



Juglandaceae

Carya Nutt.

Cyclocarya Iljinsk.

Engelhardtia Lesch. ex Blume

Juglans L.

Platycarya Siebold & Zucc.

Pterocarya Kunth

**VEGETATIVE KEY TO SPECIES
CULTIVATED IN WESTERN EUROPE**

Jan De Langhe

(24 September 2006, 12 January 2012)

Vegetative key.

This key is based on characteristics visible during the longest period of the year.

Taxa treated in this key: see page 6.

Taxa referred to synonymy: see page 6.

Frequently misidentified taxa: see page 6.

To improve accuracy:

- Use a hand lens to judge glands, scales and pubescence in general.
- Features like glands and pubescence can decrease during autumn.
- Look at the entire plant. Young specimens and strong shoots give an atypical view.
- Beware of hybridisation, especially with plants raised from seed gathered in collections.

Features based on:

- JDL herbarium specimens
- living specimens, in various arboreta, botanic gardens and collections
- literature:

Bean W.J. - (1976) - *Carya* in Trees and Shrubs hardy in the British Isles vol.1, p.511-517.
Bean W.J. - (1981) - *Juglans* in Trees and Shrubs hardy in the British Isles vol.2, p.471-478.
Bean W.J. - (1976) - *Platycarya* in Trees and Shrubs hardy in the British Isles vol.3, p.278.
Bean W.J. - (1976) - *Pterocarya* (including *Cyclocaria*) in Trees and Shrubs hardy in the British Isles vol.3, p.430-434 (432).
Grimshaw J. - (2003) - IDS Yearbook: Notes on the temperate species of *Juglans*, p.107-130.
Grimshaw, J. & Bayton, R. - (2009) - *Carya* in New Trees, p.214-216.
Grimshaw, J. & Bayton, R. - (2009) - *Engelhardtia* in New Trees, p.321-322.
Grimshaw, J. & Bayton, R. - (2009) - *Juglans* in New Trees, p.411-414.
Grimshaw, J. & Bayton, R. - (2009) - *Pterocarya (Cyclocarya)* in New Trees, p.674-679.
Hillier J. & Coombes A. - (2002) - The Hillier Manual of Trees & Shrubs, p.59-60, 162-163, 225, 244.
Krüssmann G. - (1978) - *Carya* in Handbuch der Laubgehölze vol.1, p.304-308.
Krüssmann G. - (1978) - *Juglans* in Handbuch der Laubgehölze vol.2, p.196-200.
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More D. & White J. - (2003) - Trees of Britain & Northern Europe, p.292-301.
Rehder A. - (1940) - Manual of cultivated trees and shrubs hardy in North America, p.115-124
Schaarschmidt, H. - (2006) - Die Walnussgewächse, 170 p.
Wijnands, D.O. - (1989) - European Garden Flora vol.3, p.17-20.
Wu, Z.Y., & Raven, P. - (1999) - Flora of China, vol.4, p.277-285.

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<http://www.plantentuin.ugent.be>

- 01 a Mature shoot with solid pith at longitudinal section (*Carya*, *Engelhardtia*, *Platycarya*). 02
- b Mature shoot with chambered pith at longitudinal section (*Cyclocarya*, *Juglans*, *Pterocarya*). 13
- 02 a Leaf paripinnate. Leaflet margin entire. Nut 3-winged. *Engelhardtia roxburghiana*
- b Leaf imparipinnate. Leaflet margin serrate or dentate. Nut 2-winged or nut in a husk. 03
- 03 a Terminal bud small, pale green, <0,5 cm long AND imbricate. Nut winged +/- 0,5 cm, many together between bracts of a +/- 6 cm cone-like structure. *Platycarya strobilacea*
- b Terminal bud >0,5 cm, OR valvate OR naked. Nut in a husk, similar to the common walnut, but segments partly or completely dehiscent. 04
- 04 a Bud valvate or naked. Husk with 'winged' sutures where segments meet. 05
- b Bud imbricate. Husk grooved where segments meet. 08
- 05 a Leaflets usually 7-9 (5-13), rarely falcate. 06
- b Leaflets usually 9-13 (5-17), often falcate. 07
- 06 a Leaf <40 cm long. Shoot and especially petiole densely scaly. Leaflet LS densely scaly. *Carya myristiciformis*
- b Leaf often 40-60 cm long. Shoot not or +/- scaly, petiole scale less but +/- hairy towards rachis. Leaflet LS not densely scaly. *Carya cordiformis*
- 07 a Leaflets 9-11 (5-13), not or slightly aromatic when crushed. Lateral petiolule often reddish, ≤2 mm. *Carya aquatica*
- b Leaflets 9-13 (7-17), aromatic when crushed. Lateral petiolule yellow-green, ≤7 mm (examine several leaves). *Carya illinoensis*
- 08 a Margins with tufted pubescence just below teeth apices (LENS). Leaflets usually 5 (3-7). *Carya ovata*
- b Margins without such tufted pubescence just below teeth apices (LENS). Leaflets 3-9 (3-11). 09
- 09 a Annual shoots thick, >4 mm, terminal bud to 20 mm long. Leaflets 7-9 (5-11). 10
- b Annual shoots thin, <4 mm, terminal bud to 15 mm long. Leaflets 5-7 (3-9). 11
- 10 a Leaf to 50 cm. Lamina LS, petiole and rachis densely pubescent, clearly visible to the naked eye. Leaf very aromatic when crushed (in particular during spring and summer). *Carya tomentosa*
- b Leaf to 90 cm. Lamina LS, petiole and rachis finely/softly pubescent to the touch (LENS). Leaf without aromatic smell when crushed. *Carya laciniosa*
- 11 a Petiole and rachis clearly pubescent with fasciculate hairs. Leaf very aromatic when crushed (in particular during spring and summer). Leaflets 7 (5-9). *Carya pallida*
- b Petiole and rachis glabrous or almost so (hardly visible with lens). Leaf vaguely aromatic, resembling +/- walnuts when crushed. Leaflets 5-7 (3-9). 12

