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REVISION OF THE OLDEST ORIGINAL SPECIMENS OF *BETULA PRISCA* ETTINGSHAUSEN

Wyniki rewizji najstarszych oryginalnych okazów *Betula prisca* Ettingshausen

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ABSTRACT. As a result of analyzing original C. v. Ettingshausen's materials stored at the Geologische Bundesanstalt and at the Naturhistorisches Museum in Vienna it was established that the fossil leaves called *Betula prisca* from the Arsenal locality in Vienna (Austria) most propably represent a different birch species, *B. subpubescens* Goepp., whereas the *Betula prisca* from the Bilina locality (Czecho-Slovakia) are probably the leaves of fossil alder, *Alnus julianaeformis* (Sternb.) Kvaček et Holý. The leaves of *Betula prisca* Ett. assigned by Goeppert (1855) in the flora from Sośnica, as well as the leaves of the same kind from the Ruszów fossil flora, belong to *Carpinus grandis* Unger emend. Heer, as proved by morphological feature analysis of the remains from Ruszów.

KEY WORDS: leaves, morphology, anatomy, *Betula*, Miocene, Pliocene

The species of *Betula prisca* Ett. fossil leaves was described by Ettingshausen in 1851, in the dissertation "Die Tertiär-Floren der Österreichischen Monarchie: 1. Die tertiäre Flora der Umgebung von Wien". In this dissertation the author illustrates three leaf remains of the species. Two of them (l.c. Pl. 1, figs 15, 16) come from the Arsenal locality in Vienna (Austria), and the third one (l.c. Pl. I, fig. 17) – from the locality of Bilina (Czecho-Slovakia). The name "*Betula prisca*" was later used by Goeppert (1855) in "Tertiäre Flora von Schossnitz", and for the second time by Ettingshausen (1867) in "Die fossile Flora des Tertiarbeckens von Bilin I." – each time referring to the leaves of different morphological features. The lack of correctly assigned type and heterogenous character of the primary designations resulted in numerous erroneous assigments and in using the name of "*Betula prisca*" in reference to leaves of various systematic designation.

The problem of *Betula prisca* Ett. came up during my research on the *Betulaceae* remains in the Pliocene flora from Ruszów (Hummel 1991). Therefore I examined the

original materials of C. v. Ettingshausen stored at the Geologische Bundesanstalt and in the Naturhistorisches Museum in Vienna. The studies were carried out during my stay in Austria in 1986.

