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Tulip tree in Poland's Pomerania

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Abstract: The measurements and the observations of tulip tree in Pomerania region were conducted in years 2000 and 2004. The height of the trees was measured with the use of Suunto height gauge, and the trunk perimeter with the aid of tape measure in the height of 130 cm of the trunk length measured from the soil level. The general appearance, condition and wholesomeness of yellow-poplar trees, blossom and the presence of self-sown plants were observed. 37 tulip trees, in these 35 yellow-poplar trees, 2 Chinese tulip trees and one individual of yellow-poplar tree of variety – ‘Aureomarginatum’ were inventoried. The blossom and seed setting was observed on 29 trees and 2 of them produced self-sown plants. The highest yellow-poplar tree was measured in Przemysław. The tree reached the height of 44.5 m. The largest trunk perimeter – 367 cm, possessed the individual of yellow-poplar tree in Barzkowice. The legal protection in the form of recognizing the trees as tree natural monuments should be given to minimum of 13 of inventoried yellow-poplar trees. Old individuals of yellow-poplar trees growing in parks of Pomerania show full acclimatization. That fact is proved by the dimensions they reach and undergoing by them all stages of their development cycle.

Additional key words: *Liriodendron tulipifera* L., tree natural monuments, trunk perimeter, the height of trees

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Introduction

Yellow-poplar tree falls into Magnolia family (*Magnoliaceae*). Yellow-poplar grows throughout the Eastern United States from southern New England, west through southern Ontario and Michigan, south to Louisiana, then east to north-central Florida. It is most abundant and reaches its largest size in the valley of the Ohio River and on the mountain slopes of North Carolina, Tennessee, Kentucky and West Virginia (Little 1979). Yellow-poplar is a major species in four forest cover types and a minor species in 11 types (Eyre 1980). Among angiospermous trees it distinguishes itself with original shape of leaves and flowers.

The species was introduced to cultivation in 1663 (Krüssmann 1977). Szymanowski (1959) informs, that it was brought to Europe (Germany) in 1697. It was quickly distributed in parks in Europe – western, central, southern and south-eastern (Ukraine) parts of the continent. In Poland in old parks, often huge trees possessing high and single or short and low branched trunks are met (Bugala 2000, Szymanowski 1960). Yellow-poplar tree growing on the territory of Poland was first mentioned in Czartoryska tree register in 1808 as well as in work by Wodzicki from 1818 (Szymanowski 1959, 1960). Probably the oldest individual of yellow-poplar tree grows in locality of Pożarowo (community Wronki). In 1992 the tree was 208 years old, reached the height of 26 m and 439 cm

of trunk perimeter (Pacyniak 1992), and in 2004 – the height of 28 m and trunk perimeter of 454 cm (Korszun and Zalewska, personal observation).

The aim of this work was to determine present locations of yellow-poplar tree growing in the area of Pomerania, conducting tree measurements as well as describing the degree of their acclimatization to natural environmental conditions at the area mentioned.

Methods

Information and materials for this paper were collected in the year 2000 and completed in year 2004. Site researches were conducted in the area of Pomerania. Pomerania is a geographical and historical land located in northern Poland. According to Kondracki's (1998) physical and geographical regionalization of Poland the area of the research encompasses Southern-Baltic Sea-shorts (3 macro-regions: Szczecińskie Sea-short – 8 thousand square kilometres, Koszalińskie Sea-short – 6.5 thousand square kilometres and Gdańskie Sea-short – 4.5 thousand square kilometres) as well as Pomeranian Lakelands (6 macro-regions: Zachodniopomorskie Lakeland – 9.7 thousand km², Wschodniopomorskie Lakeland – 4.3 thousand km², Południowopomorskie

Lakeland – 17.8 thousand km², Valley of Lower Wisła (Vistula) around 1 thousand km², Iławskie Lakeland – 4.2 thousand km², Chełmińsko-Dobrzyńskie Lakeland – 8.6 thousand km²).

