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The possibilities for growing trees and shrubs that come from warm climatic regions in the gardens of Szczecin

Received: 2 June 2003, Accepted: 18 August 2003

Abstract: The article presents the results of observations in the years from 1998–2002/2003 concerning the adaptation of some plants that come from warmer climatic regions to the weather conditions that are found in Szczecin. A list of species and varieties of trees and shrubs among which no frost damages were observed is presented in table 1.

Additional key words: exotic arborescent plants, frost-resistance, acclimatization in Szczecin, Poland

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Introduction

In the round-the-house gardens in Szczecin we can more and more often find arborescent plants whose natural positions are generally in the regions of much warmer climate. It can be easily foreseen that the cultivation of some of them will fail if a severe winter comes. However there are also plants that have been growing in Szczecin for several years without any particular protection against the frost.

Analysing the minimum temperature of Europe that occurred in the period of many years Heinze and Schreiber (1984) observed the zones of the potential resistance of arborescent plants to the frost. According to these findings Szczecin is situated in the sub-zone 7a with its average minimum temperature of -17.7°C to -15.0°C . A bit farther to the North of Szczecin there is a border of "the warmest sub-zone" in Poland with its average minimum temperature of -14.9 to -12.3°C . Three indicator plants: *Cedrus libani* subsp. *atlantica*, *Ilex aquifolium*, *Prunus laurocerasus*

were included in zone 7. They are quite often grown in Szczecin and they do not get frozen.

This the aim of the present study was to find out which plants that come from the region of the warm climate tolerate the weather conditions occurring in Szczecin, particularly in the winter.

Methods

In the years 1998–2002/2003 the health condition of trees and shrubs that come from warm climatic regions growing in the gardens of Szczecin was examined after each winter. The species and varieties that are damaged according to Krüssmann (1960, 1962, 1972) at the temperature of -5°C to -10°C and -10°C to -15°C and the ones which have been growing in the gardens of Szczecin for two or more years were chosen for the observations.

The climatic conditions of Szczecin were characterised on the basis of the research work carried out by Koźmiński and Czarnecka (1993) and the data ob-

tained from the meteorological station (IMiGW Oddział Morski) in Gdynia.

While assessing the damages caused by the frost the partial or entire damage of leaves, flower buds, tops of the shoots, the frost penetration through older buds and the plant dieback (according to the scale given by Łukasiewicz 1994) were taken into consideration. Table 1 shows the plants in which frost damages were not observed in the years 1998–2003.

Weather conditions in Szczecin

The average annual temperature of the years 1956–1990 in Szczecin Dąbie (low terrain in the right-bank of the town) amounts to the value of 8.4°C. In the periods from November to March there are on average from 28 to 30 frosty days in the region of Szczecin out of which only one is considered to be very frosty. In the years 1956–1990 the absolute annual minimum temperature of the air i.e. –30°C (at the height of 2 m above the ground level) was recorded in January. The largest spans between the ab-

Table 1. Trees and shrubs growing in the gardens of Szczecin in the years 1998–2002/2003 in which no frost damages were observed

