

WOOD OF *BRIDELIA* FROM THE CRETACEOUS OF BOHEMIA

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ABSTRACT

Fossil wood of *Bridelia* from the Cretaceous of Bohemia is described in the present paper. This discovery indicates the presence of *Bridelia* in the Central Europe during the Cretaceous times, thus suggesting a far wider distribution of this genus in the Cretaceous period than at the present time.

INTRODUCTION

FRANTIŠEK Macák of the Central Geological Institute, Praha, while mapping the Teplice sheet, M-33-IV, in 1964, found some pieces of fossil wood in the sandy-silty marlites from the base of the Middle Turonian at Bila Horka, near Louny, in the Northwestern part of the Bohemian Upper Cretaceous platform (MAP 1). These were kindly given to one of us (Březinova) for investigation and when the first author (Prakash) was visiting the Geological Institute, Praha, during 1967, it was decided to work it out jointly. The first author acknowledges with appreciation the invitation extended to him by the Czech Academy of Sciences, Praha, under the Indo-Czech Cultural Exchange Program, which facilitated his visit.

The present finding of a fossil wood from this locality forms an important contribution, since no plant remains have so far been recorded from this area.

SYSTEMATIC DESCRIPTION

Family — EUPHORBIACEAE

Bridelioxylon Ramanujam, 1956

Bridelioxylon bohemicum sp. nov.

The present species is based on a small piece of petrified secondary wood measuring about 10 cm in length and 2.5 cm. in diameter. The preservation of the fossil wood is fairly good.

Topography — Wood diffuse-porous (PL. 1, FIG. 1). *Growth rings* not very distinct. *Vessels* visible with the naked eye, medium-sized to small or very small, solitary and mostly in radial multiples of 2-4 or more (PL. 1, FIG. 1), sometimes in clusters, 12-22 per sq. mm., profusely occluded with tyloses. *Parenchyma* paratracheal and diffuse (PL. 1, FIGS. 1, 5) occurring as few cells in association with the vessels and scattered in the fibrous ground mass. *Xylem rays* fine, 1-3 (mostly 3) seriate (PL. 1, FIG. 3), 15-75 μ broad, closely spaced, 8-10 per mm.; ray tissue heterogeneous (PL. 1, FIGS. 3, 5, 7) with rays composed both of procumbent and upright cells; uniseriate rays rare about 15-19 μ in width, variable in height, 105-240 μ and 2-5 cells high, composed either of upright cells or both upright and procumbent cells; multiseriate rays 2-3 seriate, composed of procumbent cells in the median thickened portion or with sheath cells along the flanks and upright cells at one or both the ends; end to end ray fusion frequent; brownish-black gummy infiltration frequent in ray cells. *Fibres* not aligned in distinct radial rows.

Elements — *Vessels* thin-walled, the walls about 3-4 μ thick, t.d. 60-195 μ r.d. 105-210 μ , round to oval in cross-section when solitary (PL. 1, FIG. 1), those in radial multiples flattened at the places of contact; vessel-members 375-675 μ in length with truncate or abruptly tailed ends; perforations simple; intervessel pit-pairs (PL. 1, FIG. 6) bordered, 7-10 μ in diameter, oval or angular through crowding with linear-lenticular apertures; vessel-parenchyma and vessel-ray pits not seen. *Parenchyma cells* thin-walled, t.d. 22-30 μ , height 300-480 μ . *Ray cells* thin-walled with brownish black deposits in most of them, variously shaped as seen in tangential section; procumbent cells with r.d. 90-225 μ , vertical height 38-48 μ ; upright cells r.d. 42-48 μ , vertical height 60-64



Locality in the village Bila Horka near Louny

μ ; cells occasionally crystalliferous. *Fibres* non-libriform to semi-libriform with big lumina, the walls about 3-4 μ thick, angular in cross section, septate (PL. 1, FIG. 5), t.d. 16-18 μ , r.d. 15-22 μ , and 400-975 μ in length; interfibre pits not seen.

