

## RESEARCH ON MORPHOLOGICAL AND DECORATIVE TRAITS OF PEONY ORIGINATED IN KAUNAS BOTANICAL GARDEN

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The results of investigation on the morphological and decorative properties of Lithuanian peony cultivars and hybrids (author O. Skeivienė), grown at the Kaunas Botanical Garden of Vytautas Magnus University, are presented in this work. It was established, that the morphological and decorative properties of Lithuanian peonies distinguish themselves in large diversity: blossom duration – 10–20 days, blossom productivity – 12–35 units per bush, blossom size – 14–20 cm in diameter, bush height – 70–114 cm, blossoms are single and double. The blossom productivity increases with plant age. 41.6% changeability of bush height, blossom diameter, blossom productivity was influenced by genotype. The detected pathogens *Botrytis paeonia* Oud., *Fusarium oxysporum* Schltdl., *Septoria paeonia* Vest. did not cause significant damage to plants.

**Key words:** Lithuanian cultivars and hybrids, morphological and decorative traits, *Paeonia lactiflora* Pall.

**Introduction.** Peony belongs to *Paeoniaceae* family, *Paeonia* genus. There are known 52 species in genus, mainly spread in Eastern and Central Asia, less spread in Southern Europe and North America (Antanaitienė, Stanienė, 2001a). The taxonomy of the genus *Paeonia* is controversial (Sang, 1995). The International register includes about 5000 peony cultivars (Ипполитова, 2005). 69% of all peony cultivars are originated from Chinese peony (*Paeonia lactiflora* Pall.). 30% comprise group of peony hybrids (*Paeonia hybrida hort.*) created by cross-pollination Chinese, common and other peony species. Only 1% of peony cultivars are originated from common peony (*Paeonia officinalis* L.). The majority of tetraploid peonies are allopolyploids derived from crosses between phylogenetically distinct diploid lineages (Sang, 1995; Sang et al., 2004). Cultivars of Chinese peony differ in blossom colour, form, blossoming time and duration, bush height and leaf colour (De-Yuan Hong, 2003). Shrubs are 60–130 cm high. Blossoms are white and red of various shades, with diameter of 15–20 cm. They can be of different forms: single, Japan-type, anemone,

half-double, double. According to form and distribution of inner petals, double blossoms are as follows: crown-like, half-spherical, rose, half-rose (Македонская, 1988). The breeder professional O. Skeivienė created a great number of cultivars and hybrids of peony. These peonies distinguish themselves by various morphological, decorative and biological properties (Varkulevičienė, Stankevičienė, 2005). Collection, preservation, investigation and evaluation of Lithuanian flower genefund are a new trend of scientific researches in our country. Lithuanian cultivars are original, adapted to the local climate condition and it is urgent task to conserve, investigate and foster them as a part of our culture (Dapkūnienė et al., 2002). Three cultivars ('Virgilijus', 'Garbė Motinai', 'Prof. K. Grybauskas') and sixteen hybrids ('Maironis', 'Freda', 'Darius-Girėnas', 'Skeivienės vėlyvasis', 'Žilvinas', 'Elena', 'Rytas', 'Kastytis', 'Ona', 'Jadvyga', 'Ramunis', 'Vakaris', 'Danutė', 'Jonas', 'Tadas' and 'Regina') are confirmed by Orders of Minister of Environmental as National Plant Genetic Resources. These cultivars and hybrids will be preserved in the future.

The aim of this work was to investigate morphological and decorative traits of Kaunas Botanical Garden peony cultivars and hybrids originated in and to evaluate their ornamental quality.

**Materials and methods.** Investigation was carried out in the Kaunas Botanical Gardens of Vytautas Magnus University. Three Lithuanian peony cultivars: 'Virgilijus' ('Pierre Reignoux' × 'Auguste dessert'), 'Garbė Motinai' ('Pierre Reignoux' × 'Germaine Burgos'), 'Prof. K. Grybauskas' ('General Mac Mahon' × 'Perette') and sixteen hybrids: 'Maironis', 'Freda' ('Auguste Dessert' × 'Perette'), 'Darius-Girėnas' ('Germaine Burgos' × 'Madame Calot'), 'Skeivienės Vėlyvasis' ('Eugene Verdier' × 'Germaine Bigot'), 'Žilvinas', 'Elena', 'Rytas', 'Kastytis', 'Ona', 'Jadvyga', 'Ramunis', 'Vakaris', 'Danutė', 'Jonas', 'Tadas', 'Regina' were investigated. Hybrid's names used in this article are conditional.