Trees and shrubs (species, variety) and origin	Temperature [°C] below which frost damages may occur (according to Krüssmann 1960, 1962, 1972)	Localization of the garden in Szczecin (district, street) Measurements of the species and other notes
<i>Araucaria araucana</i> (Molina) K. Koch Chile, south-western Argentina	–10	Gumieńce: Tarnobrzaska str. – specimen in height 4,5 m with 9 whorls (it has been growing since 1996), Jesionowa str. – specimen 2,5 m in height with 7 whorls; Okulickiego str. – specimen 1 m in height; Mierzyńska str. – specimen 2 m in height with 9 whorls; Pogodno: Korfantego str.
<i>Cunninghamia lanceolata</i> (Lamb.) Hook. southern and central China	–5	Zawadzkiego-Klonowica: Międzyzyparkowa str.- a specimen 1,5 m in height
<i>Cupressus macrocarpa</i> Hartw. ex Gordon California	–5 or –10	Śródmieście: Moczyńskiego str.
<i>Cupressus sempervirens</i> L. Mediterranean area	–5	Śródmieście: Moniuszki str. – a specimen 6 m in height and of the 26 cm in circumference of trunks (growing at the wall of the building)
<i>Torreya nucifera</i> (L.) Siebold et Zucc. Japan	–10 or –15	Krzekowo: Łukasińskiego str.
<i>Aucuba japonica</i> Thunb. ‘Variegata’ Japan	–10 or –15	Gumieńce: Okulickiego str. – a shrub 1 m in height; Kwiatowa str. – a shrub 1,6 m in height and in width; Pogodno: Przybyszewskiego str.; Modrzewskiego str.; Karłowicza str.; Łukasińskiego str. – a shrub 1,3 m in height; Kochanowskiego str.; Somosierry str. – a shrub 1,5 m in height; female specimens give fruit
<i>Clematis armandii</i> Franch. central and western China	–5	Krzekowo: Łukasińskiego str. – the climb planted in 2000 r. (annual growth approx 1,5 m)
<i>Elaeagnus pungens</i> Thunb. ‘Maculata’ Japan	–10	Krzekowo: Łukasińskiego str. – a shrub 1,5 m in height (planted in 2000)
<i>Quercus ilex</i> L. Mediterranean area	–5	Krzekowo: Łukasińskiego str. – a specimen 1,3 m in height (planted in 2000)
<i>Euonymus japonicus</i> Thunb. Japan, Korea	–5	Orla Białego Square; Central Cemetery – a shrub 1,5 m in height; in many gardens, e.g. Pogodno: Konopnickiej str., Orłąt Lwowskich str., Ujejskiego str., Karłowicza str., Bałuskiego str., Marii Skłodowskiej-Curie str., Libelta str. – a shrub 2 m in height, Wojska Polskiego str. – a shrub 2,5 m in height and of the 17 cm in circumference of trunks (above the ground level)
<i>Euonymus japonicus</i> Thunb. ‘Elegantissima’ Japan, Korea	–5	Krzekowo: Łukasińskiego str. – a shrub 1,5 m in height
<i>Magnolia grandiflora</i> L. south-eastern North America	–5	Bezrzecze: Kirasjerów str. – a specimen 1,5 m in height (grafted on the trunk)
<i>Photinia davidiana</i> Rehder et E.H.Wilson central China	–5	Golęcino: the area of Regional Onkological Hospital at Strzałowska str. – a 2 specimens 1,5 m in height
<i>Prunus lusitanica</i> L. Spain, Portugal	–5	Bukowo: Tęczowa str. – a shrub 3 m in height
<i>Skimmia reevesiana</i> Thunb. China	–10	Gumieńce: Okulickiego str.; Krzekowo: Łukasińskiego str.

solute minimum temperature and the absolute maximum temperature of the air occur in January, February and March and they vary from 40°C to 46°C and in the remaining months they amount to about 30°C to 38°C (Kozłowski, Czarnecka 1993). In the years 1998–2002/2003 the lowest temperature (−18.3°C) during the studies was recorded in the winter in 1998/1999 (Fig. 1).

In winter and autumn there are on average about 10 days with the freeze at the height of 2 m above the ground level and the ground frost at the height of 5 cm above the ground level occurs twice as often and it can even be observed in June (Kozłowski 1983, Kozłowski, Czarnecka 1993).

The average annual sum of precipitation in Szczecin Dąbie in the years 1956–1990 amounts to 528 mm. The lowest average precipitation occurs in February (26 mm) and in March (27mm). In the region of Szczecin the snowfalls resulting in the snow-cover thicker than 10 cm are recorded very rarely. Daily precipitation of more than 20 mm and drought spells lasting more than 20 days are also rare (Kozłowski, Czarnecka 1993).

The average relative humidity of the air in the years 1956–1990 in Szczecin Dąbie equals 80%. The largest relative humidity amounting to about 90% is characteristic for December and it is the lowest in May and in June (Kozłowski, Czarnecka 1993).

