

Corylus avellana L. – Hazel

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PRESENT DISTRIBUTION IN THE WESTERN CARPATHIANS

In the Polish part of the Carpathians, *Corylus* grows in various forest communities, both zonal and azonal, in which it extends to altitudes of 900–1000 m a.s.l. It is found in the foothill association of the oak-hornbeam forest, *Tilio-Carpinetum* Traczyk 1962, the submontane riparian ash forest, *Carici remotae-Fraxinetum* Koch 1926, the montane acidophilous beech forest, *Luzulo nemorosae-Fagetum* (Du Rietz 1923) Marker. 1932 em. Meusel 1937, and, within the lower montane forest belt, in all variants of the Carpathian beech forest, *Dentario glandulosae-Fagetum* Klika 1927 em. Mat. 1964, though it is not found within this association in the Tatra Mountains. Hazel is also a component of the azonal association of montane riparian alder forest, *Alnetum incanae* Aich. et Siegr. 1930, and humid sycamore forest with hart's-tongue fern, *Phyllitido-Aceretum pseudoplatani* Moor 1952 (Dzwonko 1986, Matuszkiewicz J.M. 2008).

ECOLOGY

Corylus grows on a wide variety of soils and is only limited by conditions exceptionally dry (sands) or permanently humid throughout the year (peats) (Tallantire 2002). The pollination period occurs in dry and warm conditions, after the catkins become elongated. The initiating stimulus for this process is a rise in temperature. Generally, the pollination period begins earlier in southern and western areas occupied by hazel, in the lowlands and on south-facing slopes, rather than in northern and eastern areas, on mountains and on north-facing slopes (Sokołowska 1962).

EXPANSION IN EUROPE DURING THE LATE GLACIAL AND HOLOCENE

Deacon on the basis of an isochron map of then available radiocarbon dates proposed locations of *Corylus* refugia to the north of the Pyrenees, in small, ice-free areas adjacent to the British Isles, and somewhere between southern Sweden and Denmark (Deacon 1974). However both the areas which she listed are highly doubtful since during the last glaciation and both are now considered to

have been covered by ice-sheets, and in the Baltic area no evidence has been found for the presence of ice-free nunataks. Lang assumes that refugial areas of *Corylus*, during the Last Glaciation, were situated in the southern and south-eastern areas of Europe, on the Apennine and Balkan Peninsulas (Lang 1994). Occurrence of hazel refugia in other European regions does not seem very likely.

According to Stewart and Lister, the early appearance of *Corylus* (between 8500 and 8000 BP) in the Scandes Mountains may have resulted from the presence of small groups of this shrub in the surroundings of the ice sheet. The authors recognize such groups as cryptic refugia (Stewart & Lister 2001). Tallantire also claims that the location of hazel refugia in south Sweden is not as unusual as it may seem (Tallantire 2002).

Authors discussing the Late Glacial-Holocene history of *Corylus* in the territory of Poland suggest that the shrub arrived in this part of Europe from refugia near the Bay of Biscay (i.e. south-western France), and probably also from the region of Lithuania, at any rate from refugia closer than the southern regions of Europe (Miotk-Szpiganowicz et al. 2004).

According to Lang by the end of the Late Glacial, hazel, migrating from southern European areas, attained a distribution extending from the lower Rhone valley, to the east, along the forelands of the Alps, and reaching the Carpathians (Lang 1994). From here it started its Holocene expansion towards the north of Europe. A delay in its appearance in the region of Poland probably resulted from the increasing continentality, observed in summer months (Tallantire 2002).

HISTORY OF EXPANSION IN THE WESTERN CARPATHIANS DURING THE HOLOCENE

(Fig. 16)

10 000 BP

At the end of the Late Glacial, the upper forest limit of the Carpathians was found at a low altitude of 700 (800) m (Rybničková & Rybniček 1993). Therefore, at the beginning of Holocene, pollen rain falling on the Western Carpathians may have been strongly affected by

long-distance transport. *Corylus* pollen grains recorded in the Carpathian sections most likely still derive from distant areas of occurrence.