Chinese peony seedlings are grown according to the generally accepted cultivation technology (Македонская, 1988). Peonies were planted in an open area in rows to the southwest direction. The distance between rows was 1 m, between individual plants – 0.8 m.

The samples of peonies were selected to National Plant Genetic Resources according to criteria for selection of ornamental plants to national plant genetic resources approved by Commission of Plant National Genetic Resources. Plants were selected following by the investigation methods of individual and population selection, introductive researches. Eleven criteria were evaluated in a 1–5 point scale system; point value increased for a better indication. Total point sum was divided by a number of criteria. The average point indicated value of selected plant. Objects with point value three and more were offered to attach to national genetic resources of ornamental plants.

For evaluation of the decorative and morphological properties of *P. lactiflora* cultivars and hybrids the phenology of plants was observed, the beginning and the end of blossoming were established, morphological measurements were accomplished according to J. Vaidelys' methodology (Vaidelys, 2005).

The samples for fungi identification were collected from plants bearing symptoms of fungi diseases. Fungi disease agents were isolated in pure culture using moist–

chamber method and then identified with microscopic analysis according to M. B. Ellis and J. P. Ellis (1997).

Both effects of plant age and peony cultivars on the growth and productivity parameters were assessed by redundancy analysis (RDA) in the computer program Canoco® for Windows 4.0. Statistical tests of significance were carried out after an independent of distribution laws Monte Carlo permutation test (1 000 permutations). Statistical analysis was done using MEAN (MS EXCEL), GLM (STATISTICA 5.5).

**Results.** The decorative features of peony are definite by flowering duration, blossom size, form, colour, number and bush height. The decorative value was established – 4.73 for ‘Darius-Girėnas’, ‘Skeivienės vėlyvasis’ and 4.82 – for other peonies. According to the flowering time (Antanaitienė, Stanienė, 2001 b) based on average data obtained in 2000–2006, the investigated *P. lactiflora* cultivars and hybrids were grouped as medium, medium late and late. The blossoming of Lithuanian peonies begins in 1st–3rd week of June. The hybrids with single blossoms are earlier; double blossom hybrids begin to blossom 2–3 weeks later. The cultivars ‘Virgilijus’, ‘Prof. K. Grybauskas’, and hybrids ‘Freda’, ‘Elena’, ‘Rytas’, ‘Kastytis’, ‘Ona’, ‘Jadvyga’ and ‘Tadas’ have the longest flowering duration (15–18 days). Other cultivars and hybrids blossom 11–14 days. Blossoms are hollow and double, white, rose and red of various shades. According to the form and distribution of inner petals, double blossom hybrids ‘Freda’ and ‘Vakaris’ are crown-like. The blossoms of ‘Darius–Girėnas’, ‘Skeivienės vėlyvasis’, ‘Garbė Motinai’ are half-spherical double and ‘Prof. K. Grybauskas’ is spherical double (Table 1).

Table 1. The decorative traits of Lithuanian *Paeonia lactiflora* Pall. cultivars and hybrids

1 lentelė. Lietuviškų *Paeonia lactiflora* Pall. veislių ir hibridų dekoratyvinės savybės

