

# Descriptions and a Key to Cultivars of Japanese Cedar Cultivated in the Eastern United States

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ADDITIONAL INDEX WORDS. conifer, *Cryptomeria*, gymnosperm, ornamental, morphology, taxonomy, Taxodiaceae, Cupressaceae

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**SUMMARY.** Japanese cedar, *Cryptomeria japonica* (Thunb. ex L.f.) D. Don [Cupressaceae Bartling, formerly assigned to Taxodiaceae Warm.] is increasing in popularity as a landscape plant in the eastern United States. A taxonomic study of cultivars grown in the eastern United States was conducted. Forty-five cultivars were recognized. Each cultivar bears synonymy, a quantitative morphological description newly described from field data, herbarium vouchers, references to original literature and observational notes. A glossary of taxonomic terms relevant to *Cryptomeria* is presented. A taxonomic key is presented for segregation of cultivars that should assist professional plantmen in identification of taxa cultivated in the eastern United States.

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**C***ryptomeria japonica* (japanese cedar or cryptomeria) is indigenous to Japan. Dirr (1990) noted that japanese cedar is underused in the southern United States and has potential for use in any landscape situation. Cultivars of *C. japonica* performed well in heavy red clay soils during both prolonged dry and wet periods, exhibited remarkable tolerance to hot, humid, summer conditions, and have been regarded as nearly pest free (Tripp, 1993). Japanese cedar is considered as one of the better gymnosperms adapted for the eastern United States, and is increasing in popularity as a landscape plant (Tripp, 1993).

Tripp (1993) reported that several new cultivars introduced into the United States lacked descriptions. Rouse et al. (1997) established that japanese cedar in the eastern United States included a large number of named cultivars that needed an organized inventory of taxa, correct scientific names and synonyms, quantitative descriptions, taxonomic keys for segregation of taxa, and documentation of existing germplasm. The objective of this paper is to provide an inventory of cultivars of japanese cedar in cultivation in the eastern United States, original quantitative morphological descriptions of each cultivar, and a taxonomic key segregating the cultivars. This would provide a useful resource in assisting professional plantmen in segregation and identification of cultivars of japanese cedar.

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Research Project NC0 6104 funded in part by the North Carolina Agricultural Research Service, Raleigh, NC 27695-7643. Use of nursery and trade names in this publication does not imply endorsement by the NCARS of the nurseries or the products mentioned nor criticism of similar ones not mentioned. The cost of publishing this paper was defrayed in part by the payment of page charges. Under postal regulations, this paper therefore must be hereby marked *advertisement* solely to indicate this fact.

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**Table 1. Morphological characteristics examined for *Cryptomeria*.**

Characteristic
Habit
Growth type
Crown
Form
Shape
Plant height
Plant width
Seasonal growth
Warm season
Length
Width
Parastichy distance
Leaf type
Cool season
Length
Width
Parastichy distance
Leaf type
Foliage color
Color quantification
Seasonal variation
Branching pattern
Primary shoot
Orientation
Length
Secondary shoots
Number
Length
Tertiary shoots
Number
Length
Quarternary shoots
Number
Length
Leaves
Type
Attachment angle
Curvature
Apex
Orientation
Shape
Length
Cross-section
Glaucous bands
Prominence
Width
Female cones
Attachment
Height
Width
Scale/bract
Number
Height
Width
Shape
Attachment
Umbo
Number
Length
Width
Processes
Number
Length
Width
Male cones
Type
Number
Attachment
Length
Width
Shape
Apex

## Materials and methods

Data were collected by Rouse from named cultivars of mature plants of Japanese cedar at multiple sites in 1994–96. Limited availability of many cultivars restricted data collected to three to six plants per cultivar. However, many cultivars of Japanese cedar are rare in the landscape/nursery industries. Therefore, sampling was limited to only one or two plants. All plants sampled were labeled with cultivar names and were at least 4 years old.

Standardized data sheets were prepared listing various morphological characters appropriate for plants in this family (Table 1). Morphological terminology used followed standard taxonomic references (Eiselt, 1960; Harris and Harris, 1994; Vidakovic, 1991). Vegetative shoot data were recorded from 12 to 15 different locations per plant. Data on branch growth patterns were recorded from six to eight different primary branches and leaf data were recorded from 10 to 20 leaves per location. Strobili data were recorded from 12 to 15 strobili per plant when available, yet many cultivars lacked male and/or female strobili. Foliage color was quantified utilizing the Munsell color chart (Wilde and Voigt, 1977). Data sampling replicated on different plants of cultivar in different locations, when available, up to six replications. Data replication after three plants rarely produced new results in data obtained.

Quantitative descriptions were prepared for each cultivar from the data collected and compared to prepare a taxonomic key of segregation. Herbarium vouchers (Rouse numbers) of each plant were obtained and will be deposited at the herbarium of North Carolina State University and the National Arboretum.

## Results and discussion

Professional plantsmen working with Japanese cedar are interested in the proper identification of cultivars. Plantsmen wanting to view a number of different cultivars can visit those sites examined in this study that maintain large collections of cultivars of Japanese cedar. These included the Atlanta Botanical Garden (Atlanta, Ga.), Morris Arboretum (Philadelphia, Pa.), the JC Raulston Arboretum of North Carolina State University (Raleigh, N.C.), and the U.S. National Arboretum (Washington, D.C.).

This study recognized 45 distinct cultivars. All cultivar descriptions are based upon firsthand field data from live plants. Cultivar descriptions herein are expanded and more quantitative than descriptions found in standard gymnosperm references (Den Ouden and Boom, 1978; Hornibrook, 1938; Krüssmann, 1985; Tripp, 1993; Welch, 1979, 1991).

Analysis of shoots of Japanese cedar required modification of some of the standardized morphological terminology used for *Cryptomeria*. A glossary of modified terminology is included in Table 2. Terminology for growth forms and crowns has been modified. Shoots of cultivars of *Cryptomeria* exhibited distinct seasonal growth periods that could be characterized, but which have not been to date (Den Ouden and Boom, 1978; Hornibrook, 1938; Krüssmann, 1985; Tripp, 1993; Welch, 1979). Thus, seasonal growth terminology is newly defined (Table 2).

Foliage color variation in the species occurs as a result of age differences, seasonal differences, and cultural differences. Cultivar variation occurs mostly in hues of green. Age differentiation is typically from lighter green (new foliage) to darker green (mature foliage). Newly emerged foliage is creamy-white or silvery-white in some cultivars. Winter color is influenced by exposure to winter sun, low temperatures, wind protection, and severity of winter conditions. Winter foliage color exhibits bronze to brown to purplish-red coloration, but these colors denoted for cultivars may not be consistent. Foliage color is defined using the Munsell system (Wilde and Voigt, 1977). The notation for any chromatic color is hue value/chroma (HV/C), where hue represents one of the basic primary colors (red, green, yellow, blue, purple), value the degree of lightness (<5) or darkness (>5), and chroma the strength of saturation (increases with higher number). However, color chips are lacking for white pigmentations, thus our terms creamy-white and silvery-white are defined along with Munsell notations for other colors in Table 1.

Literature descriptions available for cultivars describe adult leaves as awns, needles, awl-shaped, acicular or subulate (Den Ouden and Boom, 1978; Krüssmann, 1985; Tripp, 1993; Welch, 1991, 1993). Different authors, describing the same cultivar, will often use

Text continued on p. 265

**Table 2. Terminology used in describing the morphology of Japanese cedar. Measurements cited are in metric units (25.4 mm = 1.0 inch; 0.3 m = 1.0 ft) and standard taxonomic format (x-y is common measurement range). Crown H/W = the height to width ratio. Foliage color defined follows Wilde and Voigt (1977) notation of hue value/chroma (e.g., 5G 6/4-6 is color chart 5 Green with a degree of lightness value of 6 and a chroma or saturation strength of 4 or 6). Color chips are lacking for whitish pigmentations and are defined here.**

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### Characteristic and definition

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#### Growth forms

- Compact shrub: 1-3 m tall × 1-3 m wide, accompanied by increased growth rate, with either linear or saber leaves.
- Dwarf shrub: 1 m tall × 1 m wide, with slow growth rate and saber leaves.
- Tree: Pyramidal to conical, to 50 m tall × 3-5 m wide, with saber leaves.

#### Crowns

- Columnar: Shrub with narrow width, 0.5-4 m tall (H/W 8:1), acute apex and cuneate base.
- Conical: Cone-shaped tree, to 30 m tall × 3 m wide (H/W 10:1); broader basally than columnar, but narrower than pyramidal.
- Cylindrical: Shrub with width to 1 m wide throughout height (H/W 4:1), apex obtuse and base narrow.
- Ovoid: Shrub widest at middle to below, to 3 m tall × 2 m wide (H/W 1.5:1), apex tapering obtuse.
- Globose: Round shrub, to 2 m tall × 3 m wide (H/W 0.6:1), midsection broad and flattened.
- Mound: Pincushion shrub with broad base, to 0.3 m tall × 0.5 m wide (H/W 0.6:1), apex obtusely rounded.
- Oval: Oval shrub to 3 m tall × 2 m wide (H/W 1.5:1), midsection broad and rounded.
- Pyramidal: Tree with triangular shape, to 30 m tall × 6 m wide (H/W 5:1); broader basally than conical.
- Subglobose: Flattened globular shrub, to 2 m tall × 2 m wide (H/W 1:1); apex narrower than globular and broader basally.

#### Branches

- Cool season growth: Growth with short internode length, small leaves, narrow shoot width and short shoot length.
- Primary shoot: Central axis of a spray composed of several seasonal growth cycles; longest shoot with attached secondary shoots.
- Quarternary shoot: First order of shoot borne from tertiary shoot axis, exhibiting only one seasonal growth cycle.
- Seasonal growth: Growth occurring during one season, divided into a cool and a warm season growth phase.
- Secondary shoot: First order of shoots borne from the primary shoot.
- Shoot width: Distance between two tangential lines parallel to branch axis, touching the most exterior leaves.
- Spray: Main branch axis and associated secondary/tertiary shoots; terminal portion of branch that is entirely green and extending beyond the lignified portion of the branch.
- Tertiary shoot: First order of shoot borne from the secondary shoot axis.
- Warm season growth: Growth with long internode length, large leaves, broad shoot width and long shoot length.

#### Foliage color

- Bluish-green: 5G 6/4-6
- Bronze: 2.5YR 4/4-8 and 3/4-6
- Brown: 7.5YR 5/4-8 and 4/4
- Creamy-white: White color with slight yellow pigmentation becoming light green with maturation.
- Dark green: 7.5GY 4/4-6
- Greenish-yellow: 2.5GY 7/6-10
- Light green: 5GY 5/6-8
- Medium green: 5GY 4/6-8
- Purplish-red: 10R 4/6-10
- Silvery-white: Whitish color lacking any green pigmentation with maturation.
- Yellow: 5Y 8/8-10

#### Leaves

- Appressed: Attachment angle of 5-20°, growing with at least half of leaf touching the twig axis.
- Ascending: Attachment angle of 20-85°, causing leaf apex to point forward and only the basal portion touching the twig axis.
- Incurved: Leaf shaft forms a concave arc toward the twig axis.
- Linear: Leaves are flat, straight to recurved, 4-25 mm long, 2-4 mm wide, acute to acuminate, straight to inflexed, attached at angle of 45-95°.
- Perpendicular: Attachment angle 85-95°, causing leaves to appear at a right angle with twig axis.
- Recurved: Leaf shaft forms a slight convex arc, bending backwards from twig axis.
- Saber: Leaves swordlike, quadrangular or dorsiventrally compressed, inflexed, 7-24 mm long, 1.5-3 mm wide, acute to acuminate, reflexed or inflexed (acicular, needle of some authors).
- Shaft: Free portion of leaf blade not attached to twig.
- Short saber: Leaves swordlike, keeled, straight to slightly incurved, 1-6 mm long, 1-4 mm wide, acute, straight or inflexed (awn or subulate of some authors).
- Spiral: Leaf shaft twisted counterclockwise or clockwise around the twig axis, twisting varying from 0.25-1 complete rotation.
- Straight saber: Leaf shaft lacks an arc, and forms a straight line from base to apex.

