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POPULATION STRUCTURE OF *LILIUM MARTAGON* L. IN ZALESKIE (CENTRAL POMERANIA)

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Abstract

The paper presents the results of research into a population of *Lilium martagon* L. in Zaleskie at Central Pomerania. Edaphic and phytocenotic conditions of the population were specified. The plants were described as to their individual and group features. *L. martagon* is found in mineral soil of acid reaction abundant with nitrogen and phosphorus, and as to its quantity it belongs to less numerous ones at Pomerania. The population is characterized by cluster spatial distribution, low density and 39.37% of blooming plants in their total population.

Key words: *Lilium martagon*, manor park, Zaleskie, Central Pomerania

INTRODUCTION

In Poland, the population of *L. martagon* was numerous in the past times in the Carpathians, Carpathian Foothills and in Małopolska (Little Poland) (Raciborski 1919). At present, it is quite common, except for Lubuska Land and Pomerania where its stands are rarely found (Zając and Zając 2001). In Western Pomerania, *L. martagon* belongs to endangered species (Żukowski and Jackowiak 1995).
In Central Pomerania, whose borders are marked conventionally by the River Łeba in the East and the River Parsęta in the West (according to Kondracki (2004), it is an eastern part of Western Pomerania), *L. martagon* is found in former manor park complexes as well as at Protestant cemeteries (Sobisz and Truchan 2006).
L. martagon is found at the former manor park complex in Zaleskie. *L.martagon* stands are situated within the square ATPOL - BA 68, following the principles adopted for the "Atlas of the Distribution of the Vascular Plants in Poland" (Zając

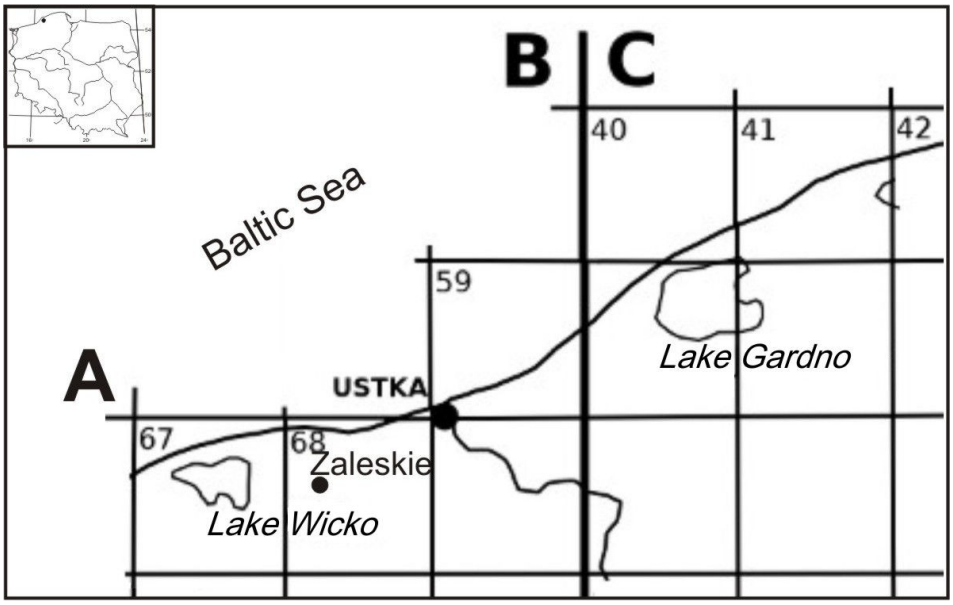

Fig. 1. Locality of a former manor park in Zaleskie

1978). Zaleskie is a small village within the premises of Ustka Commune in Pomeranian Province (Fig. 1). According to a geobotanical division of Poland (Matuszkiewicz 1993), the village belongs to the Słupsk Region included within the area of the Southern Baltic Coastland and Pomeranian Divide. According to a physical-geographical division of Poland (Kondracki 2004), Zaleskie is situated within the mesoregion of the Sławno Plain.

The village of Zaleskie had belonged to the family of von Below since 1461 for over 480 years (Pagel 1989). The park area having over 7 ha was established in 1790 by Franz von Below. About 1700, construction of the manor house started. In the period 1850-1880, a new wing of the building was constructed (Pusch 1940). The park was substantially transformed. A large lawn surface of 2 ha was designed in front of the manor house and the park system was divided into two terraces using a long buttress at the side of the garden elevation. Large lawn surfaces were made upon them and groups of native trees were planted around their borders. Substantial transformations of the spatial arrangement were connected with enrichment of the tree stands by foreign species. Maple trees were imported: sugar maple tree – *Acer saccharum*, silver maple tree – *A. saccharinum*, tartar maple tree – *A. tataricum*, false cypress: cypress pea – *Chamaecyparis pisifera*, Nootka cypress – *Ch. nootkatensis* and northern white cedars – *Thuja occidentalis* (Späth 1930). At the lower terrace in the years 1890-1893 in the north-western border of the park, a family cemetery was founded (most probably it was a mausoleum of the children of the owners). In its vicinity cypress pea, yew trees – *Taxus baccata*, European silver fir – *Abies alba* and European beech trees – *Fagus sylvatica* were planted (Dombois 1929). The manor park complex in Zaleskie comprises a church constructed in the period 1754-1757 (Faryna-Paszkiewicz et al. 2003).

The paper contains edaphic, phytosociological and morphological characteristics of the population of *L. martagon*.

