***Carpinus grandis* Unger emend. Heer (Betulaceae)**

Leaf description

- **morphology:**
  organisation: simple; **petiole:** short petiolate; **shape:** slender elliptic to oblong to slender ovate, usually about 3–5 cm long; **leaf base:** base angle wide acute to obtuse, base shape rounded to subcordate; **leaf apex:** apex angle acute, apex shape straight to somewhat acuminate; **margin:** more or less sharply double serrate, main teeth with one or more smaller teeth on the basal side, tooth apex and sinus acute; **1°-vein framework:** network pinnate, midrib slender, straight; **2°-vein framework:** secondaries craspedodromous, densely spaced, slender, parallel among each other, running in the tooth apices of the major teeth, sending further veinlets into the smaller teeth below; **3°-vein framework:** tertiaries percurrent, partly forked, sinuous; higher order veins reticulate.
- **cuticle:**
  both leaf surfaces very delicate; hypostomatic; **adaxial cuticle:** anticlines slender, straight, curved to undulate, cell outlines polygonal, 10–44 µm across, trichome bases occasionally occurring, simple, about 12 µm across, trichome head glandular; **abaxial cuticle:** anticlines and cell shape as on the adaxial cuticle, stomatal complexes anomocytic, stomata elliptic to roundish, up to 28 µm across, stomatal ledges thickened, outer front cavity narrow spindle-shaped to elliptic, not reaching the poles, "giant" stomata may occur, trichome bases very rare, or absent.

Palecology

- **habitat:** mesophytic forests to alluvial forests
- **vegetation type:** deciduous broad-leaved and mixed mesophytic forests
- **life form:** tree
- **foliage persistence:** deciduous leaves
- **flower ecology (pollination):** wind-pollinated (anemophilous)
- **fruit ecology (dispersal):** wind-dispersed (anemochorous)

Stratigraphy / Distribution

- **stratigraphy:** Lower Oligocene to Pliocene
- **distribution:** First records in Central Europe stem from the Early Oligocene; Miocene and Pliocene widespread in Europe.

Miscellaneous

- **synonyms:** –
- **modern relationship:** *Carpinus*; closer infrageneric relationship remains open due to the high uniformity of hornbeam leaves.
- **remarks:** *Carpinus grandis* is regarded as a formal aggregate for fossil leaves because neither by gross morphological nor by cuticular features fossil species are to be well distinguished. Even the distinction from *Ostrya* leaves may be equivocal. *Carpinus* leaves are often found associated with winged fruits of hornbeam.

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26 macroscopic leaf traits are stored in *Digiphyll*

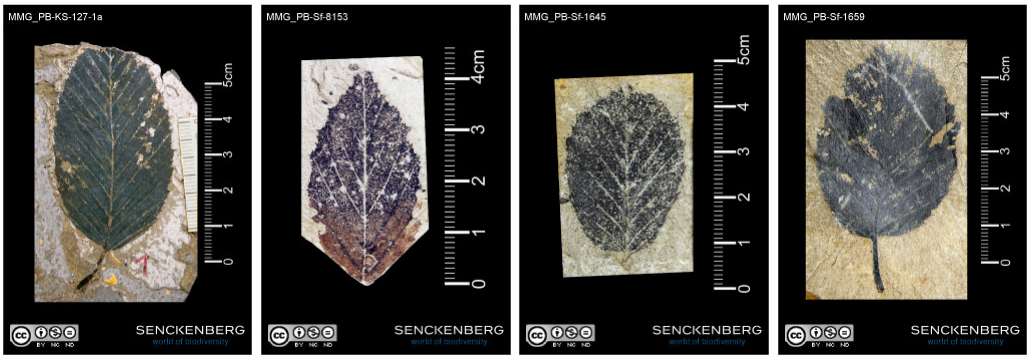
#	trait code	trait: charcters state
1	A-1.2	petiole: present
2	A-1.2.1	petiole, present: short
3	A-2.1	leaf organisation: simple
4	A-3.1	leaf shape: elliptic
5	A-4.2	leaf base angle: obtuse
6	A-5.1	leaf base shape: without basal extension
7	A-5.1.1	leaf base shape, without basal extension: cuneate (straight)
8	A-5.1.2	leaf base shape, without basal extension: rounded
9	A-5.2	leaf base shape: with basal extension
10	A-5.2.1	leaf base shape, with basal extension: cordate
11	A-6.1	leaf apex angle: acute
12	A-7.2	leaf apex shape: acuminate
13	A-8.2	leaf margin: toothed
14	A-8.2.2	leaf margin, toothed: dentate
15	A-9.1.2	leaf teeth, order number of teeth: double (second order) or higher orders
16	A-9.2.1	leaf teeth, tooth density: dense
17	A-9.3.1	leaf teeth, tooth size: small
18	A-9.4.1	leaf teeth, tooth apex shape: acute
19	A-9.5.1	leaf teeth, tooth sinus shape: acute
20	B-1.1	primary vein framework: pinnate
21	B-2.1	secondary vein framework: 2° veins reach margin
22	B-2.1.1	secondary vein framework, 2° veins reach margin: craspedodromous
23	B-3.2	intramarginal vein: absent
24	B-4.2	intersecondaries: absent
25	B-5.1	tertiary vein framework: percurrent
26	B-5.1.1	tertiary vein framework, percurrent: opposite

For a detailed description of the leaf traits see menu *Manuals*.

? microscopic leaf traits are stored in *Digiphyll*

comming soon

Fossil images



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