Information about locations of yellow-poplar tree growing at the area of Pomerania was obtained from literature review as well as based on the authors' of this paper personal site inspections and research. The height of trees [m] was measured with the aid of Finnish produce height gauge Suunto PM-5/1520, and the trunk perimeter [cm] with the aid of tape measure in the height of 130 cm of the trunk length measured from the soil level. The general appearance, condition and wholesomeness of yellow-poplar trees, blossom and the presence of self-sown plants were observed. For the trees measured in 2004 to the above measurements mentioned also precise localisation on the basis of GPS readings is attached. Also photographic documentation of chosen individuals was accomplished. In the text of the chapter 'Results' as well as on the attached map (Fig. 1), the yellow-poplar trees measured were denoted with the same arabic numerals. On the basis of trunk perimeter measurements it was designated, which of the tree individuals should be taken under legal conservation in the form of tree natural monuments. As tree natural monu-

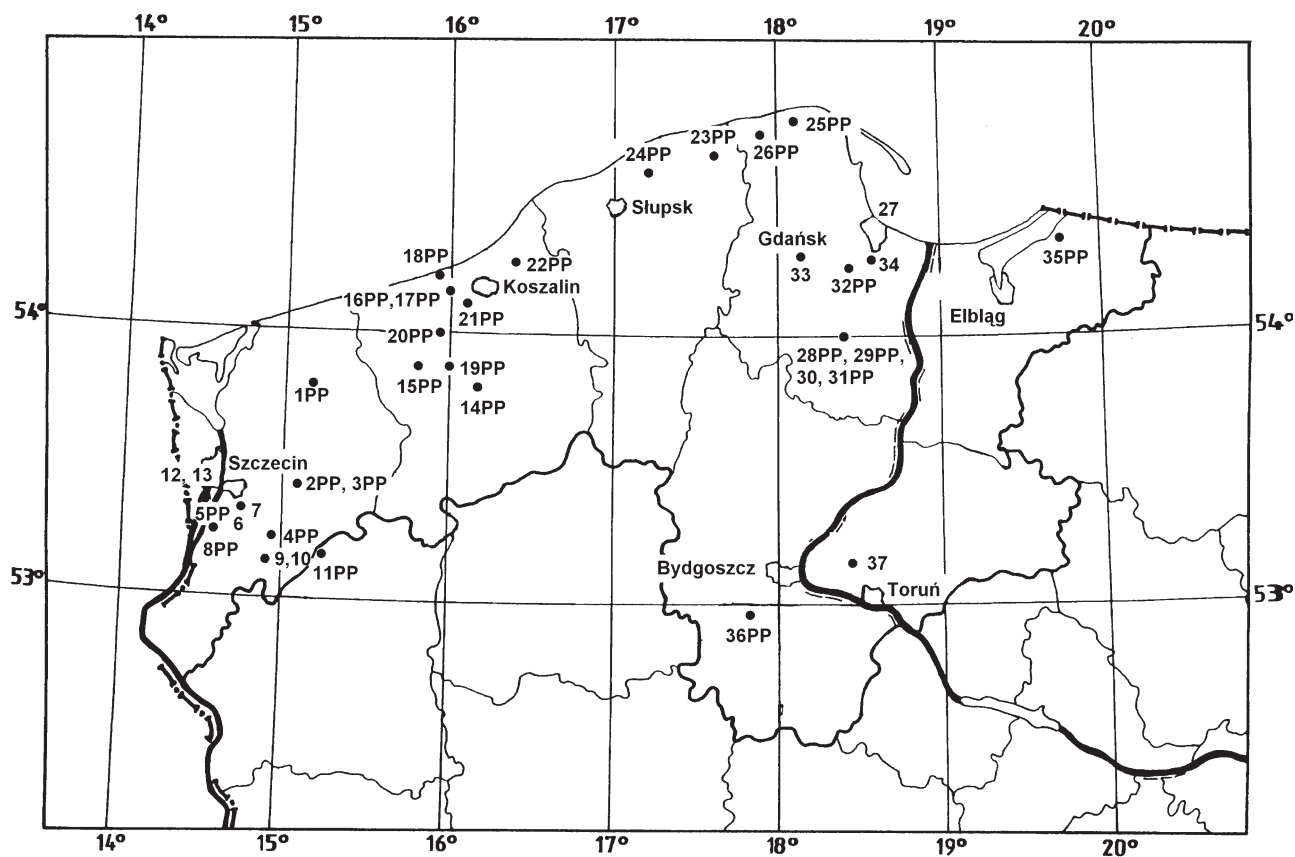


Fig. 1. Map of tulip tree distribution on the area of Pomerania

ments the individuals of yellow-poplar tree were recognised for which the trunk perimeter on the height of 130 cm of the trunk length, measured from the soil level, reached or exceeded 250 cm. Adopted for that purpose the yellow-poplar tree dimension value follows the instructions of The Department of Environment and Agriculture of Pomeranian Voivodeship Office. On the map the abbreviation "PP" placed after arabic numerals indicates tree natural monument.