MATERIAL AND METHODS

The research was done in the period of 2009-2010. *Lilium martagon* was found in two places within the area of the park in Zaleskie: by the manor house and near the family cemetery (19 specimens) (Fig. 2). The research work comprised the popula-

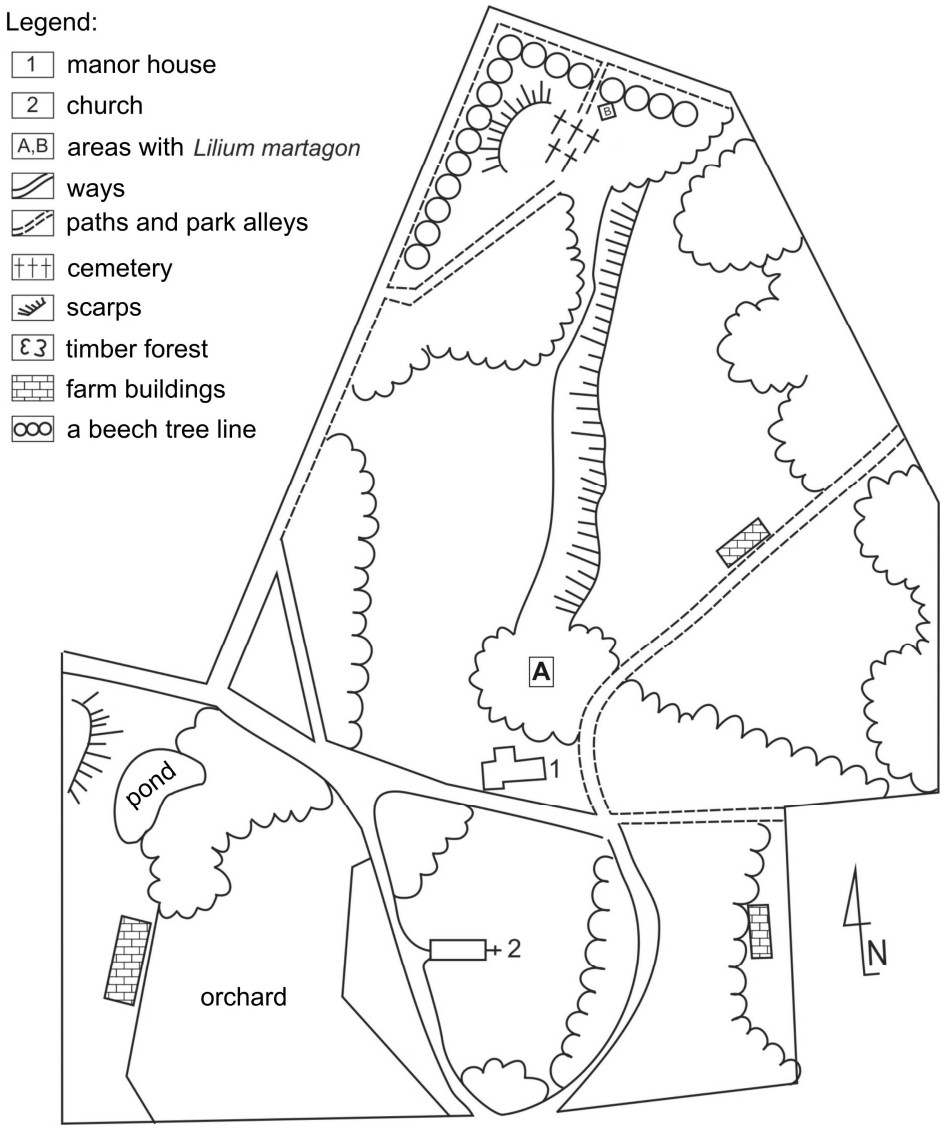

Fig. 2. Plan of a former manor park in Zaleskie

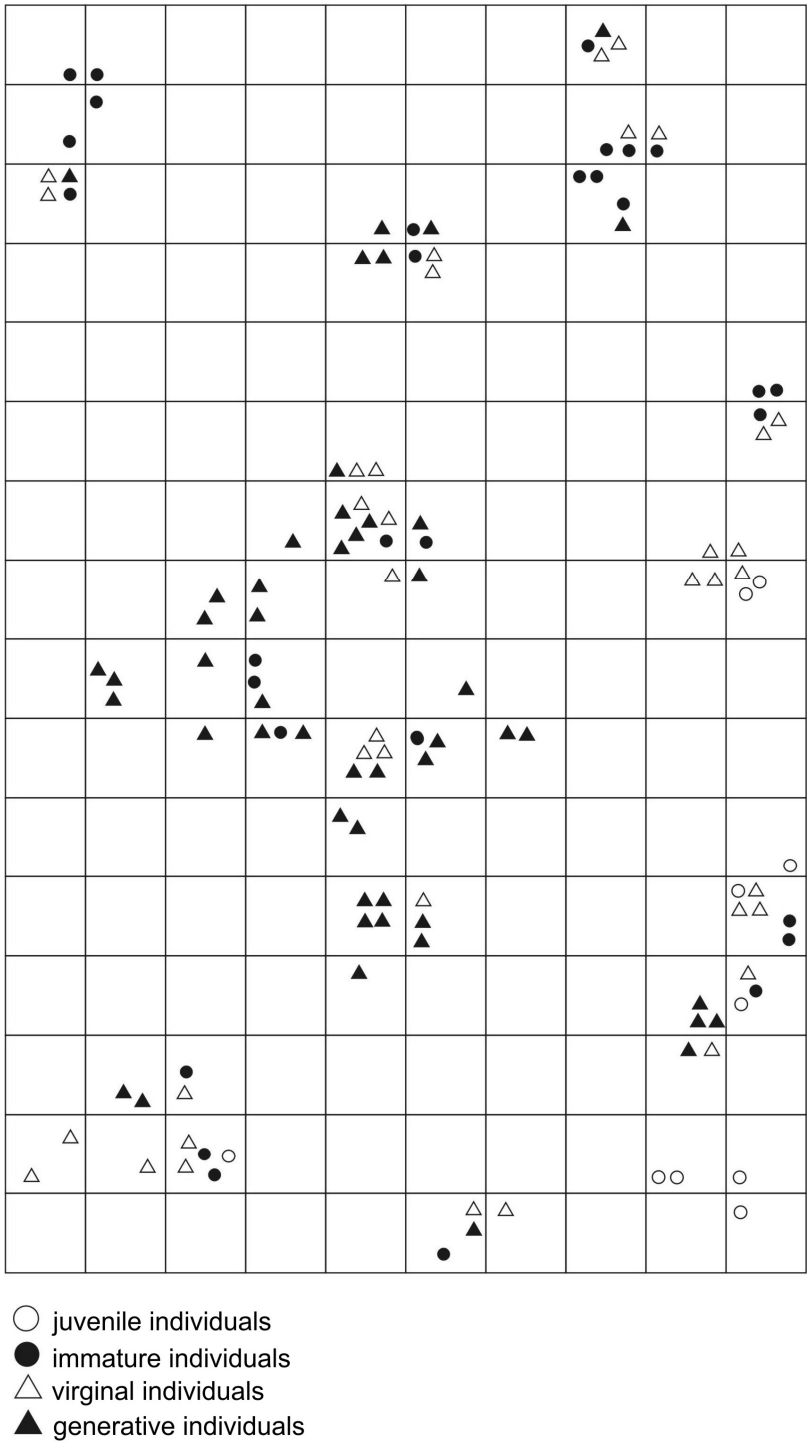

Fig. 3. Spatial and age structure of *Lilium martagon* specimens in Zaleskie

tion by the manor house. *Lilium martagon* (Turk's cap lily) grows over the area of 160 m^2 there. The whole area where the Turk's cap lily appeared was divided into squares of 1 m^2 each, and the plants were distributed over the plan according to their natural distribution, marking adequate age stage with a particular symbol (Fig. 3). Based on cartographic documentation, the group features of a population over examined areas were specified, i.e. numerical force, density expressed with the number of plants per 1 m^2, average congestion expressed by the value of Lloyd's index of patchiness (Collier et