#### Cones or strobili

- Conical: Male strobilus acute with width less than half the length.
  - Oblong: Male strobilus obtuse with length 2-4 times longer than width.
  - Ovoid: Male strobilus obtuse, broadly elliptic, with width over half the length.
  - Processes: Acuminate apical protrusions from the scale/bracts of female cones, 1-6 mm long, to 1.5 mm wide.
  - Scale/bracts: Combination of an ovulate scale and a bract fused together at the base to midsection, leathery becoming woody at maturation, upon which the seeds occur basally; commonly 4-8 mm long, 4-8 mm wide.
  - Spikelike: Terminal cluster of male cones formed when nearly each axis of a dwarf shoot initiates a male strobilus.
  - Strobili complex: Globose cluster of male strobili with bases appearing fused, formed when a strobili-bearing shoot fails to elongate.
  - Umbo: Scale/bract apex, straight to reflexed, acute.
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**Fig. 1. An alphabetized list of selected cultivar names of *Cryptomeria japonica*. Measurements cited are in metric units (25.4 mm = 1.0 inch; 0.3 m = 1.0 ft) and standard taxonomic format (number in parenthesis is measurement seldom encountered; x-y is common measurement range). Voucher numbers cited are Rouse collections that will be deposited at the herbarium of North Carolina State University and the National Arboretum. Cultivar names recognized include synonymy [alternative names applied in Horticulture (Hort.) or in literature] enclosed in brackets, a quantitative morphological description, herbarium vouchers, authorities and observations. Cultivar names recognized as synonyms include the authority, and the correct cultivar name following the equal symbol. Article 17.9 of the International Code of Nomenclature (ICNCP; Trehane, 1995) requires cultivar names published after 1 Jan. 1959 to be words in a modern language, not Latin; new names are proposed in these cases known.**

**'Araucarioides'** [*Cryptomeria araucarioides* Siebold; 'Enko-sugi'; 'Yenko-sugi']. Tree 11–15 m tall, 2–3 m wide, narrow pyramidal. Primary shoots ascending, (10) 25–56 cm long; secondary shoots ascending, 0–10 (14), 7–35 cm long; tertiary shoots 0–1 (6), (2) 5–11 cm long; quaternary shoots lacking; seasonal growth conspicuous; warm season growth 3.5–9.5 cm long, 8–16 mm wide; cool season growth 0.5–6 cm long, 3–7 mm wide. Foliage color brown in winter, dark green in summer, medium green on new growth. Warm season leaves saber, slightly incurved, 7–14 mm long, apex inflexed, acute to acuminate, attachment ascending 30–45% angle. Cool season leaves short saber, straight to deeply incurved, 2–5 mm long, apex straight, acute, attachment appressed to ascending 5–45% angle. Female strobili rare on young plants. Male strobili rare on young plants. Vouchers: 178, 210, 267. Named as species (Siebold, 1856); as cultivar (Dallimore and Jackson, 1948).

Observations: Tree recognized easily by snakelike branches, but confused with 'Dacrydioides' which has shorter leaves and tufted secondary branches.

**'Aurea'** [var. *aurea* Beissner; 'Ogon-sugi']. Tree to 20 m tall, 4 m wide, broad conical to narrow pyramidal, central leader strong. Primary shoot 10–15 cm long; secondary shoots 7–20, 4–11.5 cm long; tertiary shoots 0–16, 0.6–15 cm long; quaternary shoots 0–1, to 0.6 cm long;

seasonal growth conspicuous; warm season growth 1.5–4.5 cm long, 12–17 mm wide; cool season growth 1–1.5 cm long, 5–7 mm wide. Foliage color bronze in winter, light green in summer, yellow on new growth, darkening with first warm night temperatures. Warm season leaves straight saber, 7–20 mm long, apex straight, acuminate, attachment ascending 30–45% angle. Cool season leaves short saber, straight, attachment 3–4 mm long, apex straight, acute, ascending 30–45% angle. Female strobili not observed. Male strobili not observed. Vouchers: 232, 272. Named as variety (Beissner, 1891); as cultivar (Den Ouden and Boom, 1965).

Observations: 'Aurea' and 'Sekkan' are shrubs distinguished easily by the yellow variegated new growth. However, 'Aurea' quickly becomes a light green by summer, whereas 'Sekkan' retains a yellowish-green color throughout summer.

**'Bandai-sugi'** [var. *bandai sugi*; 'Ito-sugi']. Compact shrub to small tree, very slow growing to 1 m tall, 1.5 m wide, irregular. Primary shoot 2–14 cm long; secondary shoots 0.4–6 cm long, congested along axis, only warm season 20–80, only cool season (0) 10–20; tertiary shoots 0–12, 0.3–2.5 cm long, congested along axis; quaternary shoots lacking; seasonal growth difference conspicuous; warm season growth 1–1.5 cm long, 11–19 mm wide; cool season growth 0.5–1.5 cm long, 4–7 mm wide. Foliage color purplish-red in winter, medium green in summer, light green on new growth. Warm season leaves saber, straight to slightly recurved, 11–19 mm long, apex straight, acuminate, attachment ascending 60–80% angle. Cool season leaves short saber, straight, 1–3 mm long, apex straight, acute, attachment ascending 45–80% angle. Female strobili rare. Male strobili rare. Voucher: 219. Named as variety (Hornibrook, 1938); as cultivar (Den Ouden and Boom, 1965).

Observations: 'Bandai-sugi' and 'Yokohama' are slow growing dwarf shrubs of those cultivars with irregular crowns and profuse cool season secondary shoots. 'Bandai-sugi' is distinguished by the longer leaves, large number of secondary shoots, and mature size to nearly a meter tall.

**'Benjamin Franklin'** Hatch (1985) ['Bennie's Best']. Tree to 20 m tall, 3–4 m wide, narrowly conical, central leader straight, dead and tertiary shoots not persisting. Primary shoot ascending, 13–29 cm long; secondary shoots 7–16, pendulous, 0.5–15.4 cm long; tertiary shoots 0–16, pendulous, 0.4–9 cm long; quaternary shoots lacking; seasonal growth conspicuous; warm season growth

3.5–6 cm long, 8–12 mm wide; cool season growth 0.5–7 cm long, 2–6 mm wide. Foliage color dark green in winter, medium green in summer, light green on new growth. Warm season leaves saber, straight to deeply incurved, 9–17 mm long, apex straight or inflexed, acute, attachment ascending 30–45% angle. Cool season leaves short saber, straight to slightly incurved, 2–5 mm long, apex straight, acute to acuminate, attachment ascending 45% angle. Female strobili persistent on upper crown of mature trees. Male strobili persistent on upper crown of mature trees. Voucher: 181.

Observations: A conical tree distinguished by the dark green winter color, lack of quaternary shoots, and shedding of inner dead branches.

**'Bennie's Best'** Hort. = 'Benjamin Franklin'

**'Birodo-sugi'** Hort. = 'Compressa'

**'Black Dragon'** Tripp (1993). Compact shrub to 2 m tall, 0.5 m wide, columnar. Primary shoot 7–16 cm long; secondary shoots 2–22, 0.5–4 cm long, congested along axis; tertiary shoots 0–6, 0.4–3.2 cm; quaternary shoots lacking; seasonal growth difference conspicuous; warm season growth 0.8–3.2 cm long, 9–25 mm wide; cool season growth 0.7–1.3 cm long, 3–6 mm wide. Foliage color dark green in winter and summer, bluish-green on new growth. Warm season leaves saber, straight to slightly incurved, 8–18 mm long, apex straight to inflexed, acute to acuminate, attachment ascending 30–45% angle. Cool season leaves short saber, straight, 1–3 mm long, apex straight, acute to acuminate, attachment 30–45% angle. Female strobili rare. Male strobili persistent, terminal spikelike clusters on secondary and tertiary shoots, 1–11 per cluster, ovoid, 4–5 mm long, 2–3 mm wide, apex obtuse. Vouchers: 198, 227.

Observations: Cool season growth very short. Similar to 'Giokumo' but distinguished by narrower columnar form and dark green foliage.

**'Bloomers Witches Broom'** Hort. ['National Arboretum Witches Broom'; 'Rein's Dense Jade']. Compact shrub to 1.5 m tall, 1 m wide, subglobose to broad pyramidal. Primary shoot ascending, 8.5–19.5 cm long; secondary shoots 7–23, 0.3–18 cm long; tertiary shoots 0–15, 0.3–8 cm long; quaternary shoots 0–7, 0.3–4 cm long; seasonal growth conspicuous; warm season growth 1.5–9 cm long, 7–11 mm wide; cool season growth 0.9–2.9 cm long, 3–4 mm wide. Foliage color

medium green in winter and summer, bluish-green on new growth. Warm season leaves saber, slightly incurved, 8–11 mm long, apex straight to inflexed, acute, attachment ascending 30–45% angle. Cool season leaves short saber, slightly incurved, 2–4 mm long, apex inflexed, acute, attachment appressed 5–20% angle. Female strobili rare. Male strobili rare. Vouchers: 193, 203, 247, 280.

Observations: Distinguished by appressed cool season leaves (or narrow cool seasonal growth). 'Little Diamond' appears to be a diminutive form of this cultivar.

**'Buckiscope'** Hort. Compact shrub, adult, 1.5 m tall, 0.75 m wide, narrowly conical. Primary shoot 7.5–13 cm long; secondary shoots 8–14, 1–6 cm long; tertiary shoots 0–5, 0.7–2.3 cm long; quaternary shoots rare, 0–1, 0.4–0.7 cm long; seasonal growth conspicuous; warm season growth 1.5–7.2 cm long, 9–14 mm wide; cool season growth 1.0–1.5 cm long, 3–4 mm wide. Foliage color bronze in winter, medium green in summer, light green on new growth. Warm season leaves saber, slightly incurved, 6–9 mm long, apex straight, acuminate, attachment ascending 45% angle. Cool season leaves short saber, slightly incurved, 1–3 mm long, apex straight, acute, attachment appressed to ascending at 5–30% angle. Female strobili rare. Male strobili rare. Voucher: 240.

Observations: More plants required for additional data for adequate characterization. Known from Atlanta Botanical Garden.

**'Compressa'** Den Ouden (1949). ['Birodo-sugi']. Dwarf shrub to 1 m tall, 0.5 m wide, ovoid. Primary shoot ascending, 1.4–5 (6.5) cm long; secondary shoots 1–10, 0.4–5 cm long; tertiary shoots 0–3, 0.3–0.6 cm long, not exerted beyond margin of shrub; quaternary shoots lacking; seasonal growth conspicuous; warm season growth 0.8–3.5 cm long, 15–27 mm wide; cool season growth 0.7–1.8 cm long, 5–7 mm wide. Foliage color bronze in winter, dark green in summer, bluish-green on new growth. Warm season leaves linear, straight to slightly incurved, 7–13 mm long, apex straight, acute to acuminate, attachment ascending to perpendicular, 60–90% angle. Cool season leaves short saber, straight to slightly recurved, 1.5–6 mm long, apex reflexed, acute to acuminate, attachment ascending to perpendicular, 45–90%. Female strobili rare. Male strobili rare. Vouchers: 202, 208, 243, 263.

Observations: 'Compressa' is distinguished by warm season linear leaves and cool season short saber leaves. Often confused with 'Vilmoriniana' which is a broader and taller shrub with nodding terminal shoots exerted beyond the rest of the foliage and short saber warm season leaves.

