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The seasonal development characteristics of different taxa and cultivars of rhododendrons in Northern Lithuania.

2. Flowering peculiarities

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Abstract

The pattern of seasonal development of rhododendrons, as well as of all other introduced plants, in the conditions of a specific region is one of the most reliable indicators of their positive acclimatization. One of the most important indicators is the time and duration of the production of generative structures. The grouping of these plants into phenorhythmotypes made it possible to evaluate the indicators characterizing the flowering peculiarities of rhododendrons.

We assessed flowering peculiarities of 37 deciduous and 89 evergreen or semi-evergreen taxa and cultivars of rhododendrons (1–7 individuals of each taxa and cultivars) that had reached the generative status of biological maturity, but a different calendar age. The rhododendrons grown in Northern Lithuania were grouped into specific phenorhythmotypes according to indicators of flowering beginning, flowering ending and average duration of flowering.

According to indicators of flowering beginning and flowering ending, the rhododendrons were classified into phenorhythmotypes of 1) especially early, 2) early, 3) rather late, and 4) especially late. According to flowering duration, the rhododendrons were divided into phenorhythmotypes of 1) short flowering duration, 2) medium flowering duration and 3) long flowering duration. These results are relevant for grouping different types of rhododendrons intended for planting in green areas of urban territories.

Key words: *Rhododendron*, flowering indicators, secondary flowering, phenorhythmotypes.

Introduction

The pattern of seasonal development of rhododendrons, as well as of all other introduced plants, in the conditions of a specific region is one of the most reliable indicators of their positive acclimatization. The knowledge about variation of flowering time is important for the adaptation of plant species to different natural and agricultural environments (Kole et al., 2001; Higgins et al., 2010). It is known that flowering period typical of particular plant usually becomes shorter with the lack of humidity in the soil or too high air temperature (Min, 2000; Sharp et al., 2009). The flowering process is attuned to seasons through environmental cues, particularly

photoperiod and temperature (Elzinga et al., 2007; Tooke, Battey, 2010). Resource state, in turn, may be correlated with age, size, and reproductive effort in the previous years (Dahlgren et al., 2007).

The first rhododendrons start to flower at the end of April and their flowering lasts till the middle of July (Šaulienė et al., 2010). In the tropical Kalimantan islands and New Guinea, rhododendrons flower almost all year round. The flowering intervals are typical of rhododendrons flowering in other geographical latitudes and those introduced into various regions. In this case, the plants that reached the biological maturity due to particular

reasons do not reproduce any generative structures during one or several years consecutively. Uneven flowering may be determined by some biological reasons, e.g. young calendar age of rhododendrons; but more frequently it is related to not quite suitable environmental conditions for rhododendrons growing (Malciūtė, Naujalis, 2010). Sometimes secondary or repeated flowering during the same vegetation season is specific to rhododendrons (Александрова, 1989; Šaulienė et al., 2010). Two types of generative buds – with short period of dormancy and with long period of dormancy are specific to rhododendrons flowering for the second time during the same vegetation season. Dormancy period of the first type of generative buds lasts only several summer months and such plants flower out in autumn.

In order to evaluate the adaptation of rhododendron taxa and cultivars grown in the Šiauliai University Botanical Garden to flourish in the cultivated conditions, special researches of these plants' seasonal development were conducted paying particular attention to flowering peculiarities. The rhododendrons grown in Northern Lithuania were grouped into specific phenorhythmotypes according to long term research results. This research fills the gap in the knowledge of phenological aspects of introduced rhododendrons in Lithuania. Seasonal patterns of plant development are one of the key aspects of the plant-growing (Malciūtė et al., 2010). Similar studies based on single species of rhododendrons were done in Moscow. Aleksandrova (1989) used the growth of annual shoots, the beginning of flowering and the flowering duration for dividing plants into phenorhythmotypes (Александрова, 1989).

Grouping different types of rhododendrons according to phenorhythmotypes is undoubtedly significant in scientific and practical dimensions. Findings presented in this article would facilitate grouping of these plants according to ornamental aspects in collections and plantings and would ensure the expansion of rhododendrons in public green areas.

Materials and methods

Investigation was carried out at the Botanical Garden of Šiauliai University during 2007–2009. The collection of rhododendrons occupies a territory of 0.1 ha. Plants grew in the soil prepared according to the needs of organically grown rhododendrons. Before planting, the soil upper layer (30–50 cm) was removed and replaced by peat from an upland bog. Substrate acidity was pH 4.5–5.5. The microclimate was created with planted seedlings of the *Pinus* L. The development of introduced plants can vary because there are different lighting conditions (Malciūtė, Naujalis, 2010). Some places of the

rhododendrarium close to the growing creepers and apple-trees received insufficient amount of sunlight or, conversely, there was too much sunlight in open, sunny places of the rhododendrarium. The same agrotechnical operations and agrochemical agents were used for all the territory.

In 2009, rhododendrons of 178 taxa and cultivars were grown in the Botanical Garden of Šiauliai University. During the investigations of flowering peculiarities, 37 deciduous and 89 evergreen or semi-evergreen taxa and cultivars of rhododendrons were assessed. All these rhododendrons had reached the generative status of biological maturity, but they were of a different calendar age.

Rhododendron flowering duration is the period from appearance of the first flower until the death of the last one. The same criteria of rhododendrons seasonal development evaluation were used during the first and the second periods of flowering. During the statistical processing of research data the semi-evergreen rhododendrons were included into the evergreen ones. In the results section, the flowering indicators of such rhododendrons are presented separately from deciduous rhododendrons. For data presentation during the year we used Julian calendar. The data were statistically processed using the software *Statistica*, version 8.0. According to flowering beginning and flowering ending, the rhododendrons were divided into phenorhythmotypes of 1) especially early, 2) early, 3) rather late, and 4) especially late.

According to flowering duration, the rhododendrons were divided into phenorhythmotypes of 1) short flowering duration, 2) medium flowering duration and 3) long flowering duration.

In the results section tables and figures were used just for explanation of first flowering of rhododendrons. The analysis of secondary flowering is described in text without illustrations.

Results and discussion

Deciduous rhododendrons. Annual phenological researches of rhododendrons showed that the earliest flowering rhododendrons in the Botanical Garden among the deciduous rhododendrons were *R. canadense* (L.) Torr. and *R. canadense* var. *album*. This usually occurs on the 122nd and on the 123rd day of the year. The variation among the earliest and latest flowering of rhododendrons in the collection is 41 days. Every year, the last flowering rhododendron was *R. viscosum* (L.) Torr. – approximately on the 163rd day of the year. Most deciduous rhododendrons fully flowered in late May or early June. Statistical indicators of rhododendrons flowering beginning in separate years are presented in Table 1.

Table 1. Statistical indicators of deciduous rhododendrons flowering beginning, 2007–2009

Years	X ± SE	M	SD
2007	139.8 ± 4.0	145.0	24.6
2008	133.7 ± 3.9	138.0	23.5
2009	135.0 ± 4.0	140.0	24.6

Note. X – average dates of phase period, SE – standard error, M – the most frequently repeating criterion value, SD – standard deviation.

