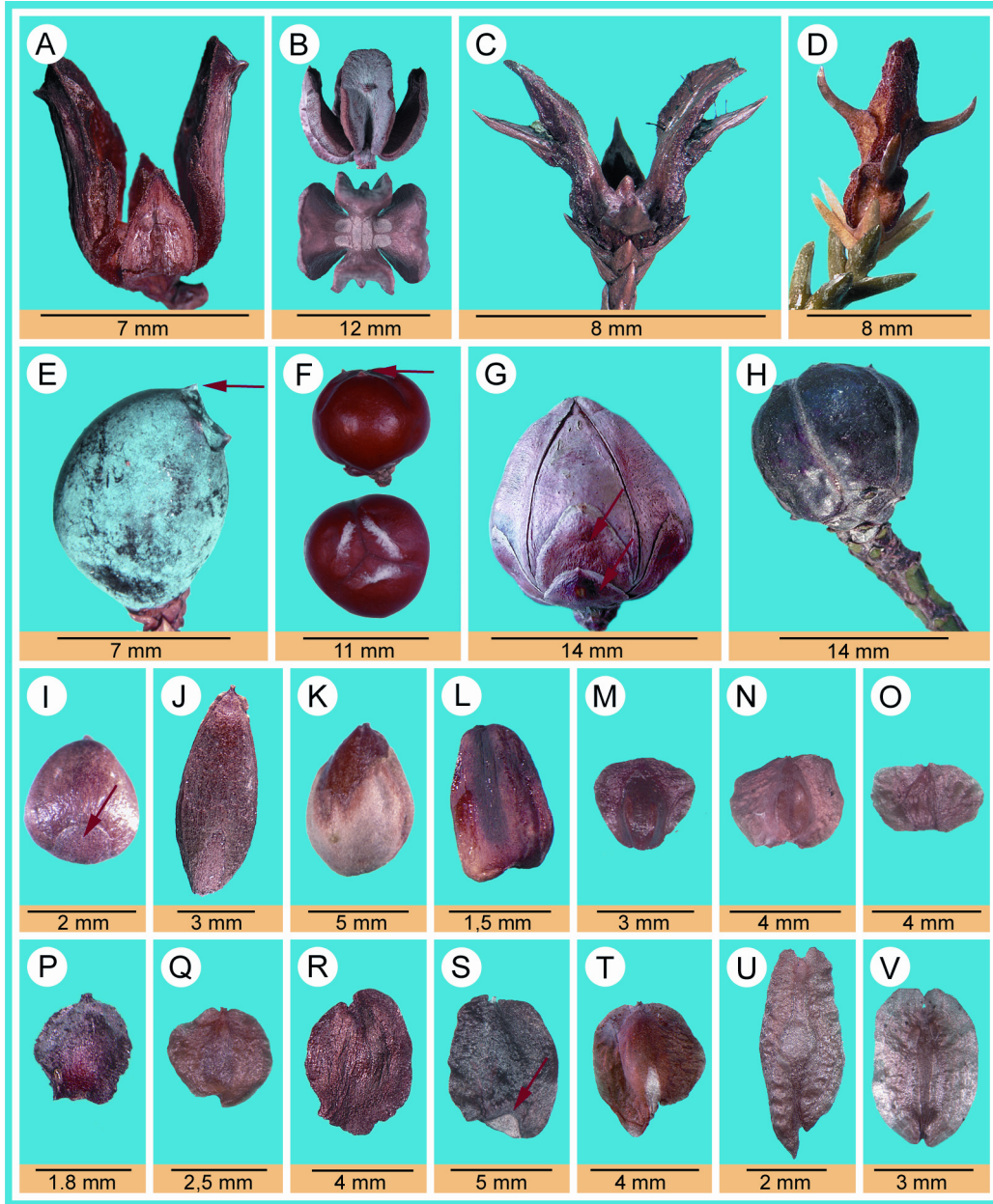


Fig. 5

Female cones and seeds of different Cupressaceae-taxa

A–H: female cones. **A:** *Austrocedrus chilensis*; **B:** *Tetraclinis articulata*; **C:** *Libocedrus bidwillii*; **D:** *Pilgerodendron uviferum*; **E:** *Juniperus communis* var. *communis*; **F:** *Juniperus oxycedrus* subsp. *oxycedrus*. **G:** *Actinostrobus pyramidalis*. **H:** *Callitris drummondii*. **I–V:** seeds. **I:** *Microbiota decussata*; **J:** *Platycladus orientalis*; **K:** *Juniperus recurva* var. *recurva*. **L:** *Athrotaxis laxifolia*; **M:** *Chamaecyparis obtusa* var. *obtusata*; **N:** *Chamaecyparis lawsoniana*; **O:** *Chamaecyparis pisifera*; **P:** *Chamaecyparis thyoides* var. *thyoides*; **Q:** *Chamaecyparis formosensis*; **R:** *Cunninghamia lanceolata*; **S:** *Widdringtonia nodiflora*; **T:** *Thuja koraiensis*; **U:** *Thuja occidentalis*; **V:** *Thuja plicata*