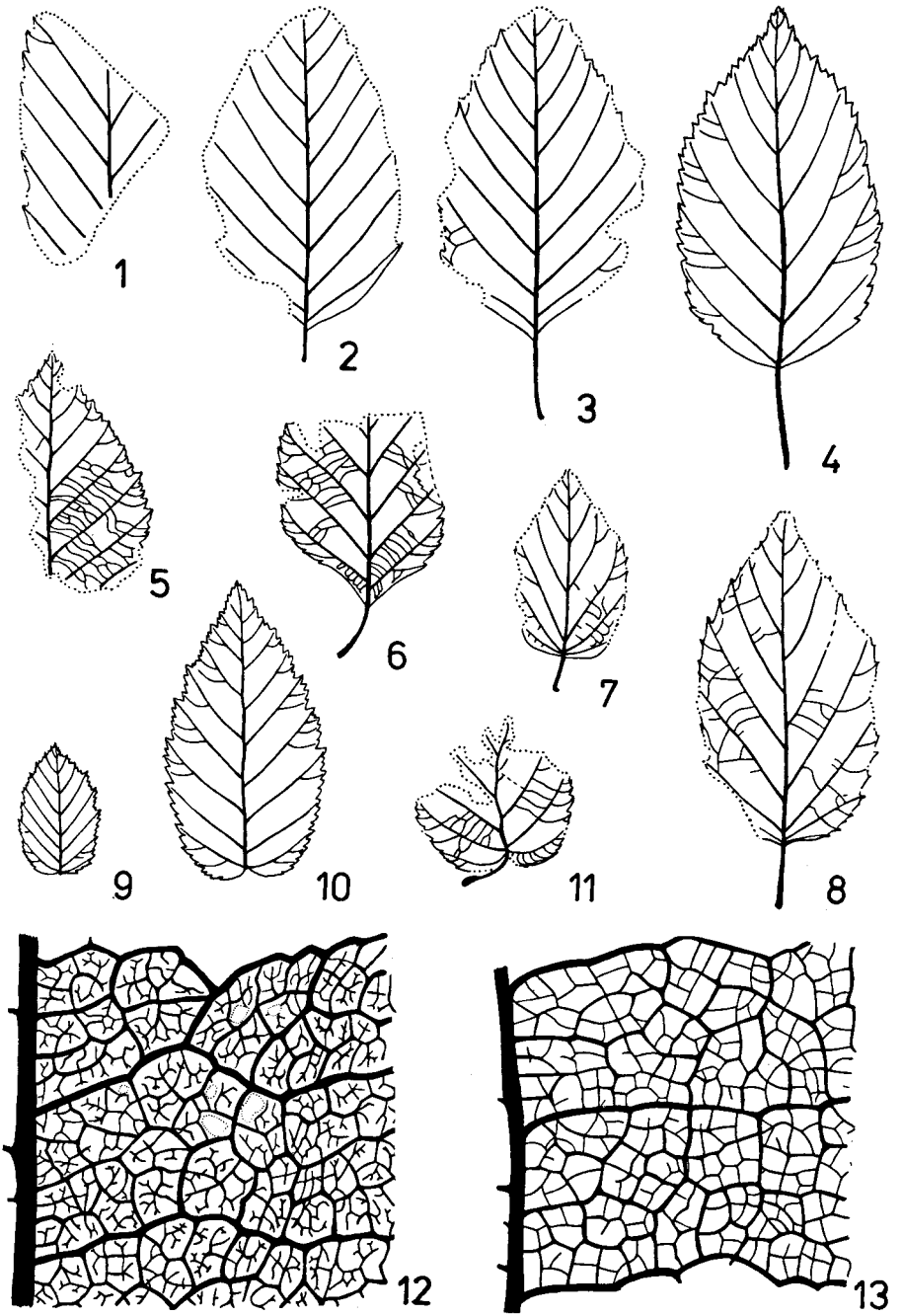
While reviewing the Ettingshausen collection I did not find the specimen of *Betula prisca* Ett. coming from Bilina (Ettingshausen 1851, Pl. 1., fig. 17) which, being best preserved, enabled the author to assign and diagnose a new species of *Betula prisca* Ett. In the Ettingshausen collection at the Geologische Bundesanstalt there were only two of the three leaf impressions illustrated by Ettingshausen (l.c. Pl. 1, figs 15, 16), both coming from the flora of Arsenal in Vienna. Also, there was a twin impression of the specimen from fig. 16, which was preserved better then the one presented by Ettingshausen in his work, and an unpublished specimen from the same locality, assigned as *Betula prisca* Ett. (Pl. 1, fig. 4).

The lack of the original specimen of *Betula prisca* Ett. from Bilina, which was established as the lectotype of the species by Budantsev (1982), makes its detailed morphological analysis impossible. Comparing its picture with the Arsenal specimens one can notice that the lamina of the Bilina leaf is of a more oblong shape, has coarser serration of the leaf margin as well as smaller number and different arrangement of the lateral veins. In order to eventually clarify what this kind of leaves from the Bilina flora are, more detailed research on the leaf remains from that locality should be conducted.

The specimens called *Betula prisca* Ett. from the flora of Arsenal (Fig. 1: 1–3, Pl. 1, figs 1–4) are about 5.0 cm long and 3.0 cm wide, have elliptic-ovate shape with a wide cuneate base. Leaf petiole is 1.2 cm long. Leaf margins are entire at the base, and doubly serrated higher up, poorly visible. Primary teeth are about 1.0–1.5 mm high and 2.0–2.5 mm wide at the base, with acute apices, most of them damaged; apical sides of teeth are shorter then the lower ones, basal sides are longer, acuminate or convex. Secondary teeth, 0–2(3) between the endings of two adjacent lateral veins are about 0.5–1.0 mm high and 1.5–2.0 mm wide at the base; apical sides of secondary teeth are short, while basal sides are longer, acuminate or convex. Sinuses between the teeth are angular.