Affinities — Structural features of the fossil wood indicate, after extensive comparison, that its closest affinities are with the wood of the modern genus *Bridelia* Willd. A survey of all available woods of the genus *Bridelia* indicates that the nearest resemblance of the fossil is with *Bridelia retusa*. Our survey included the study of thin sections of the woods of *Bridelia retusa*, *B. tomentosa*, *B. montana* and *B. stipularis* supplemented by published description of *Bridelia retusa* (PEARSON & BROWN, 1932, pp. 875-877, FIG. 273); *Bridelia aubrevillei* Pellegr. (NORMAND, 1955, PL. 59, pp. 151-172); *Bridelia minutiflora* Hook. & *B. glauca* (JANSSONIUS, 1930, pp. 480-497, FIG. 318).

The size and distribution of vessels in the present fossil wood nearly agree with the distributional pattern in the modern wood of *Bridelia retusa*. Both in *B. retusa* and the fossil species, the perforations are simple, the intervessel pit-pairs are oval to polygonal with linear-lenticular apertures and the vessels are heavily tylosed.

The distribution of parenchyma appears to be almost identical in both, as is the fibre structure. However, a conspicuous difference between the two species is in the

absence of distinct terminal parenchyma and the crystalliferous parenchyma strands in the fossil species. Crystalliferous parenchyma is absent also in *Bridelia montana* and *B. tomentosa* and the latter even does not possess distinct terminal parenchyma. It occurs in indistinct broken lines and can be overlooked in a petrified piece of wood.

The xylem rays of the fossil wood and of *Bridelia retusa* are basically similar with occasional presence of crystals in the ray cells, although there is slight difference in the breadth of the rays. In both they are closely spaced, heterocellular with frequent ray fusion. However, the rays are 1-3 cells broad in *Bridelioxylon bohemicum*, whereas in the thin sections of *Bridelia retusa* examined, they are 1-4 cells broad.

Twenty-five species of fossil woods assigned to the family Euphorbiaceae have been reported hitherto (SPACKMAN, 1948; GRAMBAST, 1961; SALARD, 1961; MÄDEL, 1962; NAVALE, 1962; MAHABALE & DESHPANDE, 1963; LAKHANPAL & DAYAL, 1964; DAYAL, 1968; KOENIGUER, 1968). These have been described under the names *Euphorbioxylon* Felix (1887), *Paraphyllanthoxylon* Bailey (1924), *Heveoxylon* Kruse (1954), *Bridelioxylon* Ramanujam (1956), *Putraniivoxylon* Ramanujam (1956), *Piranheoxylon* Grambast (1961), *Aleuritoxylon* Mädel (1962), *Securinegoxylon* Mädel (1962), and *Mallotoxylon* Lakhapal & Dayal (1964). Of these, four have been assigned to *Bridelioxylon* Rama-

nujam. These are *Bridelioxylon cuddalorensis* Ramanujam (1956) and *B. miocenicum* (RAMANUJAM, 1960) Mädel (1962) both from the Mio-Pliocene beds of the Cuddalore series, South India, *B. krauselii* (PRAKASH, 1959) Mädel (1962) from the Eocene beds of the Deccan Intertrappean series, India, and *B. fibrosum* Mädel (1962) from the Upper Cretaceous Umzamba beds of South Africa. All these species differ quite distinctly from the present fossil wood from Czechoslovakia.

Bridelioxylon krauselii differs from the present fossil wood in having smaller vessels (t.d. 29-164 μ) lacking tyloses, in possessing slightly more paratracheal parenchyma with 1-2 layers of cells encircling the vessels completely or partially, in the absence of diffuse parenchyma and in having several rows of marginal upright cells in the xylem rays. However, in the present fossil wood, the xylem rays are usually with marginal rows of upright cells.

Bridelioxylon cuddalorensis is also quite distinct from this fossil wood in possessing slightly smaller vessels (t.d. 90-140 μ), broader, 1-4 seriate xylem rays and in having slightly more thickened, libriform fibres. In the present fossil wood, the fibres are non-libriform to semi-libriform and the xylem rays are 1-3 seriate. Similarly *B. miocenicum* differs from *B. bohemicum* in having smaller vessels (75-165 μ), broader, 1-4 (mostly 3-4) seriate xylem rays, libriform fibres and in the absence of diffuse parenchyma.