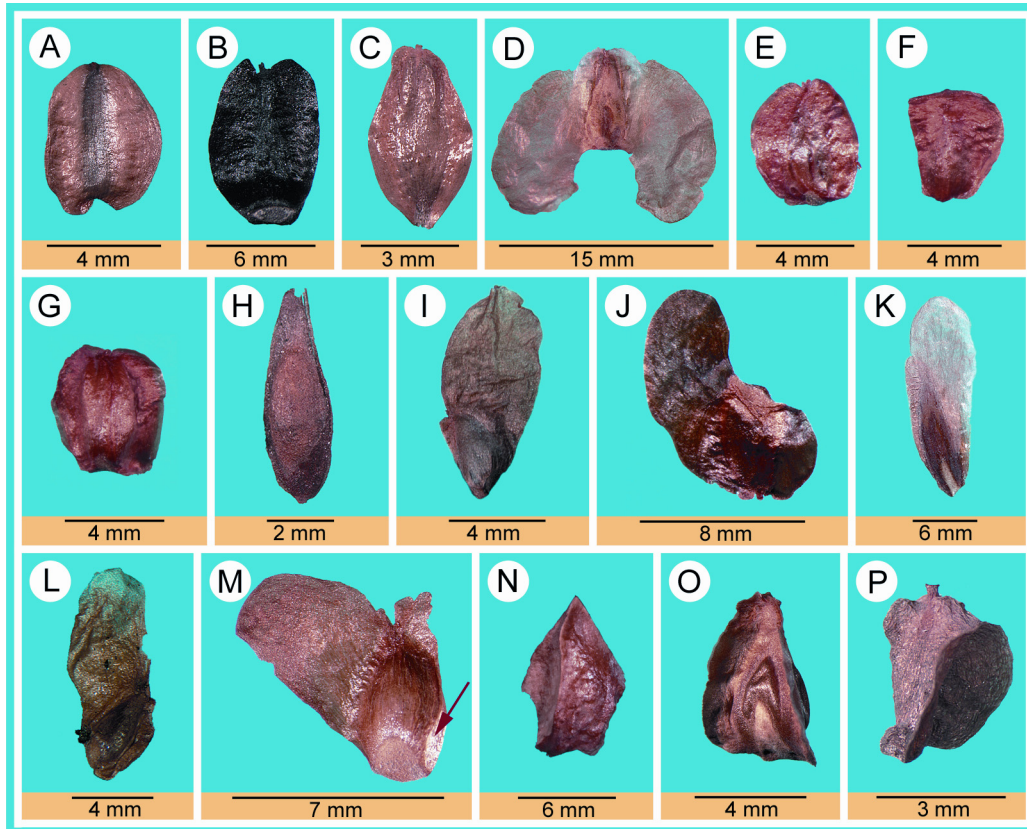


Fig. 6

Seeds of different Cupressaceae-taxa

A: *Sequoiadendron giganteum*; **B:** *Widdringtonia schwarzii*; **C:** *Thujopsis dolabrata* var. *dolabrata*; **D:** *Tetraclinis articulata*; **E:** *Cupressus torulosa*; **F:** *Cupressus arizonica* var. *arizonica*; **G:** *Cupressus dupreziana* var. *atlantica*; **H:** *Glyptostrobus pensilis*; **I:** *Austrocedrus chilensis*; **J:** *Callitris drummondii*; **K:** *Calocedrus decurrens*; **L:** *Libocedrus bidwillii*; **M:** *Fokienia hodginsii*; **N:** *Taxodium distichum* var. *distichum*; **O:** *Actinostrobus pyramidalis*; **P:** *Fitzroya cupressoides*

