

## TURKEY OAK (*QUERCUS CERRIS* L.) IN POLISH FORESTS

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**Abstract.** The Turkey oak (*Quercus cerris* L.) is one of the least known species of trees of alien origin introduced to forests in Poland. Its natural geographical range embraces southern Europe and Asia Minor. It started to be grown on the Polish lands in 1813, planted primarily in parks and gardens, mostly in the western part of the country. On the basis of the present authors' own field search, the literature, and unpublished data, it was possible to collect information about 22 places of occurrence of the Turkey oak in the woodland areas of Poland. A map of the distribution of this species is presented and the characteristics of its most extensive localities in forests are given. The oldest and most robust tree stands comprising *Quercus cerris*, planted in the fertile riverside habitats of the Oder river valley, have reached the age of 130-150 years. In those conditions the Turkey oak attains a height of 37 m and a breast-height diameter of up to 120 cm. Because of frequent frost damage and a low quality of trunks, it is of no productive significance in forestry. Even so, it is an interesting example of an alien oak species which, like the well-known *Q. rubra*, shows the ability to expand in a woodland environment.

**Key words:** *Quercus cerris*, Turkey oak, alien plants, naturalization, forests, Poland

### INTRODUCTION

One of the poorly known trees of alien origin introduced to Polish forests is the Turkey oak (*Quercus cerris* L.). There has been so little interest in its cultivation, even at an experimental scale, that it has not found itself among the several dozen alien species whose development and growth in the woodland environment have been an object of detailed research [Bellon et al. 1977, Gazda 2013]. The few publications with information about *Q. cerris* in Polish forests that have appeared so far concern single sites in Wielkopolska [Browicz 1953, Krotoska 1953] and Małopolska [Mączyński 1981], or some dozen places in the Oder valley, where it was found in the course of dendrological studies [Danielewicz 2008]. Although this species is of no economic significance in forestry and its proportion in tree stands is small, it deserves attention for at least two

reasons. First, today it is a peculiar, noteworthy relic of former attempts at an introduction of an alien tree species to forests. Secondly, while it now belongs to plants well established in Poland [Danielewicz and Maliński 2003, Tokarska-Guzik et al. 2012], so far there has been no precise information in the literature about localities in which this species shows the ability to expand in the woodland environment [cf. Danielewicz and Pawlaczyk 2006].

The goal of this paper is to sum up the body of knowledge about the localities of the Turkey oak in Polish forests and to identify its dynamic tendencies on the basis of observations made by the present authors in West Pomerania, Wielkopolska and Lower Silesia. A detailed characterisation of selected stands of this species will be the topic of separate papers.

## CHARACTERISTICS OF THE SPECIES

The Turkey oak is one of the four European representatives of the section *Cerris* in the subgenus *Quercus*, which also includes *Q. suber* L., *Q. trojana* Webb. and *Q. macrolepis* Kotschy [Schwarz 1964, Menitski 1984, Boratyński et al. 2006]. In optimum conditions this tree attains a height of up to 35–40 m and a breast-height diameter of up to 2 m. It has a characteristic thick, dark and deeply cracked outer bark. In the conditions of central Europe, its trunk often features frost cracks. Buds are surrounded by characteristic long filamentous scales. Leaf blades are oblong or obovate, variably lobed even on one tree, sometimes almost to midrib. They have glossy and scabrid upper surface and stellate hairs on the underside. Acorns, half hidden in cupules with filamentous scales, attain maturity in the second year. The cupules sit on short peduncles.

*Quercus cerris* is a sub-Mediterranean species with a geographical range embracing a vast area (Fig. 1) extending from south-western France through Italy, Switzerland, Austria and the Balkan Peninsula to Asia Minor and Lebanon [Meusel et al. 1965, Browicz 1982, Atlas... 1976, Menitski 1984]. Its northern limit in central Europe goes across central Slovakia [Požgaj and Horváthová 1986, Pagan 1992] and southern Moravia [Kaplan 2012]. In the Czech Republic it has only few natural sites and is regarded as a rare species [Chytrý 1997, Danihelka et al. 2012, Grulich 2012], while in Slovakia stands with its participation occupy 2.5% of the woodland area [Pagan 1992]. In the European part of its range, the localities of the Turkey oak extend from the sea level to a height of about 1,500 m a.s.l., in Anatolia usually between 500 and 1,500 m a.s.l., and in the Lebanon mountains, from 1,300 to 2,200 m a.s.l. [Browicz 1982, Menitski 1984]. The climate in the areas where this species occurs ranges between warm temperate (maritime and transitional) and subtropical (from maritime to the continental and highland types). Mean annual temperatures range from about 8°C to about 15°C. Požgaj and Horváthová [1986] believe that the factor limiting its occurrence is a mean annual temperature lower than 8–8.5°C and a mean temperature in the growth period of less than 15.5°C. Annual rainfall in its area of occurrence ranges from 400 mm to 1000 mm. According to Ellenberg et al. [1991], the thermal requirements of *Q. cerris* are similar to those of *Q. pubescens*, but the former is less photophilous and slightly more demanding in terms of soil moisture. It tolerates periods of summer drought fairly well, but responds to extreme water deficit worse than *Q. suber* [Nardini et al. 1999]. It is thought to be a moderately mesophilic species, comfortable on fairly deep and not overly heavy