**'Cristata'** Beissner (1901). ['Sekka-sugi'; 'Sekkwia-sugi']. Small tree to 6 m tall, 2.5 m wide, pyramidal, trunk knotted or twisted irregularly. Primary shoots ascending, 5–22 cm long; secondary shoots 3–30, 4–16 cm long, occasionally fasciated; tertiary shoots 0–18, 1–6.5 cm long, occasionally fasciated; quaternary shoots lacking; seasonal growth not conspicuous; nonfasciated growth 5–10 cm long, 15–30 mm wide; fasciated shoots 6–15.5 cm long, 2.5–10.5 cm wide. Foliage color brown in winter, medium green in summer, light green on new growth. Nonfasciated leaves saber, straight to slightly incurved, 7–18 mm long, apex straight to inflexed, acute to acuminate, attachment ascending 45–60% angle. Fasciated leaves saber, straight to slightly incurved, 4–18 mm long, apex straight to inflexed, acute to acuminate, appressed 45% angle. Female strobili rare. Male strobili rare. Vouchers: 284, 288, 292.

Observations: Distinguished by the larger fasciated (cockscomb-like) shoots than 'Kilmacurragh'. The twisted or knotted trunks of 'Cristata' and 'Kilmacurragh' appear to be the result of grafting during development.

**'Dacrydioides'** [*Cryptomeria dacrydioides* Carr.]. Tree, adult, 11–15 m tall, 2–3 m wide, narrow pyramidal. Primary shoots ascending, (10) 25–56 cm long; secondary shoots ascending, 15–27, 1.4–6 cm long; tertiary shoots 0–1 (3), 0.5–5 cm long; quaternary shoots lacking; warm seasonal growth 1–6 cm long, 7–11 mm wide; seasonal growth conspicuous; cool seasonal growth 0.7–3 cm long, 3–6 mm wide. Foliage color purplish-red in winter, dark green in summer, medium green on new growth. Warm season leaves saber, slightly incurved, 5–7 mm long, apex inflexed, acuminate, attachment ascending 45–60% angle. Cool season leaves saber to short saber, slightly incurved, 2–6 mm long, apex inflexed, acute, attachment appressed to ascending 5–45% angle. Female strobili rare on young plants. Male strobili rare on young plants. Voucher: 230. Named as species (Carrière, 1867); as cultivar (Dallimore and Jackson, 1948).

Observations: Tree with snakelike branches bearing tufted secondary

branches, and with shorter leaves than 'Araucarioides'.

**'Dwarf Whitetip'** = proposed name for 'Nana Albospica' in accordance with Article 17.9 of the ICNCP.

**'Elegans'** [*Cryptomeria elegans*, 'Hime-sugi']. Small tree (juvenile 3 m tall, 1 m wide), columnar to narrowly conical. Primary shoots perpendicular, 19–27 cm long; secondary shoots 10–19, 1.7–12 cm long; tertiary shoots 0–9, 1.5–7 cm long; quaternary shoots lacking; seasonal growth conspicuous; warm season growth 1.5–4.9 cm long, 13–52 mm wide; cool season growth 0.5–0.7 cm long, 4–6 mm wide. Foliage color bronze to purplish-red in winter, medium green in summer, medium green on new growth. Warm season leaves linear, straight to slightly recurved, 8–25 mm long, apex inflexed, acute to acuminate, attachment perpendicular, 80–95% angle. Cool season leaves linear, straight to recurved, 1–5 mm long, apex straight, acute to acuminate, attachment ascending to perpendicular, 60–90% angle. Female strobili rare. Male strobili persistent, clustered on primary shoots, proximal, 1–8 per cluster; conical, 3–7 mm long, 2–3 mm wide, apex acute. Vouchers: 186, 237. Named as species (Makoy, 1864); as cultivar (Dallimore and Jackson, 1948).

Observations: Small tree with narrow crown and leaves linear. Distinguished from 'Elegans Viridis' by winter foliage becoming bronze to purplish-red.

**'Elegans Aurea'** Welch (1966) = 'Golden Elegance'. Compact shrub to small tree (juvenile, 3 m tall, 1 m wide), columnar to narrowly conical. Primary shoot perpendicular, 11.5–46 cm long; secondary shoots 8–40, 0.6–16 cm long; tertiary shoots 0–12, 0.6–4.2 cm long, distal ends pendulous; quaternary shoots lacking; seasonal growth conspicuous; warm season growth 1.4–3.7 cm long, 12–40 mm wide; cool season growth 0.5–0.7 cm long, 4–6 mm wide. Foliage color greenish-yellow in winter, light green in summer, greenish-yellow on new growth. Warm season leaves linear, straight to slightly recurved, 8 to 27 mm long, apex straight, acute to acuminate, attachment ascending to perpendicular, 45–90% angle. Cool season leaves linear, straight to recurved, 1–5 mm long, apex straight, acute to acuminate, attachment ascending to perpendicular, 60–90% angle. Female strobili rare. Male strobili persistent, clustered on primary shoots, proximal, 1–8 per cluster; conical, 3–7 mm long, 2–3 mm wide, apex acute.

Vouchers: 166, 180, 191, 235, 238.

Observations: Linear leaf selection distinguished by the greenish-yellow new and winter foliage.

**'Elegans Compacta'** Dallimore and Jackson (1948). Dwarf shrub to 0.7 m tall, 1.3 m wide, dense spreading mounded. Primary shoots 2–17 cm long; secondary shoots 9–24, 1.8–9 cm long, congested; tertiary shoots 0–10, 0.4–5.0 cm long, congested; quaternary shoots lacking; seasonal growth difference conspicuous, warm season growth 3.5–5.5 cm long, 12–30 mm wide; cool season growth 0.5–0.7 cm long, 4–6 mm wide. Foliage color dark green to bronze in winter, medium green in summer with terminal shoots often yellow, medium green or yellow on new growth. Warm season leaves saber, straight, (9) 11–17 mm long, apex straight to reflexed, acute to acuminate, attachment ascending 30–45% angle. Cool season leaves short saber, straight to recurved, apex straight, acute to acuminate, 1–5 mm long, attachment ascending to perpendicular, 60–90% angle. Female strobili rare. Male strobili persistent, proximal on primary and secondary shoots, in 1–6 globose complexes of strobili fused at the base; strobili complex 10–15 mm long, 9–13 mm wide, with 8–16 strobili per complex; strobilus oval, apex obtuse, 3–6 mm long, 2–3 mm wide. Vouchers: 253, 273, 282.

Observations: 'Elegans Compacta' is confused with 'Nana', but distinguished by the more prostrate habit.

**'Elegans Gracilis'** Hort. = 'Elegans Nana'

**'Elegans Nana'** = 'Nana' pro parte

Observations: Name applied to two distinct cultivars, misapplied here. Named as variety by Knight and Perry (1850), but polynominal name was illegitimate; as cultivar by Welch (1966), but name illegitimate as published for another cultivar a year earlier.

**'Elegans Nana'** [var. *elegans nana* Veitch; 'Elegans Gracilis']. Compact shrub (juvenile 1 m tall, 2 m wide), irregular with conical upturned branches. Primary shoots perpendicular, 19–27 cm long; secondary shoots 10–19, 1.7–12 cm long; tertiary shoots 0–7, 1.5–6.5 cm long; quaternary shoots lacking; seasonal growth conspicuous; warm season growth 1.4–4.5 cm long, 13–49 mm wide; cool season growth 0.5–0.7 cm long, 4–6 mm wide. Foliage color bronze to purplish-red in winter, medium green in summer, medium green on new growth. Warm

season leaves linear, straight to slightly recurved, 8–25 mm long, apex inflexed, acute to acuminate, attachment perpendicular, 80–95% angle. Cool season leaves linear, straight to recurved, 1–5 mm long, apex straight, acute to acuminate, attachment ascending to perpendicular, 60–90% angle. Female strobili rare. Male strobili persistent, oblong oval, 3–7 mm long, 2–3 mm wide, apex acute, 1–8 per cluster, proximal on primary shoots. Voucher: 277. Described as variety by Veitch (1881); as cultivar by Den Ouden and Boom (1965).

Observations: Confused with 'Nana', but distinguished by the linear leaves. This cultivar has foliage and branching pattern similar to 'Elegans', but differs in the limbs being decumbent, growing down toward the ground and turning up distally.

**'Elegans Viridis'** [var. *elegans viridis* Hornibrook]. Small tree (juvenile 3 m tall, 1 m wide), columnar to narrowly conical. Primary shoots perpendicular, 19–27 cm long; secondary shoots 10–19, 1.7–12 cm long; tertiary shoots 0–9, 1.5–7 cm long; quaternary shoots lacking; seasonal growth conspicuous; warm season growth 13–52 mm wide; cool season growth 0.5–0.7 cm long, 4–6 mm wide. Foliage color medium green in winter, summer, and on new growth. Warm season leaves juvenile, linear, straight to slightly recurved, 8–25 mm long, apex inflexed, acute to acuminate, attachment perpendicular, 80–95% angle. Cool season leaves linear, straight to recurved, 1–5 mm long, apex straight, acute to acuminate, attachment ascending to perpendicular, 60–90% angle. Female strobili rare. Male strobili persistent, oblong oval, 3–7 mm long, 2–3 mm wide, apex acute, 1–8 per cluster, proximal on primary shoots. Voucher: 293. Named as variety (Hornibrook, 1923); as cultivar (Den Ouden and Boom, 1965).

Observations: 'Elegans Viridis' is nearly identical to 'Elegans' in morphology and growth habit, but distinguished by the persistent green winter coloration.

**'Enko-sugi'** Fitch (1930) = 'Araucarioides'

**'Giokomo'** Hort. = 'Giokumo'

**'Giokumo'** Hort. ['Gyokryu']. Compact shrub to 2 m tall, 1 m wide, conical. Primary shoot 8–31 cm long; secondary shoots 6–13, 1–14 cm long; tertiary shoots 0–6, 0.8–2.5 cm long; quaternary shoots 0–2, 0.5–1 cm long; seasonal growth conspicuous; warm season growth

1.5–3 cm long, 13–30 mm wide; cool season growth 0.5–1.1 cm long, 3–7 mm wide. Foliage color medium green in winter and summer, bluish-green on new growth. Warm season leaves saber, slightly incurved, 6–24 mm long, apex straight to inflexed, acute, attachment ascending 45–60% angle. Cool season leaves short saber, straight, 2–5 mm long, apex straight, acute, attachment ascending 45–60% angle. Female strobili rare. Male strobili rare. Vouchers: 177, 217.

Observations: 'Giokomo', 'Giokuro', 'Gyo Kruya', 'Gyokryu' and 'Gyo Kuryu' are common misspellings found in both botanic gardens and the nursery and landscape industries. Cool season growth very short. Similar to 'Black Dragon' but distinguished by broader conical form and medium green foliage.

**'Giokuro'** = 'Giokumo'

**'Globes'** Hort. ['Globus']. Compact shrub (juvenile 2 m tall, 1 m wide), pyramidal to oval. Primary shoots perpendicular, 17–34 cm long; secondary shoots 6–23, 1–10 cm long; tertiary shoots 0–7, 1–4 cm long; quaternary shoots lacking; seasonal growth conspicuous; warm season growth 1.4–3.7 cm long, 25–42 mm wide; cool season growth 0.4–0.8 cm long, 3–6 mm wide. Foliage color bronze to purplish-red in winter, medium green in summer, medium green on new growth. Warm season leaves juvenile, linear, slightly recurved to deeply recurved, 12–25 mm long, apex inflexed, acute to acuminate, attachment perpendicular, 80–90% angle. Cool season leaves linear, straight to recurved, 1–5 mm long, apex straight, acute to acuminate, attachment ascending to perpendicular, 60–90% angle. Female strobili rare. Male strobili persistent, clustered on primary shoots or first secondary shoot, proximal, 2–25 per cluster, conical, 5–14 mm long, 2–5 mm wide, apex acute. Vouchers: 176, 239.

