

**DECORATIVE VALUES  
AND THE NUTRITIONAL STATUS OF SOME *Magnolia* L.  
SPECIES UNDER THE CLIMATIC  
CONDITIONS OF LUBLIN (POLAND)**

**PART. I. DECORATIVE VALUES OF THE PLANTS**

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**Abstract**

Six species of *Magnolia* L., growing in the Botanical Garden of the Maria Curie-Skłodowska University in Lublin which is located on the north-western outskirts of the city of Lublin, were studied during the period 2006-2008. The aim of this study was to determine the dynamics of leaf and flower development in these *Magnolia* species under the climatic and soil conditions of Lublin as well as to evaluate the size of their leaves and long shoots. The present study included the following species: *M. acuminata* L., *M. kobus* DC, *M. liliiflora* Desr., *M. salicifolia* Siebold et Zuch, *M. x soulangiana* Soul.-Bod., and *M. tripetala* L. The magnolia trees were planted in 1968-1989 on grey-brown podzolic soil derived from loess. The study area is affected by the continental climate which is characterized by large annual amplitude of temperatures, long summers as well as long and cold winters. The long-term average annual air temperature for this region is 8.1°C, while the long-term average annual rainfall reaches 541.6 mm. The obtained results showed that, among the *Magnolia* species studied, *M. salicifolia* flowered earliest under the climatic and soil conditions of Lublin, while *M. tripetala* was the last to bloom. Full leaf development, on average for the study period, was recorded earliest in *M. salicifolia* and *M. liliiflora*, whereas it occurred latest in *M. tripetala*. The leaves of *M. tripetala* were characterized by the greatest length and width, while the smallest leaves were recorded in *M. kobus*. *M. liliiflora* was found to show the smallest annual shoot increments and the lowest number of leaves.

**Key words:** *Magnolia*, six species, flowering dynamics, foliage, leaf size, long shoots

**INTRODUCTION**

The genus *Magnolia* includes about 80 tree and shrub species growing in the wild in the eastern part of North America and in south-eastern Asia (Callaway, 1994; Czekałski, 2007). In this group, there are both low trees and shrubs growing up to a height of 60 m which produce impressive flowers from early spring until mid-summer (Weaver, 1987; Matysiak, 2002). The great popularity of these plants in park and garden plantings is attributable to their precious decorative values – the varied form and growth habit of trees, characteristic different coloured flowers as well as interesting foliage. The species flowering in early spring before leaf development are exceptionally attractive visually (Dirr, 1990; Tumiłowicz, 2005). Many authors stress the important role that magnolias play in the maintenance of the biodiversity of ecosystems that they inhabit. Yasukawa et al. (1992) draw attention to the importance of magnolia flowers in the biology of pollinating insects, whereas Callaway (1994) reports that magnolia fruits can be food for numerous animal species. The latest research shows new possibilities of using these valuable plants. The reports of Liu (2008) and Zhenhong (2011) confirm the usefulness of essential oils obtained from various *Magnolia* species in pharmacology and aromatherapy.

The aim of the present study was to compare the decorative values of six *Magnolia* species on the basis

of their flowering phenology and leaf development under the climatic and soil conditions of Lublin as well as to evaluate some morphological characters of their leaves and shoots.

## MATERIALS AND METHODS

The study was conducted in 2006-2008 on six *Magnolia* species growing in the Botanical Garden of the Maria Curie-Skłodowska University in Lublin, central-eastern Poland. This garden is located on the north-western outskirts of the city of Lublin in the Czechówka River valley, at an altitude of 200 m a.s.l. The garden area includes a part of the river valley, a slope cut by three loess gullies, and a part of a plateau. The elevation difference is about 40 m. The study area is clearly affected by the continental climate which is characterized by large annual amplitude of temperatures, long summers as well as long and cold winters. The long-term average annual air temperature for this region is 8.1°C, while the long-term average annual rainfall reaches 541.6 mm. Grey-brown podzolic soils derived from less are predominant in the garden area, on the slopes there are eroded brown soils, whereas alluvial soils are found in the depressions in the land surface. Varied locations with the following characteristics were selected for the investigations:

- I – a semi-shaded location occupied by the cucumber tree (*Magnolia acuminata*), planted in 1989;
- II – a semi-shaded location occupied by the Kobushi magnolia (*Magnolia kobus* DC), planted in 1974;
- III – a shaded location occupied by the purple lily magnolia (*Magnolia liliiflora* Desr.), planted in 1979;
- IV – a sunny location occupied by the Japanese willow-leaf magnolia (*Magnolia salicifolia* Siebold et Zuch), planted in 1982;
- V – a semi-shaded location occupied by the saucer magnolia (*Magnolia x soulangeana* Soul.-Bod.), planted in 1979;
- VI – a semi-shaded location occupied by the umbrella magnolia (*Magnolia tripetala* L.), planted in 1968.

Observations and biometric measurements of the selected *Magnolia* species were carried out in 2006-2008 from the beginning of April until the end of September every 6-7 days and every 3-4 days during the flowering period. The study included observations of flower and leaf development with the determination of flower bud stage, full flowering and end of flowering, leaf bud stage, beginning of leaf development and full leaf stage. During the study, measurements of the

length of long shoots were also made and the number of leaves on long shoots was determined.

The characteristics of meteorological conditions prevailing during the present study were made based on the data obtained from the Weather Station of the Maria Curie-Skłodowska University located in the Botanical Garden.

## RESULTS AND DISCUSSION

Plan growth and development during the growing season is closely correlated with weather conditions prevailing in a given area (Kluz a and Zientarska, 1999). According to the climatic regionalization used for the selection of ornamental trees and shrubs in Poland, the Lublin Upland is situated in the eastern zone (III) that provides less favourable conditions for growing magnolias (Czekalski, 2007). The analysis of the meteorological data for the Botanical Garden in Lublin showed that average monthly temperatures for the study area were higher in all study years compared to the long-term average (Table 1). The highest average temperature throughout the entire study period was recorded in 2006 (17.2°C) and the lowest one in 2008 (16.1°C). The average monthly distribution of rainfall during the successive years of the study much differed from the long-term average. The highest rainfall total was recorded in 2006 (402.9 mm) and the lowest one in 2008 (346.3 mm).

Observations of the development of flower buds and of the flowering pattern in the selected *Magnolia* species carried out throughout the study years showed that, under the climatic and soil conditions of Lublin, *M. salicifolia* produced flower buds and bloomed earliest, whereas *M. tripetala* was the last to flower (Fig. 1). These results are in agreement with literature reports (Bugala, 2000; Hryniewicz-Sudnik et al. 2001; Tumiłowicz, 2005; Guy, 2006). Czekalski (2007) reports that *M. salicifolia* flowers in the second half of April and that it is the earliest flowering magnolia among all *Magnolia* species growing in the Kórnik Arboretum. In the present study, this magnolia flowered on average between 14 April and 8 May. *M. x soulangeana* and *M. kobus* bloomed several days later – on average on 21 April. *M. liliiflora* (on average on 9 May) and *M. acuminata* (on average on 16 May) were the next to burst into flower. The latest-flowering species was *M. tripetala* whose flowers blossomed on average on 20 May and were in bloom until 3 July. These observations showed that *M. salicifolia*, *M. x soulangeana*, and *M. kobus* produced flowers before the development of leaves, whereas the other species (*M. liliiflora*, *M. acuminata*, and *M. tripetala*) bloomed after the leaves developed. Guy (2006) reports that *M. tripetala*

blooms at the end of May under the climatic conditions of Ohio (USA). The present study does not confirm this correlation, since the obtained results are similar to the reports of Czekalski (2007) which show that in Poland *M. tripetala* flowers at the turn of June and July.