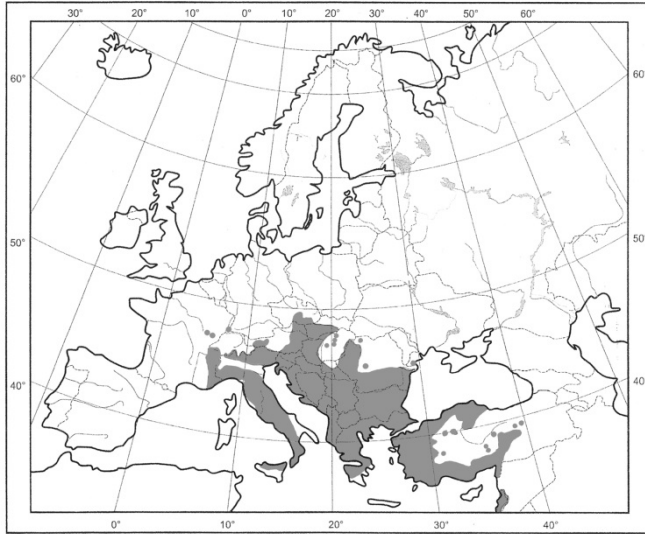


Fig. 1. Natural range of *Quercus cerris* [on the basis of Meusel et al. 1965, Browicz 1982, Atlas... 1976]

Rys. 1. Naturalny zasięg *Quercus cerris* [na podstawie Meusel i in. 1965, Browicz 1982, Atlas... 1976]

sandy or stony soils, with a pH ranging from moderately acidic and neutral to moderately basic [Browicz 1982, Ellenberg et al. 1991, Mayer A. 1984, Pożgaj and Horváthová 1986].

Because of its wide geographical range, the Turkey oak is a component of a great variety of communities, usually specific to the flora of individual geobotanical regions. In the southern areas of its range in Europe it usually grows in mixed thermophilous oak forests from the class *Quercetalia pubescenti-petraeae* and the alliances *Aceri tatarici-Quercion* and *Ostryo-Carpinion*, for which the Balkan Peninsula is the centre of their occurrence [Horvat et al. 1974, Mayer H. 1984]. There it grows with such species as: *Quercus pubescens*, *Q. pedunculiflora*, *Q. petraea*, *Q. frainetto*, *Acer tataricum*, *A. campestre*, *Carpinus orientalis*, and *Ostrya carpinifolia*. In Italy it attains the greatest phyto-sociological constancy in associations of thermophilous forests belonging to the alliances *Quercion pubescenti-petraeae*, *Carpinion orientalis*, *Teucro siculi-Quercion cerridis*, and *Erythronio-Quercion-petraeae* [Blasi et al. 2004, Taffetani et al. 2012]. It grows there with such species as *Acer obtusatum*, *A. monspesulanum*, *Cercis siliquastrum*, *Fraxinus ornus*, *Mespilus germanica*, *Quercus pubescens*, *Sorbus domestica*, and *S. torminalis*.

Near the northern limit of its range, in the Czech Republic, the Turkey oak is a rare admixture species in thermophilous oak forests growing on heavy soils developed from loess deposits [Chytrý 2012], while in Slovakia it is a dominant species in stands of the association *Quercetum petraeae-cerris*, the habitat of which is a soil developed on a substratum of andesite rocks [Roleček 2005].

The wood of *Q. cerris* differs from that of *Q. robur* and *Q. petraea*, among other things, in having broader sapwood, thicker fibres and greater density (0.8-0.9 g/cm<sup>3</sup>),

higher resistance to cleavage, and a slightly better fuel value, but it is not as durable and so is generally considered less valuable [Browicz 1982, Menitski 1984, Lavisici and Scalbert 1991, Kubiak and Laurow 1994].