- 12 a Shoot usually glabrous. Pubescence on rachis, petiole and leaflet midvein base absent or fine and soft. Leaflets 5-7 (3-9). *Carya glabra*
- b Shoot often pubescent. Pubescence on rachis, petiole and leaflet midvein base coarse and stiff. Leaflets 7 (5-9). *Carya texana*
- 13 a Terminal internode on well developed shoots often >5 mm. Nut disc-like winged or two-winged. 14
- b Terminal internode on well developed shoots <5 mm. Nut in a husk, like common walnut. 21
- 14 a Leaf rarely more than 25 cm long and almost as wide. Rachis never winged. Leaflets 7-9 (5-11). Nut disc-like winged. *Cyclocarya paliurus*
- b Leaf 20 to 45 cm (occasionally >60 cm) long and clearly longer than wide. Rachis sometimes winged. Leaflets 5-27. Nut two-winged. 15
- 15 a Rachis winged at least in part. 16
- b Rachis not winged. 17
- 16 a Terminal leaflet often absent. Rachis winged over its total length, with flat wings. Nut with narrow to linear wings. *Pterocarya stenoptera*
- b Terminal leaflet present, sometimes absent. Rachis irregularly or partly winged, with erect ridges or reduced wings. Nut with rounded to (oblong) ovate wings. *Pterocarya xrehderiana*
- Leaves doubly pinnate. *Pterocarya stenoptera* 'Fern Leaf'
- 17 a Terminal bud with 2-4 caducous bud scales (+/- hood-like covering each other at first). 18
- b Terminal bud naked, without bud scales. 19
- 18 a Leaflets 11-21. Petiole and rachis finely pubescent (fading feature). Wings of nut +/- orbicular, to +/- 2 cm long. *Pterocarya rhoifolia*
- b Leaflets 7-13. Petiole and rachis tomentose (fading feature). Wings of nut +/- orbicular, ovate to rhombic, to +/- 3 cm long. *Pterocarya macroptera*
- 19 a Leaf paripinnate. Nut wings narrow to linear. *Pterocarya tonkinensis*
- b Leaf imparipinnate. Nut wings orbicular ovate to elliptic rhomboid. 20
- 20 a Leaf <30 cm. Leaflets 5-11(-15). *Pterocarya hupehensis*
- b Leaf 20-60 cm (occasionally more). Leaflets 9-21 (7-27). *Pterocarya fraxinifolia*
- Shrubby, with short trunk, broad crown and smaller leaf. *Pterocarya fraxinifolia* var. *dumosa*
- 21 a Leaflet entire, or very shallowly/distantly serrate to distantly toothed with ≤ 2 teeth/cm (LENS). 22
- b Leaflet always serrate with ≥ 3 teeth/cm, always easily noticeable by naked eye. 25
- 22 a Leaflets 7-11 (-9-11) AND LS with glandular hairs (particularly on venation), sometimes with stellate hairs. *Juglans xsinensis*
- b Leaflets 5-7, OR LS without glandular hairs. 23

