

Leaf description

- **morphology:** leaves pinnately compound but in the fossil record usually only isolated leaflets are preserved; **petiole:** leaflets sessile; **organisation:** pinnately compound; **shape:** lamina oblong to slightly ovate, more or less asymmetrical, usually only few centimeters long; **leaf base:** base angle acute, base shape mainly slightly convex, mostly asymmetrical; **leaf apex:** apex angle acute; apex shape more or less straight; **margin:** entire near the base, then simple serrate, saw-like, to almost entire; leaf teeth often widely spaced and tiny, tooth apex acute, tooth sinus rounded; **1°-vein framework:** pinnate, midvein often gently bent; **2°-vein framework:** secondaries arising at angles $> 45^\circ$ from the midvein, densely spaced, weakly brochidodromous, loops narrow with the tip at the tooth sinus, intersecondaries frequent; **3°-vein framework:** tertiaries and higher order veins reticulate.
 - **cuticle:** adaxial and abaxial cuticle very delicate, often not preserved, hypostomatic; **adaxial cuticle:** anticlines distinctly Omega-shaped undulate, occasionally pitted, only near the margin almost straight forming interfingering cell outlines; trichome bases of two types on veins: (1) of peltate trichomes (glands) as on the abaxial cuticle (see below) and (2) of simple trichomes; **abaxial cuticle:** anticlines often hardly visible, straight to curved, sometimes pitted, cells somewhat domed; stomatal complexes anomocytic, sunken except near the leaf margin, 15–28 μm long, largely overlapped by domed (papillate) neighbouring cells, front cavity narrow spindle-shaped, porus slit-like; trichome bases of peltate trichomes (glands) one-celled with very thick margin, diameter about 10–20 μm , surrounding cells unmodified; peltate heads composed of numerous, radially organised cells, margin undulate, diameter of heads 90–150 μm , peltate trichomes may be very dense, even overlapping each other.
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Paleecology

- **habitat:** probably mesophytic forests
 - **vegetation type:** broad-leaved evergreen to mixed mesophytic forests
 - **life form:** tree
 - **foliage persistence:** evergreen or deciduous leaves
 - **flower ecology (pollination):** wind-pollinated (anemophilous)
 - **fruit ecology (dispersal):** wind-dispersed (anemochorous)
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Stratigraphy / Distribution

- **stratigraphy:** Eocene to Miocene, exceptionally in the Pliocene
 - **distribution:** Europe mainly bound to plant assemblages that reflect warm climatic conditions.
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Miscellaneous

- **synonyms:** *Engelhardia detecta* SAPORTA, *Palaeocarya orsbergensis* (WESSEL & WEBER) JÄHNICHEN, FRIEDRICH & TAKAC
- **modern relationship:** tribe Engelhardiae, close to living *Oreomunnea* OERST. (*Engelhardia roxburghiana* WALL. (India and E-Asia) and *Oreomunnea mexicana* (STANDL.) J.-F. LEROY).

- **remarks:** Earlier such small, mainly asymmetrical fossil leaf remains were assigned to various genera with either simple or compound leaves (e.g., *Myrica*, *Rhus*, *Zanthoxylum* and even to the South Hemispherian family Proteaceae). Grossmorphologically these leaflets differ from *Myrica* leaves, which are often found in the same fossil assemblages, by their asymmetry and the shorter slightly convex leaf base as well as the absence of a distinct petiole. On the genus level this taxon has an intermediate character and therefore was assigned also to *Palaecarya* SAPORTA (fossil genus) or *Oreoroa* (Manchester 1987). The cuticle features have been described very detailed by Jähnichen et al. (1977). Winged fruits of *Engelhardia macroptera* (BRONGNIART) UNGER are more common in the fossil record than leaf remains. It is generally accepted that both organs derive from the same natural plant species. According to the nomenclatural rules they must be treated as separate taxa as long as there is no unambiguous proof that they derive from one natural species.

32 macroscopic leaf traits are stored in *Digiphyll*

#	trait code	trait: charcters state
1	A-1.2	petiole: present
2	A-1.2.2	petiole, present: long
3	A-2.2	leaf organisation: compound
4	A-2.2.2	leaf organisation, compound: pinnately
5	A-3.1	leaf shape: elliptic
6	A-3.4	leaf shape: oblong
7	A-4.1	leaf base angle: acute
8	A-4.2	leaf base angle: obtuse
9	A-5.1	leaf base shape: without basal extension
10	A-5.1.1	leaf base shape, without basal extension: cuneate (straight)
11	A-5.1.2	leaf base shape, without basal extension: rounded
12	A-6.1	leaf apex angle: acute
13	A-7.1	leaf apex shape: attenuate (straight)
14	A-8.2	leaf margin: toothed
15	A-8.2.2	leaf margin, toothed: dentate
16	A-9.1.1	leaf teeth, order number of teeth: simple order (first order)
17	A-9.2.2	leaf teeth, tooth density: not dense
18	A-9.3.1	leaf teeth, tooth size: small
19	A-9.4.1	leaf teeth, tooth apex shape: acute
20	A-9.5.1	leaf teeth, tooth sinus shape: acute
21	A-9.5.2	leaf teeth, tooth sinus shape: rounded
22	B-1.1	primary vein framework: pinnate
23	B-2.1	secondary vein framework: 2° veins reach margin
24	B-2.1.2	secondary vein framework, 2° veins reach margin: semicraspedodromous
25	B-2.2	secondary vein framework: 2° veins do not reach margin
26	B-2.2.1	secondary vein framework, 2° veins do not reach margin: eucamptodromous
27	B-2.2.2	secondary vein framework, 2° veins do not reach margin: cladodromous
28	B-2.3	secondary vein framework: 2° veins form loops and do not reach margin
29	B-2.3.2	secondary vein framework, 2° veins form loops and do not reach margin: weak brochidodromous
30	B-3.2	intramarginal vein: absent
31	B-4.1	intersecondaries: present
32	B-5.2	tertiary vein framework: reticulate

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

? microscopic leaf traits are stored in *Digiphyll*

coming soon

Fossil images



References

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