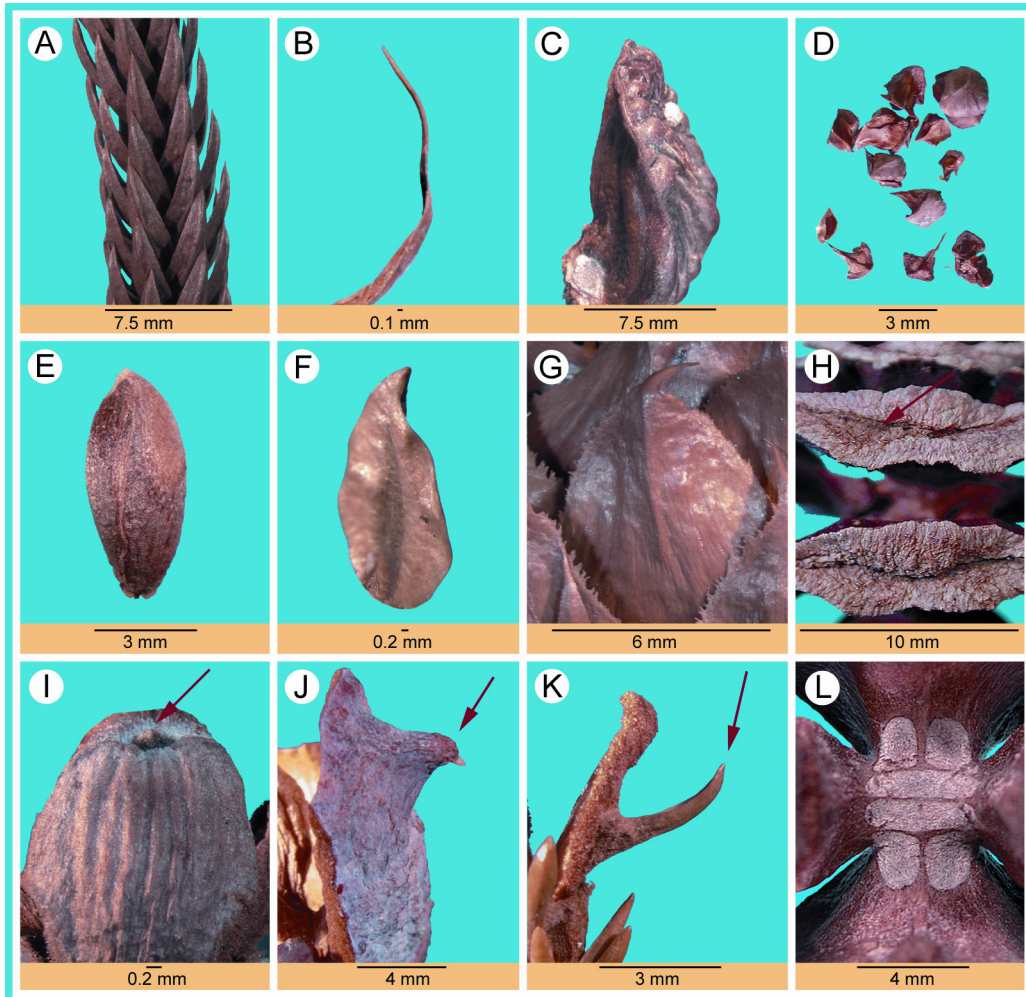


Fig. 7

Different features

A: *Neocallitropsis pancheri*; leaves in whorls of 4, herbarium sample (not the natural colour). **B:** *Cunninghamia lanceolata*, female cone scale thin; **C:** *Widdringtonia schwarzii*, female cone scale thick; **D:** *Taxodium distichum* var. *distichum*, female cone disintegrated; **E:** *Platycladus orientalis*, side view of seed (thick seed); **F:** *Sequoiadendron giganteum*, side view of seed (thin seed). **G:** *Cunninghamia lanceolata*, female cone scale without umbo or depression; **H:** *Metasequoia glyptostroboides*, female cone scale with depression; **I:** *Thuja koraiensis*, umbo small, umbo near the apex; **J:** *Platycladus orientalis*, umbo large; **K:** *Pilgerodendron uviferum*, umbo very large; umbo in the center; **L:** *Tetraclinis articulata*, without columella