Fig. 1. *Betula prisca* Ett., Arsenal; Ettingshausen 1851, Pl. I, fig. 15; Geol. Bundesnast., Vienna, No. 1851/02/5 = *Betula* aff. *subpubescens* Goepp., 2 – *Betula prisca* Ett., Arsenal; Ettingshausen 1851, Pl. 1, fig. 16; Geol. Bundesnast., Vienna, No. 1851/02/5 = *Betula* aff. *subpubescens* Goepp., 3 – *Betula prisca* Ett., Arsenal; twin impression of the leaf in fig. 2; Geol. Bundesanst., Vienna, No. 1851/02/05 = *Betula* aff. *subpubescens* Goepp., 4 – *Betula prisca* Ett., Bilina; Ettingshausen 1851, Pl. 1, fig. 17; specimen disappeared, 5 – *Betula subpubescens* Goepp., Ruszów; Museum of the Earth, Warsaw, No. MZ VII/67/0.59, 6 – *Betula subpubescens* Goepp., Ruszów; Museum of the Earth, Warsaw, No. MZ VII/67/0.63, 7 – *Betula prisca* Ett., Bilina; Ettingshausen 1867, Pl. 14, fig. 15; Geol. Bundesanst., Vienna, No. 1867/01/31 = ? *Alnus julianaeformis* (Sternb.) Kvaček et Holý, 8 – *Betula prisca* Ett., Bilina; Ettingshausen 1867, Pl. 14, fig. 15; Geol. Bundesanst., Vienna, No. 1867/01/31 = ? *Alnus julianaeformis* (Sternb.) Kvaček et Holý, 9 – *Betula prisca* Ett., Sośnica; Goeppert 1855, Pl. 3, fig. 11; specimen disappeared = *Carpinus grandis* Unger emend. Heer, 10 – *Betula prisca* Ett., Sośnica; Goeppert 1855, Pl. 3, fig. 12; Institute of Geological Sciences, Wrocław, No. 850p = *Carpinus grandis* Unger emend. Heer, 11 – *Carpinus grandis* Unger emend. Heer, Ruszów; Museum of the Earth, Warsaw, No. MZ VII/67/I. 37, 12 – *Betula subpubescens* Goepp., fragment of leaf venation in fig. 5, x 15, 13 – *Carpinus grandis* Unger emend. Heer, fragment of leaf venation in fig. 11, x 15

1–3, 5–8, 11 drawn by A. Hummel; 12, 13 drawn by J. Wieser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Leaves have about 8 pairs of lateral veins alternately and sometimes almost oppositely diverging from the midvein in intervals of 4–7 mm at an angle of 35–40° (50° at the lower part of a leaf). The veins are running almost parallely to each other. They are basically straight, slightly curved in the upper part of the leaf. The lowest pair of lateral veins diverges from midvein slightly above the base and runs almost parallely to leaf margins. Below, right at the margin of leaf base, one can see a pair of thin veins which merge with the loops of tertiary veins. Higher order venation is poorly visible. Due to poor state of leaf preservation, in the lower part of lamina there can be observed only one exmedial branch, and also in one case an upward branch of secondary vein at leaf margin which is connected by loops with tertiary veins diverging from superadjacent lateral vein. Tertiäry veins, about 6 per 1 cm of the lenght of lateral vein, are percurrent, usually forked halfway its length.