The Turkey oak is an important species in woodland management in the south of Europe [Mediterranean... 2003]. Outside its natural range it is mostly cultivated as a fast-growing ornamental tree with low soil requirements and resistant to drought. In several countries, especially in north-western France and southern Great Britain, it has been noted in spontaneously developed secondary sites [Atlas... 1976, Preston et al. 2002]. On Polish lands *Q. cerris* started to be cultivated in 1813 [Tokarska-Guzik et al. 2012], but in the former Prussian sector it could have been planted even before this date.

## MATERIAL AND METHODS

The material on the occurrence of *Quercus cerris* in the woodland environment had been gathered since 1993, in the course of floristic fieldwork conducted by the present authors mostly in the western part of Poland: West Pomerania, Wielkopolska and Lower Silesia. Use was also made of unpublished information obtained from other persons, as well as Juwa's [1968] master's thesis prepared in the Chair of Forest Botany of the Higher Agricultural School in Poznań. The location of its sites was determined on the basis of current maps of forest districts, and when topographic maps were used in the field, their location was identified by geographical coordinates. Data on the places of the non-forest cultivation of the Turkey oak employed to draw a holistic map of the localities of this species in Poland, including city parks and greenery, came from dendrological literature and the authors' own notes.

Localities with the most abundant clusters of the oak were selected for inventory work involving mostly measurements of breast-height diameters and heights of trees, establishing the number of trunks with frost cracks, and observations of the natural regeneration of the species. Two master theses were prepared as part of this research in the Wołów [Domański and Basałyga 1999] and Kościan Districts [Bugala 2006]. In the years 1995 and 2011 further inventories were made of the site in the Czerniejewo District, and in the years 2013-2014, in the Wrocław municipal forests (Rędzin and Osobowice quarters) and in the Choszczno District.

## RESULTS

The register of the places of introduction of the Turkey oak in Poland documented so far embraces 116 localities, nearly 100 of which have been found outside forests, mostly in old parks established before the Second World War. In the woodland environment, 22 localities of this species have been recorded. Most sites of *Q. cerris* cultivation can be found in the western part of the country (Fig. 2), especially in West Pomerania, Wielkopolska, Lubuska Land, and Lower Silesia. In the remaining areas this species is much more rare, with the exception of Przemyśl Land. So far there has been no information about its cultivation in the cool north-eastern parts of Poland: the Mazurian Lakeland and the North Podlasie Lowland. 'Forest' sites of the Turkey oak have been

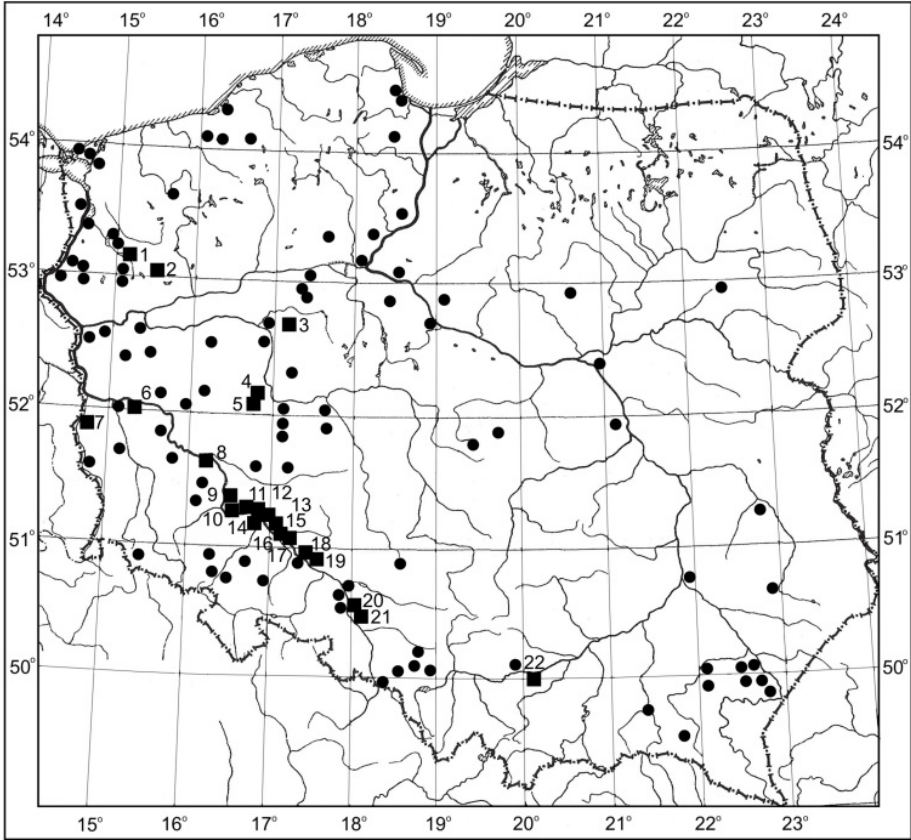


Fig. 2. Distribution of the localities of *Quercus cerris* in Poland: squares with numbers – localities in forests, circles – localities outside forests