In the opinion of Barbour (2008), *M. acuminata* is the only *Magnolia* species that flowers before leaf buds develop. The present study does not confirm this opinion, since during the study period the beginning of flowering of this magnolia was recorded in the middle of May, whereas the onset of leaf development in the first decade of May. Czekalski (2007) presents a similar opinion; he thinks that *M. acuminata* flowers at the turn of May and June after the appearance of leaves.

The results of the observations of the dynamics of leaf development in the studied species of *Magnolia* showed that, under the soil and climatic conditions of Lublin, leaves developed earliest in *M. salicifolia* and *M. liliiflora* – on average around 28 April. Full foliage development was also observed at a similar time in both species (on average around 6 May). The present study showed that, in the urban agglomeration of Lublin, full foliage development occurred latest in *M. tripetala* – on average around 1 June. The obtained results are in agreement with the data cited in literature sources (Tumiłowicz, 2005; Guy, 2006; Czekalski, 2007).

One of important characters that determine decorative values of plants are foliage size and colour (Callaway, 1994). The analysis of the biometric

measurements made in the present study showed that, among the magnolia species under evaluation, *M. tripetala* produced the longest (33.5-38.2 cm) and at the same time widest leaves (14.4-14.9 cm). These results are consistent with the views of some other authors who report that the length of leaves of this magnolia can even reach 50-65 cm (Weeks, 2003; Guy, 2006; Czekalski, 2007). In the opinion of these authors, *M. tripetala* produces the largest leaves among all known *Magnolia* species. The shortest leaves (8.2-9.1 cm) were recorded in the case of *M. kobus*. Czekalski (2007) reports that this species produces leaves with a length of 5-15 cm. In this study, the narrowest leaves were noted in *M. salicifolia* (4.8-5.2 cm) and in *M. kobus* (4.7-5.3 cm.).

*Magnolia liliiflora* was characterized by the smallest length of annual increments (long shoots). At the same time, this species was found to have the lowest number of leaves per long shoot (on average 6-7). The obtained results can be related to the nutritional status of the studied plants. The leaves of the purple lily magnolia (*M. liliiflora*) were shown to have the significantly lowest amount of total nitrogen and calcium (Michałojć et al. in press). Significantly worse nitrogen supply to the plants of *M. liliiflora*, compared to the other species under evaluation, was probably the reason for reduced elongation growth of their long shoots. It is known that the nutritional status largely determines vegetative plant development (Nurzyński, 2003). The longest long shoots were found in *M. acuminata* (on average 24.4 cm) and in *M. tripetala* (on average 23.7 cm).

Table 1.  
Meteorological data during the 2006-2008 study period and long-term averages

Month	Monthly air temperature (°C)				Total rainfall (mm)			
	2006	2007	2008	Average 1960-2008	2006	2007	2008	Average 1960-2008
April	10.3	9.8	10.2	8.4	67.9	14.1	66.8	40.6
May	15.0	16.0	14.3	14.1	72.6	93.3	76.0	58.3
June	18.5	19.5	19.0	17.3	43.3	67.9	25.3	65.5
July	23.5	19.9	19.4	18.9	16.3	71.2	76.5	78.0
August	19.1	19.7	19.7	18.1	190.5	33.5	32.7	69.7
September	16.8	13.6	13.8	13.5	12.3	106.4	69.0	52.1
$\bar{x}$	17.2	16.4	16.1		67.2	64.4	57.7	