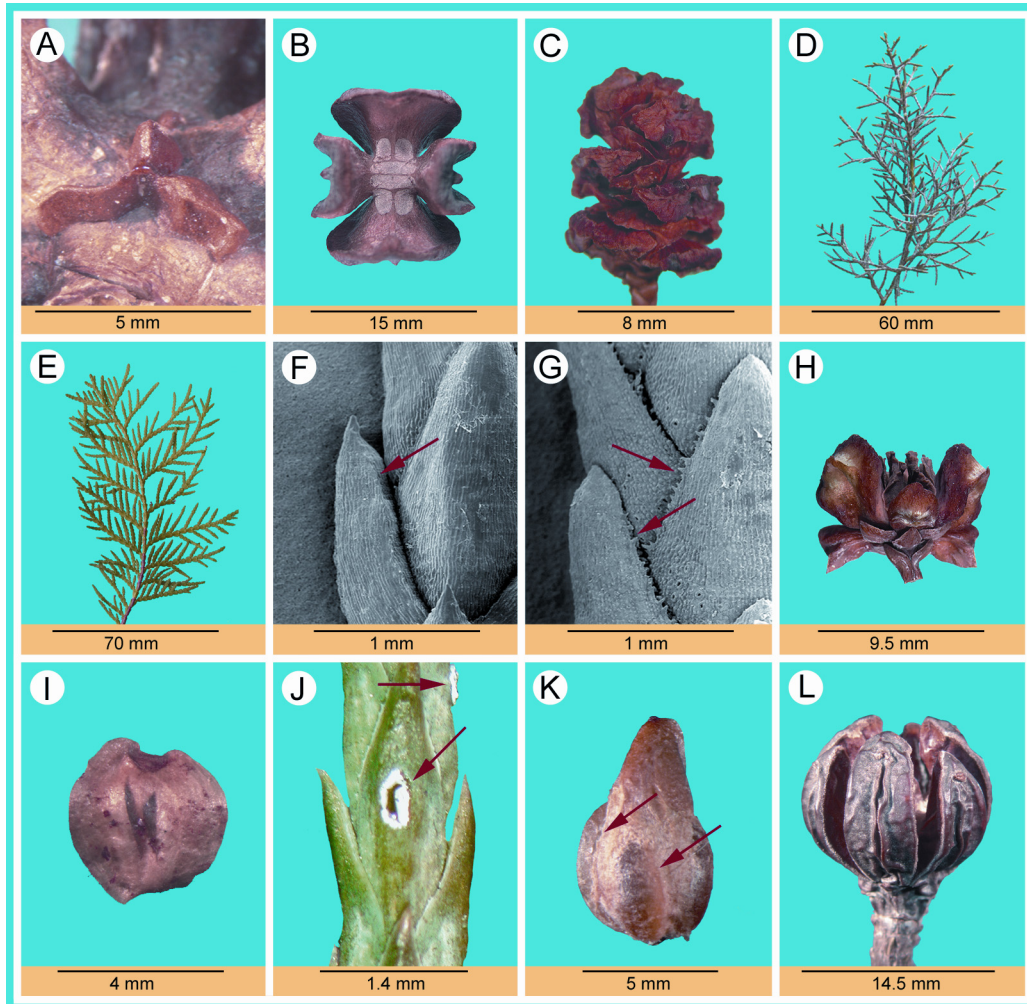


Fig. 8

Different features

A: *Callitris endlicheri*, columella 3-partite; **B:** *Tetraclinis articulata*, all female cone scales insert on the same level in mature cones; **C:** *Chamaecyparis formosensis*, female cone scales insert on different levels in mature cones; **D:** *Cupressus arizonica* var. *glabra*, branchlets arranged 3-dimensionally; **E:** *Thuja occidentalis*, branchlets arranged in one plane; **F:** *Cupressus cashmeriana*: scale leaves margin entire; **G:** *Cupressus arizonica* var. *glabra*: scale leaves margin serrate; **H:** *Fitzroya cupressoides*, female cone side view; **I:** *Metasequoia glyptostroboides*, seed; **J:** *Cupressus macrocarpa*, scale leaves with white resin; **K:** *Juniperus rigida* subsp. *rigida*, seed tubercled; **L:** *Callitris drummondii*, female cone scales unequal