Rys. 2. Rozmieszczenie stanowisk *Quercus cerris* w Polsce: kwadraty z numerami – stanowiska w lasach, koła – stanowiska poza lasami

found in the Choszczno Lakeland, central and southern Wielkopolska, Lubuska Land, the Niepołomicka Forest, and the Oder valley in the Silesian Lowland.

In forests *Quercus cerris* is represented by single trees or groups of trees, and it is only in a few places that stands with a greater proportion of this species have survived (Table 1). The results of inventories taken in 2009-2014 indicate that the most extensive sites of the oak have been preserved in the Oder riverside municipal forests in Wrocław and in the Wołów, Kościan and Czerniejewo Districts. In the last district, in 1967 there were 269 trees 65 years old forming a compact stand in an oak-hornbeam forest habitat covering an area of 0.39 ha [Juwa 1968], but the number of the oaks had dwindled by more than 75% over the next 44 years. According to the author cited, at that time the total volume of this tree stand was 349 m<sup>3</sup>/ha.

Today the most sizeable woodland collection of the Turkey oak, confirmed lately, is the Rędziński Forest 2 site, where 164 trees aged 130 have been recorded in an area of about 1 ha. It is situated in the Oder valley in an ash-elm riparian forest habitat, in a group of communities with the common oak in the tree stand. As in many other

Table 1. List of sites *Quercus cerris* identified in Polish forests  
 Tabela 1. Wykaz stanowisk *Quercus cerris* stwierdzonych w lasach Polski

Number Numer	Site Section Stanowisko Oddział	Date of observation Rok obserwacji	Forest site type Typ siedliskowy lasu	Number of trees Liczba drzew	Age of trees Wiek drzew
1	2	3	4	5	6
1.	Choszczno Forest District Nadleśnictwo Choszczno  Section – Oddział 355 c	2014	LMśw	28	100
	Section – Oddział 353 b, 353 g, 354 a, 355 d, 363 b, 367 l, 368 a, 369 c		LMśw	S3	50-60
	Section – Oddział 355 h, 364 d		LMśw		
2.	Drawno Forest District Nadleśnictwo Drawno 53°12'27" N 15°39'43" E	2010	Lśw	S2	ca. 80 ok. 80
3.	Czerniejewo Forest District Nadleśnictwo Czerniejewo  Section – Oddział 229 a	1967	Lśw	269	65
		1995	Lśw	102	93
		2011	Lśw	61	109
	Section – Oddział 215, 216, 217, 224	2011	LMśw		
4.	Konstantynowo Forest District Nadleśnictwo Konstantynowo  Section – Oddział 261 b	2014	Lśw	25	140
	Section – Oddział 261 g		Lśw	6	50

DBH Pierśnica cm	Height Wysokość m	Natural regeneration Odnowienie naturalne	Remarks Uwagi
min.-max. (mean) [dimensions of single tree]	min.-maks. (średnia) [wymiary pojedynczych drzew]		
7	8	9	10
27-62 (45.5)	15-23 (19.5)	C +	after Antosz and Kiciński (unpbl.) relic of mid-forest alley według Antosza i Kicińskiego (npbl.) pozostałość alei śródleśnej  oak stands on post-agricultural soils drzewostany dębowe na gruntach porolnych
		B +	clumps of beech regeneration gniazda z odnowieniem buka  after Kujawa-Pawlaczyk (unpbl.) według Kujawy-Pawlaczyk (npbl.)
15-35 (23.4)	15-28 (24.7)	C +	after Juwa (1968) według Juwy (1968)
20-50 (32.9)	21-30 (25.3)	C +	after Danielewicz and Maliński (unpbl.) według Danielewicza i Malińskiego (npbl.)
31-63 (41.9)	23-31 (27.7)	C +	after Kiciński (unpbl.) według Kicińskiego (npbl.)
		B ++	substitute communities of Scots pine on post- agricultural soils; after Kiciński (unpbl.) zbirowiska zastępcze z sosną na gruntach porolnych; według Kicińskiego (npbl.)
41-73 (54.2)	22-33 (25.8)	B +, C +	after Danielewicz and Kiciński (unpbl.) według Danielewicza i Kicińskiego (npbl.)
9-37 (21.2)	8-16 (13.5)		

Table 1 cont. – Tabela 1 cd.