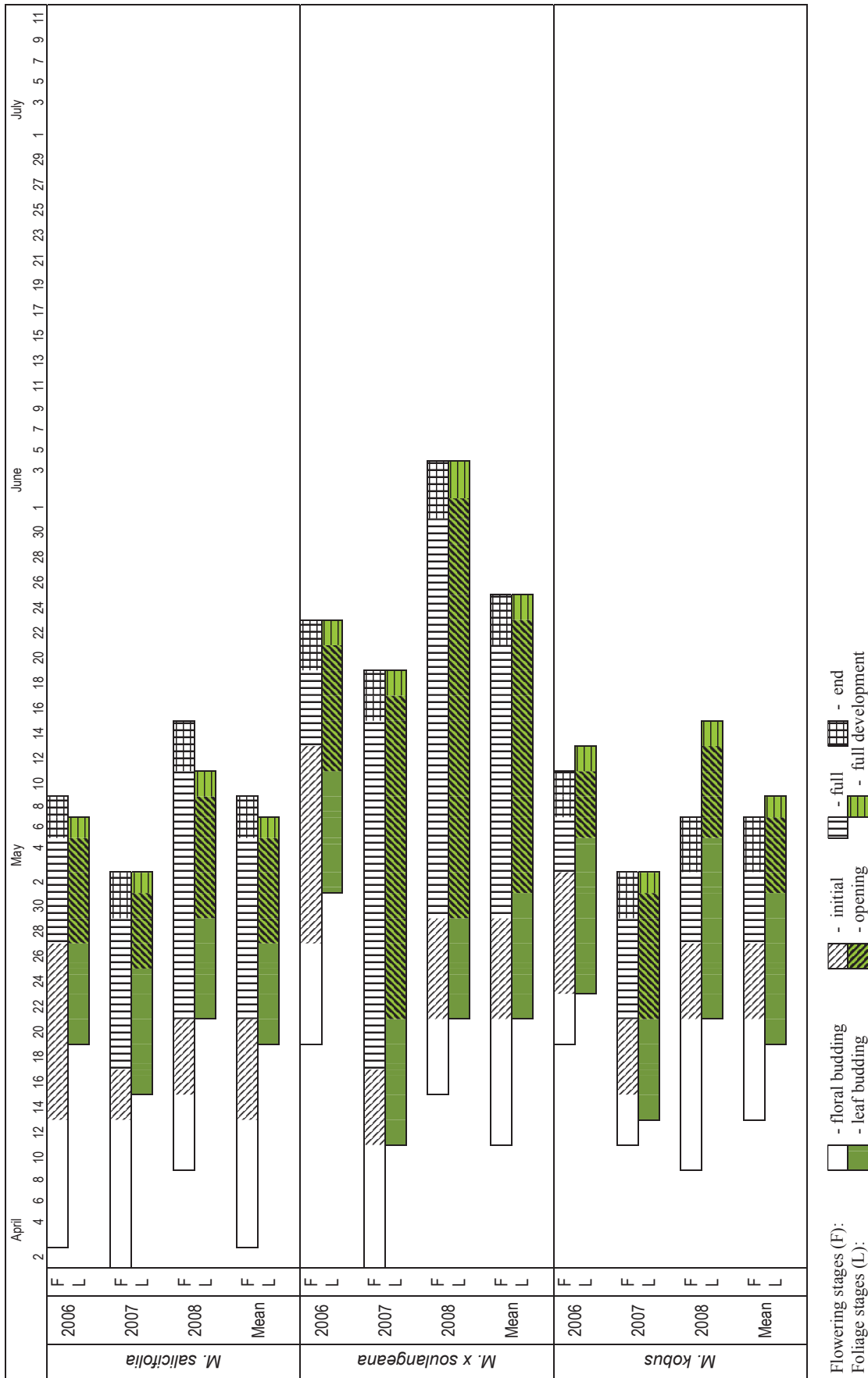


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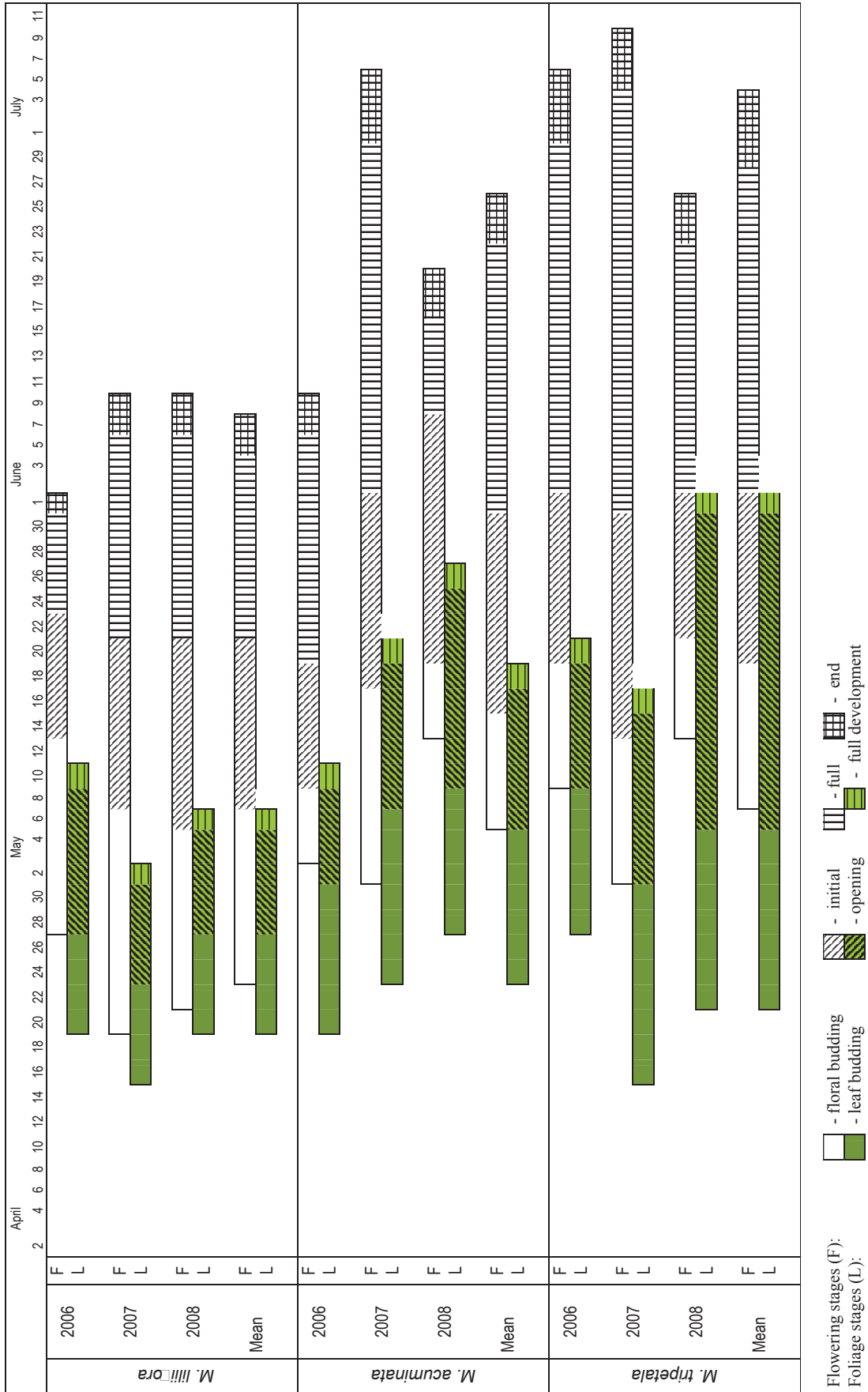


Fig. 1. Dynamics of flowering and foliage development in six *Magnolia* species in the climatic and soil conditions of Lublin

Table 2.  
Morphological characters of leaves of some *Magnolia* species in 2006-2008

Species	Leaf length (cm)				Leaf width (cm)			
	2006	2007	2008	$\bar{x}$	2006	2007	2008	$\bar{x}$
<i>Magnolia acuminata</i>	23.9	23.5	24.4	23.9	12.3	14.0	13.6	13.3
<i>Magnolia kobus</i>	8.2	8.3	9.1	8.5	4.7	5.3	5.0	5.1
<i>Magnolia liliiflora</i>	11.6	14.5	16.4	14.2	6.5	8.1	8.3	7.6
<i>Magnolia salicifolia</i>	11.3	11.5	11.7	11.5	4.8	4.9	5.2	5.0
<i>Magnolia x soulangeana</i>	14.4	13.9	14.8	14.4	6.9	6.4	6.8	6.7
<i>Magnolia tripetala</i>	38.2	33.5	36.0	35.9	14.7	14.9	14.4	14.7
$\bar{x}$	17.9	17.5	18.7		8.3	9.0	8.7	
LSD <sub>0.05</sub> species			1.8				1.2	
year			ns.				ns.	
location x year			2.7				2.4	

ns. – not significant

Table 3.  
Morphological characters of shoots of some *Magnolia* species in 2006-2008