The analysis of the morphological features of leaves called *Betula prisca* Ett. from the flora of Arsenal shows that most probably they belong to the same birch species which was four years later described by Goeppert in the Sośnica flora under the name of *Betula subpubescens* (Goeppert 1855, Pl. 3, fig. 9). This statement should be treated as a hypothesis due to the unsatisfactory state of preservation of the Arsenal specimens. It is noticeable that the impressions lack clearly marked exmedial branches of secondary veins. It is hard to say whether they did not exist or whether they have not been preserved. The results of investigating the leaf flora from Ruszów show that the statement is very probable. All the leaves of fossil birch *Betula subpubescens* Goepp. from that locality are characterized by identical anatomical features of epidermis, whereas they differ to some extent in morphological structure (Fig. 1: 5, 6). Therefore the leaves of *Betula prisca* Ett. from Arsenal might also belong to *Betula subpubescens* Goepp., despite their more elongated shape and some inconsistencies in the type of venation.

The original materials from the Bilina flora were also analyzed in detail. They were later published under the same name of *Betula prisca* by the author of species (Ettingshausen 1867, Pl. 14, figs 14–16). The leaves presented in plate XIV, fig. 15, were examined. The remaining specimens were not found. It turned out that the morphological differences between those leaves and the specimens of *Betula prisca* Ett. from Arsenal are so significant that we probably deal with two different genera.

The leaf remains from Bilina (Fig. 1: 7, 8, Pl. 1, figs 5, 5a) have small teeth, particularly in the upper part of the leaf lamina, which sometimes are only slightly marked; apical angles are acute; basal sides are often concave. There is a significant difference in secondary venation of the leaves. Leaves from Bilina have 6–7 pairs of lateral veins which are arranged irregularly. Veins of the middle and upper part of the leaves are almost parallel, spaced 4.0–9.0 mm, and diverging from midvein at the angle of 30–40°. Two lowermost pairs diverge from the midvein at a larger angle of 45–70°, at intervals of 1.0–1.5 mm which significatly increase towards leaf margins. These features indicate that those are not birch leaves but most probably alder leaves of *Alnus julianaeformis* (Sternb.) Kvaček et Holý species, very common in the flora from Bilina (Kvaček & Holý 1974). Major indications are leaf shape and margin line. The only difference can be observed in the pattern of lateral veins. The pattern of the secondaries at the base of

the *Betula prisca* Ett. leaves from Bilina is slightly different from the pattern of the *Alnus julianaeformis* (Sternb.) Kvaček et Holý leaves from the same locality (Sternberg 1823, Pl. 36, fig. 2; Kvaček & Holý l.c.) and from the pattern of recent *Alnus japonica* Sieb. et Zucc. leaves with which the fossil taxon is comparable. Without detailed investigation of a larger amount of fossil and recent leaves it is difficult to assess whether this feature has a diagnostic value.

The foregoing discussion shows that none of the original specimens of *Betula prisca* Ettingshausen 1851 cannot serve as a lectotype. One specimen disappeared, other specimens are poorly preserved and similar to another birch species. Moreover, the specimens which were later included in *Betula prisca* species by Ettingshausen (1867) most probably are not birch leaves altogether. Therefore, according the rules of the International Code of Botanical Nomenclature (1988), the name of *Betula prisca* Ett. should be rejected.

What are *Betula prisca* Ett. leaves from Sośnica (Goeppert 1855, Pl. 3, figs 11, 12)? The answer was found during investigation of the fossil flora from Ruszów, and particularly of a fragment of one leaf remain with a distinctly cordate base (Fig. 1: 11, Pl. 1, fig. 6), very similar to both specimens from Sośnica (Fig. 1: 9, 10). The leaf fragment from Ruszów is not eligible for anatomical research because of poorly preserved cuticula, but its higher order venation, characteristic of genus *Carpinus*, is clearly visible. Well developed areoles, their oriented arrangement, and the lack of or a simple character of veinlets (Fig. 1: 13) in Ruszów leaves differentiate this remain from *Betula* leaves whose areoles are bigger, imperfect and randomly arranged, and whose veinlets are branched (Fig. 1: 12). This characteristic difference in higher order venation of *Betula* leaves and *Carpinus* leaves was pointed out by Wolfe and Wehr in their paper (Wolfe & Wehr 1987). Such minute details cannot be observed in the clay impressions of Sośnica leaves. However, there is strong correspondence of all the other features of leaf shape, margin line and venation between the preserved leaf fragment and other similar remains from Ruszów, and the leaves of Sośnica. This indicates that the latter should be considered hornbeam leaves – *Carpinus grandis* Unger emend. Heer.

