

Pinus cembra L. – European stone pine

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PRESENT DISTRIBUTION IN THE WESTERN CARPATHIANS

At present, the range of occurrence of *Pinus cembra* covers western and central Siberia, the Alps and the Carpathians (Meusel et al. 1965). In Asia the tree is represented by a subspecies, *P. cembra* subsp. *sibirica* (Rupr.) Kryl. The European range of the species is of a relict type, most likely originating from the end of the Tertiary and beginning of the Quaternary – the time when Siberian stone pine, as well as other taiga plants, inhabited Central and Western Europe (Szczepanek 1971). In the Alps, pure cembran tree stands are found on the northern slopes of inner alpine valleys, at sites located between 1500 and 2500 m a.s.l., where the climate clearly displays continental features (Saulnier et al. 2011).

In the area of Poland, stone pine is a very rare species, occurrence of which is limited exclusively to the Tatra Mountains. The tree grows on poor soils, devoid of calcium carbonate (Myczkowski & Bednarz 1974), in an altitudinal zone between 1300 and 1650 m a.s.l. (Piękoś-Mirkowa & Mirek 1996), and is a characteristic species of the *Piceion abietis* alliance (Matuszkiewicz J.M. 2001). According to Pawłowski (1956), the taxon is found in spruce communities of the upper montane belt and the dwarf mountain pine belt, while at altitudes of 1500–1650 (1700) m a.s.l. it locally forms small distinctive monospecies groves.

ECOLOGY

Pinus cembra shows good adaptations to harsh climatic conditions and is resistant to frosts of ca. -7°C (Erschbamer & Wallnöfer 2007). However, slight frosts in the summer, down to -2°C , cause leaf bud damage, while ones down to -6°C – disturb the process of photosynthesis in older needles (Tranquillini 1979). Decrease in the annual amount of rainfall to values below 700 mm results in a gradual transition from cembran forests into communities with *Juniperus*, *Pinus mugo* or *P. uncinata* (Hofmann 1970).

Pinus cembra is wind-pollinated. Studies of the present-day pollen count of the largest site covered by stone pine in the Tatra Mountains indicate that its

proportion in pollen spectra changes from 27% in the centre of the site to ca 5% at the periphery, which provides a basis for the assumption that a pollen value of 5% suggests the presence of this taxon *in situ* (Obidowicz et al. 2004b).

HISTORY OF EXPANSION IN THE WESTERN CARPATHIANS DURING THE LATE GLACIAL AND HOLOCENE (Fig. 21)

In both the Alps and the Carpathians, *Pinus cembra* survived the last glaciation at lower altitudes in ice-free areas, located beyond the present-day distribution of the taxon (Casalegno et al. 2010, Obidowicz et al. 2004b). In the eastern part of Alps, stone pine most likely possessed a refugium (Wick 1996, Vescovi et al. 2007). Occurrence of Carpathian refugia of the species is confirmed by Late Glacial occurrences of its macrofossil remains (Jankovská 1984, 1995), recorded on both the southern and northern side of the Tatra Mountains (Obidowicz et al. 2004b and references), as well as by isopollen maps plotted for the Late Glacial (Obidowicz et al. 2004b), which indicate high pollen values for *Pinus cembra* in the Carpathians between 12 500 and 10 500 BP. Maximum values (16.5%), observed in the Jasło-Sanok Depression, provide evidence for the presence of stone pine *in situ*. However, the 10 000 BP map, from the beginning of the Holocene, already shows lower frequencies. Similarly as in the Late Glacial, the highest percentage values (12%) were recorded in the Jasło-Sanok Depression. At sites from the Tatra Mountains, maximum proportions in spectra amounted to 10%, while from the Bieszczady Mountains (Polish Eastern Carpathians) – to 7%. High frequency, attaining 18%, were observed to the south-east of the Orawa-Nowy Targ Basin, at the Slovakian site Bobrov (site no. 285). Isopollen data obtained for this period indicate a continuous occurrence, since the Late Glacial, of stone pine beyond its present-day distribution within the Carpathians. Most likely, at 9500 BP it was still found beyond its present range, as is demonstrated in the respective isopollen map, which also suggests that the species was present in two further centres other than the Tatra Mountains – the Bieszczady Mountains and the Jasło-Sanok Depression. Occurrence of the taxon to the

south-east of the Orawa-Nowy Targ Basin can also not be excluded.

A visible regression of stone pine is illustrated in the 9000 and 8500 BP maps. Percentage values exceeding

1% are recorded exclusively in sediments from the Tatra Mountains. According to subsequent isopollen maps, the distribution of *Pinus cembra* in the Carpathians was limited to its present-day, relict range from ca 8000 BP.