Species	Shoot length (cm)				Number of leaves (pcs)			
	2006	2007	2008	$\bar{x}$	2006	2007	2008	$\bar{x}$
<i>Magnolia acuminata</i>	18.4	26.6	28.2	24.4	7.8	8.0	7.6	7.8
<i>Magnolia kobus</i>	12.8	15.9	21.9	16.9	7.6	7.4	9.5	8.2
<i>Magnolia liliiflora</i>	11.9	14.2	17.0	14.4	6.7	5.8	5.7	6.1
<i>Magnolia salicifolia</i>	15.7	16.2	20.3	17.4	8.8	8.1	9.5	8.8
<i>Magnolia x soulangeana</i>	22.1	19.4	23.1	21.6	9.3	8.1	7.9	8.4
<i>Magnolia tripetala</i>	13.1	24.4	33.6	23.7	7.6	6.6	10.9	8.4
$\bar{x}$	15.7	19.5	24.1		8.0	7.3	8.5	

## CONCLUSIONS

1. Among the studied species of *Magnolia*, *M. salicifolia* flowered earliest, while *M. tripetala* was the last to bloom.
2. Full leaf development was observed earliest in *M. salicifolia* and *M. liliiflora*, whereas it occurred latest in *M. tripetala*.
3. The leaves of *M. tripetala* were characterized by the largest dimensions, while *M. kobus* had the smallest leaves.
4. The study showed that *M. liliiflora* had the shortest shoots with, at the same time, the lowest number of leaves.

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## Walory dekoracyjne oraz stan odżywiania wybranych gatunków *Magnolia* L. w warunkach klimatycznych Lublina

### Cz. I Wartość dekoracyjna roślin

#### Streszczenie

W latach 2006-2008 badano sześć gatunków magnolii *Magnolia* L. rosnących na terenie Ogrodu Botanicznego UMCS, zlokalizowanego na północno-zachodnich obrzeżach Lublina. Celem badań było określenie dynamiki rozwoju liści i kwiatów wybranych gatunków magnolii w warunkach klimatyczno-glebowych Lublina oraz ocena wielkości liści i długopędów. Badaniami objęto *M. acuminata* L., *M. kobus* DC, *M. liliiflora* Desr., *M. salicifolia* Siebold et Zuch, *M. x soulangiana* Soul.-Bod. oraz *M. tripetala* L. Drzewa posadzono w latach 1968-1989 na glebie płowej pochodzenia lessowego. Na terenie badań uwidacznia się wpływ klimatu kontynentalnego, charakteryzującego się dużą roczną amplitudą temperatur, długim latem oraz długą i chłodną zimą. Średnioroczna wieloletnia temperatura powietrza dla tego regionu wynosi 8.1°C natomiast średnioroczna wieloletnia suma opadów atmosferycznych osiąga 541.6 mm. Uzyskane wyniki wykazały, iż spośród badanych gatunków magnolii w warunkach klimatyczno-glebowych Lublina najwcześniej kwitnie *M. salicifolia*, a najpóźniej *M. tripetala*. Pełne rozwinięcie liści, w ujęciu średnim ze wszystkich lat badań, odnotowano najwcześniej u *M. salicifolia* oraz *M. liliiflora* a najpóźniej u *M. tripetala*. Największą długością i szerokością charakteryzowały się liście *M. tripetala* natomiast najmniejsze liście odnotowano u *M. kobus*. Najkrótsze przyrosty roczne pędów, oraz najmniejszą liczbę liści wykazano u *M. liliiflora*.