The analysis of the data of separate years shows that according to the indicators of flowering beginning deciduous rhododendrons were classified

into four phenorhythmotypes in the Botanical Garden (Table 2).

The data analysis of flowering end of deciduous rhododendrons showed the difference in 57 days between the earliest and latest flowering rhododendrons in the Botanical Garden. The earliest end of flowering of the deciduous rhododendrons was specific to *R. canadense* and *R. canadense* var. *album* (on 134th–136th days of the year). The latest date of the flowering end (on the 191st day of the year) was recorded for *R. viscosum*. Statistical indicators of rhododendrons flowering end in separate years are presented in Table 3.

Table 2. Phenorhythmotypes of deciduous rhododendrons according to the flowering beginning

Pheno-rhythmotypes	Description	Typical representatives
1	Especially early (122 nd –123 rd days of the year)	<i>R. canadense</i> , <i>R. canadense</i> var. <i>album</i>
2	Early (on 130 th –139 th days of the year)	<i>R. albrechtii</i> Maxim., <i>R. Austrinum</i> Rehder, <i>R. luteum</i> (L.) Sweet., <i>R. schlippenbachii</i> Maxim., <i>R. vaseyi</i> A. Gray, <i>R. gandavense</i> 'Unigue', <i>R. luteum</i> 'Canon's Double', <i>R. molle</i> 'Satan', <i>Rhododendron</i> 'Anita', <i>Rhododendron</i> 'Inga', <i>Rhododendron</i> 'Madame Debene'
3	Rather late (on 140 th –148 th days of the year)	<i>R. camtschaticum</i> Pall., <i>R. japonicum</i> (A. Gray) Suring., <i>R. molle</i> (Blume) G. Don, <i>R. calendulaceum</i> (Michx.) Torr. var. <i>croceum</i> , <i>R. japonicum</i> 'Album', <i>R. luteum</i> 'Gibraltar', <i>R. luteum</i> 'Persil', <i>R. luteum</i> 'Royal Command', <i>R. viscosum</i> 'Soir de Paris', <i>Rhododendron</i> 'Alina', <i>Rhododendron</i> 'Francisa', <i>Rhododendron</i> 'Hotspur Red', <i>Rhododendron</i> 'Ilze', <i>Rhododendron</i> 'Indra', <i>Rhododendron</i> 'Laura', <i>Rhododendron</i> 'Lidija', <i>Rhododendron</i> 'Līva', <i>Rhododendron</i> 'Mazais Jefinš', <i>Rhododendron</i> 'Narcissiflora', <i>Rhododendron</i> 'Pasacina', <i>Rhododendron</i> 'Polārzvaigne', <i>Rhododendron</i> 'Rīgas Rhododendrs', <i>Rhododendron</i> 'Skaidrīte'
4	Especially late (on 163 rd day of the year)	<i>R. viscosum</i>

Table 3. Statistical indicators of flowering end of deciduous rhododendrons, 2007–2009

Years	X ± SE	M	SD
2007	155.5 ± 4.5	160.0	27.7
2008	158.4 ± 4.8	165.0	29.0
2009	158.3 ± 5.0	–	30.2

Note. Explanation under Table 1.

The analysis of the data of separate years shows that the deciduous rhododendrons could be divided into four phenorhythmotypes according to the indicators of average flowering end (Table 4).

Statistical indicators of rhododendrons flowering duration in separate years are presented in Table 5.

In the year 2007, about 46% of deciduous rhododendrons (*R. molle* 'Satan' and others) in the Botanical Garden had a short flowering – 10–15 days (Fig. 1). Medium flowering duration (16–25 days) was specific to the same number of rhododendrons (*R. luteum* 'Royal Command' and others). Long flowering (32–33 days) was specific to 5% of deciduous rhododendrons (*R. calendulaceum* var. *croceum* and *R. luteum* 'Canon's Double'). *R. schlippenbachii* did not flower in the year 2007.

About 11% of rhododendrons (*R. canadense* and others) had a short flowering (11–13 days) in the year 2008. Medium flowering (17–25 days) was specific to 27% of rhododendrons (*Rhododendron* 'Anita' and others). Long flowering duration (26–38 days) was specific to 59% of deciduous rhododendrons (*R. viscosum* and others) grown in the Botanical Garden. Like in 2007, *R. schlippenbachii* did not flower in the year 2008.

Table 4. Phenorhythmotypes of deciduous rhododendrons according to the flowering end

Pheno-rhythmotypes	Description	Typical representatives
1	Especially early (on the 134 th –136 th days of the year)	<i>R. canadense</i> , <i>R. canadense</i> var. <i>album</i>
2	Early (on 145 th –159 th days of the year)	<i>R. albrechtii</i> , <i>R. austrinum</i> , <i>R. schlippenbachii</i> , <i>R. vaseyi</i> , <i>R. gandavense</i> ‘Unigue’, <i>R. molle</i> ‘Satan’, <i>Rhododendron</i> ‘Inga’, <i>Rhododendron</i> ‘Līva’, <i>Rhododendron</i> ‘Madame Debene’, <i>Rhododendron</i> ‘Narcissiflora’
3	Rather late (on 160 th –174 th days of the year)	<i>R. camtschaticum</i> , <i>R. japonicum</i> , <i>R. luteum</i> , <i>R. molle</i> , <i>R. calendulaceum</i> var. <i>croceum</i> , <i>R. japonicum</i> ‘Album’, <i>R. luteum</i> ‘Canon’s Double’, <i>R. luteum</i> ‘Gibraltar’, <i>R. luteum</i> ‘Persil’, <i>R. luteum</i> ‘Royal Command’, <i>R. viscosum</i> ‘Soir de Paris’, <i>Rhododendron</i> ‘Alina’, <i>Rhododendron</i> ‘Anita’, <i>Rhododendron</i> ‘Francisa’, <i>Rhododendron</i> ‘Hotspur Red’, <i>Rhododendron</i> ‘Ilze’, <i>Rhododendron</i> ‘Indra’, <i>Rhododendron</i> ‘Laura’, <i>Rhododendron</i> ‘Lidija’, <i>Rhododendron</i> ‘Mazais Jefin’, <i>Rhododendron</i> ‘Pasacina’, <i>Rhododendron</i> ‘Polārzaigzne’, <i>Rhododendron</i> ‘Rīgas Rhododendrs’, <i>Rhododendron</i> ‘Skaidrīte’
4	Especially late (on 191 st day of the year)	<i>R. viscosum</i>

Table 5. Statistical indicators of deciduous rhododendrons flowering duration, 2007–2009

Years	X ± SE	M	SD
2007	16.2 ± 1.0	–	5.8
2008	25.5 ± 1.4	30.0	8.7
2009	24.2 ± 1.3	–	8.0