In my opinion, the majority of leaf remains from fossil floras of the European Neogene, called *Betula prisca* Ett., relatively small and having a characteristic cordate base (incl. Menzel 1906, 1910; Jung 1963), are actually leaves of the fossil hornbeam *Carpinus grandis* Unger emend. Heer. It should be added here that leaves of recent *Carpinus betulus* L., growing at branch base, often have cordate base and their margins are serrato – emarginate (Pl. 1, figs 7, 8). Therefore all the earlier assignments of *Betula prisca* Ett. leaves from Euroasian Neogene require revision of the original materials.

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STRESZCZENIE

W związku z opracowaniem szczątków liści *Betulaceae* z plioceńskiej flory Ruszowa przeprowadzono w roku 1986 badania oryginalnych materiałów C. v. Ettingshausena, przechowywanych w Geologische Bundesanstalt i w Naturhistorisches Museum w Wiedniu. W wyniku tych badań ustalono, że nazwę *Betula prisca* Ettingshausen należy w ogóle odrzucić, zgodnie z przepisami Międzynarodowego Kodeksu Nomenklatury Botanicznej. Żaden z trzech oryginalnych okazów *Betula prisca*, opublikowanych przez Ettingshausena w "Die Tertiär-Floren der Österreichischen Monarchie. 1. Die tertiäre Flora der Umgebung von Wien" (Ettingshausen 1851, Pl. 1, figs 15–17), nie może służyć jako lektotyp gatunku. Jeden okaz, który pochodził z flory kopalnej Biliny (Czechsłowacja), a który był podstawą diagnozy, zaginął. Dwa pozostałe pochodzące z innego stanowiska – Arsenal w Wiedniu, są podobne do innego kopalnego gatunku brzozy – *Betula subpubescens* Goeppert, o ile można to stwierdzić na podstawie słabo widocznych odcisków liści. Później opisane okazy *Betula prisca* Ett. z flory Biliny (Ettingshausen 1867) reprezentują prawdopodobnie liście kopalnej olszy – *Alnus julianaeformis* (Sternb.) Kvaček et Holý. Liście *Betula prisca* Ett. oznaczone przez Goepperta (1855) z flory Sośnicy, a także liście tego samego typu z flory Ruszowa, należą do *Carpinus grandis* Unger emend. Heer.

PLATE

Plate 1

1. *Betula prisca* Ett., Arsenal;
   Ettingshausen 1851, Pl. I, fig. 15
   = *Betula* aff. *subpubescens* Goepp.
2. *Betula prisca* Ett., Arsenal;
   Ettingshausen 1851, Pl. I, fig. 16
   = *Betula* aff. *subpubescens* Goepp.
3. *Betula prisca* Ett., Arsenal;
   twin impression of the leaf in fig. 2
   = *Betula* aff. *subpubescens* Goepp.