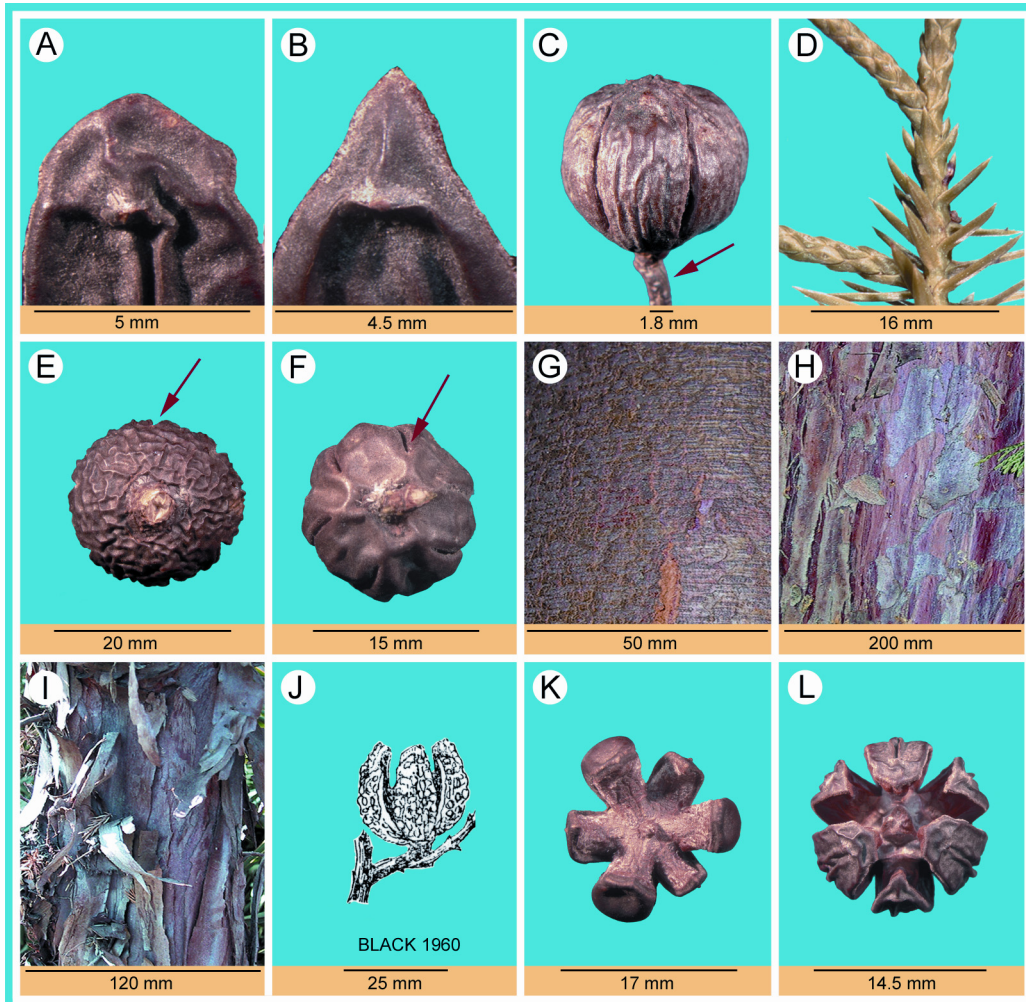


Fig. 9

Different features

A: *Callitris drummondii*, female cone scales angled into a (broad) apex; **B:** *Callitris drummondii*, female cone scales tapering towards the apex; **C:** *Callitris canescens*, female cone with slender fruiting branchlet; **D:** *Juniperus phoenicea* subsp. *turbinata*, branchlet with scale and needle leaves; **E:** *Callitris preissii*, female cone scales united at the base and forming a thick cone base; **F:** *Callitris endlicheri*, female cone scales separating almost to the base; **G:** *Chamaecyparis pisifera*: bark smooth-scaly; **H:** *Xanthocyparis nootkatensis*, bark divided in plates; **I:** *Juniperus squamata*, bark peeling off in strands; **J:** *Callitris verrucosa*, female cones dense warts; **K:** *Callitris endlicheri*, female cone scales spreading widely after opening; with untypical columella **L:** *Callitris drummondii*, female cone scales not spreading widely after opening