1	2	3	4	5	6
	Section – Oddział 262 a		Lśw	7	140
	Section – Oddział 261 f		Lśw		
5.	Kościan Forest District Nadleśnictwo Kościan	2009			
	Section – Oddział 199 g		Lśw	(A1) 117	90
				(A2) 44	20-50
	Section – Oddział 197 h, 198 f, 200 b		Lśw		
6.	Nietków (Oder river valley) Nietków (dolina Odry) 52°01'40" N 15°20'27" E	2005	Lśw	3	ca. 100 ok.100
7.	Brody near Lubsko Brody k. Lubaska 51°47'28" N 14°46'01" E	2010	Lśw	1	ca. 100 ok. 100
8.	Gołkowice near Szlichtyngowa (Oder river valley) Gołkowice koło Szlichtyngowej (dolina Odry) 51°41'14" N 16°13'47" E	2006	Lł/Lśw	S2	ca. 80 ok. 80
9.	Iwno near Ścinawa (Oder river valley) Iwno koło Ścinawy (dolina Odry) 51°23'10" N 16°28'13" E	1997	Lśw	S2	ca. 120 ok. 120
10.	Wołów Forest District (Oder river valley) Nadleśnictwo Wołów (dolina Odry) Tarchalice Forest Range Leśnictwo Tarchalice Section – Oddział 97 b	1999	Lł/ Lśw	137	110
		2011		93	120
11.	Wołów Forest District (Oder river valley) Nadleśnictwo Wołów (dolina Odry) Prawików Forest Range Leśnictwo Prawików Section – Oddział 323 k Section – Oddział 330 a	1999			
			Lł/Lśw	S2	ca. 100 ok.100
			Lł/Lśw	S2	ca. 100 ok.100



7	8	9	10
47-80 (67.1)	8-28 (25.5)	B ++	substitute community of Scots pine zbiiorowisko zastępcze z sosną
24-68 (41.9)	14-33 24.56		after Danielewicz and Kiciński (unubl.) według Danielewicza i Kicińskiego (npbl.)
6-18 (8.8)	4-15 (9.2)	B +, C ++	
		B +++, C ++	substitute community of Scots pine zbiiorowisko zastępcze z sosną
[81; 90; 103]	[23; 25; 28]	B +, C ++	after Danielewicz (unubl.) według Danielewicza (npbl.)
[75]	[25]		after Danielewicz (unubl.) według Danielewicza (npbl.)
		B ++, C +	after Danielewicz (unubl.) według Danielewicza a(npbl)
		B ++, C +	after Danielewicz (unubl.) według Danielewicza (npbl.)
28-76 (48.9)	30-37 (35.1)	C +	after Domański i Basałyga (1999) według Domańskiego i Basałygi (1999)
28-88 (53.1)	15-36 (29.6)	C +	stand destroyed by windstorm in 2009; after Kiciński (unubl.) drzewostan zniszczony przez huragan w 2009 roku; według Kicińskiego (npbl.)
			after Czeryba (unubl.) według Czeryby (npbl.)
			after Czeryba (unubl.) według Czeryby (npbl.)

Table 1 cont. – Tabela 1 cd.

1	2	3	4	5	6
	Section – Oddział 348 d		Lł/Lśw	63	100
	Section – Oddział 348 f		Lł/Lśw	S2	
	Section – Oddział 367 a		Lł/Lśw	S2	
12.	Kotowice (Oder River valley) Kotowice (dolina Odry) 51°13'04" N 16°54'04" E	1997	Lł/Lśw	1	
13.	Paniewice (Oder river valley) Paniewice (dolina Odry) 51°12'14" N 16°54'54" E	1997	Lł/Lśw	S2	
14.	Janówek near Piszczowice (Oder river valley) Janówek koło Piszczowic (dolina Odry) 51°12'41" N 16°54'06" E	1997	Lł/Lśw	S2	
15.	Lesica near Wrocław (Oder river valley) Lesica koło Wrocławia (dolina Odry) 51°11'38" N 16°55'23" E	2013	Lł/Lśw	28	130
16.	Rędzin Forest 1 (Wrocław, Oder river valley) Las Rędziński 1 (Wrocław, dolina Odry) 51°10'12" N 16°57'02" E	2013	Lł/Lśw	7	150
17.	Rędzin Forest 2 (Wrocław, Oder river valley) Las Rędziński 2 (Wrocław, dolina Odry) 51°10'27" N 16°56'07" E	2013	Lł/Lśw	164	130
	Osobowice Forest (Wrocław, Oder river valley) Las Osobowicki (Wrocław, dolina Odry ) 51°09'42" N 16°59'01" E	2013	Lł/Lśw	74	130
	Osobowice Forest (Wrocław, Oder river valley, in front of levee) Las Osobowicki (Wrocław, dolina Odry, przed wałem przeciwpowodziowym) 51°09'22" N 16°58'40" E	2013	Lł		
18.	Ścinawa Polska near Oława (Oder river valley) Ścinawa Polska koło Oławy (dolina Odry) 50°56'23" N 17°21'17" E	2008	Lł/Lśw	1	ca. 100 ok.100