Observations: Linear-leaved cultivar distinguished by the purplish-red summer foliage.

**'Globosa'** Den Ouden and Boom (1949). Compact shrub to 1.3 m tall, 1 m wide, subglobose. Primary shoot ascending, 11–19 cm long; secondary shoots 1–12, 0.5–14 cm long; tertiary shoots 0–6, 0.5–6 cm long; quaternary shoots (0) 3–6, 0.5–2.5 cm long, new growth spirally twisted; seasonal growth conspicuous; warm season growth 3–10.5 cm long, 6–11 mm wide; cool season growth 0.3–1.2 cm long, 3–6 mm wide. Foliage color purplish-red in winter, medium green in summer, bluish-green on new growth.

Warm season leaves saber, straight to slightly incurved, 7–11 mm long, apex straight to inflexed, acute, attachment appressed to ascending 10–45% angle. Cool season leaves short saber, slightly incurved, 2–4 mm long, apex straight to inflexed, acute, attachment ascending 5–45% angle. Female strobili rare. Male strobili rare. Vouchers: 223, 252, 254.

Observations: Cool seasonal growth very short. 'Globosa' is a shorter, more compact plant than 'Globosa Nana' with which it is confused. Morphological similarity and misleading cultivar name has led to many misidentifications in both botanic gardens and the nursery and landscape industries.

**'Globosa Nana'** [var. *globosa nana* Hornibrook; 'Lobbii Nana']. Compact shrub to 2 m tall, 2 m wide, subglobose to oval. Primary shoot ascending, 3.5–12 cm long; secondary shoots 1–18, 0.8 to 7.2 cm long; tertiary shoots 0–7, 0.5–3 cm long; quaternary shoots lacking; seasonal growth conspicuous; warm season growth 0.8–9 cm long, 7–16 mm wide; cool season growth 0.4–1.6 cm long, 4–8 mm wide. Foliage color purplish-red in winter, medium green in summer, bluish-green on new growth. Warm season leaves saber, straight, 5–10 mm long, apex straight, acute to acuminate, attachment ascending 40–60% angle. Cool season leaves short saber, straight, 2–4 mm long, apex straight to reflexed, acute to acuminate, attachment ascending 30–45% angle. Female strobili rare. Male strobili rare. Vouchers: 179, 245, 259, 261, 270, 274. Named as variety (Hornibrook, 1923), as cultivar (Den Ouden and Boom, 1965).

Observations: 'Globosa Nana' grows larger and branching is more sparse than 'Globosa' with which it is confused.

**'Globus'** Tripp (1993) = 'Globes'

**'Golden Elegance'** = proposed name for 'Elegans Aurea' as per Article 17.9 of the ICNCP.

**'Graceful'** = proposed name for 'Gracilis' as per Article 17.9 in accordance with the ICNCP.

**'Gracilis'** Krüssmann (1972) = 'Graceful'. Tree to 5 m tall, 2 m wide, broad conical to narrow pyramidal. Primary shoot 15–29 cm long; secondary shoots 12–45, 0.5–22 cm long; tertiary shoots 0–31, 0.3–8 cm long; quaternary shoots 0–6, 0.3–2.5 cm long; seasonal growth conspicuous; warm season growth 4–8 cm

long, 4–6 mm wide; cool season growth 0.8–2.8 cm long, 2–4 mm wide. Foliage color greenish-yellow in winter, summer, and on new growth. Warm season leaves short saber, straight to slightly incurved, 3–5 mm long, apex straight or inflexed, acuminate, attachment ascending 45% angle. Cool season leaves short saber, straight to slightly incurved, 1–3 mm long, apex straight or inflexed, acute to acuminate, attachment appressed to ascending, 10–45% angle. Female strobili persistent, terminal on secondary or tertiary shoots, solitary, subglobose, 8–14 mm long, 10–14 mm wide; scale-bracts 15–20, quadrangular, 5–8 mm long, 5–8 mm wide, apex acute, attachment cuneate to peltate; umbo straight or reflexed, acute; processes 1–3, 2–4 mm long, exerted. Male strobili rare. Vouchers: 201, 278.

Observations: Distinguished as tree with short saber leaves with foliage consistently greenish-yellow all year.

**'Granny's Ringlets'** Hort. = 'Spiralis'

**'Green Pencil'** Hort. Compact shrub, adult, 2 m tall, 1 m wide, oval to ovoid. Primary shoot 4–10 cm long; secondary shoots 6–10, 0.3–5.3 cm long; tertiary shoots 0–3, 0.3–3.0 cm long; terminal shoots clustered, often towards the apex of the crown; quaternary shoots lacking; seasonal growth conspicuous; warm season growth 1.2–1.7 cm long, 10–17 mm wide; cool season growth 0.3–2.6 cm long, 5–6 mm wide. Foliage color bronze in winter, medium green in summer, light green on new growth. Warm season leaves adult, saber, straight to slightly recurved, 6–10 mm long, apex straight, acute, attachment ascending 45–60% angle. Cool season leaves adult, short saber, straight to slightly recurved, 1–4 mm long, apex reflexed, acute, attachment ascending 45% angle. Female strobili rare. Male strobili rare. Vouchers: 212, 213.

Observations: More plants required for additional data for adequate characterization. Known from Atlanta Botanic Garden.

**'Gyo Kruya'** Hort. = 'Giokimo'

**'Gyo Kuryu'** Hort. = 'Giokumo'

**'Gyokuryu'** Hort. = 'Giokumo'

**'Hime-ikari-sugi'** Hort. = 'Ikari'

**'Hime-sugi'** Hort. = 'Elegans'

**'Hino-sugi'** Hort. = 'Vilmoriniana'

**'Ikan-sugi'** Hort. = 'Ikari'

**'Ikar-sugi'** Hort. = 'Ikari'

**'Ikari'** Kortmann (1987). ['Hime-ikari-sugi'; 'Ikan-sugi'; 'Ikar-sugi']. Compact shrub to 1.5 m tall, 1.5 m wide, broad pyramidal to subglobose. Primary shoot 10–20 cm long; secondary shoots 9–18, pendulous, 1.2–13.8 cm long; tertiary shoots (0) 3–12, pendulous, 1–8.4 cm long; quaternary shoots 0–1, 0.4–0.8 cm long; seasonal growth conspicuous; warm season growth 0.8–1.8 cm long, 7–12 mm wide; cool season growth (1.5) 3–11.5 cm long, 4–5 mm wide. Foliage color light green in winter, medium green in summer, light green on new growth. Warm season leaves short saber, straight to slightly incurved, 3–6 mm long, apex straight or reflexed, acute to acuminate, attachment ascending 45% angle. Cool seasonal leaves short saber, straight to slightly incurved, 1–3 mm long, apex straight or reflexed, acute to acuminate, attachment ascending 45% angle. Female strobili rare. Male strobili rare. Voucher: 199.

Observations: Compact shrub with short saber leaves with light green new and winter foliage.

**'Ito-sugi'** Hort. = 'Bandai-sugi' pro parte

**'Ito-sugi'** Hort. = 'Taisho-tama' pro parte

**'Ito-sugi'** Krüssmann (1972). Not observed, but Welch (1979) noted similarity to 'Araucarioides'.

**'Jindai-sugi'** [var. *jindai sugi* Hornibrook]. Compact shrub to small tree, to 3 m tall, 1.5 m wide, broad conical to pyramidal when mature. Primary shoot (6.5) 9–18.5 cm long; secondary shoots 6–20, 1.5–8 cm long, congested along axis; tertiary shoots 0–9, 1–4.5 cm long, congested along axis; quaternary shoots 0–1, 0.4–1 cm long; seasonal growth difference conspicuous; warm season growth 0.8–1.8 (2.0) cm long, 6–15 mm wide; cool season growth 0.5–1.5 cm long, 3–6 mm wide. Foliage color bronze in winter, dark green in summer, medium green on new growth. Warm season leaves short saber, straight to slightly incurved or slightly recurved, (4) 6–11 mm long, apex straight, acute to acuminate, attachment ascending 30–60% angle. Cool season leaves short saber, straight, 1–3 mm long, apex straight to

inflexed, acute, attachment appressed to ascending 5–45% angle. Female strobili rare. Male strobili persistent, terminal strobili complex on secondary and tertiary shoots, 1–12 per cluster, oblong, 2–10 mm long, 1.5–3 mm wide, apex obtuse; occasionally compound strobilus with 1–2 conelets. Vouchers: 205, 257, 262, 268. Named as variety (Hornibrook, 1923); as cultivar (Den Ouden and Boom, 1965).

Observations: This cultivar often is found mislabeled in the United States under the name 'Bandai-sugi'. Similar to 'Taisho-tama', but distinguished by shorter seasonal growth and secondary shoots, and longer, oblong male strobili.

**'Kilmacurragh'** Hornibrook (1938).

Small tree to 6 m tall, 2.5 m wide, pyramidal, trunk knotted or irregularly twisted. Primary shoots ascending, 5–22 cm long; secondary shoots 1–30, 1–16 cm long, occasionally fasciated; tertiary shoots 0–20, 1–6 cm long, occasionally fasciated; quaternary shoots lacking; seasonal growth not conspicuous; nonfasciated growth 5–10 cm long, 15–28 mm wide; fasciated shoots 1–6 (8) cm long, 1–6 (10.5) cm wide. Foliage color bronze in winter, medium green in summer, light green on new growth. Nonfasciated leaves straight saber, straight, 7–18 mm long, apex straight to reflexed, acute to acuminate, attachment ascending 45–60% angle. Fasciated leaves straight saber, straight, 4–18 mm long, apex straight to reflexed, acute to acuminate, appressed 45% angle. Female strobili rare. Male strobili rare. Voucher: 207.

'Kilmacurragh' described by Hornibrook (1938) from a specimen located at Kilmacurragh, Ireland, as belonging to var. *cristata* Bleiss.

Observations: 'Kilmacurragh' has smaller fasciated (cockscumb-like) shoots than 'Cristata'.

**'Knaptonensis'** [var. *knaptonensis* Lyttel].

Dwarf shrub to 1 m tall, 0.7 m wide, ovoid to oval. Primary shoots ascending, 6–19.5 cm long; secondary shoots 9–12, 3–13 cm long; tertiary shoots 0–7, 0.5–3 cm long; quaternary shoots 0–2, 0.5–2 cm long; pentanary shoots 0–1, 0.5–0.8 cm long; seasonal growth conspicuous; warm season growth 2.5–3.5 cm long, 9–13 mm wide; cool season growth 0.9–2.0 cm long, 3–5 mm wide. Foliage color bronze in winter, light green in summer, silvery-white on new growth, variegations completely engulf tertiaries and quaternary shoots or borne as irregular patches, darkening to light green. Warm season leaves short saber, slightly incurved, 2–4 mm long, apex inflexed, narrowly acuminate, attachment ascending 30–45% angle. Cool season leaves

short saber, slightly incurved, 1–3 mm long, apex inflexed, narrowly acuminate, attachment ascending, 30–45% angle. Female strobili rare. Male strobili rare. Vouchers: 169, 221. Described as variety (Lyttel, 1934); as cultivar (Hornibrook, 1938).

Observations: Dwarf shrub with silvery-white new foliage. Tripp (1993) reported that hot weather causes this cultivar to revert, both in variegation color and habit, to 'Nana Albospica' in the southeastern United States. Cultivars labeled as 'Knaptonensis' in the southeastern U.S. often are misidentified as 'Nana Albospica'. 'Nana Albospica' is distinguished by longer leaves and new leaves being creamy to silvery-white colored.