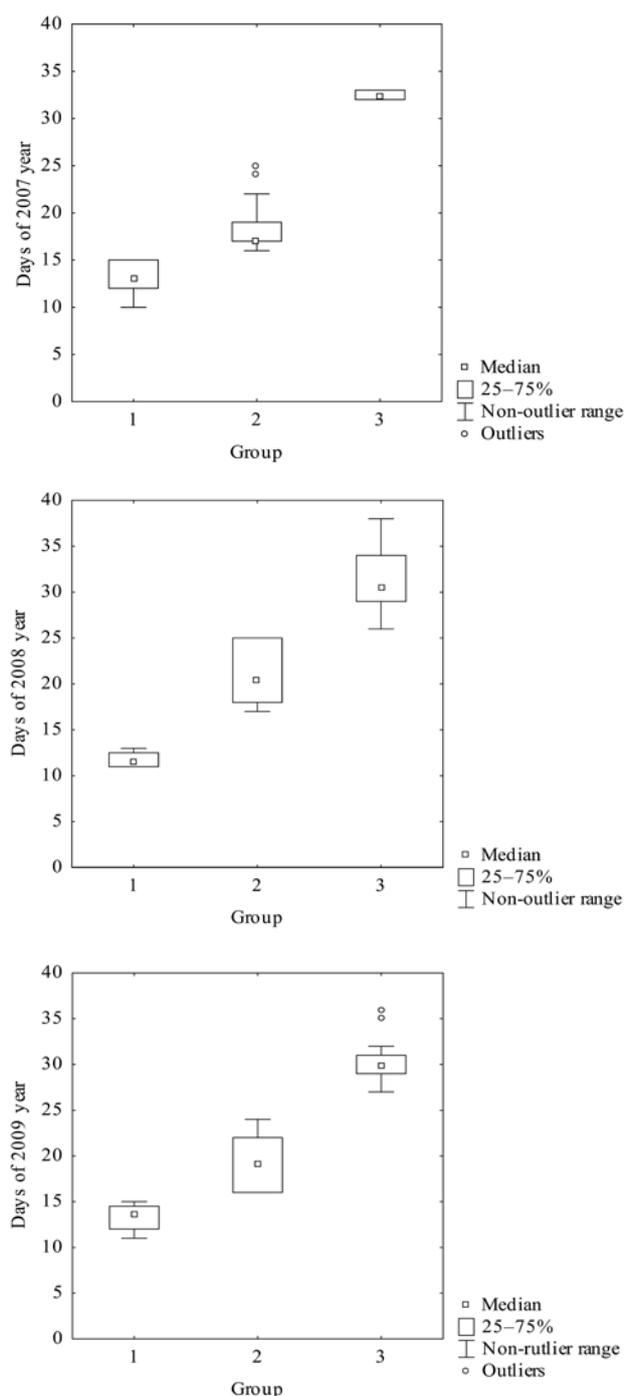
Note. Explanation under Table 1.

In the year 2009, about 11% of rhododendrons (*R. vaseyi* and others) had a short flowering – 11–15 days (Fig. 1). Medium flowering (16–24 days) was specific to approximately 30% of deciduous rhododendrons (*Rhododendron* ‘Francisa’ and others). About 57% of deciduous rhododendrons (*Rhododendron* ‘Lidija’ and others) had a long flowering – 27–36 days. *R. calendulaceum* var. *croceum* did not flower in the year 2009.

In summary, the deciduous rhododendrons could be divided into three phenorhythmotypes according to the indicators of average flowering duration (Table 6).

Table 6. Phenorhythmotypes of deciduous rhododendrons according to the flowering duration

Pheno-rhythmotypes	Description	Typical representatives
1	Short flowering duration (11–15 days)	<i>R. albrechtii</i> , <i>R. austrinum</i> , <i>R. canadense</i> , <i>R. vaseyi</i> , <i>R. canadense</i> var. <i>album</i>
2	Medium flowering duration (16–25 days)	<i>R. schlippenbachii</i> , <i>R. gandavense</i> ‘Unigue’, <i>R. japonicum</i> ‘Album’, <i>R. luteum</i> ‘Persil’, <i>R. molle</i> ‘Satan’, <i>R. viscosum</i> ‘Soir de Paris’, <i>Rhododendron</i> ‘Alina’, <i>Rhododendron</i> ‘Anita’, <i>Rhododendron</i> ‘Francisa’, <i>Rhododendron</i> ‘Hotspur Red’, <i>Rhododendron</i> ‘Ilze’, <i>Rhododendron</i> ‘Indra’, <i>Rhododendron</i> ‘Inga’, <i>Rhododendron</i> ‘Laura’, <i>Rhododendron</i> ‘Lidija’, <i>Rhododendron</i> ‘Līva’, <i>Rhododendron</i> ‘Mazais Jefinš’, <i>Rhododendron</i> ‘Madame Debene’, <i>Rhododendron</i> ‘Narcissiflora’, <i>Rhododendron</i> ‘Pasacina’, <i>Rhododendron</i> ‘Rīgas Rhododendrs’, <i>Rhododendron</i> ‘Skaidrīte’
3	Long flowering duration (26–34 days)	<i>R. camtschaticum</i> , <i>R. japonicum</i> , <i>R. luteum</i> , <i>R. molle</i> , <i>R. viscosum</i> , <i>R. calendulaceum</i> var. <i>croceum</i> , <i>R. luteum</i> ‘Canon’s Double’, <i>R. luteum</i> ‘Gibraltar’, <i>R. luteum</i> ‘Royal Command’, <i>Rhododendron</i> ‘Polārzaigzne’



Note. Phenorhythmotypes of rhododendrons: 1 – short flowering duration, 2 – medium flowering duration, 3 – long flowering duration.

Figure 1. Distribution of deciduous rhododendrons according to the flowering duration in separate years

The first phenorhythmotype contains 14% of deciduous rhododendrons with the short (11–15 days) flowering. *R. vaseyi* was the rhododendron of the shortest annual flowering – about 11 days. The medium flowering (16–25 days) was specific to about 59% of rhododendrons. The longest flowering

was specific to *Rhododendron* ‘Mazais Jefinš’ and *Rhododendron* ‘Skaidrīte’ – approximately 25 days. Long flowering (26–33 days) was specific to rhododendrons of the third phenorhythmotypes. In the collection about 27% of deciduous rhododendrons belonged to this group. During the research, *R. calendulaceum* var. *croceum* was the rhododendron of the longest flowering – approximately 34 days, *R. molle* and *R. luteum* ‘Canon’s Double’ – about 33 days.

Secondary flowering was typical of particular rhododendrons. The fluctuation of this phenomenon is expressed in change of abundance of rhododendrons flowers, flowering duration and intensity of generative structures production. Among deciduous rhododendrons only *R. camtschaticum* had secondary flowering in the years 2007 and 2009. No deciduous rhododendrons had secondary flowering in the year 2008. This phenological phase of rhododendrons in separate years had various durations. In the year 2007, the duration of secondary flowering of *R. camtschaticum* was 22 days. Hence, the duration of secondary flowering of this rhododendron was 7 days longer than the first one. However, this phenological phase lasted only 16 days of the same rhododendrons in the year 2009, the duration of their first flowering was 35 days.