7	8	9	10
30-76 (51.3)	21-30 (26.5)	C +	after Domański and Basałyga (1999) według Domańskiego i Basałygi (1999)  after Czeryba (unpubl.) według Czeryby (npubl.)  after Czeryba (unpubl.) według Czeryby (npubl.)  after Danielewicz (unpubl.) według Danielewicza (npubl.)    after Danielewicz (unpubl.) według Danielewicza (npubl.)    after Danielewicz (unpubl.) według Danielewicza (npubl.)
46-93 (65.8)	22-30 (25.6)	C +	after Antosz and Kiciński (unpubl.) według Antosza i Kicińskiego (npubl.)
61-95 (75.1)	28-32 (30)		after Kiciński and Antosz (unpubl.) według Kicińskiego i Antosza (npubl.)
18-92 (54.5)	15-31 (26.9)	C +	after Kiciński and Antosz (unpubl.) według Kicińskiego i Antosza (npubl.)
18-120 (44.2)	14-36 (29.9)	C +	after Danielewicz, Antosz and Kiciński (unpubl.) według Danielewicza, Antosza i Kicińskiego (npubl.)
		B ++, C +	after Danielewicz, Kiciński and Antosz (unpubl.) według Danielewicza, Kicińskiego i Antosza (npubl.)
[30]	[23]		after Danielewicz (unpubl.) według Danielewicza (npubl.)

Table 1 cont. – Tabela 1 cd.

	1	2	3	4	5
19.	Lednica near Oława (Oder river valley) Lednica koło Oławy (dolina Odry) 50°55'27" N 17°24'28" E	2003	L1/Lśw	S1	ca. 100 ok.100
20.	Krępna near Zdziezowice (Oder river valley) Krępna koło Zdziezowic (dolina Odry) 50°25'55" N 18°03'52" E	1996	L1/Lśw	1	
21.	Rozwadza near Zdziezowice (Oder river valley) Rozwadza koło Zdziezowic (dolina Odry) 50°25'14" N 18°05'16" E	1996	L1/Lśw	1	ca. 100 ok. 100
22.	Kłaj near Niepołomice Kłaj koło Niepołomic 50°00'21" N 20°18'24" E	1981			

S – estimate number of trees: S1 – 2-10, S2 – 11-20, S3 – >20; B – undergrowth; C – young natural regeneration; + single, ++ numerous, +++ abundantly.

Oder riverside stands, those communities have lost their original specificity, and in terms of the floristic composition of ground cover, they show clear similarities to oak-hornbeam forests.

In the Tarchalice Forest Range (Wołów District, section 97b, a riparian forest habitat tending to evolve towards an oak-hornbeam one) in 1999 there were 137 Turkey oaks 110 years old with a total volume of this tree stand of 723 m<sup>3</sup>/ha, growing in a test area of 0.76 ha in a two-storey mixed stand containing *Carpinus betulus* (266 trees), *Tilia cordata* (108 trees) and *Acer platanoides* (37 trees) [Domański and Basałyga 1999]. The tallest oak was 37 m high. In 2000 this stand was seriously damaged by a hurricane, with only 93 trees left, many of them with broken trunks.

In the neighbouring Prawików Forest Range, in similar habitat conditions (section 348 f) in an area of 1.42 ha, in a 100-year-old tree stand consisting of *Quercus robur* (157 trees), *Tilia cordata* (158 trees), *Acer platanoides* (128 trees) and *Carpinus betulus* (86 trees), the Turkey oak was represented by 89 trees. The stand volume of this species was 152.6 m<sup>3</sup>/ha, and of the common oak, 174.3 m<sup>3</sup>/ha [Domański and Basałyga 1999].

In the Kościan District, in a fresh broadleaved forest habitat there is a loose, two-storey stand of the Turkey oak occupying an area of 0.82 ha, with 177 trees that are 100 years old in the first storey and 44 younger specimens in the second one. The lower storey is formed by trees probably grown from natural seeding.