**'Kukamiga'** Hort. Dwarf shrub, adult, 1 m tall, 0.8 m wide, oval to ovoid. Primary shoot 4–6.5 cm long; secondary shoots 1–6, 1–3.5 cm long; tertiary shoots 0–4, 0.5–2.5 cm long; quaternary shoots lacking; seasonal growth conspicuous; warm season growth 2.5–7 cm long, 17–23 mm wide; cool season growth 0.7–1.0 cm long, 4–6 mm wide. Foliage color bronze in winter, medium green in summer, light green on new growth. Warm season leaves saber, straight to slightly incurved, 8–14 mm long, apex straight, acuminate, attachment ascending 45–60% angle, new leaves occasionally 2–3 grafted. Cool season leaves short saber, straight to slightly incurved, 3–4 mm long, apex straight, acute, attachment ascending 45% angle. Female strobili rare. Male strobili rare. Voucher: 244.

Observations: More plants are required for additional data for adequate characterization. Known from Atlanta Botanical Garden.

**'Kusari-sugi'** Dallimore and Jackson (1948) = 'Spiraliter Falcata'

**'Little Diamond'** Laar (1990). Dwarf shrub to 0.5 m tall, 0.5 m wide, globose, extremely compact. Primary shoot 5–6.5 cm long; secondary shoots 5–8, 0.4–2.5 cm long; tertiary shoots 0–4, 0.4–1 cm long; quaternary shoots lacking; seasonal growth conspicuous; warm season growth 0.8–1.5 cm long, 6–7 mm wide; cool season growth 1.2–2.5 cm long, 3–4 mm wide. Foliage color medium green in winter, dark green in summer, bluish-green on new growth. Warm season leaves saber, slightly incurved, (4) 6–10 mm long, apex inflexed, acute to acuminate, attachment ascending 45% angle. Cool season leaves short saber, slightly incurved to deeply incurved, 2–3 mm long, apex inflexed, acute, attach-

ment appressed 5–20% angle. Female strobili rare. Male strobili rare. Voucher: 219.

Observations: A diminutive form of 'Bloomers Witches Broom', differing with narrower shoots, smaller habit, and slower growth.

**'Littleworth Dwarf'** Welch (1991) ['Littleworth Gnome'; 'Littleworth Gnom']. Dwarf shrub, adult, 0.7 m tall, 0.7 m wide, subglobose. Primary shoot 7–10 cm long; secondary shoots 3–6, 2.3–4.8 cm long; tertiary shoots 0–1, 0.8–1 cm long; quaternary shoots lacking, new shoots spirally twisted; seasonal growth conspicuous; warm season growth 0.8–2 cm long, 8–12 mm wide; cool season growth 0.4–0.8 cm long, 3–7 mm wide. Foliage color medium green in summer, bronze in winter, light green on new growth. Warm seasonal leaves saber, straight to slightly incurved, 6–9 mm long, apex straight to inflexed, acuminate, attachment ascending 45% angle. Cool season leaves adult, short saber, slightly to deeply incurved, 2–5 mm long, apex inflexed, acuminate, attachment ascending 45% angle. Female strobili rare. Male strobili rare. Voucher: 215.

Observations: More plants required for additional data for adequate characterization.

**'Littleworth Gnom'** Hort. = 'Littleworth Dwarf'

**'Littleworth Gnome'** Hort. = 'Littleworth Dwarf'

**'Lobbii'** [*Cryptomeria lobbiana* Billain]. Tree to 30 m tall, 5 m wide, conical, congested proliferation of secondary, tertiary, and quaternary shoots at terminal end of major limbs. Primary shoot ascending, 20–55 cm long; secondary shoots 8–25, pendulous, 0.4–23 cm long, inner dead shoots persistent; tertiary shoots 0–24, pendulous, 0.4–6 cm long, inner dead shoots persistent; quaternary shoots 0–5, pendulous, 0.5–0.7 cm long, inner dead shoots persistent; seasonal growth conspicuous; warm season growth 2–17.5 cm long, 8–18 mm wide; cool season growth 0.5–5 cm long, 4–6 mm wide. Foliage color brown in winter, medium green in summer, light green on new growth. Warm season leaves saber, slightly incurved, 8–20 mm long, apex straight to inflexed, acute to acuminate, attachment ascending 20–45% angle. Cool season leaves short saber, straight to slightly incurved, 2–3 mm long, apex straight, acute, attachment ascending 45% angle. Female strobili persistent 2 years, terminal on secondary or tertiary shoots, solitary, subglobose, 14–16 mm long, 11–

13 mm wide; scale-bracts 15–30, 3–5 mm long, 3–5 mm wide, quadrangular, apex acute, attachment cuneate to peltate; umbo acute, reflexed; processes 3–6, 2–3 mm long, exerted. Male strobili persistent, terminal spikelike clusters on secondary and tertiary shoots, 3–33 per cluster, ovoid, 3–5 mm long, 2–3 mm wide, apex obtuse. Vouchers: 192, 249, 250. Described as species (Billain, 1853); as cultivar (Dallimore and Jackson, 1948).

Observations: This selection is virtually identical to members of the typical species in most characters when not subjected to consistently cold winters. Then, 'tufting' of secondary shoots is more prevalent.

'Lobbii Nana' Hillier (1964) = 'Globosa Nana'

'Lobbii Nana' Dallimore and Jackson (1948) = 'Nana'

'Lobbii Nana Aurea' Tripp (1993) = 'Lobbs Golden Dwarf'. Compact shrub to 1.5 m tall, 1–1.5 m wide, ovoid to pyramidal. Primary shoot ascending, 16–28 cm long; secondary shoots 11–21, 0.5–12.1 cm long; tertiary shoots 0–13, 0.5–4.9 cm long; quaternary shoots 0–3, 0.5–0.7; seasonal growth conspicuous; warm season growth 1–2.5 cm long, 11–20 mm wide; cool season growth (3) 4–12 cm long, 3–7 mm wide. Foliage color greenish-yellow in winter, summer, and on new growth. Warm season leaves saber, straight to slightly recurved, 5–9 mm long, apex straight, acute, attachment ascending 45–60% angle. Cool season leaves short saber, straight, 2–4 mm long, apex straight or reflexed, acute to acuminate, attachment ascending 45% angle. Female strobili rare. Male strobili persistent, terminal spikelike clusters on secondary and tertiary shoots attached to trunk, 2–18 per cluster, ovoid, 4–5 mm long, 2–3 mm wide, apex acute. Vouchers: 197, 204, 218.

Observations: Shrub with greenish-yellow foliage all year.

'Lobbs Golden Dwarf' = proposed name for 'Lobbii Nana Aurea' in accordance with Article 17.9 of the ICNCP.

'Majiro-sugi' Hort. = 'Nana Albospicata'

'Manhismi-sugi' Hort. = 'Monstrosa Nana'

'Mankichi' Hort. = 'Monstrosa Nana'

'Mejero-sugi' Hort. = 'Nana Albospicata';

'Mejiro-sugi' Hort. = 'Nana Albospicata'

'Monstrosa' Beissner and Fitschen (1930). Small tree 4–5 m tall, 1–3 m wide, irregular. Primary shoot ascending, 8–42 cm long; secondary shoots 0.3–18 cm long, warm season only 17–20, cool season only 20–70; tertiary shoots 0–20, 0.3–18 cm long; quaternary shoots 0–5, 0.3–1 cm long; seasonal growth conspicuous, primarily cool season; warm season growth (1) 4–36 cm long, 9–17 mm wide; cool season growth 0.5–2.5 cm long, 3–7 mm wide. Foliage color bronze in winter, medium green in summer, medium green on new growth. Warm seasonal leaves saber, straight, 7–20 mm long, apex straight or reflexed, acute to acuminate, attachment ascending 20–45% angle. Cool season leaves short saber, straight to slightly incurved, 2–4 mm long, apex straight, acute, attachment ascending 45–75% angle. Female strobili rare. Male strobili persistent, terminal spikelike clusters on secondary and tertiary shoots, 1–13 per cluster, ovoid, 3–8 mm long, 2–3 mm wide, apex obtuse. Vouchers: 184, 190, 294.

Observations: Tree with irregular crown, distinguished from the dwarf selection by longer primary shoots and warm season growth, and bronze winter foliage color.

'Monstrosa Nana' [var. *monstrosa nana* Hornibrook; 'Manhismi-ugi'; 'Mankichi']. Compact shrub to 3 m tall, 0.6–1 m wide, crown irregular. Primary shoot 8.5–11 cm long; secondary shoots 1–4 cm long, warm seasonal only 8–20, cool season only 18–24; tertiary shoots 0–8, 0.4–1.3 cm long; quaternary shoots 0–3, 0.2–0.8 cm long; seasonal growth conspicuous; warm season growth (1) 2–3.5 (5) cm long, 9–14 mm wide; cool season growth 0.5–1.7 cm long, 3–6 mm wide. Foliage color medium green in winter, summer, and on new growth. Warm season leaves saber, straight to slightly incurved, 8–15 mm long, apex straight, acute to acuminate, attachment ascending 45% angle. Cool season leaves short saber, straight to slightly incurved, 1–3 mm long, apex straight, acute. Female strobili rare. Male strobili rare. Vouchers: 231, 248, 269. Described as variety (Hornibrook, 1938); as cultivar (Dallimore and Jackson, 1948).

Observations: 'Monstrosa Nana' has similar foliage but a smaller habit and less vigorous growth than 'Monstrosa'.

'Nana' = 'Knights Dwarf' [var. *elegans*

*nana* Knight and Perry; 'Elegans Nana' Welch (1966); 'Lobbii Nana']. Compact shrub to 2.5 m tall, 2 m wide, broad pyramidal to subglobose. Primary shoots 2–11 cm long; secondary shoots 15–24, 1.8–6.5 cm long, congested, pendulous; tertiary shoots 0–17, 0.4–5.0 cm long, congested, pendulous; quaternary shoots lacking; seasonal growth difference conspicuous; warm season growth (2.5) 3.5–7.5 cm long, 12–30 mm wide; cool season growth 0.5–0.7 cm long, 4–6 mm wide. Foliage color bronze to purplish-red in winter, medium green in summer, medium green on new growth. Warm season leaves straight saber, straight, (9) 11–17 mm long, apex straight, acute to acuminate, attachment ascending, 30–45% angle. Cool season leaves short saber, straight to recurved, 1–5 mm long, apex straight, acute to acuminate, attachment ascending to perpendicular, 60–90% angle. Female strobili rare. Male strobili persistent, terminal on secondary and tertiary shoots located on the upper portion of older plants, in 1–3 globose complexes of strobili fused at the base; strobili complex, 10–15 mm long, 9–13 mm wide, with 8–16 strobili per complex; strobilus oval, apex obtuse, 3–6 mm long, 2–3 mm wide. Vouchers: 200, 286, 290. Described as variety (Knight and Perry, 1850); as cultivar (Welch, 1991).

Observations: 'Nana' is confused often with 'Elegans Nana', which is distinguished as a compact shrub with linear leaves and conical, solitary, male strobili. 'Nana' has straight saberlike leaves with ovoid strobili arranged in a strobili complex. Welch (1991) noted that immature 'Nana' cultivars are misidentified often as 'Lobbii Nana'.