Evergreen and semi-evergreen rhododendrons. The analysis of data of semi-evergreen and evergreen rhododendrons flowering beginning showed that *R. mucronulatum* Turcz. and *R. dauricum* L. were the first to flower at the Botanical Garden – on average on the 112th and 113th days of the year. Hence, in the Botanical Garden evergreen rhododendrons began flowering 10 days earlier than the deciduous ones. There was an 89-day difference between the earliest and latest flowering of evergreen and semi-evergreen rhododendrons. The last flowering rhododendron every year was *R. caucasicum* – on the 201st day of the year. Most evergreen and semi-evergreen rhododendrons fully flowered in late May or early June. Statistical indicators of rhododendrons flowering beginning in separate years are presented in Table 7.

Table 7. Statistical indicators of evergreen and semi-evergreen rhododendrons flowering beginning, 2007–2009

Years	X ± SE	M	SD
2007	132.6 ± 3.9	–	37.2
2008	130.1 ± 3.2	136.0	30.5
2009	127.7 ± 4.2	–	39.3

Note. Explanation under Table 1.

The analysis of the data of separate years shows that according to the indicators of average flowering beginning the evergreen and semi-

evergreen rhododendrons could be divided into four phenorhythmtypes (Table 8).

Table 8. Phenorhythmtypes of evergreen and semi-evergreen rhododendrons according to the flowering beginning

Pheno-rhythmtypes	Description	Typical representatives
1	Especially early (on 112 th –129 th days of the year)	<i>R. dauricum</i> , <i>R. impeditum</i> Franch., <i>R. mucronulatum</i> , <i>R. caucasicum</i> ‘Cunningham’s White’, <i>R. forrestii</i> ‘Baden Baden’, <i>R. forrestii</i> var. <i>repens</i> ‘Elviira’, <i>R. impeditum</i> ‘Moerheim’, <i>R. yakushmanum</i> ‘Flava’, <i>Rhododendron</i> ‘Gertruda’, <i>Rhododendron</i> ‘P. J. Mezitt’, <i>Rhododendron</i> ‘Praecox’
2	Early (on 130 th –139 th days of the year)	<i>R. fortunei</i> Lindl., <i>R. yungningense</i> Balf., <i>R. orbiculare</i> Decn., <i>R. oreotrepes</i> W. W. Sm., <i>R. racemosum</i> Franch., <i>R. searsiae</i> Rehder et Wilson, <i>R. williamsianum</i> Rehder et Wilson, <i>R. yakushmanum</i> ssp. <i>makinoi</i> Tagg, <i>R. aureum</i> Georgi var. <i>aureum</i> , <i>R. yedoense</i> Maxim. var. <i>poukhanense</i> (H. Lev.) Nakai, <i>R. minus</i> Michx. var. <i>album</i> , <i>R. brachycarpum</i> ssp. <i>tigerstedtii</i> ‘Helsinsigin Yliopisto’, <i>R. brachycarpum</i> ssp. <i>tigerstedtii</i> ‘P. M. A. Tigersted’, <i>R. catawbiense</i> ‘Hachman’s Charmant’, <i>R. caucasicum</i> ‘Pohjolan Tytär’, <i>R. forrestii</i> ‘Bengal’, <i>R. impeditum</i> ‘Bili Nowinka’, <i>R. yakushmanum</i> ‘Blurettia’, <i>R. yakushmanum</i> ‘Bohlken’s Juditha’, <i>R. yakushmanum</i> ‘Fantastica’, <i>R. yakushmanum</i> ‘Kalinka’, <i>R. yakushmanum</i> ‘Kullervo’, <i>R. obtusum</i> ‘Maruschka’, <i>R. smirnowii</i> ‘Dace’, <i>R. wardii</i> ‘Goldbukett’, <i>R. williamsianum</i> ‘Gartendirektor Rieger’, <i>Rhododendron</i> ‘Corinna’, <i>Rhododendron</i> ‘Eskimo’, <i>Rhododendron</i> ‘Germania’, <i>Rhododendron</i> ‘Irina’, <i>Rhododendron</i> ‘Lavanda’, <i>Rhododendron</i> ‘Schneekrone’
3	Rather late (on 140 th –157 th days of the year)	<i>R. catawbiense</i> Michx., <i>R. ferrugineum</i> L., <i>R. hirsutum</i> L., <i>R. maximum</i> L., <i>R. micranthum</i> Turcz., <i>R. × obtusum</i> Planch., <i>R. smirnowii</i> Trautv., <i>R. vernicosum</i> Franch., <i>R. wardii</i> W. W. Smith, <i>R. calostrotum</i> Balf. et Kingdom-Ward ssp. <i>keleticum</i> (Balf. f et Forrest) Cullen, <i>R. degronianum</i> Carr. var. <i>heptamerum</i> , <i>R. nitidulum</i> var. <i>omeiense</i> M. N. Philipson et Philipson, <i>R. brachycarpum</i> ssp. <i>tigerstedtii</i> ‘Haaga’, <i>R. catawbiense</i> ‘Calsap’, <i>R. catawbiense</i> ‘Gomer Waterer’, <i>R. catawbiense</i> ‘Humboldt’, <i>R. catawbiense</i> ‘Nova Zembla’, <i>R. catawbiense</i> ‘Uldis’, <i>R. dichroanthum</i> ‘Karibia’, <i>R. indicum</i> ‘Macrantha’, <i>R. yakushmanum</i> ‘Koichiro Wada’, <i>R. yakushmanum</i> ‘Percy Wiseman’, <i>R. yakushmanum</i> ‘Polaris’, <i>R. obtusum</i> ‘Geisha’, <i>R. obtusum</i> ‘Kermesina Rosea’, <i>R. ponticum</i> ‘Chionoides’, <i>R. smirnowii</i> ‘Hellikki’, <i>R. wardii</i> ‘Lachsgold’, <i>Rhododendron</i> ‘Album Novum’, <i>Rhododendron</i> ‘Bielicy’, <i>Rhododendron</i> ‘Blaauw’s Pink’, <i>Rhododendron</i> ‘Catawbiense Grandiflorum’, <i>Rhododendron</i> ‘Emils’, <i>Rhododendron</i> ‘Erich’, <i>Rhododendron</i> ‘Ginta’, <i>Rhododendron</i> ‘Jānis’, <i>Rhododendron</i> ‘Kārlis’, <i>Rhododendron</i> ‘Lita’, <i>Rhododendron</i> ‘Mikkeli’, <i>Rhododendron</i> ‘Rasputin’, <i>Rhododendron</i> ‘Scintillation’, <i>Rhododendron</i> ‘Sprīditis’
4	Flowering especially late (on 158 th –160 th and on 201 st days of the year)	<i>R. brachycarpum</i> G. Don, <i>R. caucasicum</i> Pall., <i>Rhododendron</i> ‘Gold Crone’

There was an 80-day difference between the earliest and latest flowering end of evergreen and semi-evergreen rhododendrons. The earliest end of flowering was specific to *R. dauricum* (125th day of the year) and *R. forrestii* var. *repens* ‘Elviira’

(127th day of the year). Every year, the latest date of the flowering end, on the 215th day of the year, was recorded for *R. caucasicum*. Statistical indicators of rhododendrons flowering end in separate years are presented in Table 9.