Results

On the basis of literature review the authors of this paper stated that there were 75 localities where the yellow-poplar trees were grown. As a result of their personal site research in years 2000 and 2004 in 28 places 37 trees in total were measured. In these two individuals of Chinese tulip tree and one individual of yellow-poplar tree of variety – 'Aureomarginatum' (Table 1) were measured. Six localities – i.e. with No. 20, 21, 31, 33, 34, 35 – were not earlier described in the literature. Blossoming and fruiting were observed in 29 individuals of the trees. In Dębogóra and Łętowo in September in the year 2000 under the canopies of the yellow-poplar trees self-sown plants were found. In the rest of the localities finding of self-sown plants was impossible *inter alia* because of lawn mowing. The height of the yellow-poplar trees described by the authors ranged from 2.0 to 44.5 m. The height up to 20.0 m possessed 9 trees, from 21.0 to 30.0 m – 17 trees, from 31.0 to 40.0 m – 9 trees, and above 40.0 m – 2 trees. The highest individuals were measured in Przemysław near Świdwin (44.5 m) and in Łętowo (42.5 m).

Trunk perimeter at the height of 130 cm of the trunk length, measured from the soil level among measured tree individuals ranged from 39 to 367 cm. The perimeter from 150 to 199 cm was measured in 4 yellow-poplar tree individuals, from 200 to 249 cm in 9 individuals, 250 – 299 cm in 7 individuals, 300 cm and above in 6 individuals. The largest trunk perimeter – 367 cm possessed an individual of yellow-poplar tree in Barzkowice near Stargard Szczeciński.

The legal protection in the form of recognizing the trees as tree natural monuments should be given to minimum of 13 of inventoried yellow-poplar trees. That fact is proved by the dimensions they reached and undergoing by them all stages of their development cycle. The treatment should be given to 4 individuals.

The yellow-poplar trees measured by the authors of this paper grow the most frequently in the area of palace and manor house parks. The trees were the most probably planted during their establishment i.e. in 19th century. The efforts of determining the exact age of separate old individuals of the trees were unsuccessful. During site research it was observed, that

in parks the yellow-poplar trees were planted in the lawns in well exposed places, near the palace or the manor house.

Large area of the research and the lack in scientific studies of dendro-flora of old parks allow to suppose that as a result of conducting further research the number of yellow-poplar trees found growing in Pomerania may rise.

Discussion

Szymanowski presented point map of yellow-poplar tree distribution in the area of entire Poland in 1959. The author marked at the map 12 localities mentioned in the work cited as well as 75 localities not described more precisely, without the names of the places. However, in the text of his work the information about 78 localities of yellow-poplar trees in "Western Pomerania, in Poznań area, Zielona Góra area, in Silesia, in Kraków area, in Rzeszów area as well as in central provinces" was given.

The author did not find data about occurrence of yellow-poplar trees in Podlasie and in the areas of Olsztyn and Białystok. Czekalski and Danielewicz (1985) found in the literature data about the occurrence of individuals of *Liriodendron tulipifera* in 176 localities in Poland. The number of the trees was estimated by them to be between 322 to 350, in this 72 tree natural monuments. According to the authors mentioned the highest concentration of localities of yellow-poplar tree individuals is in north-western and south-western part of Poland, where the yellow-poplar tree finds the most propitious climatic and habitat conditions.

According to data gathered from literature review in the years 1959–64; 53 trees of yellow-poplar tree grew in Pomerania (Browicz and Jakusz 1961, Kownas and Sienicka 1965, Sienicka and Kownas 1963, 1968). From the map published by Szymanowski can be noted that at the area described there were only 9 localities of yellow-poplar tree, i.e. 2 in the neighbourhood of Szczecin, 3 in the neighbourhood of Gdańsk and 4 in the neighbourhood of Bydgoszcz and Toruń.

From the information gathered by Czekalski and Danielewicz (1985) in the area of Pomerania grew 65 individuals of yellow-poplar tree. During personal site research of the authors of this paper only 24 of them were found and measured. Probably the rest of the trees was damaged by storms or cut down. In year 2004 the authors did not succeed to find the individuals of yellow-poplar trees in Rzeplin, Ulików i Sokoliniec, even though they had the information about the trees given by Stachak et al. (2001, 2002).