- 23 a Largest lateral leaflet with secondary veins longer than 1 cm usually ≥ 15 /side. Leaflets acuminate. *Juglans sigillata*
- b Largest lateral leaflet with secondary veins longer than 1 cm usually < 14 /side. Leaflets acute. 24
- 24 a Terminal leaflets variable, from absent to as large as lateral leaflets on the single tree (examine the whole plant). *Juglans \times intermedia*
- b Terminal leaflets well developed, always present: +/- as large or clearly larger than the lateral leaflets. *Juglans regia*
- Form with leaflets irregularly and acutely lobed. *Juglans regia* 'Laciniata'
- Form with dark wine-red foliage and husks. *Juglans regia* 'Purpurea'
- 25 a Leaf (30-)40-90 cm (and more). Leaflet $> 3,5$ cm wide. 26
- b Leaf < 45 cm. Leaflet $< 3,5$ cm wide. 28
- 26 a Terminal leaflet absent or reduced in size. Not sticky to the touch. Husk globoid, 3,5-8 cm wide (the largest resembling a tennis ball), 1-2 (-3-5)/short raceme. Nut globoid, 3-4 cm, with numerous warty ridges. *Juglans nigra*
- b Terminal leaflet always present and well developed. Very sticky to the touch in all parts due to glandular hairs (in particular in spring, fading in autumn). Husk ovoid, 3-20/long raceme. Nut +/- ovoid, 3-6 cm long, smooth or with up to 8 +/- sharp longitudinal ridges. 27
- 27 a Bud +/- pyramidal, beige to pale brown (leaf scar upper margin emarginated). Husks 5-20/raceme. Nut smooth or ridged. *Juglans mandshurica* (sensu lato)
- Husk ovoid, 5-13 in a raceme. Nut ovoid and obviously ridged. *Juglans mandshurica*
- Husk globoid-ovoid to 20 in a raceme. Nut ovoid to heart-shaped, smooth to ridged.
- Husk globoid-ovoid. Nut ovoid and ridged: *Juglans ailantifolia*
- Husk globoid. Nut more heart-shaped, with almost smooth thin shell. *Juglans ailantifolia* var. *cordiformis*
- J. regia* hybrid, with intermediary features. *Juglans \times notha*
- b Bud +/- cylindrical, white to greyish (leaf scar upper margin flat!). Husks 3-5/raceme. Nut ridges razor-sharp (at least initially). *Juglans cinerea*
- J. regia* hybrid, with intermediary features. *Juglans \times quadrangulata*
- 28 a Leaflet apex obtuse to acute, LS vein axils glabrous. Leaf < 25 cm. *Juglans californica*
- b Leaflet apex acuminate, LS vein axils often with tufts of hairs. Leaf to 45 cm. 29
- 29 a Terminal leaflet always present. Leaflet LS glabrous between the veins (LENS). Husk 3,5-5 cm wide, nut smooth or shallowly ridged and 2,4-3,2 cm wide. *Juglans hindsii*
- b Terminal leaflet often absent or reduced. Leaflet LS pubescent between the veins (LENS). Husk $< 3,5$ cm wide, nut ridged and $< 2,7$ cm wide. 30

- 30 a Leaflets 9-15, >1,5 cm wide, margin sharply serrate. Husk 2-3,5 cm wide. Nut to 2,7 cm wide. Tree to 18 m. ***Juglans major***
- b Leaflets 15-25, <1,5 cm wide, margin entire to serrate. Husk 1,4-2,3 cm wide. Nut to 1,7 cm wide. Shrub or tree to 10 m. ***Juglans microcarpa***

Plant larger in all parts: hybrid between *Juglans microcarpa* and *Juglans major* or *Juglans nigra*.

Taxa treated in this identification key.

Carya aquatica
Carya cordiformis
Carya glabra
Carya illinoensis
Carya laciniata
Carya myristiciformis
Carya ovata
Carya pallida
Carya texana
Carya tomentosa

Cyclocarya paliurus

Engelhardtia roxburghiana

Juglans × *intermedia* (*J. nigra* × *J. regia*)
Juglans × *notha* (*J. ailantifolia* × *J. regia*)
Juglans × *quadrangulata* (*J. cinerea* × *J. regia*)
Juglans × *sinensis* (*J. mandshurica* × *J. regia*)
Juglans ailantifolia
Juglans ailantifolia var. *cordiformis*
Juglans californica
Juglans cinerea

Juglans hindsii
Juglans major
Juglans mandshurica
Juglans mandshurica
Juglans microcarpa
Juglans nigra
Juglans regia
Juglans regia 'Laciniata'
Juglans regia 'Purpurea'
Juglans sigillata

Platycarya strobilacea

Pterocarya fraxinifolia
Pterocarya fraxinifolia var. *dumosa*
Pterocarya hupehensis
Pterocarya macroptera
Pterocarya rehderiana (*P. fraxinifolia* × *P. stenoptera*)
Pterocarya rhoifolia
Pterocarya stenoptera
Pterocarya stenoptera 'Fern Leaf'
Pterocarya tonkinensis

Taxa referred to synonymy in this identification key.

Carya buckleyi = *Carya texana*
Juglans cathayensis = *Juglans mandshurica*
Pterocarya paliurus = *Cyclocarya paliurus*

Frequently misidentified taxa.

Juglans californica Hort. = *Juglans nigra* or *Juglans nigra* hybrid
Pterocarya tonkinensis Hort. = *Pterocarya stenoptera*

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	cm
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