al. 1978) and the type of the spatial structure – calculating the dispersion coefficient according to Trojan (1975). The age structure of the population was established by adopting four development stages of *L. martagon* after Łukasiewicz (1962), Jańczyk-Węglarska and Węglarski (1992), Kolon and Krawczyk (1996): 1 – juvenile – (1-year old, 1-2 leaves), 2 – immature (growing, 2-3 years old up to 12 leaves inclusive), 3 – virginal (vegetatively grown, non-blooming), 4 – generative (blooming, 4 years old and more, over 12 leaves) (Fig. 4).

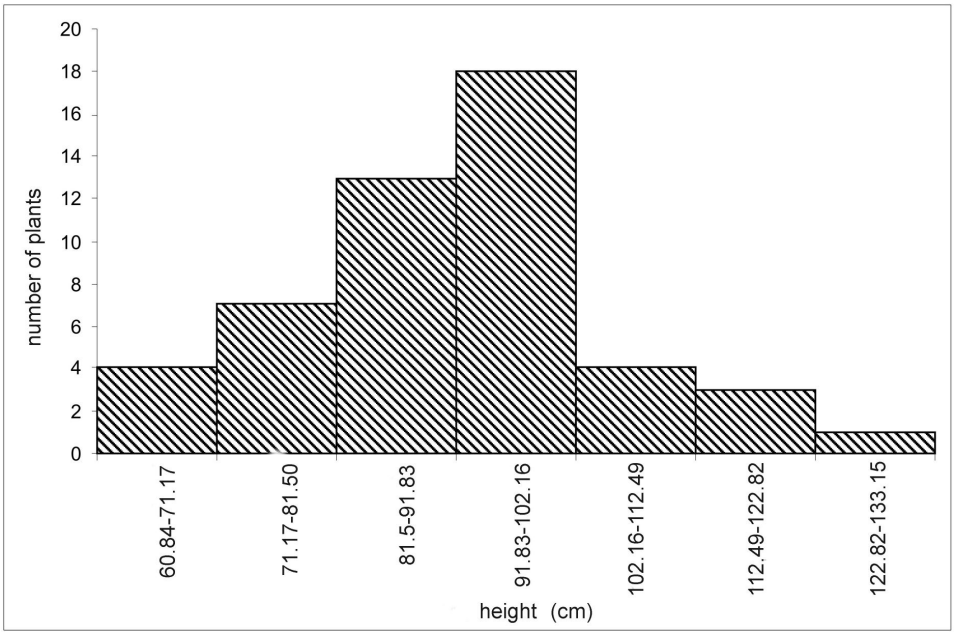

Fig. 4. A frequency diagram for height of flowering plant

All blooming plants (50 specimens) were measured biometrically and were described as to the eight individual characteristics: 1 – the height of sprouts (cm), 2 – the length of inflorescence measured from the stipule (cm), 3 – number of flowers of inflorescence, 4 – number of leaves of the sprout, 5 – the length of the largest leaf (cm), 6 – the width of the widest leaf (cm), 7 – the length of the stipule, 8 – the width of the stipule.

