New data on the genus *Cornus* L. (Cornaceae) in the Bulgarian Miocene flora

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**Abstract.** New data on the distribution of species of the genus *Cornus* on the territory of Bulgaria during the Miocene are presented. The species *C. megaphylla* was found for the first time in the middle Miocene flora from Satovcha (SW Bulgaria). So far, this species has been established in the middle Miocene flora from Ruzhintsi (NW Bulgaria). A revision of the species *C. distans* from the Satovcha paleoflora as *Cornus* aff. *alba* has also been made. A new finding of a leaf imprint from the Satovcha local paleoflora proves that the fossil material has the closest morphological features to the recent species *C. alba*.

**Keywords:** Bulgaria, *Cornus*, macrofossils, Miocene, paleobotany.

**Introduction**

So far, the Genus *Cornus* was represented by six species in the Bulgarian Cenozoic macroflora. Its stratigraphic distribution spans the interval lower Oligocene–lower Pliocene (Table 1). Hristova and Ivanov (2009) reported the presence of the genus *Cornus* also based on pollen data during the late Miocene in the Sofia Basin.

The new studies conducted in the vicinity of the village of Satovcha in 2022 led to the expansion of the area on Bulgarian territory of the species *Cornus megaphylla* and a new taxonomic solution for fossil material from this site.

**Material and methods**

The new studied material is stored in the Palaeobotanical Collection of the Institute of Biodiversity and Ecosystem Research, Bulgarian Academy of Sciences. It consists of two leaf imprints on sedimentary rocks (Sat-2059, Sat-4617). The flora-bearing rocks, exposed close to the village of Satovcha, Blagoevgrad District (SW Bulgaria), belong to the Sivik Formation of the Satovcha Graben (Vatsev, Pirumova, 1983).

Determination of the leaf types followed the scheme for leaf morphology of the angiosperms of Dilcher (1974). The photographs were taken with a digital camera Panasonic DC-FZ82.

**Results and discussion**

Palamarev and Petkova (1987) published a detailed description of *Cornus megaphylla* found in the fossil macroflora from the area of the village of Ruzhintsi (NW Bulgaria). Our finding (Pl. 1, Fig. 3) is identical to the leaf morphology of this species. The same authors indicate that this species, firstly established in Miocene of Eastern China (Hu, Chaney, 1940), is identified in Europe, only in Ukraine and Bulgaria. With the new finding, the Bulgarian range of the fossil species is expanded, as its stratigraphic distribution remains in the middle Miocene. The East Asian species *C. macrophylla* Wall. and *C. controversa* Hemsl. are accepted as the nearest living relatives (NLR) of the fossil species.
Table 1. List of species of Cornus in the Bulgarian Cenozoic fossil macroflora arranged alphabetically

<table>
<thead>
<tr>
<th>Species</th>
<th>Fossil type</th>
<th>Locality</th>
<th>Age</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Cornus aff. alba</em> L. (= <em>C. distans</em> Boulay)</td>
<td>leaf imprint</td>
<td>Satovcha</td>
<td>middle Miocene</td>
<td>Bozukov <em>hoc loco</em> Bozukov (1999)</td>
</tr>
<tr>
<td><em>C. distans</em> Boulay</td>
<td>leaf imprint</td>
<td>Brezhani</td>
<td>early Oligocene</td>
<td>Palamarev (1963, 1964a)</td>
</tr>
<tr>
<td><em>C. gorbunovii</em> Dorof.</td>
<td>endocarp</td>
<td>Melnik</td>
<td>early Pontian</td>
<td>Palamarev (1982)</td>
</tr>
<tr>
<td><em>C. graeffii</em> (Heer) Hantke</td>
<td>leaf imprint</td>
<td>Pelovo</td>
<td>middle Miocene</td>
<td>Palamarev and Petkova (1987)</td>
</tr>
<tr>
<td><em>C. megaphylla</em> Hu &amp; Chaney</td>
<td>leaf imprint</td>
<td>Ruzhintsi</td>
<td>middle Miocene</td>
<td>Palamarev and Petkova (1987)</td>
</tr>
<tr>
<td><em>C. orbifera</em> Heer</td>
<td>leaf imprint</td>
<td>Chukurovo</td>
<td>middle Miocene</td>
<td>Bozukov <em>hoc loco</em></td>
</tr>
</tbody>
</table>

(Palamarev, Petkova, 1987). *C. megaphylla* is distinguished from the other species of the genus by its leaf lamina, which is almost twice larger.