Cultivar, hybrid Veislė, hibridas	Origination year Sukūrimo metai	Blooming duration, month Žydėjimo trukmė, mėnuo	Form of blossom Žiedo forma	Colour of blossom Žiedo spalva
1	2	3	4	5
‘Garbė Motinai’	1958	06-22 – 07-05	Half-spherical, double Pilnaviduris, pusiau rutulinis	Light rose with violet shade Šviesiai rožinė su violetiniu atspalviu
‘Virgilijus’	1958	06-14 – 07-02	Single Tuščiaaviduris	Rose red Rožiniai rausva
‘Prof. K. Grybauskas’	1958	06-30 – 07-15	Spherical double Pilnaviduris, pusrutulinis	Dark red with white edging Tamsiai raudona su baltu apvadu
‘Maironis’	1964	06-09 – 06-22	Single Tuščiaaviduris	White Balta
‘Freda’	1964	06-14 – 06-30	Crown-like, double Pilnaviduris, karūninis	Light rose Šviesiai rožinė
‘Darius–Girėnas’	1964	06-28 – 07-11	Half-spherical, double Pilnaviduris, pusiau rutulinis	Rose Rožinė
‘Skeivienės vėlyvasis’	1964	06-29 – 07-10	Half-spherical, double Pilnaviduris, pusiau rutulinis	Light rose Šviesiai rožinė

Table 1 continued

1 lentelės tęsinys

1	2	3	4	5
'Žilvinas'	1964	06-18 – 06-30	Single Tuščiaviduris	Light rose Šviesiai rožinė
'Kastytis'	1964	06-11 – 06-29	Single Tuščiaviduris	Dark rose Tamsiai rožinė
'Vakaris'	1964	06-14 – 06-25	Crown-like, double Pilnaviduris, karūninis	Rose Rožinė
'Elena'	1970	06-11 – 06-28	Single Tuščiaviduris	Light rose Šviesiai rožinė
'Rytas'	1970	06-14 – 06-30	Single Tuščiaviduris	Light rose Šviesiai rožinė
'Ona'	1970	06-10 – 06-25	Single Tuščiaviduris	Light rose Šviesiai rožinė
'Jadvyga'	1970	06-14 – 06-29	Single Tuščiaviduris	Light rose Šviesiai rožinė
'Ramunis'	1970	06-11 – 06-23	Single Tuščiaviduris	Violet rose Violetiniai rožinė
'Danutė'	1970	06-14 – 06-25	Single Tuščiaviduris	Light rose Šviesiai rožinė
'Jonas'	1970	06-11 – 06-25	Single Tuščiaviduris	Light rose lilac Šviesiai rožiniai alyvinė
'Tadas'	1970	06-10 – 06-28	Single Tuščiaviduris	Red Raudona
'Regina'	1970	06-14 – 06-28	Single Tuščiaviduris	Violet rose Violetiniai rožinė

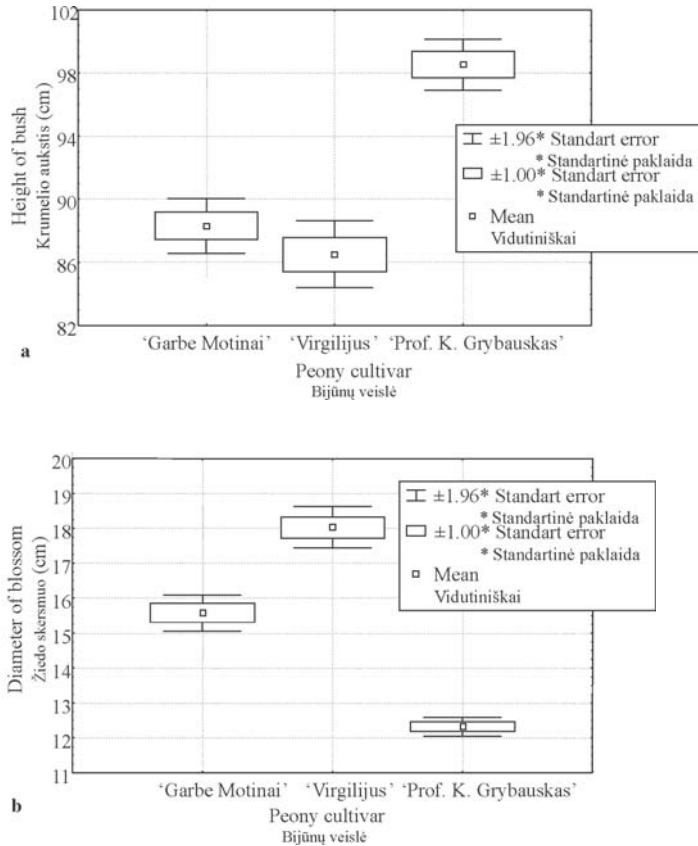
Our data obtained in 2000–2006 revealed that bushes of 'Ramunis', 'Kastytis', 'Jonas' and 'Vakaris' were very high (more 100 cm), 'Tadas', 'Jadvyga' and 'Žilvinas' – middle high.