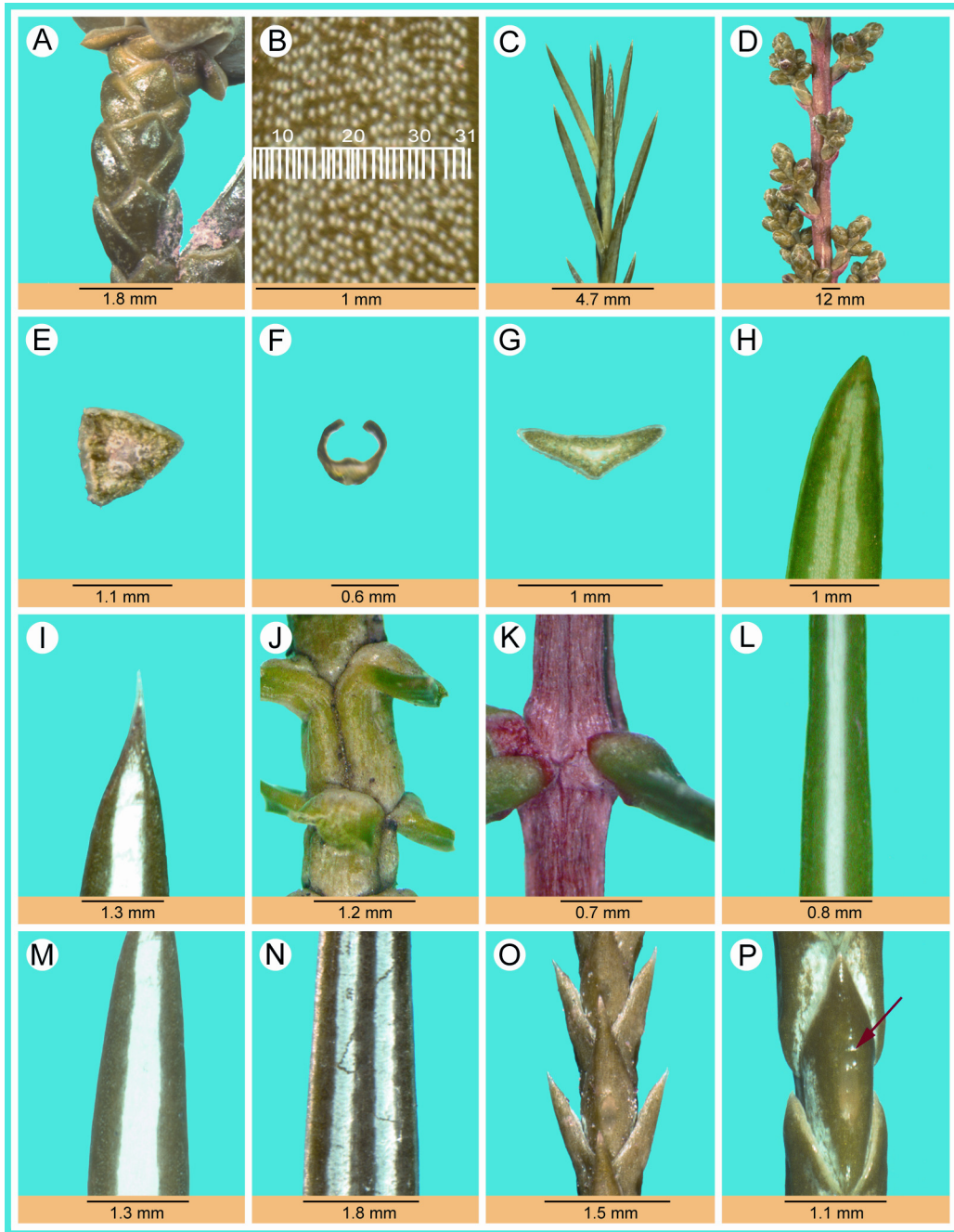


Fig. 10

◀ Fig. 10

Different features

A: *Calocedrus formosana*, cone-bearing-branchlets flattened, like branchlets without female cones, **B:** *Cunninghamia lanceolata*, rows of stomata on the abaxial side in one white stripe; **C:** *Juniperus procera*, needle leaves slightly spreading; **D:** *Taxodium distichum* var. *imbricatum*, branches with male cones short and crowded, the cones commonly in short compact secondary branches; **E:** *Callitris drummondii*, branchlets triangular; **F:** *Juniperus squamata*, dorsal side of needle leaves rounded; **G:** *Juniperus drupacea*, dorsal side of needle leaves keeled; **H:** *Juniperus cedrus*, needle leaf tip blunt; **I:** *Juniperus communis* var. *saxatilis*, needle leaf tip acute; **J:** *Juniperus squamata*, needle leaves decurrent; **K:** *Juniperus rigida* subsp. *rigida*, needle leaves not decurrent; **L:** *Juniperus rigida* subsp. *rigida*, needle leaf with one narrow white stripe; **M:** *Juniperus communis* var. *saxatilis*, needle leaf with one wide white stripe; **N:** *Juniperus oxycedrus* subsp. *macrocarpa*, needle leaf with two white stripes; **O:** *Juniperus thurifera*, scale leaves spreading slightly; **P:** *Juniperus sabina* var. *davurica*, scale leaf with a conspicuous gland