Bozukov (1999), on the basis of a scarce fossil material, determined the species *C. distans*, known from the upper Miocene of France (Boulay, 1887; Grangeon, 1958) and was recorded in the lower Oligocene of Bulgaria (Palamarev, 1964a). Grangeon (1958), studying the paleoflora from Coiron (SE France), distinguished two forms of the fossil species *C. distans*. The author associated the forms respectively with two modern species *C. macrophylla* Wall. (indicated as *C. distans* aff. *C. macrophylla*) and *C. sericea* L’Herit. (indicated as *C. distans* aff. *C. sericea*).

The fossil material from the lower Oligocene, which was determined by Palamarev (1964a) can be referred to the form *C. distans* aff. *C. macrophylla* by the number of secondary veins (6–7 pairs). However, there is a difference in the shape of the leaf lamina. It is wide elliptic at the material from France, while the one from Bulgaria is elliptic. The shape of the leaf lamina in the modern species is a variable morphological feature (eFloras, 2008), and it can be assumed that the material determined by Palamarev (1964a) belongs to the shape circle of *C. macrophylla*. i.e., it belongs to the *C. distans sensu lato*.

The fossil material determined from the middle Miocene flora of the area of the village of Satovcha (Bozukov, 1999) (Pl. I, Fig. 2) is analogous to the form *C. distans* aff. *C. sericea*, both in the number of secondary veins (5 pairs) and in the elliptic shape of the leaf lamina. The new fossil material, however, has an ovate shape (Pl. I, Fig. 1). *C. alba* L. (Pl. I, Fig. 4) is a modern species with lamina variability that contains both elliptic and ovate shape. Although less common, *C. sericea* also has ovate leaf lamina (Pl. I, Fig. 5). However, they have a rounded basal part, in contrast to our new fossil material, which has an obtuse normal basal part and in this respect is identical to the ovate laminae of *C. alba*.

Palamarev (1982) identified *C. gorbunovii* by endocarps in lower Pontian sediments in SW Bulgaria. The author indicated for the NRL of the fossil species the recent *C. alba* and *C. sericea*. According to Lindelof et al. (2020) these two species are genetically similar, although *C. alba* is distributed in the northern parts of Eurasia and *C. sericea* in the northern parts of North America (eFloras, 2008). The presence of a fossil species determined by endocarps, which has *C. alba* as the NLR, gives us the reason to define the leaf imprint with identical morphological features of this recent species as *Cornus* aff. *alba*. If more leaf imprints are available in the future, a more correct determination will be possible.

**Conclusions**

The distribution of the genus *Cornus* marked its taxonomic peak on the territory of Bulgaria during the Miocene. Six species have been established then. Favorable climatic conditions have made it possible for species requiring high temperature and humidity such as *C. megaphylla* (NLR *C. macrophylla*, *C. controversa*) to exist, as well as species whose NLRs (*C. alba*, *C. sericea*) inhabit the northern parts of Eurasia and North America today.

The fossil form of the recent *C. mas* also existed at the end of Miocene, which is an evidence to a transition to the modern Bulgarian flora.

It is important to note that the amount of fossil material from representatives of the genus is scarce.
This shows its small role in shaping the vegetation. Future research and more material are needed to resolve taxonomic issues in the fossil representatives of the genus.

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St. Louis, MO & Harvard University Herbaria, Cambridge, MA.