9500 BP

At that time, the Carpathian tree stands still covered only small areas, mainly at lower altitudes; therefore the pollen rain may still have included large amounts of pollen derived from long-distance transport. Hazel was still not growing in the Western Carpathians. The occurrence of *Corylus* pollen in several profiles from the Tatra Mountains, recorded as initiating a continuous curve, is likely to indicate the migration of this shrub from its refugial areas to the direct surroundings of the Carpathians. Nevertheless, the “high mountain effect”, affecting pollen spectra particularly on small mountain massifs, should be taken into consideration (Rybničková & Rybniček 2006, Obidowicz, Chapter: History of palynological studies in the Polish part of the Western Carpathians..., this volume).

Part of the Beskid Niski range and the Jasło-Sanok Depression may have been already occupied by hazel, as is indicated by the 5% isopoll covering this fragment of the Carpathians.

9000 BP

If 5% in pollen spectra is considered the limiting value for the occurrence of *Corylus in situ* (see the discussion in Tallantire 2002), then on the 9000 BP map such an area covers a substantial part of the Western Carpathians, up to the Wisłoka river valley. Such an assumption is supported by the further history of hazel expansion. The relatively abundant appearance of *Corylus* at lower locations in the Jasło-Sanok Depression is not surprising. However, profiles from the Gaśienicowy Staw Lake (site no. 112 and 113) in the Tatra Mountains, located in the present-day subalpine zone (1621 and 1672 m a.s.l.), in which *Corylus* begins to attain values of several percent, may still be influenced by long-distance transport.

8500 BP

This map shows the rapid expansion of *Corylus* in the western part of the Polish Carpathians, from the Beskid Śląski range to the Wisłoka river valley. This area is covered by the 20% isopoll. That was the time of the initial “hazel phase”, observed in pollen assemblage zones (PAZ), described as *Corylus* PAZ (Orawa-Nowy Targ Basin, Beskid Makowski range), as *Corylus-Ulmus* PAZ (Beskid Niski range), and as *Pinus-Cyperaceae* PAZ (Tatra Mountains) with exceptionally high percentage values recorded for this taxon. The shrub probably became the main component of the shrub layer in spruce forests (Rybniček & Rybničková 2002).

The highest percentages of hazel are found in the Orawa-Nowy Targ Basin and in the Tatra Mountains. Its presence is indicated by values exceeding 35% in certain sections (Obidowicz 1996) and attaining even 50% in the

Slovakian Upper Orava (Rybniček & Rybničková 2002). On south-facing slopes in the Tatra Mountains *Corylus* probably formed its own belt or fragments of a belt (detailed discussion in Obidowicz 1996).

The area of occurrence of *Corylus*, forming its own communities or being a component of various tree stands, e.g. spruce ones, already covers the entire part of the Carpathians under consideration.

8000–7500 BP

Corylus constantly expanded within its range in the area of the Polish Western Carpathians. This range was to be sustained for several subsequent centuries and the frequency of hazel in stands would only locally increase or decrease. In the area between the Dunajec and the Wisłoka river valleys, in the Beskid Wyspowy and Makowski ranges, and in the Orawa-Nowy Targ Basin hazel may have even formed its own communities, occupying extensive areas. For the first time, isopollen maps include areas with amounts of *Corylus* pollen attaining 50%. These are the regions in which particular profiles contain pollen assemblage zones (PAZ) in which hazel is of great importance, e.g. *Corylus* PAZ (Orawa-Nowy Targ Basin), *Corylus-Ulmus-Tilia* PAZ (Beskid Makowski range), and *Corylus-Fraxinus-Tilia* PAZ (Beskid Niski range).

Maximum frequency of *Corylus* in pollen spectra of the “hazel phase” are dated to 8500–7000 BP. In the Orawa-Nowy Targ Basin, they fall within the period of 8700–7300 BP. However, the duration of the phase differed between various physiographic units of the Polish Carpathians, as is shown on subsequent maps and in particular pollen profiles.