In the Osobowice Forest the Turkey oak grows in a variety of places as an admixture in a multi-species oak-hornbeam stand, and in the form of a roadside row of trees. Worth noting is the thickest specimen with a breast-height diameter of 120 cm (Fig. 3). In the Choszczno District the *Quercus cerris* site is what has remained of an alley from which most trees were removed in 2013 because of the widening of a public road. In the 1950s acorns were collected there in order to reproduce the Turkey oak in a local nursery,

6	7	8	9
51-73	25-30		after Danielewicz (unpubl.) według Danielewicza (npubl.)
			after Danielewicz (unpubl.) według Danielewicza (npubl.)
[50]	[15]		after Danielewicz (unpubl.) według Danielewicza (npubl.)
			after Mączyński (1981) według Mączyńskiego (1981)

S – szacunkowa liczba drzew: S1 – 2-10, S2 – 11-20, S3 – >20; B – podrost; C – nalot; + pojedynczo, ++ licznie, +++ bardzo licznie.

after which this species was introduced into several tree stands growing on former farmland. Today, it is being systematically removed from them.

While the Turkey oak attains dimensions comparable with the breast-height diameters and heights of native oaks, it differs from them significantly in that it frequently suffers development anomalies of trunks (especially the slope of grain), and primarily their damage caused by low winter temperatures. In most of the localities under study, the proportion of trees with fissures and frost cracks exceeds 50% (Fig. 4). The different proportions of trunks with this defect are probably due to the varying intensity of maintenance measures consisting in the removal of trees of poor technical quality from a stand.

The natural seeding of the Turkey oak in the form of young natural regeneration was observed in almost all those places where this species was represented in a mature tree stand by a dozen or more trees. It occurred less frequently in the undergrowth, only at five sites. Worth noting is the fact that in the Czerniejewo District quite a lot of *Quercus cerris* specimens have grown in the shrub layer of high-polewood Scots pine communities in oak-hornbeam habitats located at a distance of about 1 km from the original tree stand. In about a 200-hectare, mid-field forest island in the Kościan District, it is a common undergrowth component in substitute phytocoenoses with Scots pines in habitats of acidophilous oak and oak-hornbeam forests. There are similar communities containing the discussed species in the Konstakowice District. In the Osobowice Forest, between the Oder channel and a levee, the Turkey oak is one of the most common trees in a thicket that has developed spontaneously in an area deforested after the flood of 1997.



Fig. 3. Trunk of a magnificent Turkey oak in the Osobowice Forest in Wrocław

Rys. 3. Pień okazałego dębu burgundzkiego w Lesie Osobowickim we Wrocławiu

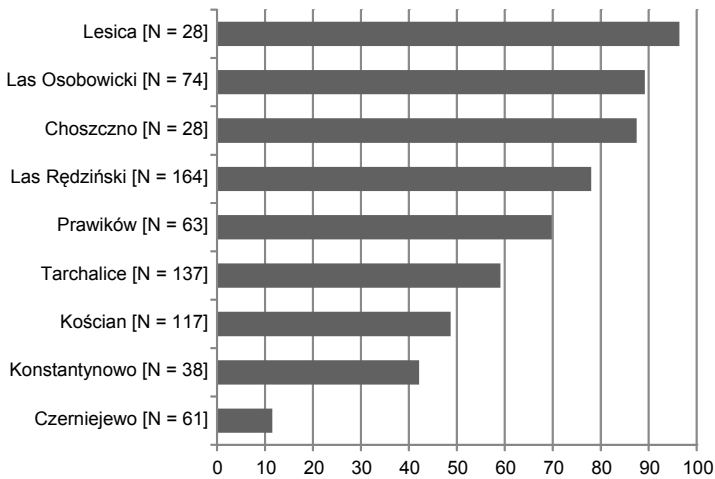


Fig. 4. Percentage of *Quercus cerris* trees with frost cracks at 9 localities under study: N – number of trees

Rys. 4. Procentowy udział drzew *Quercus cerris* z listwami mrozowymi na dziewięciu badanych stanowiskach: N – liczba drzew

## CONCLUSIONS

Today the localities of the Turkey oak listed in this paper are relics of the few early attempts at the introduction of this species into the woodland environment. Its cultivation in forests was local in range and took place mostly on the lands of the former Prussian sector. The aim was probably only to check its acclimatisation properties, rather without any intention of its use on an economic scale in forestry, since no research was conducted on the growth dynamics and productivity of its tree stands. Perhaps already the first observations of the frost damage of trunks caused the interest in the cultivation of this species on a broader scale to decline. The Turkey oak could have appeared at some sites as a result of contamination of the seed material of native oaks, as Reichenau [1911] pointed out long ago. *Quercus cerris* may also grow in other woodland places than those known so far to the authors of this paper. It does not figure in the State Forests database, SILP, neither is there any information about its occurrence in regional floristic works, for example those concerning central Wielkopolska [Czarna 2009].