The data concerning measured individuals of the yellow-poplar trees, gathered on the basis of the literature review are set together in Table 2. The majority

Table 1. The register of yellow–poplar tree growing localizations according to personal site research of the authors of this paper

Place	The number assigned to tree individual localization and its GPS localization	Height of tree [m]	Trunk perimeter measured with the aid of tape measure in the height of 130 cm of the trunk length measured from the soil level [cm]	Qualification as tree natural monument (PP)	Blossom	Wholesomeness	Presence of self-sown plants
Przemysław near Świdwin	1	44.5	322	+	+	+	–
Barzkowice near Stargard Szczeciński (Fig. 2.)	2	30	367	+	+	+, single dry branches	–
	N53°20.305' E15°15.884'						
	3	25	233	+	+	+, single dry branches	–
	N53°20.305' E15°15.884'						
Żabów near Pyrzyce	4	30	178	+	+	+, single dry branches	–
Glinna – Dendrological Garden	5	26.5	159	+	+	+	–
	N53°17.795' E14°43.232'						
	6*	11	39	–	–	+	–
	N53°17.814' E14°43.195'						
	7* (Fig. 3) N53°17.805' E14°43.203'	17	125 – the trunk perimeter at the base of the trunk, 4–trunk tree (trunk branched at the heights of 44, 52 and 54 cm). The perimeters of the individual trunks (leaders) at 130 cm are as follows: 47, 58, 57 and 31.5	–	–	+	–
Dębogóra near Gryfino	8	26.5	223	+	+	+	+
Przelewice near Pyrzyce – Dendrological Garden	9	12	55 – the trunk perimeter at the base of the trunk	–	–	+	–
	10	13	54 – the trunk perimeter at the base of the trunk	–	–	+	–
	11	27	318	+	+	+, single dry branches	–
Płotno (Fig. 4.)	N53°05.448' E15°18.088'						
Szczecin – in Słowacki street (at the area of a square at the parish bureau of The Holy Saviour)	12	15	90	–	–	+, the symptoms of chlorosis on leaves. At the height of around 1.8 m of the trunk from the soil surface a quite thick bough is excised. At the height of around 5 m a nest box for birds is hanged.	–
	N53°26.691' E14°32.608'						
	13	16	127	–	+	+, the tree trunk is crooked and supported with a pipe. At the height of around 1.6 m of the trunk length from the soil level strong shoots are growing	–
Szczecin – Botanical Garden (at the entrance side near the crossing of Serbska and Słowiańska streets) – Fig. 5.	N53°27.056' E14°31.315'						
Kołacz near Świdwin	14	12.5	245	+	+	The tree largely ravaged and mouldering at the trunk base, missing the central leader	–

Place	The number assigned to tree individual localization and its GPS localization	Height of tree [m]	Trunk perimeter measured with the aid of tape measure in the height of 130 cm of the trunk length measured from the soil level [cm]	Qualification as tree natural monument (PP)	Blossom	Wholesomeness	Presence of self-sown plants
Kozia Góra near Karlino	15	27	280	+	+	The tree ravaged, many dry branches and twigs	-
Cieszyn near Biesiekierz	16	31.5	224	+	+	+	-
	17	30	250	+	+	+	-
Gąski near Koszalin	18	22.5	273	+	+	+, at the tree trunk at the height of around 1.5 m a thick bough was cut away. The tree branched at the height of 2.5 m of the trunk from the soil surface to 5 boughs	-
Krzecko near Białogard	19	31	262	+	+	+	-
Warmino	20	32.5	300	+	+	+	-
Nowe Bielice	21	25	224	+	+	+	-
Karnieszewice – Arboretum	22	34.5	230	+	+	+, large number of sprouts at the base of the trunk	-
Cecenowo near Lębork	23	28.5	346	+	+	The tree largely ravaged and mouldering at the trunk base, many dry twigs	-
Gąbino near Słupsk	24	32.5	216	+	+	+	-
Łętowo	25	42.5	347	+	+	+, the trunk at the height of 5 m branched into two leaders	+
Zwartowo	26	30	288	+	+	+, very long boughs	-
Gdańsk Oliwa	27	21	126	-	-	Large number of dry boughs. The leaves were turning yellow and were falling untimely	-
Wirty near Starogard Gdański – Arboretum	28**	34.5	239	+	+	+	-
	29	32	178	+	+	+	-
	30	27	126	-	+	+	-
Wirty near Starogard Gdański	31	28.5	183	+	+	+, 3 meters long offshoot from the trunk	-
Arciszewo near Pruszcz Gdański	32	29.5	252	+	+	+	-
Gołubie near Wieżyca – private botanical garden	33	3	23 – the trunk perimeter at the base of the trunk	-	-	+	-
Pruszcz Gdański	34	2	18 – the trunk perimeter at the base of the trunk	-	-	+	-
Frombork	35	32	276	+	+	+, at the height of 4.5 m from its base the tree trunk branched to 2 leaders	-
Lubostroń	36	32	207	+	+	+	-
Nawra near Chełmża	37	25.5	112	-	+	+, 3 leaders, which branched at the height of 6 m of the tree trunk. The canopy partially deformed because of side shading	-