For each characteristics, the following were calculated: averages (X), standard deviations (s), coefficients of variation (V%), modal averages (M) and maximum and minimum values were established. The statistical distribution of the blooming plants

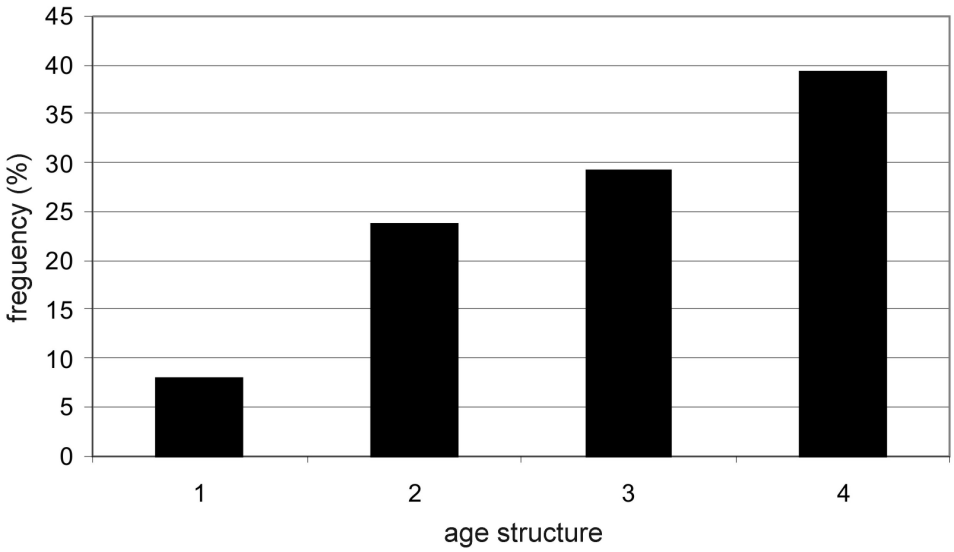

Fig. 5. Age structure of population in Zaleskie:1 – juvenile phase, 2 – immature phase, 3 – virginal phase, 4 – generative phase

is represented in a form of a bar chart (Fig. 5), and its compatibility with the normal distribution was checked by the chi-square test (Stanisz 2005).

The soil samples were taken from the layer of rhizodermis in direct vicinity of the root system of the examined plants, in order to establish chemical composition of the soil. The following characteristic features of the soil were determined: pH – potentiometrically in H_2O and 1 n HCl, total nitrogen – by the Kjeldahl's method, organic carbon – by the Tiurin's method (Bednarek et al. 2005), total phosphorus – by the molybdate method (Nowosielski 1974). In addition, the organic matter content in the examined substratum was determined. The analysis was held in the soil laboratory of the Western Pomeranian University of Technology in Szczecin. The nomenclature of vascular plants is in accordance with the list of Mirek et al. (2002), bryophyta with the list of Ochyra et al. (2003). The nomenclature of trees and bushes was adopted according to Seneta and Dolatowski (2003). Based on phyto-sociological relevés made by application of the Braun-Blanquet method (Pawłowski 1972), which were listed in the phytosociological table, the type of community was established with participation of *L. martagon* (Matuszkiewicz 2001).

RESULTS

Characteristics of the station, edaphic, phytocenotic and morphological conditions of the population of *Lilium martagon*

L. martagon grows over the area of about 160 m^2. The soil examination (Table 1) showed its acidic reaction (pH = 3.74), and it is quite well supplied with nitrogen, and a small quantity of the organic matter indicates that it is a mineral soil. Narrow

Table 1

Chemical parameters of soil

pH		Humus (%)	C (%)	N (%)	P (%)	C/N	C/P	N/P
H_2O	KCl							
5.09	3.74	5.74	3.33	0.25	0.0175	13.32	190.30	14.28

relation of C/N (13.32) represents good soil efficiency and good quality of the biotope, and the soil is sufficiently abundant with phosphorus (Table 1).

Internal structure of phytocenoses with participation of *Lilium martagon* is represented in Table 2. At natural biotopes, Turk's cap lily is found in meso- and euthrophic leafy forests belonging to the order of *Fagetalia sylvaticae* (Matuszkiewicz 2001). It is also included into brushwood communities of different syntaxonomic membership. It grows on sandy-clay soils and in fresh clay soils of different granulometric composition (from loose sands, strong clay sands and heavy clay) (Zarzycki 1984, Piękoś-Mirkowa and Mirek 2003). The park is characterized by such biotope conditions. The *Lilium martagon* stand in Zaleskie has undoubtedly anthropogenic character, since the character and features of the biotope reflect conditions of its natural occurrence.

84 taxons in total were discovered in the community. In particular patches, there were from 22 to 38 species (average 30). The tree stand of the analyzed phytocenoses is dominated by *Acer platanoides*. The layer of bushes is well developed. One can find *Symphoricarpos albus*, *Corylus avellana*, *Rubus idaeus*, *R. plicatus* and *Philadelphus coronarius* in it. Most patches are dominated by brushwood – *Acer platanoides* and *Aesculus hippocastanum*. Our attention is drawn by *Sambucus nigra* (IV class of stability) – a taxon characteristic for *Sambuco-Salicion* relationship. Elder is a phytoindicator of anthropogenic communities of a high level of euthropication of the soil (Wojterska 1990). The undergrowth is dominated by taxons of both syngenetic groups: *Fagetalia sylvaticae* Pawł. in Pawł., Sokoł. et Wall 1928 and *Querco-Fagetea* Br.-Bl. et Vlieg. 1937. They constitute the most numerous group of the plants whose inventory was taken along with *Lilium martagon*. In the group the legally protected *Campanula latifolia* is an interesting species – rare in Poland and close to extinction at the Gdańsk Pomerania (Zarzycki and Szeląg 1992, Markowski and Buliński 2004). The moss layer is poorly developed. Only *Plagiomnium undulatum* is worth mentioning, which appeared in the IV stability class with a relatively high coverage ratio (D=200). Participation of *Atrichum undulatum* – moss characteristic for both syntaxons, is scarce.