'Nana Albospica' Den Ouden and Boom (1965) = 'Dwarf Whitetip' ['Majiro-sugi' Hort.; 'Mejero-sugi' Hort.; 'Mejiro-sugi' Hort.; 'Okina-sugi' Hort.]. Compact shrub to 2 m tall, 1 m wide, ovoid to oval. Primary shoots ascending, (6.5) 9 to 26 cm long, secondary shoots 6 to 21, 3 to 11 cm long, tertiary shoots 0 to 14, 1.5 to 9.5 cm long, quaternary shoots 0 to 8, 0.8 to 4.5 cm long; seasonal growth conspicuous; warm seasonal growth 2.5 to 4.2 cm long, 9 to 13 mm wide; cool seasonal growth 0.8 to 2.7 cm long, 3 to 5 mm wide. Foliage color bronze in winter, light green in summer, creamy to silvery-white on new growth, variegations completely engulf tertiaries and quaternary shoots or as irregular patches darkening to pale green shoot. Warm seasonal leaves short saberlike, straight to slightly incurved, many twisted halfway around stem, counterclockwise and clockwise, (5) 7 to 11 mm long, apex straight, acute, attachment ascending 30 to 45% angle. Cool seasonal leaves short

saberlike, slightly incurved, many twisted halfway around stem, counterclockwise and clockwise, 1 to 3 mm long, apex inflexed, acute, attachment ascending 30 to 45° angle. Female strobili rare. Male strobili rare. Vouchers: #165, 185, 222, 256.

Observations: This cultivar is the creamy to silvery-white variegated clone found commonly in the United States.

'Knaptonensis' differs with exclusively silvery-white variegations, smaller habit, and shorter leaves.

'National Arboretum Witches Broom' Tripp (1993) = 'Bloomers Witches Bloom'

'Ogon-sugi' Hort. = 'Aurea'

'Okina-sugi' Hort. = 'Nana Albospicata'

'Osaka-tama' Hort. = 'Vilmoriniana'

'Osaka-tama-sugi' Hort. = 'Vilmoriniana'

'Pomona' Hort. Dwarf shrub (juvenile 3 m tall, 1.5 m wide), ovoid. Primary shoots green, 6.5–7.5 cm long; secondary shoots 6–9, 0.4–5.5 cm long; tertiary shoots 1–5, 0.4–2.8 cm long; quaternary shoots 0–3, 0.4–1.5 cm; seasonal growth not conspicuous, 3–8 mm wide. Foliage color bluish-green in winter, summer, and on new growth. Leaves linear, straight, 3–7 mm long, apex straight, acute, attachment ascending 45° angle. Female strobili rare. Male strobili rare. Voucher: 225.

Observations: Dwarf shrub with linear leaves and bluish-green foliage all year.

'Pygmaea' Hort. = 'Vilmoriniana'

'Rasen-sugi' Hort. = 'Spiralis'

'Rasen-sugi' Grootendorst (1977) = 'Spiraliter Falcata'

'Rein's Dense Jade' Hort. = 'Bloomers Witches Bloom'

'Sekka-sugi' Hort. = 'Cristata'

'Sekkan' Hort. ['Sekkan-sugi']. Tree to 30 m tall, 5 m wide, broad conical to narrow pyramidal, central leader strong. Primary shoot 10–39.5 cm long; secondary shoots 7–22, 0.6–2.5 cm long; tertiary

shoots 0–16, 0.6–1.5 cm long; quaternary shoots 0–1, 0.6–1 cm long; seasonal growth conspicuous; warm season growth 2.5–10 cm long, 13–35 mm wide; cool season growth 0.5–3.5 cm long, 4–10 mm wide. Foliage color light green in winter, light green to greenish-yellow in summer, yellow on new growth becoming darker with first warm night temperatures. Warm season leaves saber, straight to slightly incurved, 8–20 mm long, apex straight, acute to acuminate, attachment ascending, 30–60° angle. Cool season leaves short saber, straight, 2–6 mm long, apex straight, acute to acuminate, attachment ascending 45° angle. Female strobili persistent, terminal on secondary or tertiary shoots, solitary, subglobose, 11–20 mm long, 12–22 mm wide; scale-bracts 15–20, attachment cuneate to peltate, quadrangular, 5–8 mm long, 5–8 mm wide, apex acute; umbo straight or reflexed, acute; processes 3–6, 4–6 mm long, exerted. Male strobili persistent, terminal spikelike clusters on secondary and tertiary shoots, 1–27 per cluster, oval, 3–8 mm long, 2–4 mm wide, apex obtuse. Vouchers: 164, 175, 187, 206, 233, 276.

Observations: tree with yellow new seasonal growth. 'Sekkan' differs from 'Aurea' by a longer duration of the yellow pigmentation on new growth and a more persistent greenish-yellow coloration throughout the year.

'Sekkwia-sugi' Hort. = 'Cristata'

'Spiralis' [*Cryptomeria japonica spiralis* Siebold and Zuccarini; 'Granny's Ringlets'; 'Rasen-sugi']. Tree to 9 m tall, 3 m wide, narrow pyramidal to broad conical. Primary shoot 12–35 cm long; secondary shoots 6–10, 0.5–10 cm long; tertiary shoots 0–2, 0.5–4.5 cm long; quaternary shoots lacking; seasonal growth difference conspicuous; warm season growth 2–4 cm long, 9–14 mm wide; cool season growth 1.1–4.6 cm long, 3–5 mm wide. Foliage color medium green in winter, summer, and on new growth. Warm season leaves saber, deeply incurved to spirally twisted, many twisted more than halfway around stem, 10–20 mm long, apex straight, acuminate, attachment ascending 45° angle. Cool season leaves saber, deeply incurved to spirally twisted, many twisted more than halfway around stem, 2–4 mm long, apex straight or reflexed, acuminate, attachment ascending 30–45° angle. Female strobili rare. Male strobili rare. Vouchers: 194, 246, 258. Named as variety (Siebold and Zuccarini, 1844); as cultivar (Siebold, 1861).

Observations: Cultivar with leaves spirally arranged around the twig like stands of a

rope. 'Spiralis' is confused often with 'Spiraliter Falcata', a compact shrub with much thinner and longer shoots that often are more congested and twisted to form incomplete circles.

'Spiralis Elongata' Hort. = 'Spiraliter Falcata'

'Spiraliter Falcata' Carrière (1876) [f. torta Hort.; 'Kusari-sugi'; 'Rasen-sugi'; 'Spiralis Elongata'; 'Yore-sugi']. Compact shrub to 1.5 m tall, 1.7 m wide, irregular. Primary shoot 11–32 cm long; secondary shoots 4–16, 0.7–2.7 cm long; tertiary shoots 0–16, 0.7–1.6 cm long; quaternary shoots 0–2, 0.5–2.5 cm; seasonal growth difference conspicuous; warm season growth 4–7 cm long, 4–9 mm wide; cool season growth 1.1–7.5 cm long, 3–6 mm wide. Foliage color light green in winter, summer, and on new growth. Warm season leaves saber, straight, deeply incurved, or spirally twisted, many twisted more than halfway around stem, 9–15 mm long, apex straight or reflexed, acuminate, attachment ascending 30–45° angle. Cool season leaves short saber, deeply incurved or spirally twisted, many twisted more than halfway around stem, 2–5 mm long, apex straight or reflexed, acuminate, attachment ascending 30–45° angle. Female strobili rare. Male strobili rare. Vouchers: 168, 183, 226, 265, 279.

Observations: Shrub with light green foliage all year, the leaves spirally twisted, often halfway around twig.

'Taisho-sugi' Hort. = 'Taisho-tama'

'Taisho-tama' Hort. ['Ito-sugi'; 'Taisho-sugi'; 'Taishotama-sugi'; 'Taisho Tamasugi']. Compact shrub to small tree, to 4 m tall, 2 m wide in 20 years, crown irregular. Primary shoots upturned, (8) 10.5–29.5 cm long; secondary shoots 9–25, 0.6–10 cm long; tertiary shoots 0–14, nodding, 0.5–6 cm long; quaternary shoots 0–6, nodding, 0.4–2 cm long; seasonal growth difference conspicuous; warm season growth (1.5) 1.9–6 cm long, 5–15 mm wide; cool season growth 1–2.5 (3) cm long, 3–4 mm wide. Foliage color brown in winter, dark green in summer, medium green on new growth. Warm season leaves short saber, straight to slightly incurved, (4) 6–10 mm long, apex straight or inflexed, acute to acuminate, attachment ascending 45° angle. Cool season leaves short saber, straight to slightly incurved, 1–3 mm long, apex inflexed, acute to acuminate, attachment ascending 45° angle. Female strobili rare. Male strobili persistent, terminal spikelike clusters on tertiary shoots, 1–13 per cluster, ovoid, 3–6 mm long, 2–3 mm wide, apex obtuse. Vouchers: 174, 216, 255, 281.

Observations: Similar to 'Jindai-sugi', distinguished by longer seasonal shoots and secondary shoots, and shorter ovoid male strobili.

'**Taishotama-sugi**' Hort. = 'Taisho-tama'

'**Taisho Tamasugi**' Hort. = 'Taisho-tama'

'**Tansu**' (Hort.) Welch (1991) ['Yatsubusa'; 'Yatsubusa']. Dwarf shrub to 0.5 m tall, 0.5 m wide, irregular, extremely compact. Primary shoot 5–7.5 cm long; secondary shoots 12–16, 1.5–4.5 cm long; tertiary shoots 0–7, 0.4–2.5 cm long; quaternary shoots lacking; seasonal growth conspicuous; warm season growth 0.9–2 cm long, 9–14 mm wide; cool season growth 0.4–1 cm long, 4–5 mm wide. Foliage color dark green in winter, dark green in summer, medium green on new growth. Warm season leaves straight saber, straight, 5–10 mm long, apex straight or reflexed, acuminate, attachment ascending 45–60% angle. Cool season leaves short saber, straight to slightly recurved, 1–3 mm long, apex reflexed, attachment ascending 45% angle acute. Female strobili rare. Male strobili rare. Voucher: 224.

Observations: Dwarf shrub with straight saber leaves similar to 'Elegans Compacta', but with more green in foliage seasonally.

'**Tenzan**' (Hort.) Welch (1991) ['Tenzan Yatsubusa'; 'Yatsubusa'; 'Yatsubusa']. Dwarf shrub to 20 cm tall, 30 cm wide, mounded, extremely compact. Primary shoot 2.5–5 cm long; secondary shoots 5–13, 0.4–3.5 cm long; tertiary shoots 0–7, 0.4–1 cm long; quaternary shoots 0–1, to 0.4 cm long; seasonal growth conspicuous; warm season growth 0.5–1.5 cm long, 7–25 mm wide; cool season growth 0.5–1.4 cm long, 3–6 mm wide. Foliage color dark green in winter, medium green in summer, bluish-green on new growth. Warm season leaves saber, straight to slightly incurved, 6–12 mm long, apex straight or inflexed, acuminate, attachment ascending 45–90% angle. Cool season leaves short saber, straight to slightly incurved, 2–4 mm long, apex straight, acute to acuminate, attachment subperpendicular, 75–85% angle. Female strobili rare. Male strobili rare. Vouchers: 209, 242.

Observations: Smallest of the shrubs with bluish-green new foliage and diminutive cool season growth.

'**Tenzan Yatsubusa**' (Hort.) Tripp (1993) = 'Tenzan'

'**Vilmoriniana**' Hornibrook (1924) ['Hino-sugi'; 'Osaka-tama'; 'Osaka-tama-sugi'; 'Pygmaea']. Dwarf shrub to 1 m tall, 0.8 m wide, subglobose. Primary shoot 3.5–8 (12) cm long; secondary shoots 1–18, 0.8–7.2 cm long, terminal ones nodding and exerted 2–3 cm beyond shrub margin; tertiary shoots 0–7, 0.5–3 cm long, terminal ones nodding and exerted 2–3 cm beyond shrub margin; quaternary shoots lacking; seasonal growth conspicuous; warm season growth 0.8–9 cm long, 7–16 mm wide; cool season growth 0.4–2.3 cm long, 4–8 mm wide. Foliage color bronze in winter, dark green in summer, medium green on new growth. Warm season leaves short saber, straight, (5) 6–10 mm long, apex straight, acute to acuminate, attachment ascending 40–60 angle. Cool season leaves short saber, straight, 2–4 mm long, apex straight or reflexed, acute to acuminate, attachment ascending 30–45% angle. Female strobili rare. Male strobili rare. Vouchers: 173, 196, 241, 251, 260, 264, 271 275.