Table 2. The morphological parameters of Lithuanian *Paeonia lactiflora* Pall. hybrids2 lentelė. Lietuviškų *Paeonia lactiflora* Pall. hibridų morfologiniai parametrai

Hybrid Hibridas	Height of plants Augalo aukštis (cm)	Diameter of blossom Žiedų skersmuo (cm)	Number of blossoming shrub Kero žydinčių ūglių skaičius
'Maironis'	90.10 ± 3.10	15.21 ± 2.50	24.35 ± 2.56
'Freda'	97.22 ± 2.94	14.72 ± 2.68	23.46 ± 2.45
'Darius–Girėnas'	95.12 ± 2.05	14.63 ± 2.75	19.87 ± 3.25
'Skeivienės vėlyvasis'	100 ± 1.10	15.81 ± 1.25	15.68 ± 3.02
'Žilvinas'	74.51 ± 1.21	14.35 ± 2.31	18.67 ± 2.56
'Kastytis'	102.10 ± 2.45	20.01 ± 0.98	21.52 ± 2.63
'Vakaris'	114.2 ± 2.98	18.35 ± 1.32	26.86 ± 2.87
'Elena'	97.41 ± 4.52	19.12 ± 1.05	35.01 ± 0.98
'Rytas'	88.35 ± 5.12	18.54 ± 1.03	20.58 ± 2.87
'Ona'	84.71 ± 4.35	18.77 ± 1.02	17.52 ± 3.45
'Jadvyga'	70.55 ± 3.50	16.18 ± 1.88	11.79 ± 1.85
'Ramunis'	105.00 ± 3.76	15.22 ± 1.35	18.42 ± 1.49
'Danutė'	82.59 ± 5.42	18.46 ± 1.21	26.23 ± 1.67
'Jonas'	103.00 ± 2.50	18.60 ± 1.40	30.02 ± 1.98
'Tadas'	76.68 ± 4.95	15.20 ± 2.50	15.36 ± 1.76
'Regina'	94.03 ± 3.02	18.01 ± 1.20	21.45 ± 1.99

Other Lithuanian peonies were high (Fig. 1 a, Table 2). The hybrid ‘Kastytis’ has huge, ‘Elena’, ‘Rytas’, ‘Vakaris’, ‘Danutė’, ‘Ona’, ‘Jonas’, and ‘Regina’ – large blossoms (Table 2).

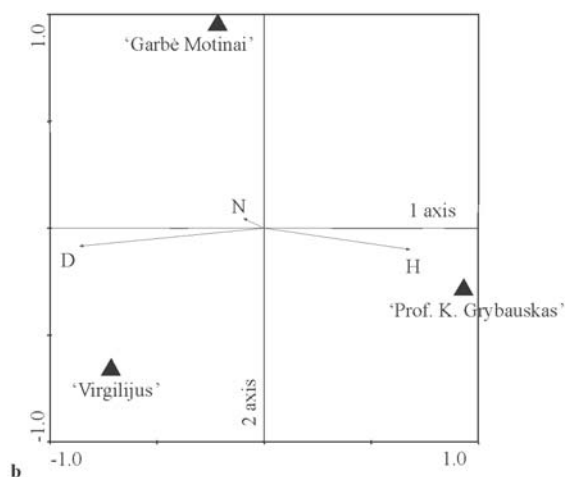
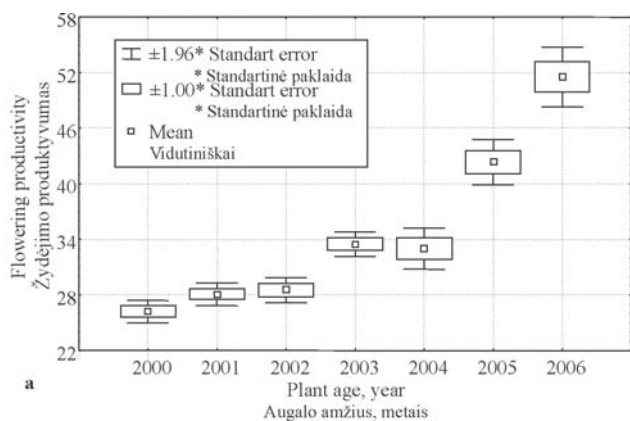
Cultivar ‘Virgilijus’ has the largest blossoms (in diameter about 18 cm) and high plants – about 87 cm. The smallest flowers had plants of complete cultivar ‘Prof. K. Grybauskas’ (in diameter about 14 cm), but they had long blossoming (about 15 days) and were high (up to 100 cm). (Fig. 1 a, b).