A visible early spring aspect is a vital characteristic feature of the phytocenoses (Table 2), which falls for the brink of May and April. The following geophytes constitute physiognomy of the early spring patches: *Anemone nemorosa*, *Ficaria verna*, *Gagea lutea* and *Adoxa moschatelina*. The early spring plants quickly yield to summer aspect species (Table 2), of which: *Poa nemoralis* (V), *Aegopodium podagraria* (III), and *Circaea lutetiana* (III) reached substantial stability. The species and classes of *Rhamno-Prunetea* – the plants of thermophilous brushwood communities are represented in phytocenoses by seven species of which *Crataegus monogyna* shows the

Table 2

Angelico-Cirsietum oleracei R. Tx. 1937 em. 1947

Successive number		1	2	3	4	5	6	7	8	9	10	11	12		
Number of phytosociological relevé		796	827	829	798	804	641	668	630	647	634	665	671		
Data (dzień, miesiąc, rok) - Date (day, month, year)		23.04 2010	10.05 2010	10.05 2010	23.04 2010	23.04 2010	20.07 2009	3.08 2009	18.07 2009	20.07 2009	18.07 2009	3.08 2009	3.08 2009		
Mechanical composition of A horizon of soil (0-20 cm)		pgl	pgm	pgm	pgm	pgm	pgl	pgm	pgl	pgm	pgm	pgl	pgm		
Crown density (%)	a	10	5	5	5	15	5	5	5	-	5	5	5		
	b	10	20	15	15	10	25	10	20	15	20	10	15		
Cover of plant layer (%)	c	50	45	65	40	50	25	30	25	45	40	15	40		
	d	20	10	+	10	20	+	30	10	5	5	5	10		
Area of relevé (m^2)		25	35	40	30	40	30	25	20	45	20	25	20		
Number of species in phytosocilogical relevé		22	27	36	38	31	35	29	31	27	29	23	31	S	D
1		2	3	4	5	6	7	8	9	10	11	12	13	14	15
Lilium martagon		1.2	2.2	2.2	+.2	1.1	+	1.1	2.2	2.2	2.2	1.2	2.2	V	1058
I. ChCl. *Querco-Fagetea*, ChO. *Fagetalia sylvaticae, ChAll. *Alno-Ulmion***, ChAll. *Carpinion betuli******															
Anemone nemorosa		2.2	1.2	1.1	2.2	2.2	.	.	+	.	+	.	.	III	537
**Ficaria verna*		1.1	+	1.2	.	1.2	.	.	.	.	.	.	.	III	133
***Gagea lutea*		.	1.2	1.1	1.2	+	.	.	.	.	.	.	.	III	133
***Adoxa moschatelina*		.	.	1.2	1.1	1.2	.	.	.	.	.	.	.	II	125
Poa nemoralis		+.2	1.1	1.2	+.2	1.1	+.2	.	+.2	.	+.2	1.2	+.2	V	212
Acer platanoides	a	1.2	1.1	+.2	+	1.1	1.2	.	+.2	.	.	+	1.1	IV	242
	b	.	+.2	+	1.2	.	.	1.1	.	1.1	+	1.1	.	III	192
***Plagiomnium undulatum*	d	1.1	+.2	+.2	1.1	.	+.2	.	1.2	+.2	.	.	1.1	IV	200
Aegopodium podagraria		+	.	+	+	1.2	.	2.2	.	2.2	1.1	.	1.1	III	433
Corylus avellana	b	1.1	1.1	.	1.2	.	1.1	.	1.2		r	.	+	III	217
****Campanula latifolia*		.	.	+	+.2	.	1.1	+.2	.	1.2	.	1.1	.	III	150
***Circaea lutetiana*		.	+	.	.	+	+	1.2	.	+	+	.	1.1	III	125

1		2	3	4	5	6	7	8	9	10	11	12	13	14	15
**Ranunculus lanuginosus*		.	.	1.2	+	+.2	1.2	.	.	.	.	+	.	III	108
**Galeobdolon luteum*		.	.	1.1	1.1	+	.	.	.	.	.	.	+	II	100
****Tilia cordata*		.	.	.	.	.	.	+	1.1	.	.	1.1	.	II	92
**Scrophularia nodosa*		.	.	.	.	.	.	1.1	.	.	+.2	r	.	II	50
**Stachys sylvatica*		.	.	.	.	+	.	+.2	.	.	.	.	+	II	25
Fraxinus excelsior	c	.	.	.	.	.	+.2	.	.	+.2	.	.	+.2	II	25
II. ChCl.ChO. *Epilobietea angustifolii, Atropetalia,* ChAll. *Sambuco-Salicion**															
**Sambucus nigra*	b	2.2	1.1	1.2	.	1.1	.	1.2	+	.	2.2	1.1	2.2	IV	654
	c	+	+	+.2	r	.	.	+.2	.	1.2	.	.	.	III	75
Rubus idaeus	b	+	+	+	.	1.1	1.2	.	.	+	.	+	r	IV	125
Fragaria vesca		.	.	+.2	+	+	.	+	.	+	.	.	+	+	III
III. ChCl. *Rhamno-Prunetea, Prunetalia spinosae,* ChAll. *Pruno-Rubion fruticosi**															
Crataegus monogyna	b	+	1.1	+	1.1	.	1.1	.	+	.	+	+	.	IV	167
	c	.	+	+	+	+.2	.	.	.	.	.	+.2	.	III	42
**Rubus plicatus*	b	.	+	+	+	.	1.2	.	1.1	.	+.2	.	+.2	III	125
Ulmus minor var. *suberosa*	b	.	.	1.1	+	.	.	+.2	.	1.1	.	+.2	.	III	100
Sarothamnus scoparius	c	.	.	+.2	+	+	.	.	+	.	r	.	.	III	42
IV. ChCl. *Molinio-Arrhenatheretea,* ChO. *Arrhenatheretalia*,* ChO. *Trifolio fragiferae-Agrostietalia stoloniferae***															
**Achillea millefolium*		1.1	1.1	+	+	1.1	.	1.1	1.1	+	1.2	+.2	1.1	V	325
**Taraxacum officinale*		+	+	1.1	+	1.1	.	+	+	.	+	.	1.1	IV	175
***Ranunculus repens*		1.1	1.1	+	.	.	1.2	.	.	+	+	.	+	III	158
**Dactylis glomerata*		.	.	.	1.2	.	+.2	+.2	+	.	1.2	.	.	III	108
Cerastium holosteoides		.	.	.	+	1.1	.	.	.	+	.	.	.	II	58
Poa trivialis		.	.	.	+	.	+.2	.	.	.	.	.	+.2	II	25
V. ChCl. *Artemisietea*															
Anthriscus sylvestris		+.2	+.2	1.1	+.2	.	1.2	1.1	.	1.1	.	+.2	+	IV	208
Glechoma hederacea		1.2	+	+	+	.	+	.	+	.	.	+	.	III	92
Artemisia vulgaris		+	+.2	.	+.2	.	.	+	1.2	.	.	.	+	III	83