7000–5500 BP

After the “hazel phase”, for the next 2000 years the proportion of *Corylus* in the vegetation of the Western Carpathians did not change much and the taxon was distributed rather evenly. In the Beskid Makowski range and in the Tatra Mountains (6000 BP), in the Beskid Sądecki range (6000–5500 BP), and in the Beskid Niski range (7000–5500 BP) larger populations of this species built up periodically. At 6000 BP, the 50% isopoll covered a substantial part of the Carpathian area under consideration between 20° and 22° N.

Some mountain ranges may be described as marked by a time shift or a continuation of the “hazel phase”, but visibly not as marked, since percentage values of hazel curves at particular sites only rarely exceed 30% of the total pollen sum. Profiles from Szymbark (126) from the Beskid Niski range and Jesionowa (261) from the Beskid Sądecki range, form an exception and still record *Corylus* values exceeding 50% at 6000 BP.

5000 BP

Hazel, however recorded in slightly lower frequency than in the preceding period, was still distributed

exceptionally evenly across nearly the entire Polish Western Carpathians. This area is bounded by the 20% isopoll. Only in a part of the Beskid Niski range a greater concentration of hazel is indicated by the 50% isopoll.

4500–4000 BP

This map illustrates the last area where the values of *Corylus* pollen exceed 20%. In part of the Beskid Niski range, the phase showing high hazel frequency did not end before 4500 BP.

In most areas of the Western Carpathians, *Corylus* still occurred over the same area as in preceding centuries. However, in the Beskid Niski, Beskid Wyspowy and Beskid Żywiecki ranges, and later also in the Beskid Mały and Beskid Śląski ranges, in the Jasło-Sanok Depression and in the San river valley its larger stands begin to disappear. For a very long time hazel scrub remained an important component of vegetation in the central part of the Western Carpathians.

3500–1500 BP

Expansion of *Fagus*, *Abies*, and *Carpinus* resulted in a visible reduction of the proportion of *Corylus* in the forests. Although hazel continued to occur throughout the entire study area within the Carpathians, it was noticeably decreasing in quantity. It is represented most abundantly in the western part of the Beskid Niski range and in the Tatra Mountains, covered by the 20% isopoll, and, subsequently, by that of 10%. After 2500 BP, the 10% isopoll covers only the Tatra Mountains. In other areas of the Western Carpathians, *Corylus* is already represented by the 5% isopoll.

1000–500 BP

The retreat of hazel continued. To the west of the Dunajec river valley, including the Tatra Mountains, it

became an occasional species. Only in profiles from the highest locations, mostly affected by regional pollen rain, values for *Corylus* exceed 2%.

0 BP

The occurrence of hazel in vegetation of the western part of the study area, up to the Dunajec river valley, is infrequent. The taxon completely or nearly disappears from some mountain ranges. To the east, values for *Corylus* are slightly higher, however and do attain, in certain sections, maybe several percent.

CONCLUSIONS

From its refugia in the south of Europe, *Corylus* migrated to the Polish part of the Western Carpathians at about 9500 BP. First, it appeared in a part of the Beskid Niski range and in the Jasło-Sanok Depression. At about 8500 BP it entered a period of expansion, this being the beginning of the “hazel phase”. However, this phase is not always indicated in the names of pollen assemblage zones (PAZ), since high amounts of *Corylus* pollen show a regional distribution, as can be observed at sites in the subalpine belt of the Tatra Mountains. This phase continued until 7000 BP; however particular mountain ranges differed in its duration. The time of ca 4500 BP is marked by the first symptoms of a reduction of amounts of hazel within the vegetation of the Western Carpathians. This reduction, initially gradual, was intensified at about 500 BP. Presently, in the western part of the study area, up to the Dunajec river valley, *Corylus* is infrequent and even disappeared from some mountain ranges, while farther to the east its frequency in tree stands is still significant.