**Fig. 1.** The comparison of morphological parameters of Lithuanian *Paeonia lactiflora* cultivars: a) the height of plants; b) the diameter of bloom.

**1 p a v.** Lietuviškų bijūnų veislių morfologinių parametų palyginimas:  
a) augalo aukštis; b) žiedo skersmuo .

Flowering productivity mean increases from 26 (in 2000) to 52 units (in 2006). It was increasing with plant aging. Environment conditions could have had an influence to the uneven increasing. From 2000 till 2002 increasing was slight (from 25 to 29) and during 2003–2004 flowering productivity had hardly increased, it was about 33 units (Fig. 2 a).



**Fig. 2.** The influence of plant age and genotype:  
 a) influence of plant age on flowering productivity;  
 b) the influence genotype on plant height (H), diameter of blossom (D) and number of blossoms in shrub (N).

**2 pav.** Augalo amžiaus ir genotipo įtaka:

- a) žydėjimo produktyvumo priklausomybė nuo augalo amžiaus;
- b) genotipo įtaka augalo aukščiui (H), žiedų skersmeniui (D) ir žiedų skaičiui kere (N).

According to the literature, the generative buds of the next year are being formed in August-September (Васильева, 1972). During the research period in 2002 in these months there was not much rainfall (14 mm in August and 42 mm in September; in 2003 – the rainfall in August was heavier – 53 mm, but less in September – 28 mm). Flowering productivity had highly increased in 2005 and 2006. This was influenced by the bigger amount of rainfall during generative bud formation: 2004 – 97 mm in August and 35 mm in September; in 2005 – 135 mm and 48 mm. The optimal



conditions in spring could also influence (temperature in April-June was higher than the average temperature of the year – 7.5°C, 12.1°C, 15°C).

Effect of peony cultivar on the growth and productivity parameters was significant ( $F = 35.8$ ;  $p = 0.001$ ) and explained 41.6% of the observed variance, as shown by redundancy analysis (RDA) (Fig. 2 b).

The most harmful and widespread disease of peony is root rot (the agent *Botrytis paeonia* Oud.), damaging plants during all vegetation period, (Petrauskaitė, Vengeliauskaitė, 1978). According to our data, obtained in 2004–2006, favourable conditions for disease spreading were in 2004–2005. Affected stem bases and buttons were found in hybrids ‘Skeivienės vėlyvasis’ (2.5%), ‘Freda’ and ‘Darius-Girėnas’ (3.5%). *Fusarium oxysporum* Schltdl. was isolated from under the roots zone of ‘Virgilijus’ in 2005, and ‘Darius-Girėnas’ in 2006. In rare cases *Septoria paeonia* Vest. was detected on ‘Skeivienės vėlyvasis’, ‘Freda’, ‘Darius-Girėnas’; their damage was not significant.

**Discussion.** According to our data, flowering duration fluctuates for 5–7 days. Sometimes analogical data (Antanaitienė, Stanienė, 2001 b) were observed by R. Antanaitienė and G. Stanienė for ‘Virgilijus’ and ‘Maironis’, which blossom beginning depends on meteorological conditions.