Observations: 'Vilmoriniana' is confused often with 'Compressa' which is narrower and has terminal shoots that are not exerted or nodding, and linear warm season leaves.

'**Yataduta**' Hort. Compact shrub to 3 m tall, 1 m wide, globose. Primary shoot 9–14.5 cm long; secondary shoots 8–11, 1–6 cm long; tertiary shoots 0–2, 1–2.7 cm long; quaternary shoots lacking; seasonal growth conspicuous; warm season growth 1.5–2.0 cm long, 6–9 mm wide; cool season growth 1.4–2.5 cm long, 3–4 mm wide. Foliage color bronze in winter, dark green in summer, medium green on new growth. Warm season leaves short saber, straight to slightly incurved, 4–6 mm long, apex straight, acuminate, attachment ascending 45% angle. Cool season leaves short saber, straight to slightly incurved, 2–3 mm long, apex straight or rarely inflexed, acute, attachment ascending 45% angle. Female strobili rare. Male strobili rare. Voucher: 220.

Observations: Compact shrub with short saber leaves similar to 'Ikari', distinguished by more green in foliage color all year and shorter cool season growth.

'**Yatsubusa**' Hort. = 'Tansu' pro parte, 'Tenzan' pro parte

'**Yatsubusa**' Hort. = 'Tansu' pro parte, 'Tenzan' pro parte, 'Yokohama' pro parte

'**Yenko-sugi**' Dallimore and Jacksson (1948) = 'Araucarioides'

'**Yokohama**' (Hort.) Laar (1983). ['Yatsubusa']. Dwarf shrub to 0.5 m tall, 0.3 m wide, extremely compact, crown irregular. Primary shoot 3–5 cm long; secondary shoots 0.3–3 cm long, warm season only 4–8, cool season only 9–20; tertiary shoots 0–4, 0.3–1 cm long; quaternary shoots lacking; seasonal growth conspicuous; warm season growth 0.9–1.4 cm long, 9–18 mm wide; cool season growth 0.3–1 cm long, 3–4 mm wide. Foliage color medium green in summer, light green on new growth. Warm season leaves saber, straight to slightly incurved, 6–9 mm long, apex inflexed to reflexed, acuminate, attachment ascending 45–90% angle. Cool season leaves short saber, straight, occasionally twisted around shoot, 2–3 mm long, apex straight, acute, attachment ascending 45% angle. Female strobili rare. Male strobili rare. Voucher: 228.

Observations: Dwarf shrub with irregular crown bearing shorter primary shoots and warm season leaves, and fewer secondary shoots of those cultivars with irregular crowns.

'**Yore-sugi**' Hort. = 'Spiraliter Falcata'

'**Yoshino**' Yokohama Nursery (1923). Tree to 30 m tall, 5 m wide, conical. Primary shoot 16–46 cm long; secondary shoots 5–16, 0.4–31 cm long; tertiary shoots 0–25, 0.4–18 cm long; quaternary shoots 0–7, 0.4–5 cm long; dead shoots persistent; seasonal growth conspicuous; warm season growth 3–11 cm long, 7–15 mm wide; cool season growth 1–4 cm long, 3–5 mm wide. Foliage color bronze in winter, medium green in summer, light to bluish-green on new growth. Warm season leaves saber, slightly incurved, 6–14 mm long, apex inflexed, acute to acuminate, attachment ascending 30–45% angle. Cool season leaves short saber, straight to slightly incurved, 2–3 mm long, apex straight or inflexed, acute to acuminate, attachment ascending 45% angle. Female strobili persistent, terminal on secondary or tertiary shoots, solitary, subglobose, 9–22 mm long, 14–20 mm wide; scale-bracts 15–20, quadrangular, 4–7 mm long and 4–8 mm wide, apex acute, attachment cuneate to peltate; umbo reflexed; processes 3–5, 2–3 mm long, exerted. Male strobili persistent, terminal spikelike clusters on secondary, tertiary, and quaternary shoots, occasionally as pairs fused at the base, 4–43 per cluster, ovoid, 5–8 mm long, 2–3 mm wide, apex obtuse. Vouchers: 167, 211, 266, 283, 295.

Observations. The growth form typically is six times taller than wide. The dead shoots persist, but the duration period appears shorter than in other selections of the species.

**Fig. 2. A key to selected cultivars of *Cryptomeria japonica*. Measurements cited are in metric units (25.4 mm = 2.54 cm = 1.0 inch; 0.3 m = 1.0 ft) and standard taxonomic format (number in parenthesis is measurement seldom encountered; x-y is common measurement range).**

- 1a. Linear leaves present; saber leaves lacking, or rarely found on cool season growth ..... 2
- 1b. Linear leaves absent; saber leaves present on warm and cool season growth ..... 8
- 2a. Warm season shoot 3–8 mm wide; warm season leaves 3–7 mm long, straight, ascending to 45° angle, apex straight; quaternary shoots present to lacking; foliage bluish-green; dwarf shrub ..... ‘**Pomona**’
- 2b. Warm season shoot 12–52 mm wide; warm season leaves 8–27 mm long, recurved to straight, ascending to perpendicular at 60–90°, apex inflexed or reflexed; quaternary shoots lacking; foliage green to bronze/purplish-red (rarely bluish-green when new); compact shrub to narrowly columnar, small tree ..... 3
- 3a. Cool season leaf short saber, apex reflexed; cool season growth 7–18 mm long; new foliage bluish-green becoming dark green in summer; ovoid dwarf shrub 1 m tall × 0.5 m wide ..... ‘**Compressa**’
- 3b. Cool season leaf linear, apex inflexed to straight; cool season growth 4–8 mm long; new and summer foliage light to medium green; compact shrub (1–2 m tall × 1–2 m wide) or small tree ..... 4
- 4a. Plant twice broader than tall; crown irregular with limbs decumbent and conical upturned branches; compact shrub to 1 m tall ..... ‘**Elegans Nana**’
- 4b. Plant 2–3 times taller than wide; crown regular, ovoid or columnar, with branches spreading; compact shrub to small tree ..... 5
- 5a. Warm season leaves slightly to deeply recurved, shorter ones 12–15 mm long; warm season shoots broader, 25–42 mm wide; crown pyramidal-oval; compact shrub ..... ‘**Globes**’
- 5b. Warm season leaves straight to slightly recurved, shorter ones 8–11 mm long; warm season shoots narrower, 12–52 mm wide; crown narrowly columnar; small tree ..... 6
- 6a. Cool season leaf apex straight; warm season leaf attachment ascending to perpendicular at 45–90°; twigs and leaves greenish-yellow in summer and winter ..... ‘**Elegans Aurea**’
- 6b. Cool season leaf apex inflexed; warm season leaf attachment perpendicular at 80–90°; twigs and leaves light to medium green in summer to bronze/purplish-red in winter ..... 7
- 7a. Twigs and leaves light to medium green in winter ..... ‘**Elegans Viridis**’
- 7b. Twigs bronze with leaves bronze to purplish-red in winter ..... ‘**Elegans**’
- 8a. Secondary and tertiary shoots with fasciations (cockcomb-like), shootexpanded laterally and appearing fanlike; cool season leaves 4–18 mm long; trunks irregularly twisted ..... 9
- 8b. Secondary and tertiary shoots lacking fasciations; cool season leaves 1–6 mm long; trunks straight ..... 10
- 9a. Fasciations large, 7–15.5 cm long, 2.5–10.5 cm wide; fasciated shoots 0–1 per primary shoot; leaf shaft straight to incurved, apex straight to inflexed ..... ‘**Cristata**’
- 9b. Fasciations small, 1–8 cm long, 1–6 (10) cm wide; fasciated shoots 1–2 per primary shoot; leaf shaft straight, apex straight to reflexed ..... ‘**Kilmacurragh**’
- 10a. Primary shoots with secondary shoots lacking or clustered near the apex and appearing tuft-like; quaternary shoots lacking; tree growth form with female strobili typically lacking ..... 11
- 10b. Primary shoot with secondary shoots distributed along axis; quaternary shoots present, 1–8, occasionally lacking; tree growth form with female strobili present, or dwarf to large shrub growth form ..... 12
- 11a. Secondary shoots few (0–10) and elongate, 7–35 cm long, spaced more proportionally along primary shoot; warm season leaves 7–14 mm long; winter color brown ..... ‘**Araucarioides**’
- 11b. Secondary shoots many (15–27) and short, 1.5–6 cm long, clustered primarily at the primary shoot apex; warm season leaves 5–7 mm long; winter color purplish-red ..... ‘**Dacrydioides**’
- 12a. Warm season leaves short saber-like, 2–6 mm long; cool season leaves 1–3 mm long; majority of growth cool season ..... 13
- 12b. Warm season leaves saber-like, (5) 6–24 mm long; cool season leaves (1) 2–6 mm long; majority of growth warm season ... 16
- 13a. Warm season growth 4–8 cm long, 4–6 mm wide; foliage greenish-yellow all year; secondary shoots (12) 18–45; tree ‘**Gracilis**’
- 13b. Warm season growth 1–3.5 cm long, 6–13 mm wide; foliage green to bronze (occasionally silvery-white on new growth); secondary shoots 8–18; shrub ..... 14
- 14a. New foliage silvery-white; warm season growth 2.5–3.5 cm long; cool season growth 0.9–2 cm long; leaf apex inflexed; dwarf shrub, to 1 m tall ..... ‘**Knaptensis**’
- 14b. New foliage green; warm season growth 1–2 cm long; cool season growth 1.5–11.5 cm long; leaf apex straight to slightly reflexed; compact shrub, 1–3 m tall ..... 15
- 15a. Tertiary shoots 3–12; cool season growth 3–11.5 cm long, 4–5 mm wide; new growth and winter color light green, medium green in summer ..... ‘**Tkari**’