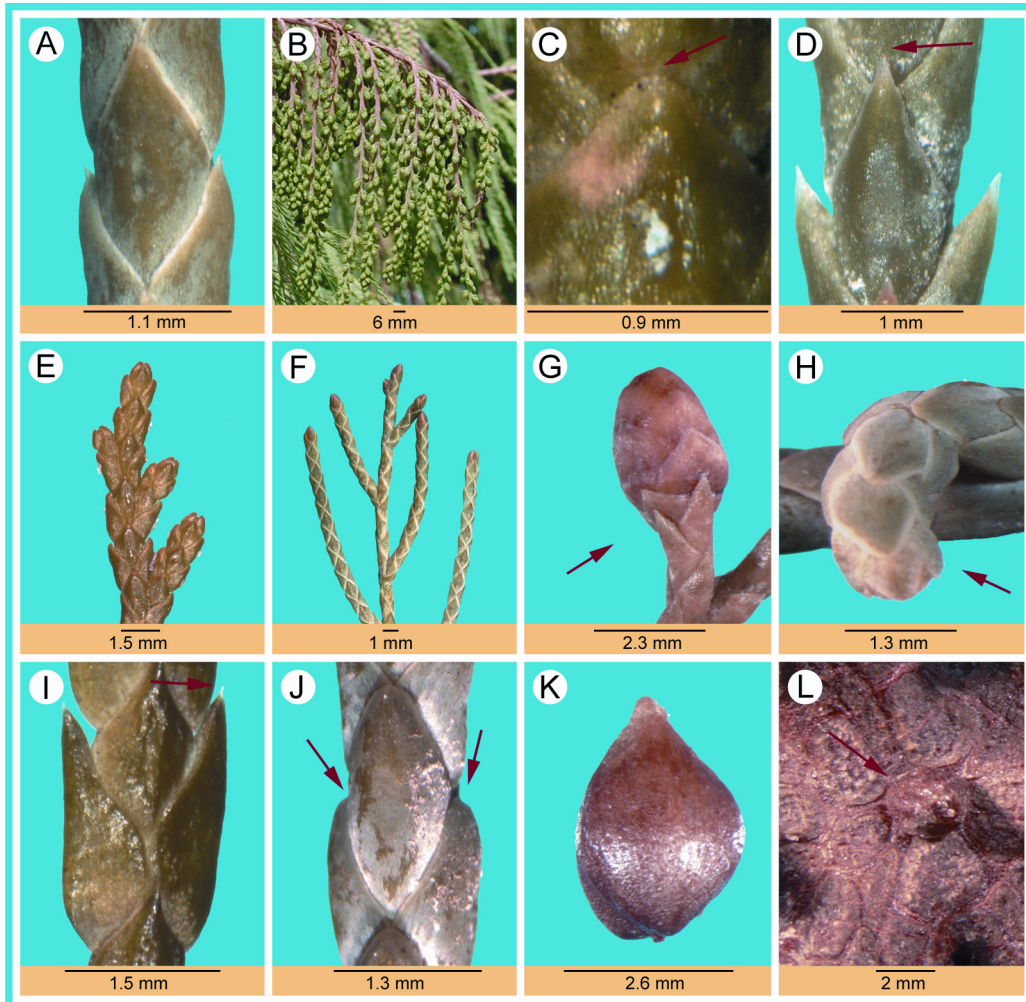


Fig. 11

Different features

A: *Cupressus gigantea*, scale leaf without a conspicuous gland; **B:** *Taxodium mucronatum*, branches of male cones long and slender, open, composed of single cones; **C:** *Cupressus dupreziana* var. *dupreziana*, scale leaf tip blunt; **D:** *Juniperus ashei*, scale leaf tip acute; **E:** *Cupressus lusitanica* var. *benthamii*, branchlets short and stout; **F:** *Cupressus gigantea*, branchlets long and slender; **G:** *Juniperus thurifera*, peduncle straight; **H:** *Juniperus sabina* var. *sabina*, peduncle curved; **I:** *Cupressus funebris*, scale leaf tip curved outwards; **J:** *Juniperus sargentii*, scale leaf incurved (appressed); **K:** *Juniperus excelsa* subsp. *excelsa*, seed not tubercled; **L:** *Callitris endlicheri*, columella simple