Liriodendron chinense* (Hemsl.)Sarg. – Chinese tulip tree*Liriodendron tulipifera* 'Aureomarginatum'

Table 2. Data concerning measured tulip trees obtained on the basis of literature review

Place	Author and the year of publication	Information about tulip trees
Przemysław near Świdwin	Sienicka and Kownas (1963)	Authors stated the measurements of the tree trunk perimeter to be 250 cm
	Seneta (1984/85)	In 1981 the author did not find that individual
Barzkowice near Stargard Szczeciński	Sienicka and Kownas (1963)	Authors reported the presence of old yellow-poplar trees with the trunk diameters of 275 cm
	Stachak et al. (2002)	Authors described 3 individuals with the trunk diameters of 350, 238 and 231 cm
Żabów near Pyrzyce	Czekalski (1970)	Author reported following dimensions of the yellow-poplar tree individual - height 22 m and the trunk diameter 145 cm
	Stachak et al. (2001)	Authors gave the measurements of yellow-poplar tree trunk perimeter to be 168 cm
Glinna – Dendrological Garden	Tumiłowicz (1994)	The author reported, that in 1993 <i>Liriodendron tulipifera</i> was 25 years old, possessed 17.5 m of height and 33 cm of breast height diameter. Described also 4-trunk individual of <i>Liriodendron chinense</i> – in the age of 24, height of 8.5 m and breast height diameter of 10 cm
	Tumiłowicz (2002)	According to the author in 2002 <i>Liriodendron tulipifera</i> was 34 years old, possessed breast height diameter of 48 cm and the height of 22 m. The individual produced seeds. Four-trunk individual of <i>Liriodendron chinense</i> was 33 years old, reached 17 cm of breast height diameter and 14 m of height. The individual was damaged by frost during winters 1977/78 and 1978/79. In 1986 the tree reached the height of 5 m. In winter of 1987 none of frost damages were noted. The rate of growth of that individual was weaker than yellow-poplar tree. The other individual of Chinese tulip tree in 2002 was 10 years old, reached 9 cm of breast height diameter and 8.5 m of height. The author described that the young individual grew intensively and possessed large, deeply cut lobed leaves. Both individuals of Chinese tulip tree did not produce seeds.
Dębogóra near Gryfino	Sienicka and Kownas (1963)	Authors informed about 3 yellow-poplar trees growing in a park, with trunk perimeters of 245, 210 and 150 cm
Przelewice near Pyrzyce – Dendrological Garden	Czekalski and Danielewicz (1985 from Chylarecki 1956)	Authors mentioned young individuals of yellow-poplar trees growing at the area of the garden
	Stachak et al. (2001)	Authors passed the information, that the trunk diameter of <i>Liriodendron tulipifera</i> in the year when they conducted the measurements was 314 cm
Świdwin – in Słowacki street	Stachak et al. (2000)	Authors reported, that in the location mentioned there is an individual of yellow-poplar tree growing
Szczecin – Botanical Garden	Czekalski and Danielewicz (1985)	Authors informed that there was notice about that individual given by Sienicka and Kownas in 1962. They mentioned that the individual did not get frozen and was blossoming
	Stachak et al. (2000)	Authors reported, that in the place mentioned grows an individual of yellow-poplar tree
Kołacze near Świdwin	Kownas and Sienicka (1965)	Authors reported presence of yellow-poplar tree in park dendro-flora
	Seneta (1984/85)	The author reported that in 1981 the individual was strongly damaged. Its breast height diameter reached at that time 100 cm. At the height of 130 cm from the soil level the tree possessed two leader-trunks
Kozia Góra near Karlino	Kownas and Sienicka (1965)	Authors wrote about a few individuals growing in the park, one of which possessed 230 cm of trunk perimeter
	Seneta (1979)	The author stated, that there were 2 individuals of yellow-poplar tree growing in the park
Cieszyn near Biesiekierz	Kownas and Sienicka (1965)	Authors mentioned, that there was 1 individual of yellow-poplar tree growing in the park
Gąski near Koszalin	Kownas and Sienicka (1965)	Authors mentioned, that there was 1 individual of yellow-poplar tree growing in the park
Krzecko near Białogard	Voivodeship Register of Nature Conservator (1970)	In the Register there was information about a single individual possessing height of 26 m and the trunk perimeter of 140 cm
	Seneta (1984/85)	According to the author in 1981 the individual possessed straight, slender trunk with the breast height diameter reaching of 70 cm
Karnieszewice – Arboretum	Czekalski and Danielewicz (1985 from Pacyniak and Surmiński 1964)	Authors informed, that the yellow-poplar tree individual possessed 26 m of height and the trunk perimeter of 139 cm