Table 9. Statistical indicators of flowering end of evergreen and semi-evergreen rhododendrons, 2007–2009

Years	X ± SE	M	SD
2007	146.6 ± 4.4	158.0	41.1
2008	151.0 ± 3.7	–	35.3
2009	146.9 ± 4.9	161.0	45.8

Note. Explanation under Table 1.

The analysis of the data of each year shows that according to the indicators of flowering end, evergreen and semi-evergreen rhododendrons were classified in four phenorhythmotypes in the Botanical Garden (Table 10).

Statistical indicators of rhododendrons flowering duration in separate years are presented in Table 11.

In the year 2007, about 44% of evergreen and semi-evergreen rhododendrons (*R. impeditum* ‘Bili Nowinka’ and others) had a short flowering

Table 10. Phenorhythmotypes of evergreen and semi-evergreen rhododendrons according to the flowering end

Pheno-rhythmotypes	Description	Typical representatives
1	Especially early (on 125 th –144 th days of the year)	<i>R. dauricum</i> , <i>R. mucronulatum</i> , <i>R. forrestii</i> ‘Baden Baden’, <i>R. forrestii</i> ‘Bengal’, <i>R. forrestii</i> var. <i>repens</i> ‘Elviira’, <i>Rhododendron</i> ‘P. J. Mezitt’, <i>Rhododendron</i> ‘Praecox’
2	Early (on 145 th –159 th days of the year)	<i>R. fortunei</i> , <i>R. impeditum</i> , <i>R. yungningense</i> , <i>R. orbiculare</i> , <i>R. oreotrephe</i> , <i>R. racemosum</i> , <i>R. searsiae</i> , <i>R. smirnowii</i> , <i>R. vernicosum</i> , <i>R. wardii</i> , <i>R. williamsianum</i> , <i>R. yakushmanum</i> ssp. <i>makinoi</i> , <i>R. aureum</i> var. <i>aureum</i> , <i>R. degronianum</i> var. <i>heptamerum</i> , <i>R. yedoense</i> var. <i>poukhanense</i> , <i>R. minus</i> var. <i>album</i> , <i>R. brachycarpum</i> ssp. <i>tigerstedtii</i> ‘Helsinki Yliopisto’, <i>R. brachycarpum</i> ssp. <i>tigerstedtii</i> ‘P. M. A. Tigerstedt’, <i>R. caucasicum</i> ‘Cunningham’s White’, <i>R. caucasicum</i> ‘Pohjolan Tytär’, <i>R. dichroanthum</i> ‘Karibia’, <i>R. impeditum</i> ‘Bili Nowinka’, <i>R. impeditum</i> ‘Moerheim’, <i>R. yakushmanum</i> ‘Blurettia’, <i>R. yakushmanum</i> ‘Bohlken’s Juditha’, <i>R. yakushmanum</i> ‘Fantastica’, <i>R. yakushmanum</i> ‘Flava’, <i>R. yakushmanum</i> ‘Kalinka’, <i>R. yakushmanum</i> ‘Koichiro Wada’, <i>R. yakushmanum</i> ‘Kullervo’, <i>R. obtusum</i> ‘Kermesina Rosea’, <i>R. obtusum</i> ‘Maruschka’, <i>R. smirnowii</i> ‘Dace’, <i>R. smirnowii</i> ‘Hellikki’, <i>R. wardii</i> ‘Goldbukett’, <i>R. williamsianum</i> ‘Gartendirektor Rieger’, <i>Rhododendron</i> ‘Album Novum’, <i>Rhododendron</i> ‘Bielicy’, <i>Rhododendron</i> ‘Corinna’, <i>Rhododendron</i> ‘Germania’, <i>Rhododendron</i> ‘Gertruda’, <i>Rhododendron</i> ‘Gold Crone’, <i>Rhododendron</i> ‘Irina’, <i>Rhododendron</i> ‘Kärlis’, <i>Rhododendron</i> ‘Spriditis’
3	Rather late (on 160 th –178 th days of the year)	<i>R. brachycarpum</i> , <i>R. catawbiense</i> , <i>R. ferrugineum</i> , <i>R. hirsutum</i> , <i>R. maximum</i> , <i>R. × obtusum</i> , <i>R. calostrotum</i> ssp. <i>keleticum</i> , <i>R. nitidulum</i> var. <i>omeiense</i> , <i>R. brachycarpum</i> ssp. <i>tigerstedtii</i> ‘Haaga’, <i>R. catawbiense</i> ‘Calsap’, <i>R. catawbiense</i> ‘Gomer Waterer’, <i>R. catawbiense</i> ‘Hachman’s Charmant’, <i>R. catawbiense</i> ‘Humboldt’, <i>R. catawbiense</i> ‘Nova Zembla’, <i>R. catawbiense</i> ‘Uldis’, <i>R. indicum</i> ‘Macrantha’, <i>R. yakushmanum</i> ‘Percy Wiseman’, <i>R. yakushmanum</i> ‘Polaris’, <i>R. obtusum</i> ‘Geisha’, <i>R. ponticum</i> ‘Chionoides’, <i>R. wardii</i> ‘Lachsgold’, <i>Rhododendron</i> ‘Blaauw’s Pink’, <i>Rhododendron</i> ‘Catawbiense Grandiflorum’, <i>Rhododendron</i> ‘Emils’, <i>Rhododendron</i> ‘Erich’, <i>Rhododendron</i> ‘Eskimo’, <i>Rhododendron</i> ‘Ginta’, <i>Rhododendron</i> ‘Jānis’, <i>Rhododendron</i> ‘Lavanda’, <i>Rhododendron</i> ‘Lita’, <i>Rhododendron</i> ‘Mikkeli’, <i>Rhododendron</i> ‘Rasputin’, <i>Rhododendron</i> ‘Schneekrone’, <i>Rhododendron</i> ‘Scintillation’
4	Especially late (on 182 nd and on 215 th days of the year)	<i>R. caucasicum</i> , <i>R. micranthum</i>

Table 11. Statistical indicators of evergreen and semi-evergreen rhododendrons flowering duration, 2007–2009

Years	X ± SE	M	SD
2007	15.5 ± 0.6	14.0	5.9
2008	21.2 ± 0.9	25.0	8.1
2009	21.9 ± 2.0	26.0	19.3