The height of *P. lactiflora* Pall. shrubs is 80–100 cm (Vaidelys, 2005; Zhou et al., 2005). The heights of Lithuanian peonies were from ‘Jadvyga’ 70.55 to 114.2 (‘Vakaris’) cm. They were middle (60–80 cm) – 3 hybrids, high (81–100 cm) – 9 hybrids and 3 cultivars and very high (more 100 cm) – 4 hybrids (Table 2; Fig. 1 a).

Peony blossoms according to size are classified as huge (diameter more than 20 cm) – 1 hybrid, large (17–20 cm) – 7 hybrids and cultivar ‘Virgilijus’, middle (13–16 cm) – 8 and ‘Garbė Motinai’ and small (less than 13 cm) – cultivar ‘Prof. K. Grybauskas’ (Table 2; Fig 1 b).

According to Y. Zhou et al. (2005), during evaluation of peony cultivars it is very important to estimate root system and its anatomy. The authors established, that *P. lactiflora* roots are cylindrical, pale white to reddish brown colour in surface (Zhou et al., 2005). In our case roots of Lithuanian peonies were reddish brown colour.

Pathogens *Ramularia paeoniae* Preuss., *Leptothyrium paeonae*, *Phyllotata paeoniae*, *Cronartium aslepiadeum* (Wild.) Fr. described on peony in literature (Petrauskaitė, Vengeliauskaitė, 1978) were not detected on Lithuanian peonies. M. Samuitienė and M. Navalinskienė tested Lithuanian peony cultivars (‘Virgilijus’, ‘Garbė Motinai’, ‘Prof. K. Grybauskas’) and 8 hybrids for visual viral symptoms (Navalinskienė, Samuitienė, 2004). Plants were found to be healthy, except one plant in the cultivar ‘Garbė Motinai’ and solitary instances in some hybrids, which showed symptoms of ringpot disease.

**Conclusions.** 1. The morphological and decorative properties of Lithuanian peony cultivars and hybrids created in Kaunas Botanical garden by O. Skeivienė distinguish themselves in large diversity: blossom duration – 10–20 days, blossom productivity – 12–35 in bush, blossom size – 14–20 cm in diameter, bush height – 70–114 cm, blossom forms are single and double.

2. 41.6% changeability of bush height, blossom diameter, and blossom productivity was influenced by genotype.

3. The detected pathogens *Botrytis paeonia* Oud., *Fusarium oxysporum* Schltdl., *Septoria paeonia* Vest. did not cause significant damage to plants.

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### **KAUNO BOTANIKOS SODE SUKURTŲ BIJŪNŲ MORFOLOGINIŲ IR DEKORATYVINIŲ SAVYBIŲ TYRIMAS**

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*Santrauka*

Straipsnyje apibendrinama Vytauto Didžiojo Universiteto Kauno botanikos sode auginamo puikiojo bijūno (*Paeonia lactiflora* Pall.) Onos Skeivienės sukurtų 3 veislių ir 16 hibridų morfologinės ir dekoratyvinės savybės. Tirtų bijūnų veislių ir hibridų morfologinėms ir dekoratyvinėms savybėms būdinga didelė įvairovė: kero žydėjimo trukmė tęsiasi 10–20 dienų; žydėjimo produktyvumas – 12–35 žiedai kere; žiedo dydis 14–20 cm, kerų aukštis – 70–114 cm; žiedų forma tuščiaavidurė ir pilnavidurė. Žydėjimo produktyvumas didėja su veislės amžiumi. 41,6% kero aukščio, žiedų skersmens ir žydėjimo produktyvumo kitimams darė įtaką genotipui. Vegetacijos metu aptikti ligų sukėlėjai (*Botrytis paeonia*, *Fusarium oxysporum*, *Septoria paeonia*) augalams didelės žalos nepadarė.

**Reikšminiai žodžiai:** lietuviškos veislės ir hibridai, morfologinės ir dekoratyvinės savybės, *Paeonia lactiflora* Pall.