Place	Author and the year of publication	Information about tulip trees
Cecenowo near Lębork	Kownas and Sienicka (1965)	Authors described the individual as being in good condition, with the trunk perimeter of 360 cm
	Seneta (1995)	The author passed the information that in 1977, when the inventory of the park was done, the trunk of the yellow-poplar tree possessed perimeter of 400 cm, whereas in 1993 – 390 cm
Gąbino near Słupsk	Kownas and Sienicka (1965)	Authors mentioned about 1 individual growing in the park
Łętowo	Sienicka and Kownas (1968)	Authors informed that the trunk perimeter of the individual reached 300 cm
Zwartowo	Sienicka and Kownas (1968)	Authors mentioned about 1 individual growing in the park
Gdańsk Oliwa	Pacyniak (1966)	The author reported about 1 individual growing in the park
	Czekalski and Danielewicz (1985)	Authors described 2 trees growing in the park named after A. Mickiewicz (one reaching 12 m of height and 120 cm of trunk diameter) as well as Oliwa Basilica (the other reaching 25 m of height and 263 cm of trunk diameter)
Wirty near Starogard Gdański – Arboretum	Czekalski and Danielewicz (1985)	Authors stated, that in 1963 Seneta informed about 3 individuals growing in Arboretum with the heights 18.5, 9.0 and 4.0 m and trunk diameters 70 and 45 cm
Arciszewo near Pruszcz Gdański	Sienicka and Kownas (1968)	Authors mentioned about the individual of yellow-poplar tree with trunk perimeter of 300 cm growing in the park
Lubostroń	Seneta (1993)	The author passed the information about trunk perimeter of the individual to be 200 cm
Nawra near Chelmża	Czekalski and Danielewicz (1985 from Szymanowski 1957)	Authors reported that in 1957 the yellow-poplar tree reached the height of 20 m and the trunk perimeter of 164 cm. The tree was in a good condition and possessed thick and narrow canopy

of the information is only notices about the yellow-poplar tree occurrence, obtained during making dendro-flora inventories in old parks. As a rule the authors gave the information of the number of the

trees and their trunk perimeter, rarely records from the observations of blossoming and wholesomeness and almost there are not records concerning the height of the individuals of the yellow-poplar trees.



Fig. 2. Yellow-poplar tree in Barzkowice



Fig. 3. Chinese Tulip Tree in Glinna



Fig. 4. Yellow-poplar tree in Płotno



Fig. 5. Yellow-poplar tree in Botanical Garden in Szczecin

It seems to be problematic to qualify the yellow-poplar trees for their legal protection in the form of tree natural monuments. Rabiński (1994) adopted, that legal protection can be given to trees when their trunk perimeter on the height of 130 cm of the trunk length, measured from the soil level reaches at least 150 cm. Majdecki (1993) set that value for about 200 cm. Czekalski and Danielewicz (1985) suggested that appropriate value is the trunk diameter reaching 70 cm i.e. to 219 cm of trunk perimeter. The Department of Environment and Agriculture of Pomeranian Voivodeship Office assumed that approximate lower limit of trunk perimeter for tree natural monuments of yellow-poplar trees is 250 cm. Because of that in the area of Pomerania the number of yellow-poplar trees, which can be protected as tree natural monuments may range from 13 to 26.

Conclusions

1. In the Pomerania region in Poland grow 34 yellow-poplar trees, 2 individuals of Chinese tulip trees and one individual of yellow-poplar tree of variety – ‘Aureomarginatum’.
2. The number and the dimensions of inventoried old individuals and undergoing by them all stages of their development cycle show full acclimatization of yellow-poplar tree in the conditions of northern and north-western Poland.

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