The Turkey oak in Polish forests goes through a full cycle of vegetative and generative development, is capable of natural seeding, and can sometimes capture new localities and penetrate woodland communities. Its acorns are transported primarily by birds (mostly jays) to considerable distances (up to about 1 km) from the original trees, with optimum conditions for the development of a young generation found primarily in anthropogenic phytocoenoses with Scots pine in the stand in mesotrophic and eutrophic post-agricultural habitats, as a rule less resistant to penetration by alien plant species than natural communities. No Turkey oak undergrowth has been observed in those woodland areas in which there were no substitute communities mentioned. Thus, the naturalisation of *Quercus cerris* bears out the hypothesis that disturbed ecosystems show higher susceptibility to penetration by neophytes than undisturbed ones [Lonsdale 1999, Pyšek et al. 2009].

In accordance with the classification system of synanthropic plants often employed in Poland [Kornaś 1968], the species under discussion qualifies for the group of agriophytes, among them for kenophytes, and at a still lower level of division, for holoagriophytes. To use the terminology taken from a description of stages in the establishment of alien species in natural communities [Faliński 1968, 1969], *Q. cerris* belongs to plants that have attained a euneophyte stage, i.e., having completed their development cycle, they have become a permanent component of those communities. It is also in a compensatory relation to other components of phytocoenoses, like native oaks, which are basic components of oak-hornbeam and acidophilous oak forests. In the light of the definitions connected with invasion ecology, standardised by Richardson et al. [2000], the Turkey oak can be regarded as an invasive plant.

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## DAŁB BURGUNDZKI (*QUERCUS CERRIS* L.) W POLSKICH LASACH

**Streszczenie.** Do mało znanych drzew obcego pochodzenia introdukowanych do polskich lasów należy dąb burgundzki (*Quercus cerris* L.). Zainteresowanie jego uprawą, nawet w skali doświadczałnej, było tak niewielkie, że nie znalazł się on wśród kilkudziesięciu obcych gatunków, których rozwój i wzrost w środowisku leśnym był przedmiotem szcze-

gółowych badań naukowych. Celem tej pracy jest podsumowanie wiedzy o stanowiskach dębu burgundzkiego w polskich lasach oraz określenie jego tendencji dynamicznych na podstawie własnych obserwacji terenowych. Rejestr dotychczas udokumentowanych miejsc introdukcji dębu burgundzkiego w Polsce obejmuje 116 stanowisk, z których prawie 100 było stwierdzonych poza lasami, głównie w starych parkach, założonych przed II wojną światową. W środowisku leśnym zinventaryzowano 22 stanowiska tego gatunku. Większość miejsc uprawy *Q. cerris* znajduje się w zachodniej części kraju, a najwięcej – na Pomorzu Zachodnim, w Wielkopolsce, na ziemi lubuskiej i na Dolnym Śląsku. Najstarsze i najdorodniejsze drzewostany z jego udziałem, występujące na żyznych siedliskach nadrzecznych w dolinie Odry, osiągnęły wiek 130-150 lat. W tych warunkach dąb burgundzki dorasta do 37 m wysokości i osiąga pierśnicę do 120 cm. Ze względu na częste uszkodzenia wywołane mrozami i niską jakość pni nie ma znaczenia produkcyjnego w leśnictwie. Przechodzi jednak pełny cykl rozwoju wegetatywnego i generatywnego, wykazuje zdolność do wytwarzania samosiewu, a niekiedy zdobywania nowych stanowisk i penetracji zbiorowisk leśnych. Optymalne warunki dla rozwoju młodego pokolenia znajduje przede wszystkim w antropogenicznych fitocenozach z sosną w drzewostanie, na mezotroficznych i eutroficznych siedliskach porolnych. Na kilku stanowiskach jest trwale zdomowionym i liczny komponentem warstwy krzewów takich zbiorowisk. Zgodnie z przyjmowanymi w polskiej literaturze kryteriami klasyfikacji roślin synantropijnych dąb burgundzki należy zaliczyć do kenofitów, a na niższym poziomie podziału – do holoagriofitów. W świetle niektórych definicji związanych z ekologią inwazji dąb burgundzki może być uznany za roślinę inwazyjną, przynajmniej w skali lokalnej.

**Słowa kluczowe:** *Quercus cerris*, dąb burgundzki, rośliny obcego pochodzenia, naturalizacja, lasy, Polska

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