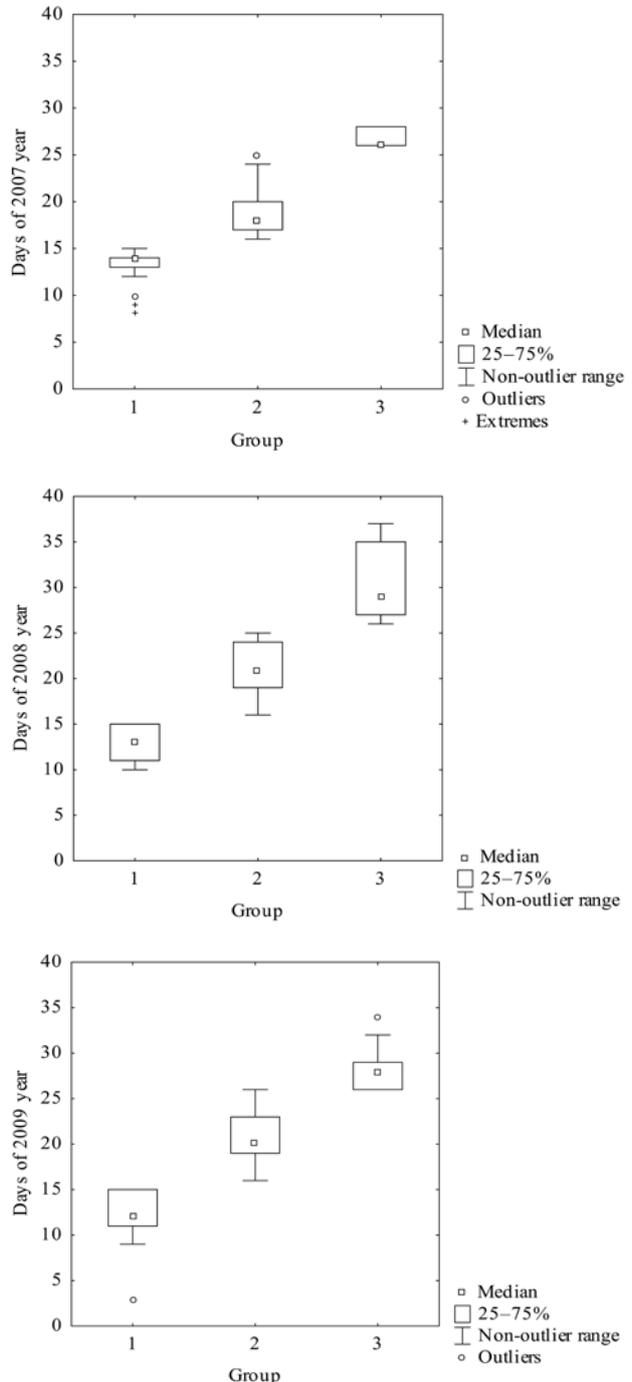
Note. Explanation under Table 1.

(9–15 days). Medium (16–25 days) flowering duration (Fig. 2) was specific to 52% of evergreen and semi-evergreen rhododendrons (*R. yakushmanum* ‘Polaris’ and others). Only 4% of the Botanical Garden evergreen and semi-evergreen rhododendrons (*R. racemosum*, *R. indicum* ‘Macrantha’ and *Rhododendron* ‘Rasputin’) had a long (26–28 days) flowering. Among rhododendrons of this phenorhythmotype *R. indicum* ‘Macrantha’ was the one that had the longest flowering – 28 days. The rhododendrons of 7 taxa (*R. aureum*, *R. aureum* var. *aureum*) and cultivars (*R. catawbiense* ‘Gomer Waterer’, *R. dichroanthum* ‘Karibia’, *R. forrestii* var. *repens* ‘Elviira’, *R. yakushmanum* ‘Blurettia’ and *R. yakushmanum* ‘Flava’) did not flower at all in the year 2007.

In the year 2008, short flowering (10–15 days) was specific to about 15% of rhododendrons (*R. williamsianum* ‘Gartendirektor Rieger’ and others). Among such rhododendrons *R. yakushmanum* ‘Blurettia’ and *R. yakushmanum* ‘Kullervo’ were the ones having the shortest flowering (10 days). Medium flowering (16–25 days) was specific to 58% of rhododendrons (*R. ferrugineum* and others). Long (26–36 days) flowering was specific to 27% of evergreen and semi-evergreen rhododendrons (*Rhododendron* ‘Rasputin’ and others). Among these rhododendrons the longest flowering was typical of *R. ponticum* ‘Chionoides’ – 37 days. Rhododendrons belonging to 2 taxa (*R. aureum* and *R. vernicosum*) and 3 cultivars (*R. forrestii* var. *repens* ‘Elviira’, *R. smirnowii* ‘Hellikki’ and *Rhododendron* ‘Gold Crone’) did not flower in the year 2008.

In the year 2009, about 13% of rhododendrons (*R. dichroanthum* ‘Karibia’ and others) had a short flowering (3–15 days). Medium flowering was specific to approximately 56% of evergreen and semi-evergreen rhododendrons (*Rhododendron* ‘Jānis’ and others). 31% of rhododendrons (*R. micranthum* and others) belonged to those of long flowering (26–34 days). Among these rhododendrons the longest flowering was specific to

R. obtusum ‘Maruschka’ and *Rhododendron* ‘Lita’ – 34 days. Rhododendrons of 3 taxa (*R. aureum*, *R. williamsianum*, *R. calendulaceum* var. *croceum*) and 5 cultivars (*R. yakushmanum* ‘Flava’, *R. smirnowii* ‘Hellikki’, *R. wardii* ‘Goldbukett’, *Rhododendron* ‘Gold Crone’ and *Rhododendron* ‘Mikkeli’) did not flower in the year 2009.



Note. Phenorhythmotypes of rhododendrons: 1 – short flowering duration, 2 – medium flowering duration, 3 – long flowering duration.

Figure 2. Distribution of evergreen and semi-evergreen rhododendrons according to the flowering duration in separate years

The analysis of the data of separate years shows that according to the indicators of average flowering duration the evergreen and semi-evergreen rhododendrons could be divided into three phenorhythmotypes (Table 12).

Rhododendrons of the first phenorhythmotype were characterized by short flowering (9–15 days). About 14% of evergreen and semi-evergreen rhododendrons in the collection belonged to this group. Among the representatives of this group *R. smirnowii* ‘Hellikki’ was the one that had the shortest flowering (9 days). However, the data is not botanically proven as this rhododendron flow-

ered only one year due to disturbances. Rhododendrons belonging to the second phenorhythmotype were characterized by middle flowering (16–25 days). 75% of evergreen and semi-evergreen rhododendrons of the Botanical Garden belonged to this group. Rhododendrons of the third phenorhythmotype were characterized by long flowering (26–29 days). About 11% of evergreen and semi-evergreen rhododendrons in the collection belonged to this group. Among the representatives of this phenorhythmotype the longest annual flowering was typical of *R. ponticum* ‘Chionoides’ – 29 days.