1		2	3	4	5	6	7	8	9	10	11	12	13	14	15
Chelidonium majus		.	.	+	+	.	+	+	.	+	.	.	+	III	50
Geum urbanum		.	.	.	.	+	+.2	.	.	.	1.1	.	+	II	67
Urtica dioica		.	.	.	.	.	+	.	+	.	+	+.2	.	II	33
Viola odorata		.	.	.	.	.	.	+.2	.	+.2	.	.	+	II	25
VI. Accompanying species															
Hedera helix		1.1	1.2	1.2	.	.	1.2	1.1	+.2	+	+	.	1.2	IV	275
Symphoricarpos albus	1.2	1.1	+	+.2	.	1.1	.	1.2	1.1	+.2	+.2	.	IV	242	
Brachythecium rutabulum	.	.	+.2	1.1	2.2	.	2.2	1.2	.	.	1.2	.	III	425	
Vinca minor		.	.	.	1.2	.	1.2	.	+.2	1.2	1.1	.	.	III	175
Rhytidiadelphus squarosus	.	.	.	.	+.2	.	+.2	.	1.1	1.1	.	1.2	III	142	
Philadelphus coronarius	.	.	.	.	+.2	.	.	1.1	.	1.2	+.2	+	III	108	
Veronica chamaedrys		.	.	.	+	.	+	.	+	.	.	+.2	.	II	33
Aesculus hippocastanum	.	.	.	+	+	.	.	.	.	.	.	+	II	25	
	.	.	.	.	+.2	.	.	+.2	.	.	.	+.2	II	25	
Frangula alnus	.	.	.	.	.	+.2	.	.	.	+.2	.	+.2	II	25	
Hypericum perforatum		.	.	.	.	.	+	.	.	+	+	.	.	II	25
Ceratodon purpureus	.	.	.	.	.	.	+.2	.	.	.	+.2	+.2	II	25	
Plantago intermedia		.	.	.	.	.	+	.	+	.	.	.	+.2	II	25

Plant species occuring only in I degree of phytosociological stability:
I.**Atrichum undulatum d* 2.3 (+.2); ***Carex remota* 6 (+), ****Carpinus betulus* a 4 (1.1), 8 (+); *Fraxinus excelsior* a 5, 10 (1.1); ***Padus avium* b 3 (1.1), c 5 (+);**Polygonatum multiflorum* 4 (+); **Ulmus glabra* a 3, 7 (1.2); **III**. *Crataegus laevigata* c 10 (+); *Prunus spinosa* b 5, 8 (+); *Rosa canina* b 6, 10 (+.2); **IV.** **Bromus hordaceus* 5 (+.2); ***Carex hirta* 9 (+.2); *Holcus lanatus* 7 (+.2); *Plantago lanceolata* 6 (+); *Rumex acetosa* 7 (+); Ch.O. *Molinietalia*: *Deschampsia caespitosa* 6 (+); **V.** *Alliaria petiolata* 9 (+); *Cirsium arvense* 7 (+.2); *Geranium robertianum* 9 (+); *Impatiens parviflora* 4(+); *Melandrium album* 8 (+); *Rumex obtusifolius* 10 (+); **VI.** *Acer pseudoplatanus* 'Worley' a 8 (+); *Aesculus hippocastanum* a 1, 5 (1.1); d 1 (2.2), 6 (+); *Erophila verna* 3.5 (+); *Gymnocarpium dryopteris* 3 (+); *Oxalis acetosella* 6 (+.2), 9 (+); *Oxyrrhynchium hians* d 1 (2.2), 6 (+); *Plagiomnium affine d 2* (1.2), 7 (2.3); *Rubus spectabilis b* 7 (1.2), c 9 (+); *Solidago virgaurea* 9 (+); Ch.Cl. *Stellarietea mediae: Galeopsis speciosa* 4.6 (+); *Stellaria media* 7 (+.2); Ch.Cl. *Vaccinio-Piceetea*: *Picea abies* c 8 (+)

Explanation: pgl – light loamy sand, pgm – heavy loamy sand, S – phytosociological stability, D – cover coefficient

highest stability (IV). In addition to the above mentioned *Sambucus nigra*, the presence of *Artemisia vulgaris*, *Glechoma hederacea*, *Chelidonium majus*, *Geum urbanum* and *Urtica dioica* can indicate synanthropization of the analysed patches of the *Lilium martagon* community. A numerous group (46 species) comprises accompanying and sporadic taxons, of which the legally protected: *Frangula alnus*, *Hedera helix* and *Vinca minor* are worth mentioning.