**Fig. 2. Continued.**

15b. Tertiary shoots 0–2; cool season growth 1.4–2.5 cm long, 3–4 mm wide; new growth medium green becoming dark green in summer and bronze in the winter .....	<b>'Yataduta'</b>
16a. Warm season leaves straight saber-like with a straight shaft and apex; male strobili oval, clustered in a globular strobili complex or arranged in a spikelike cluster when present .....	<b>17</b>
16b. Warm season leaves saber-like with the shaft, apex or both exhibiting some curvature; male strobili conical, oblong or ovoid, simple or with a primary strobilus and two conelets fused basally, when present .....	<b>21</b>
17a. Tree; cool season leaves straight; new growth yellow; quaternary shoots occasionally present, to 6 mm long .....	<b>18</b>
17b. Shrub; cool season leaves straight to slightly recurved; new growth medium green or greenish-yellow; quaternary shoots lacking .....	<b>19</b>
18a. Foliage slowly greening, becoming greenish-yellow to light green in summer, light green in winter; immature female cones bluish-green; seasonal growth more robust, warm season growth to 10 cm long and 35 mm wide, cool season growth to 3.5 cm long .....	<b>'Sekkan'</b>
18b. Foliage quickly greening, becoming light to medium green in summer and bronze in winter; immature female cones greenish-yellow; seasonal growth less, warm season growth to 4.5 cm long and 17 mm wide, cool season growth to 1.5 cm long	<b>'Aurea'</b>
19a. Warm season growth 0.9–2 cm long, 9–14 mm wide; warm season leaves 5–10 mm long; foliage dark green in summer .....	<b>'Tansu'</b>
19b. Warm season growth 3.5–7.5 cm long, 12–30 mm wide; warm season leaves 9–17 mm long; foliage medium green in summer .....	<b>20</b>
20a. Compact shrub, broad pyramidal to subglobose, to 2.5 m tall; male strobili complex 1–3, terminal on secondary and tertiary shoots; winter foliage color bronze to purplish-red .....	<b>'Nana'</b>
20b. Dwarf shrub forming low spreading mound, to 0.7 m tall; male strobili complex 2–5 fused strobili, proximal on primary and secondary shoots; winter foliage dark green to bronze .....	<b>'Elegans Compacta'</b>
21a. Majority of leaves spirally twisted halfway around twig .....	<b>22</b>
21b. Majority of leaves lacking spirally twisted leaf shaft .....	<b>23</b>
22a. Warm season growth 9–14 mm wide, 2–4 cm long; foliage medium green all year; warm season leaves 10–20 mm long, majority spirally twisted around twig; tree .....	<b>'Spiralis'</b>
22b. Warm season growth 4–9 mm wide, 4–7 cm long; foliage light green all year; warm seasonal leaves 9–15 mm long, variable in degree of twisting; shrub .....	<b>'Spiraliter Falcata'</b>
23a. New foliage greenish-yellow or creamy silvery-white .....	<b>24</b>
23b. New foliage light to medium green or bluish-green .....	<b>25</b>
24a. Warm season growth 2.5–4.2 cm long; cool season growth 0.8–2.7 cm long; warm season leaves slightly incurved, attached at 30–45° angle; new foliage creamy silvery white, becoming light green in summer and bronze in winter .....	<b>'Nana Albospica'</b>
24b. Warm season growth 1–2.5 cm long; cool season growth 4–12 cm long; warm season leaves slightly recurved, attached at 45–60° angle; foliage greenish-yellow all year .....	<b>'Lobbii Nana Aurea'</b>
25a. New foliage color bluish-green .....	<b>26</b>
25b. New foliage color light to medium green .....	<b>32</b>
26a. Cool season leaves subappressed, attached at 5–20° angle; cool season growth 0.9–3 cm long .....	<b>27</b>
26b. Cool season leaves ascending, attached at 30–85° angle; cool season growth 0.3–1.6 cm long .....	<b>28</b>
27a. Primary shoot 5–6.5 cm long; secondary shoots few, 5–8; warm season growth 0.8–1.5 cm long, 6–7 mm wide; dwarf shrub .....	<b>'Little Diamond'</b>
27b. Primary shoot 8.5–19.5 cm long; secondary shoots several, 7–23; warm season growth 1.5–9 cm long, 7–11 mm wide; compact shrub .....	<b>'Bloomers Witches Broom'</b>
28a. Dwarf shrub; primary shoots 2.5–5 cm long; cool season leaves subperpendicular, attached at 75–85° .....	<b>'Tenzan'</b>
28b. Compact shrub; primary shoots 4–19 cm long; cool season leaves ascending, attached at (5) 30–45° .....	<b>29</b>
29a. Winter foliage color purplish-red; cool season leaf apex curved; warm season growth elongate, (1) 3–9 cm long; shrubs subglobose .....	<b>30</b>
29b. Winter foliage color medium to dark green; cool season leaf apex straight; warm season growth short, 1–3.2 cm; shrubs conical to columnar .....	<b>31</b>
30a. Primary shoots 11–19 cm long; tertiary shoots present, 3–6, 5–25 mm long; warm season leaves attached at 10–45°; leaves slightly incurved; larger secondary shoots to 14 cm .....	<b>'Globosa'</b>
30b. Primary shoots 3.5–12 cm long; tertiary shoots lacking; warm season leaves attached at 40–60°; leaves nearly straight; larger secondary shoots to 7.2 cm long .....	<b>'Globosa Nana'</b>

**Fig. 2. Continued.**

31a. Leaves strongly ascending, attached 30–45°; foliage dark green in summer and winter; larger secondary shoots to 4 cm long; columnar shrub .....	<b>'Black Dragon'</b>
31b. Leaves spreading-ascending, attached 45–60°; foliage medium green in summer and winter; larger secondary shoots to 14 cm long; conical shrub .....	<b>'Giokumo'</b>
32a. Cool season leaves spreading, attached 45–80°; number of cool season secondary shoots greater than number of warm seasonal secondary shoots, ratio 2–4; crown irregular .....	<b>33</b>
32b. Cool season leaves ascending, attached (5) 30–45°; number of cool season secondary shoots nearly equivalent with number of warm season secondary shoots, ratio 0.8–1.2; crown regular .....	<b>36</b>
33a. Warm season growth 1–1.5 cm long; warm season leaves attached at 45–90°; new foliage color light green; tertiary shoots to 2.5 cm long; quaternary shoots lacking .....	<b>34</b>
33b. Warm season growth 2–35 cm long; warm season leaves attached at 20–45°; new foliage color medium green; tertiary shoots to 18 cm long; quaternary shoots sometimes present, to 1 cm long .....	<b>35</b>
34a. Secondary shoots of warm season growth 4–8, 9–20 in cool season growth; warm season leaves 6–9 mm long; primary shoots 3–5 cm; dwarf shrub .....	<b>'Yokohama'</b>
34b. Secondary shoots of warm season growth 10–20, 20–80 in cool season growth; warm season leaves 11–19 mm long; primary shoots to 14 cm long; compact shrub .....	<b>'Bandai-sui'</b>
35a. Primary shoots 8–42 cm long; warm season growth 4–36 cm long; winter foliage color bronze; small tree .....	<b>'Monstrosa'</b>
35b. Primary shoots 8–11 cm long; warm season growth 2–5 cm; winter foliage color medium green; compact shrub .....	<b>'Monstrosa Nana'</b>
36a. Conical tree; cool season growth to 7 cm long; secondary shoots to 31 cm long .....	<b>37</b>
36b. Shrub to small tree; cool season growth 0.3–3 cm long; secondary shoots 0.5–11 cm long .....	<b>39</b>
37a. Tertiary shoots 0.4–1.8 cm long; quaternary shoots to 5 cm long when present; secondary shoots to 31 cm long; winter foliage color bronze .....	<b>'Yoshino'</b>
37b. Tertiary shoots (0.4) 2–9 cm long; quaternary shoots lacking or 0.5–0.7 cm long when present; secondary shoots to 23 cm long; winter foliage color dark green to brown .....	<b>38</b>
38a. Primary shoots 13–29 cm long; winter foliage color dark green; secondary shoots to 16 cm long; tertiary shoots to 9 cm long; quaternary shoots absent; warm season growth 3.5–6 cm long .....	<b>'Benjamin Franklin'</b>
38b. Primary shoots 20–55 cm long; winter foliage color brown; secondary shoots to 23 cm long; tertiary shoots to 6 cm long; quaternary shoots sometimes present, 5–7 mm long; warm season growth 2–17.5 cm long .....	<b>'Lobbii'</b>
39a. Warm season growth 17–23 mm wide; warm season leaves 8–14 mm long; secondary shoots to 3.5 cm long .....	<b>'Kukamiga'</b>
39b. Warm season growth 5–17 mm wide; warm season leaves 6–11 mm long; secondary shoots 2.5–8 (11) cm long .....	<b>40</b>
40a. New foliage medium green, dark green in summer; tertiary shoots (0.5) 3–6 cm long .....	<b>41</b>
40b. New foliage light green, medium green in summer; tertiary shoots 0.3–2.5 cm long .....	<b>43</b>
41a. Primary shoots 3.5–8 (12) cm long; tertiary shoots lacking; warm seasonal leaves straight; dwarf shrub .....	<b>'Vilmoriniana'</b>
41b. Primary shoots (6.5) 9–26 cm long; tertiary shoots present occasionally, 4–20 mm long; compact shrub to small tree .....	<b>42</b>
42a. Warm season growth 0.8–2 cm long; cool season growth 0.5–1.5 cm long; secondary shoots 1.5–8 cm long; male strobili oblong, 2–10 mm long .....	<b>'Jindai-sui'</b>
42b. Warm season growth 2–5 cm long; cool season growth to 3 cm long; secondary shoots 6–11 cm long; male strobili ovoid, 3–6 mm long .....	<b>'Taisho-tama'</b>
43a. Warm season growth 1.5–7 cm long; cool season growth 3–4 mm wide .....	<b>'Buckscope'</b>
43b. Warm season growth 0.8–2 cm long; cool season growth 4–7 mm wide .....	<b>44</b>
44a. Cool season growth 0.4–0.8 cm long; leaves slightly incurved, apex inflexed; secondary shoots 3–6; dwarf shrub .....	<b>'Littleworth Dwarf'</b>
44b. Cool season growth to 2.6 cm long; leaves straight to recurved, apex straight to reflexed; secondary shoots 6–10 .....	<b>'Green Pencil'</b>

a different term for the leaves. In our opinion, the leaves of Japanese cedar do not agree with any of these terms previously reported. The leaves of Japanese cedar are different in shape and cross-section from awns, needles, awl-shaped, acicular and subulate leaves defined for other genera (Den Ouden

and Boom, 1978; Krüssmann, 1985; Tripp, 1993; Welch, 1991, 1993). Adult foliage leaves were quadrangular or compressed dorsoventrally, and similar in appearance to a saber in lateral view. Hence, these leaves are defined herein as saber leaves (Table 1). Linear leaves were similar to coty-

ledon leaves and may represent a juvenile trait. Glaucous bands may be present or lacking on both surfaces of linear leaves.

Female strobili are initiated in the summer, develop through the first fall and overwinter. These are receptive to pollination early the following spring.

Seeds are dispersed in the second fall. Mature strobili may, or may not, persist on the shoot for another (third) year. Male strobili were more diagnostic for cultivar identification. Cultivars with dwarf or compact growth habits typically lacked female and male strobili, even with age (20–40 years old). Thus, descriptions of cultivars may lack strobili data or be designated as rare when found in a sample size too small to be quantified.

Figure 1 provides an alphabetized checklist of cultivar names encountered. The 45 recognized cultivars include synonymy, a quantitative morphological description, herbarium vouchers, authorities, and observations. Many selections of Japanese cedar were published originally as a distinct species or as a variety, but later reduced to the rank of cultivar, the current classification rank. Variety and cultivar are not equivalent or synonymous terms, contrary to the understanding and misuse by some in the green industry and the ASHS community (Fantz, 1996). Synonyms are alternative names found in literature or used in horticulture. These names are included in brackets when the cultivar is described, and cultivar names recognized as synonyms are alphabetized and followed by the proper cultivar name that should be used.

Article 17.9 of the International Code of Nomenclature for Cultivated Plants or ICNCP (Trehane, 1995) stated “To be established, a new cultivar epithet published on or after 1 January 1959 must be a word or words in a modern language; Latin words or words which may be considered to be Latin, and thus are liable to cause confusion, may not be used unless they are the classical name of an ancient Roman person, or of a place”. The Latinized cultivar name is cited in these cases to minimize confusion in the green industry, but a new name agreeing with the Code is proposed.

Five cultivars bear the epithet “elegans” in their name, implying a cultivar group. Four are compact shrubs to small trees with spreading linear leaves. However, ‘Elegans Compacta’ has ascending saber leaves and a dwarf growth form, thus quite dissimilar. ‘Nana’ is closely related to ‘Elegans Compacta’, but often misidentified in American gardens as ‘Elegans Nana’.

Cultivars grown in southern areas exhibited many characters with similar measurement ranges as those grown in

northern areas. These characters were regarded as more reliable, thus used in preparing a taxonomic key (Figure 2) to assist in segregation and identification of the forty-five cultivars recognized.

## Conclusion

The large number of cultivars selected of Japanese cedar provided problems in segregation and the proper name to use (Rouse et al., 1997). This treatment provides new quantitative descriptions based upon field data, proper names with synonyms, and a taxonomic key to assist professional plantsmen in segregation and identification of cultivated taxa in the eastern United States.

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