Table 12. Phenorhythmotypes of evergreen and semi-evergreen rhododendrons according to the flowering duration

Pheno-rhythmotypes	Description	Typical representatives
1	Short flowering duration (9–15 days)	<i>R. caucasicum</i> , <i>R. dauricum</i> , <i>R. mucronulatum</i> , <i>R. smirnowii</i> , <i>R. wardii</i> , <i>R. aureum</i> var. <i>aureum</i> , <i>R. dichroanthum</i> ‘Karibia’, <i>R. forrestii</i> ‘Bengal’, <i>R. forrestii</i> var. <i>repens</i> ‘Elviira’, <i>R. yakushmanum</i> ‘Kullervo’, <i>R. smirnowii</i> ‘Hellikki’, <i>Rhododendron</i> ‘Gold Crone’
2	Medium flowering duration (16–25 days)	<i>R. brachycarpum</i> , <i>R. catawbiense</i> , <i>R. ferrugineum</i> , <i>R. fortunei</i> , <i>R. hirsutum</i> , <i>R. impeditum</i> , <i>R. yungningense</i> , <i>R. maximum</i> , <i>R. × obtusum</i> , <i>R. orbiculare</i> , <i>R. oreotrepthes</i> , <i>R. racemosum</i> , <i>R. searsiae</i> , <i>R. vernicosum</i> , <i>R. williamsianum</i> , <i>R. calostrotum</i> ssp. <i>keleticum</i> , <i>R. degronianum</i> var. <i>heptamerum</i> , <i>R. yakushmanum</i> ssp. <i>makinoi</i> , <i>R. yedoense</i> var. <i>poukhanense</i> , <i>R. minus</i> var. <i>album</i> , <i>R. nitidulum</i> var. <i>omeiense</i> , <i>R. brachycarpum</i> ssp. <i>tigerstedtii</i> ‘Haaga’, <i>R. brachycarpum</i> ssp. <i>tigerstedtii</i> ‘Helsinsigin Yliopisto’, <i>R. brachycarpum</i> ssp. <i>tigerstedtii</i> ‘P. M. A. Tigersted’, <i>R. catawbiense</i> ‘Calsap’, <i>R. catawbiense</i> ‘Gomer Waterer’, <i>R. catawbiense</i> ‘Hachman’s Charmant’, <i>R. catawbiense</i> ‘Nova Zembla’, <i>R. catawbiense</i> ‘Uldis’, <i>R. caucasicum</i> ‘Pohjolan Tytär’, <i>R. forrestii</i> ‘Baden Baden’, <i>R. impeditum</i> ‘Bili Nowinka’, <i>R. impeditum</i> ‘Moerheim’, <i>R. yakushmanum</i> ‘Blurettia’, <i>R. yakushmanum</i> ‘Bohlken’s Juditha’, <i>R. yakushmanum</i> ‘Fantastica’, <i>R. yakushmanum</i> ‘Flava’, <i>R. yakushmanum</i> ‘Kalinka’, <i>R. yakushmanum</i> ‘Koichiro Wada’, <i>R. yakushmanum</i> ‘Percy Wiseman’, <i>R. yakushmanum</i> ‘Polaris’, <i>R. obtusum</i> ‘Geisha’, <i>R. obtusum</i> ‘Kermesina Rosea’, <i>R. obtusum</i> ‘Maruschka’, <i>R. smirnowii</i> ‘Dace’, <i>R. wardii</i> ‘Goldbukett’, <i>R. wardii</i> ‘Lachsgold’, <i>R. williamsianum</i> ‘Gartendirektor Rieger’, <i>Rhododendron</i> ‘Album Novum’, <i>Rhododendron</i> ‘Bielycy’, <i>Rhododendron</i> ‘Blaauw’s Pink’, <i>Rhododendron</i> ‘Corinna’, <i>Rhododendron</i> ‘Erich’, <i>Rhododendron</i> ‘Germania’, <i>Rhododendron</i> ‘Gertruda’, <i>Rhododendron</i> ‘Ginta’, <i>Rhododendron</i> ‘Irina’, <i>Rhododendron</i> ‘Kārlis’, <i>Rhododendron</i> ‘Lavanda’, <i>Rhododendron</i> ‘Mikkeli’, <i>Rhododendron</i> ‘P. J. Mezitt’, <i>Rhododendron</i> ‘Praecox’, <i>Rhododendron</i> ‘Rasputin’, <i>Rhododendron</i> ‘Schneekrone’, <i>Rhododendron</i> ‘Scintillation’, <i>Rhododendron</i> ‘Sprīdītis’
3	Long flowering duration (26–29 days)	<i>R. micranthum</i> , <i>R. catawbiense</i> ‘Humboldt’, <i>R. caucasicum</i> ‘Cunningham’s White’, <i>R. indicum</i> ‘Macrantha’, <i>R. ponticum</i> ‘Chionoides’, <i>Rhododendron</i> ‘Catawbiense Grandiflorum’, <i>Rhododendron</i> ‘Emīls’, <i>Rhododendron</i> ‘Eskimo’, <i>Rhododendron</i> ‘Jānis’, <i>Rhododendron</i> ‘Lita’

In the research years 2007–2009, secondary flowering was typical of rhododendrons belonging to nine taxa and cultivars (*R. dauricum*, *R. ferrugineum*, *R. hirsutum*, *R. impeditum*, *R. catawbiense* ‘Nova Zembla’, *R. caucasicum* ‘Cunningham’s White’, *R. caucasicum* ‘Pohjolan Tytär’, *R. impeditum* ‘Moerheim’, *Rhododendron* ‘Sprīdītis’). Every year only *R. hirsutum* and *R. caucasicum* ‘Cunningham’s White’ flowered for the second time. Every year the duration of secondary flowering of these rhododendrons varied. In the year 2007, the production of *R. hirsutum* generative structures lasted for 17 days. The durations of first and secondary flowering of these rhododendrons taxa and cultivars was similar. In the year 2008, the duration of secondary flowering of this species was 27 days (the duration of their first flowering – 25 days) and in 2009 – 20 days (the duration of their first flowering – 24 days). The differences in the duration of the first and secondary flowering were not significant. Only in the years 2008 and 2008 the secondary flowering of *R. catawbiense* ‘Nova Zembla’ was longer than the first one.

The new challenges of agriculture are the development of ornamental gardening and the society’s growing interest in introduced plants. During the last years, the evolution of horticulture has prompted scientists to look at the business needs (Callewaert, Lippert, 2000). In the current period, woody plants, especially rhododendrons, are particularly marketable.

In Lithuania, rhododendrons are introduced plants whose acclimatization success depends on the specific knowledge (Malciūtė, Naujalis, 2010). As plants are transferred into new environment, their biological life cycle usually changes. Specifically important information is associated with characteristic of seasonal development. The acclimatization level of the introduced plants could be evaluated only comparing with similar phenological data of the representatives of the same taxa thriving within the limits of its native distribution range. Unfortunately, such data of the number of introduced plants, especially from other continents are often difficult to find. At the same time it is necessary to monitor plant in cultivation places (Александрова, 1989; Никитина, 2009).

Considering that the introduction of rhododendrons in green plantations is for ornamental purposes, information about phenorhythmotypes is much more important than traditional phenological indicators. Aleksandrova (1989) was one of the first who started grouping rhododendrons using flow-

ering indicators (Александрова, 1989). The cited author divided these plants into five phenorhythmotypes: especially early, semi-early, early, rather late, late flowering. For ‘date’ definition ‘ten-day period and months’ expression was used in her research. We have shown that similar grouping of rhododendrons according to flowering indicators could be employed in our country. The classification of these plants into phenorhythmotypes based on the data collected in the Botanical Garden could be applied when rhododendrons are grouped in different types of green plantations. Especially important point is that we used Julian calendar for the plant division. This allows flexibility while applying the evaluation method and the monitoring of plant development in their choice of greenery or specialized collections.