Biometric analysis of all blooming specimens of *L. martagon* (Fig. 4) proved that the sprouts of the lily are from 66 to 128 cm (average 91.63 cm) high. The modal value (Table 3) of the height of the plants is higher from the average arithmetic; in

Table 3

Individual characteristics of flowering plants of *L. martagon* in Zaleskie

Character	Min.	Max.	X	M	s	V (%)
1. Height of plants (cm)	66	128	91.63	94.55	13.81	15.07
2. Number of leaves	14	53	26.77	23.57	7.46	27.87
3. Lenght of the biggest leaf (cm)	11.6	17.10	14.71	15.03	1.59	10.81
4. Width of the biggest leaf (cm)	2.40	5.30	3.51	3.15	0.65	18.52
5. Lenght of inflorescence from bract (cm)	15.5	41.3	26.88	25.73	6.52	24.26
6. Number of flowers	2	6	3.53	3.01	1.10	31.16
7. Lenght of bract (cm)	2.60	7.90	4.56	3.92	1.37	30.04
8. Width of bract (cm)	0.40	1.30	0.86	0.62	0.29	33.72

population dominate the plants of higher average height. Variability of the height of the examined plants is 15.07%. The number of leaves is from 14 to 53 (average 26.77). The modal value for the number of leaves is lower from the average arithmetic, so the population is dominated by the plants of the number of leaves smaller than average. The length and width of the largest leaf is 14.71 cm and 3.51 cm on average. Variability ratios for such features are V=10.81% and V=18.52% respectively and along with the height of the plants, belong to the least changeable of the 6 analyzed features. The modal value of the length of the largest leaf indicated that the population is dominated by the plants with the length of the largest leaf slightly higher than the average. The modal value for the width of the largest leaf indicates that the population is dominated by specimens of slightly lower value of the width of the largest leaf than the average arithmetic.

The length of inflorescence from the stipule varies from 15.5 cm to 41.3 cm (average 26.88). The population comprises more plants of a slightly lower value of that feature, which is evidenced by the modal value. The number of flowers, next to the width and length of the stipule belongs to the most variable features (V=31.16%). The values of that feature are between 2 and 6 (average 3.53). The modal value of the number of flowers is lower than the arithmetic average, the population is domi-

nated by the plants with 3 flowers. The length of the stipule is from 2.6 cm to 7.9 cm (average 4.56). The modal value for this feature indicates that the population is dominated by the specimens of the length of the stipule slightly lower than average. The width of the stipule has values from 0.40 to 1.30 cm (average 0.86). The population is dominated by the specimens of the width of the stipule lower than average which is evidenced by the modal value of that feature.
Analysis of the group features (Table 4) represents that the density of the specimens over the examined areas is 0.79 plants/m^2 on average. The average congestion expressed by the Lloyd's index and is 2.02 and is larger than average congestion. Based on prepared cartographic documentation (Fig. 3) and calculation of the dispersion factor value (Table 3), the cluster type of distribution of specimens was determined (dispersion factor >1).

Table 4

Group features of *Lilium martagon* population

Area (m^2)	Density of plants per 1 m^2			Dispersion coefficient	Mean crowding	Numbers
	min.	max.	average			
160	1	7	0.79	2.26	2.02	127

The population of *L. martagon* in Zaleskie, comprising 127 specimens, is dominated by the pants at generative stage, and constitute 39.37% (Table 5, Fig. 5). Virginal specimens are the second as to the number developmental stage constituting 29.13%. The least numerous juvenile stage (10 species) constitutes 7.87% of the population.

Table 5

Age structure of the *Lilium martagon* population

Age spectra							
juvenile		immature		virginal		generative	
number	%	number	%	number	%	number	%
10	7.87	30	23.62	37	29.13	50	39.37

DISCUSSION

In Pomerania, *L. martagon* is found especially in old manor parks and at cemeteries. The stands usually comprise from a few, several to tens of specimens. It is quite rare when the number comprises a few hundred specimens, or even more than one thousand, as in the case of a former park complexes in Ciemino, Motłowo and Łasin Koszaliński (Sobisz and Truchan 2006, Truchan and Sobisz 2009, Truchan 2010).
The Turk's cap lily is considered to be a species characteristic for meso- and eutrophic leafy forests of *Fagetalia sylvaticae* order (Medwecka-Kornaś et al. 1977).

The phyto-sociological structure of the community with participation of *Lilium martagon* in a former manor park in Zaleskie is not typical for that forest community. Relatively high participation of synanthropic species confirms that, which is undoubtedly caused by anthropogenic character of that stand.

Examination of the soil in Zaleskie reflected its strong acidic reaction (pH = 3.74). According to Kuczyńska et al. (1985), Bednorz (1999), such reaction of the soil has negative impact on growth, foliage and blooming of *L. martagon*, and even, according to Pindel (2002), it can lead to complete destruction of the population of the Turk's cap lily. The research done by Mynett (1976) comprising *L. martagon* in cultivation showed that the soil of pH 6-7 reaction is optimum. Research done by Jańczyk-Węglarska and Węglarski (1992) from the Wielkopolski National Park, Kolon and Krawczyk (1996) from Grudno near Bolkowo in Lower Silesia, Truchan and Sobisz (2009), Truchan (2010) from Central Pomerania, just contradict the existence of any relationship between the acidic pH reaction of the soil and its negative impact of the growth of *L. martagon*. In the Wielkopolski National Park, the Turk's cap lily was optimally represented in the soils of very strong and strong acidic reaction, and the examined specimens from Grudno reached the highest values of individual features in the stand with strongly acidic reaction. In Ciemino, at very high acidification of the substratum, over 400 specimens of *L. martagon* were found, of which 40% were at the blooming stage. Similarly in Łasin Koszaliński in the soil of acidic reaction, population of Turk's cap lily reached imposing number and size.