Lastly *B. fibrosum* is distinct from this Czech fossil in having usually longer chains (upto 8 cells) of vessels, which are slightly smaller (t.d. 50-100 μ), in broader, 1-5 seriate xylem rays and in the absence of diffuse parenchyma.

As the present fossil wood compares very closely the modern wood of *Bridelia* and differs from all the other fossil species of this genus, known so far, it is assigned to the form-genus *Bridelioxylon* Ramanujam (1956) and described as a new species, *Bridelioxylon bohemicum*, the specific name indicating its occurrence in the region of Bohemia.

The discovery of the fossil wood of *Bridelia* from the Bohemian platform indicates its presence in Central Europe during the Cretaceous times. Its simultaneous record from the Upper Cretaceous beds of South Africa (MÄDEL, 1962) suggests a far wider

distribution of this genus in the Cretaceous period than at the present day. It is known also from the Deccan Intertrappean series (PRAKASH, 1959; MAHABALE & DESHPANDE, 1967), and the Mio-Pliocene of Cuddalore series in India (RAMANUJAM, 1956, 1960; MÄDEL, 1962). In the modern flora, the genus *Bridelia* with its over 50 species is widely scattered from tropical Africa and Madagascar eastward through the Indo-Malayan region and southern China to tropical Australia and the Pacific Islands (PEARSON & BROWN, 1932, p. 874).

The family Euphorbiaceae is chiefly tropical and its presence in Europe is indicated by the present fossil wood from the Cretaceous of Czechoslovakia and by another fossil wood nearly resembling *Piranhea* (GRAMBAST, 1961) from the Eocene of Belgium. It thus shows that the climate of Europe was tropical during the Cretaceous and Eocene times and the present temperate climate prevailed at a later date. The existence of a tropical climate in Europe is shown also by the discovery of London Clay flora of the Eocene age which has its link with the Malayan elements (REID & CHANDLER, 1933) and the Pansielien flora of the Eocene age from Belgium consisting of great many palms (STOCKMANS & WILLIERE, 1943).

SPECIFIC DIAGNOSIS

Bridelioxylon bohemicum sp. nov.

Wood diffuse-porous. Growth-rings not very distinct. Vessels medium sized to small, t.d. 60-195 μ , r.d. 105-250 μ , round to oval in cross section, solitary and mostly in radial multiples of 2-4 or more, 12-22 per sq. mm., profusely occluded with tyloses; vessel-members 375-675 μ in length with truncate or abruptly tailed ends; perforations simple; inter-vessel pit pairs bordered, 7-10 μ in diameter, oval or angular through crowding with linear-lenticular apertures; vessel-parenchyma and vessel-ray pits not seen. Parenchyma paratracheal and diffuse occurring as few cells in association with the vessels and scattered in the fibrous ground tissue. Xylem rays fine, 1-3, (mostly three) seriate, 15-75 μ broad, 8-10 rays per mm.; ray tissue heterogeneous; uniseriate rays rare composed either of upright cells or both upright and procumbent cells; multiseriate rays composed of

both upright and procumbent cells; end to end rays fusion frequent. *Fibres* non-libriform to semilibriform with big lumina, angular in cross-section, septate, 400-975 μ in length; interfibre pits not preserved.

Holotype—Specimen and slides with Dr. Březinová of the National Museum, Praha.

Locality—Bila Horka, near Louny, North Bohemia.

Age—Middle Turonian.

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EXPLANATION OF PLATE 1

- Bridelioxylon bohemicum* sp. nov. Transverse section of the wood. $\times 30$. Note close agreement in major structural features to the modern wood shown next.
- Bridelia retusa*. Transverse section of the wood. $\times 30$.
- Bridelioxylon bohemicum* sp. nov. Tangential section of the wood. $\times 40$. Note distribution, shape and size of the xylem rays similar to the modern wood shown next.

- Bridelia retusa*. Tangential section of the wood. $\times 40$.
- Bridelioxylon bohemicum* sp. nov. Tangential section of the wood magnified. $\times 90$.
- Bridelioxylon bohemicum* sp. nov. Intervascular pitting. $\times 150$.
- Bridelioxylon bohemicum* sp. nov. Radial longitudinal section of the wood showing nature of the xylem rays. $\times 90$.

