Pinus uncinata Ramond taxonomy based on needle characters

K. Boratyńska¹ and M. A. Bobowicz²

¹Polish Academy of Sciences, Institute of Dendrology, Kórnik, Poland
²Department of Genetics, Adam Mickiewicz University, Poznań, Poland

Received May 31, 2000
Accepted February 13, 2001

Abstract. 11 needle characters of Pinus uncinata Ramond from the Spanish Pyrenees, P. mugo Turra from the Tatra Mountains, and P. sylvestris L. from N.E. Poland were analysed. It was shown that P. uncinata is much more closely related to P. mugo than to P. sylvestris. Nevertheless P. uncinata remains distinct from both in a number of the characters examined. The species differs from P. mugo especially in the length of the needles and in the distance between the vascular bundles. It differs from P. sylvestris in such characters as the number of resin canals, thickness of epidermis cells and the distance between the vascular bundles. Width of epidermis cells was similar in all taxa studied.

Key words: Pinus uncinata, Pinus mugo, Pinus sylvestris, leaf anatomy, Mahalanobis distances.

Introduction

The systematic position of Pinus uncinata Ramond is not sufficiently known. The taxon is treated either as an independent species or as a subspecies of Pinus mugo Turra. Two hypotheses have been discussed on the origin of P. uncinata (Lewandowski et al. 2000). The first of them suggests the taxon is a result of a process of ancient hybridization between P. mugo and P. sylvestris (Gams 1928/29, Schmid 1951, Staszkiewicz and Tyszkiewicz 1972, Prus-Głowacki et al. 1998). Christensen (1987a, b) was of the opinion that it originated as result of isolation from P. mugo. Christensen distinguished two subspecies of P. mugo Turra: the eastern P. mugo ssp. mugo and the western P. mugo ssp. uncinata (Ramond) Domin. He treated the central, intermediate populations as P. mugo Turra nothossp. rotundata (Link) Janch. & H. Neumayer (see also Lüdi 1930, Gaussen et al. 1964, Holubčiková 1965).

Pinus uncinata occurs in the Pyrenees and the western and central Alps, the Massif Central, Jura, Vosges and the Ligurian Apennines (Fig. 1). It forms forests at the elevations of (850)1400 – 2400(2700) m (Meusel et al. 1965, Jalas and Suominen 1973, Bolös and Vigo 1984, Amaral Franco 1986, Carrillo and Ninot 1992, Villar et al. 1997, Barbéro et al. 1998). Records from the submountain regions of central Europe (Czech Republic, Germany, Poland) most probably concern P. uliginosa Neumann or taxa intermediate between P. mugo and P. sylvestris (Christensen 1987a).

Typical P. mugo occurs in the Alps and the Carpathians, the Sudethians, the Dynarian Alps and the central and northern Apennines. It forms a supraforestal, specific subalpine thicket belt, with the maximum elevation of about 2600–2700 m in the Alps (Meusel et al.

*Pinus sylvestris* covers the largest area of distribution through the whole of Europe and northern Asia (Boratyński 1993).

The distribution areas of all the three species are overlapping in the Alps, and in this region several intermediate forms among typical *P. mugo*, typical *P. uncinata* and *P. sylvestris* have been described (Schwarz 1949, Mirov 1967, Christensen 1987a, Neet-Sarquedda et al. 1988, Christensen and Dar 1997, Minghetti 1997).

*Pinus uncinata* from the Pyrenees and the Alps and *P. uliginosa* from mountain regions of central Europe have sometimes been considered identical species; this is the origin of *P. uncinata* records from the central European regions, north-east of the Alps (for example Pawłowski 1956, Szafer et al. 1967). It was suggested that *P. uliginosa* from Wielkie Torfowisko Batorowskie in the Sudetians is a marginal population of *P. uncinata* (Krzakowa et al. 1984b), but differences in genetic struc-
ture of these taxa exclude this hypothesis (Prus-Głowacki et al. 1998).

The aim of the present work is to establish the taxonomic position of *Pinus uncinata* in comparison with *P. mugo* and *P. sylvestris* on the basis of morphological and anatomical characters of needles.

**Materials and methods**

Material of *Pinus uncinata* was collected from outside the typical *P. mugo* range to exclude potential influence of this species. The needles came from 5 natural localities in the Central and Eastern Pyrenees (Boratyńska and Bobowicz 2000). Two populations of *Pinus sylvestris* from north-eastern Poland (outside of the range of *P. mugo* complex) and two populations of *P. mugo* from the southern part of Poland analysed previously by Bobowicz and Krzakowa (1986) and by Bobowicz and Korczyk (1994) were used as comparative material. *P. mugo* needles were collected from the sub-alpine zone of the Tatra Mts. in Poland and needles of *P. sylvestris* from old trees in natural stands in the Milomły and Supraśl forest districts of Poland (Table 1, Fig. 1).

Ten two year-old dwarf shoots were gathered from the sunny side of the crown of 42 trees of *P. uncinata*, 20 trees of *P. mugo* and 20 trees of *P. sylvestris*. A total of 820 needles were analysed: 420 of *Pinus uncinata*, 200 of *P. mugo* and 200 of *P. sylvestris* (10 for every tree). Each needle was analysed separately for 15 characters (Table 2). Character No 1 was measured on fresh material in the field, the others on material preserved for some time in 70% alcohol. Characters 2–5 were recorded under a binocular microscope at magnification of 40×, and characters 6–11 were measured on crosssections of the central region of a needle under a microscope. Characters 6–8 were observed at magnification of 50×, and characters 9–11 at 320×. The data obtained were analysed statistically. The minimal and maximal values of traits were found and arithmetical means, standard deviations and coefficients of variation were calculated and analysed.

The correlation between characters was examined and Student’s t-distribution was used for comparison of all populations studied. A discriminant analysis was performed and the position of the specimens was examined along the first three discriminant variables to find differences among