Conclusions

1. According to the indicators of flowering beginning, rhododendrons of the Botanical Garden were classified into phenorhythmotypes of 1) especially early (deciduous – on 118th–129th, evergreen – on 102nd–129th days of the year), 2) early (on 130th–139th days of the year), 3) rather late (deciduous – on 140th–159th, evergreen – on 140th–156th days of the year), and 4) especially late (deciduous – on 160th–165th, evergreen – on 158th–167th or 187th–211th days of the year).

2. According to the indicators of end of flowering, rhododendrons of the Botanical Garden were classified into phenorhythmotypes of 1) especially early (deciduous – on 132nd–139th, evergreen – on 110th–144th days of the year), 2) early (on 145th–159th days of the year), 3) rather late (deciduous – on 160th–174th, evergreen – on 160th–178th days of the year), and 4) especially late (deciduous – on 184th–197th, evergreen – on 180th–196th or 215th–225th days of the year).

3. Phenorhythmotypes of rhododendrons were also classified according to the indicators of flowering duration: 1) short flowering duration (deciduous 11–15, evergreen and semi-evergreen 9–15 days), 2) medium flowering duration (deciduous, evergreen and semi-evergreen 16–25 days) and 3) long flowering duration (deciduous 26–34 days, evergreen and semi-evergreen 26–29 days). Medium flowering duration was exhibited by 59 % of deciduous and 75 % of evergreen and semi-evergreen rhododendrons of the collection.

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References

- Callewaert L., Lippert T. HOPLICCS: Horticultural planning and integrated cost control systems // *Acta Horticulturae*. – 2000, vol. 519, p. 221–230. <http://www.actahort.org/books/519/519_23.htm> [accessed 15 02 2011]
- Dahlgren J. P., Zeipel H., Ehrlén J. Variation in vegetative and flowering phenology in a forest herb caused by environmental heterogeneity // *American Journal of Botany*. – 2007, vol. 94, p. 1570–1576
- Elzinga J. A., Atlan A., Biere A. Time after time: flowering phenology and biotic interactions // *Trends in Ecology and Evolution*. – 2007, vol. 22, No. 8, p. 432–439
- Higgins J. A., Bailey P. C., Laurie D. A. Comparative genomics of flowering time pathways using *brachypodium distachyon* as a model for the temperate grasses // *PLoS One*. – 2010, vol. 5, iss. 4. <<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2856676/>> [accessed 30 10 2010]
- Kole C., Quijada P., Michaels S. D. et al. Evidence for homology of flowering-time genes VFR2 from *Brassica rapa* and FLC from *Arabidopsis thaliana* // *Theoretical and Applied Genetics*. – 2001, vol. 102, p. 425–430
- Malciūtė A., Naujalis J. R. Some relevant problems of *Rhododendron* introduction in Lithuania // *Botanica Lithuanica*. – 2010, vol. 16, No. 2–3, p. 69–73
- Malciūtė A., Naujalis J. R., Šaulienė I. The seasonal development characteristic of different rhododendrons taxa and cultivars in Northern Lithuania. 1. Leafing peculiarities // *Žemdirbystė=Agriculture*. – 2010, vol. 97, No. 4, p. 107–114
- Min B. M. Comparison of phenological characteristics for several woody plants in urban climates // *Journal of Plant Biology*. – 2000, vol. 43, iss. 1, p. 10–17
- Sharp R. G., Else M. A., Cameron R. W., Davies W. J. Water deficits promote flowering in *Rhododendron* via regulation of pre and post initiation development // *Scientia Horticulturae*. – 2009, vol. 120, iss. 4, p. 511–517
- Tooke F., Battey N. H. Temperate flowering phenology // *Journal of Experimental Botany*. – 2010, vol. 61, No. 11, p. 2853–2862
- Šaulienė I., Malciūtė A., Naujalis J. R. Estimation of *Rhododendron* flowering intensity in Botanical Garden of Šiauliai University during 2003–2007 // *Acta Horticulturae*. – 2010, vol. 885, p. 313–317. <http://www.actahort.org/books/885/885_43.htm> [accessed 08 02 2011]
- Александрова М. С. Рододендрон. – Москва, 1989, с. 29–38 (in Russian)
- Никитина Л. С. Фенологические особенности рододендронов в условиях города Уфы // *Вестник ОГУ*. – 2009, № 6, с. 278–280. <http://vestnik.osu.ru/2009_6/86.pdf> [accessed 10 01 2011] (in Russian)

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Rhododendro skirtingų taksonų ir veislių sezoninės raidos rodikliai Šiaurės Lietuvoje. 2. Žydėjimo ypatumai

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Santrauka

Rhododendrų, kaip ir daugelio kitų introdukuotų augalų, sezoninės raidos pobūdis konkretaus krašto sąlygomis yra vienas patikimiausių jų teigiamos aklimatizacijos rodiklių. Vienas svarbiausių tokių rodiklių yra generatyvinių struktūrų produkavimo laikas ir trukmė. Šiaulių universiteto Botanikos sodo rododendrų žydėjimo ypatumus apibūdinančius rodiklius padeda įvertinti šių augalų skirstymas į fenoritmotipus.

Botanikos sode tarp rododendrų pagal žydėjimo pradžios rodiklius išsiskiria 1) ypač anksti žydinčių (vasaržaliai 118–129, visžaliai 102–129 metų dieną), 2) anksti žydinčių (130–139 metų dieną), 3) vėlokai žydinčių (vasaržaliai 140–159, visžaliai – 140–156 metų dieną) ir 4) ypač vėlai žydinčių (vasaržaliai 160–165, visžaliai – 158–167 arba 187–211 metų dieną) rododendrų fenoritmotipai. Pagal žydėjimo pabaigos rodiklius išsiskiria 1) itin anksti baigiančių žydėti (vasaržaliai 132–139 metų dieną, visžaliai – 110–144 metų dieną), 2) anksti baigiančių žydėti (145–159 metų dieną), 3) vėlokai baigiančių žydėti (vasaržaliai 160–174, visžaliai – 160–178 metų dieną) ir 4) itin vėlai baigiančių žydėti (vasaržaliai 184–197, visžaliai – 180–196 arba 215–225 metų dieną) rododendrų fenoritmotipai. Pagal žydėjimo trukmės rodiklius išsiskiria 1) trumpai žydinčių (vasaržaliai – 11–15, visžaliai ir pusiau visžaliai – 9–15 dienų), 2) vidutinės trukmės (vasaržaliai, visžaliai ir pusiau visžaliai 16–25 dienas) ir 3) ilgai žydinčių (vasaržaliai 26–34, visžaliai ir pusiau visžaliai – 26–29 dienas) rododendrų fenoritmotipai. 59 % tirtų vasaržalių ir 75 % visžalių bei pusiau visžalių kolekcijos rododendrų yra vidutinės žydėjimo trukmės. Tokie fenoritmotipai, jungiantys skirtingų taksonų ir veislių rododendrus, neabejotinai gali būti šių augalų įvairiapusiškesnio ir dekoratyviniu atžvilgiu patrauklesnio grupavimo kolekcijose ar želdynuose pagrindas.

Reikšminiai žodžiai: *Rhododendron*, žydėjimo ypatumai, pakartotinis žydėjimas, fenoritmotipas.