In the period between 23rd September 1997 and 15th March 1998 the temperature and humidity of the air were measured in chosen days in different districts of Szczecin (Assmann's psychrometer was used). The measurements showed significant differentiation of these weather factors in relation to the place and time (park, town centre, other parts of the town). The

range of the air humidity in the period between February and March 1998 was 40 to 100%.

The average velocity of the wind in the years 1956–1999 in Szczecin Dąbie is equal to 3,9 m/s. The municipal agglomeration causes a decrease in the speed of the winds as compared to the areas outside the town (Kozłowski, Czarnecka 1993).

Results

The observations carried out in the years 1998–2002/2003 show that some plants which come from warm climatic zones (Table 1) and tolerate the minimum temperature range characteristic for the 7a sub-zone as determined by Heinze, Schreiber (1984) can grow in Szczecin in the period in which no severe winters occur. The absolute minimum temperature in the years in which studies were carried out is within the limits given by the mentioned authors. However the absolute minimum temperature in Szczecin in the intervals of 7–9 years is lower i.e. −22.8°C (in 1996) and even −30°C (in 1987). The place in which a plant has been put is of great significance. Shelter positions guarantee their longer survival.

Out of the observed plants only Monterey cypress in the 'Goldcrest' variety (*Cupressus macrocarpa* 'Goldcrest') had the upper part of the crown frozen (up to the height of 0.5 m above the ground level).

The place and the microclimate of the area in which the plant has been put are of considerable significance. The positions sheltered from drying winter winds and from the direct rays of the sun are important in the case of evergreen plants which also undergo transpiration in winter.

It is not easy to elucidate the plant resistance to the frost. According to Bouillon (2001) the resistance of plants depends on many factors out of which the ecological requirements of the species and the position and weather conditions are most important. The majority of the observed plants were brought to Szczecin from plant nurseries in Western Europe (Germany, Holland, Belgium and Denmark). They were probably propagated from the parent plants already acclimatized there. These plants tolerate the weather conditions in Szczecin because they are very similar to the weather conditions in the mentioned countries. Tumiłowicz (2000) emphasises the significance of the right choice of the plants suitable for the climatic conditions and the information concerning the regionalization of the cultivation of trees and shrubs may be very helpful in making the choice.

The further studies which are carried out in Szczecin may help to elucidate this important problem appearing while plants from warm areas are introduced.

In 2002 some other plants that come from warm regions were planted in the gardens of Szczecin. These

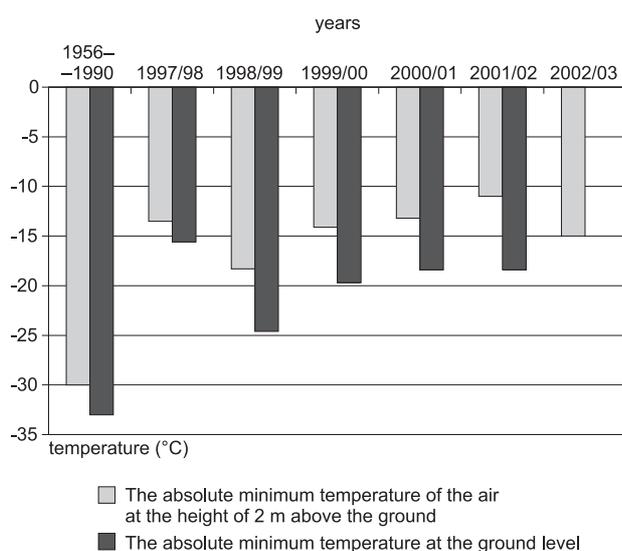


Fig. 1. The absolute minimum temperature of the air from December to April in the years 1956–1990 and 1998–2002/2003 (on the basis of the data obtained from IMiGW Oddział Morski in Gdynia)

are: *Camellia japonica* L., *Choysia ternata* H.B.K. 'Sundance', *Choysia ternata* H.B.K. 'Aztec Pearl', *Laurus nobilis* L., *Nandina domestica* Thunb. The observations will show what are the possibilities of their cultivation.

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