Lily sprouts at the stand in Zaleskie reach much higher than provided by Medwecka-Kornaś (1949) and Raciborski (1919). The highest of the measured ones (Table 3) are the within the limits provided by: Matthews (1980), Szafer et al. (1988), Piękoś-Mirkowa and Mirek (2003), Rutkowski (2004).

Average values for all analyzed features of *L. martagon* from Zaleskie are higher than provided by Kolon and Krawczyk (1996) from Lower Silesia. The average height of the plants blooming in Zaleskie exceeds that of the lilies described by Kuczyńska et al. (1985) from Lower Silesia, Kolon and Krawczyk (1996) from Lower Silesia, Bednorz (1999) from the area of the Bieniszew Forest Administration, Pindel (2002) from Beskid Średni, Miciniak and Zątek (1999) from the Wielkopolski National Park. The average number of flowers on a sprout in Zaleskie is higher than provided by Kolon and Krawczyk (1996), Miciniak and Zątek (1999), Bednorz (1999), Pindel (2002). The average number of leaves on a lily sprout in Zaleskie is higher than the values provided by Kuczyńska et al. (1985), Kolon and Krawczyk (1996), Pindel (2002) and Bednorz (1999). An average value for the length of the largest leaf and the width of the largest leaf of the examined population is higher than the value of this feature for majority of population in Lower Silesia (Kuczyńska et al. 1985), Kolon and Krawczyk (1996) from Lower Silesia, and provided by Bednorz (1999) from Bieniszewo. The average length and width of the stipule is higher than the ones provided by Kolon and Krawczyk (1996). The average values of the features of Turk's cap lily from Zaleskie are lower from the ones provided by Truchan and Sobisz (2009), Truchan (2010) from Western Pomerania, Truchan (2010) from Central Pomerania.

Population of *L. martagon* in Zaleskie contains 127 specimens in total, so it belongs to the less numerous ones in Pomerania. The Turk's cap lily stands described in oth-

er manor park systems and at Protestant cemeteries comprised from 300 to over 3 000 individuals (Truchan and Sobisz 2009, Sobisz and Truchan 2010, Truchan 2010). During earlier observations of that population in the years 2004-2007, there were 250, 191, 180, 155 individuals of *L. martagon* respectively found. According to Ellenberg et al. (1992), the Turk's lily belongs to the plants of semi-darkness. Optimum development conditions *L. martagon* has in over-exposed places (Kuczyńska et al. 1985, Pindel 2002). The examined stand in the park in Zaleskie is heavily shaded. It is under the canopy of the European ash – *Fraxinus excelsior*, common buckeyes – *Aesculus hippocastanum* and brushwood of Norway maple – *Acer platanoides*. On the leaves, the traces of predation of scarlet lily beetle (*Lilioceris lilii*) were discovered, but they were not numerous and perhaps they should not be treated as the cause of decrease of the specimens by 50% in the last few years.

The age structure of *L. martagon* might have contributed to the decrease of the population in Zaleskie. However, in the period 2004-2007 only the number of population was specified, not its age structure, but the research of 2009 might to certain extent explain a possible decrease of the numerical force of the population.

The population of *L. martagon* in Zaleskie is composed of the specimens in four developmental stages: juvenile, immature, virginal and generative. It is characteristic for small frequency of juvenile plants which constitute only 7.87% of the population with the highest frequency of blooming plants (39.37%). Such proportions of the age structure can lead to decrease of the numerical force of the population, which in turn may be its effect. The state of the population can be connected with the course of weather conditions in previous years. According to observations from Łasin Koszaliński held in the period 2007-2009 (Truchan and Sobisz 2009), the temperature and volume of precipitation during the period of intensive growth (from April till June) had big impact on numerical force of that population of *L. martagon* in subsequent years of observation.

CONCLUSIONS

1. *L. martagon* in Zaleskie appears in the mineral soil abundant with nitrogen and phosphorus, with acidic reaction (pH= 3.74). It seems that the acidic reaction of the substratum does not have any impact on growth, foliage and blooming of *L. martagon*, as suggested by some authors in their papers.
2. Anthropogenic stand of *Lilium martagon* in Zaleskie belongs to the less numerous in Pomerania and is characterized by cluster spatial distribution, small congestion and large participation of blooming plants in the population (39.37%).
3. The specimens of *L. martagon* in their generative stage are substantially higher, have more leaves and flowers on the sprout, than the same values in natural biotopes as provided by many authors.
4. In spite of large decrease of the numerical force of specimens (about 50%) in 2009 in relation to 2004, the population does not seem to be endangered in the nearest future.

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STRUKTURA POPULACJI *LILIUM MARTAGON* L. W ZALESKICH (POMORZE ŚRODKOWE)

Streszczenie

W pracy przedstawiono wyniki badań nad populacją *Lilium martagon* L. w Zaleskich, niewielkiej wsi znajdującej się w gminie Ustka w województwie pomorskim, na Pomorzu Środkowym. Badania przeprowadzono w latach 2009-2010. Badana populacja lilii złotogłów znajduje się na terenie dawnego założenia dworsko-parkowego i zajmuje powierzchnię 160 m^2. Określono warunki edaficzne i fitocenotyczne populacji. Rośliny scharakteryzowano pod względem cech osobniczych oraz grupowych. *L. martagon* występuje na glebie mineralnej, dobrze zaopatrzonej w azot i fosfor, o odczynie kwaśnym, a pod względem liczebności należy do mniej licznych na Pomorzu (127 osobników). Populacja charakteryzuje się skupiskowym rozkładem przestrzennym, małym zagęszczeniem i udziałem roślin kwitnących wynoszącym 39,37% ogółu populacji.