3a. leaf fragment, x 2

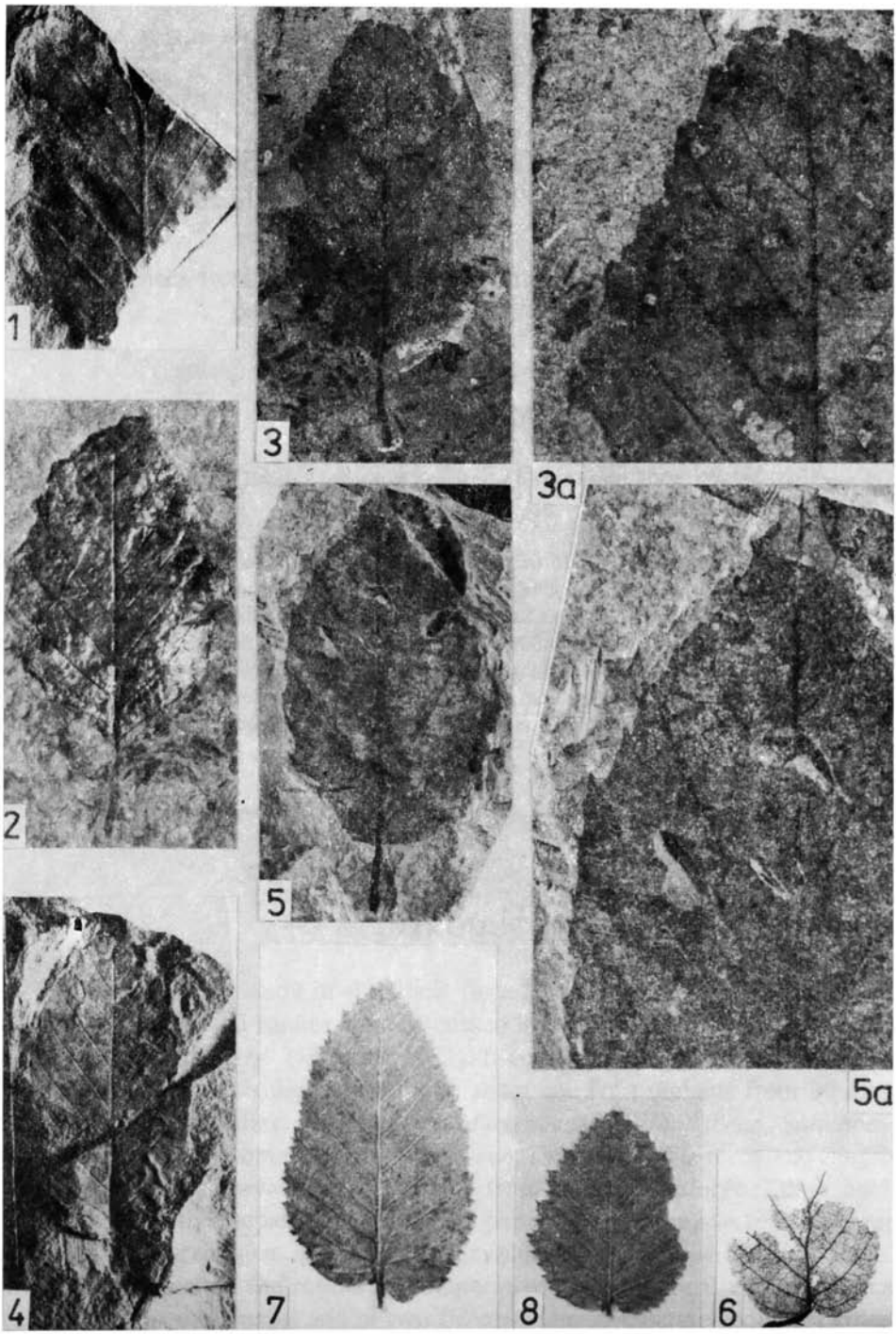
4. *Betula prisca* Ett., Arsenal; specimen unpublished;
   Geol. Bundesanst., Vienna, No. 1851/02/5
   = *Betula* aff. *subpubescens* Goepp.
5. *Betula prisca* Ett., Bilina;
   Ettingshausen 1867, Pl. 14, fig. 15
   = ? *Alnus julianaeformis* (Sternb.) Kvaček et Holý

5a. leaf fragment, x 2

6. *Carpinus grandis* Unger emend. Heer, Ruszów;
   Museum of Earth, Warsaw, No. MZ VII/67/I. 37
7. *Carpinus betulus* L.;
   specimen of herbarium, Silesia, SW Poland, WA ME
8. *Carpinus betulus* L.;
   specimen of herbarium, Silesia, SW Poland, WA ME

1–3, 5 – phot. G. Pascher
4 – phot. Z. Kvaček
6–8 – phot. M. Dąbrowska

Plate 1



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