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COMPARATIVE STUDY OF FLOWER MORPHOLOGY AND FLOWERING PHENOLOGY IN SOME *HEMEROCALLIS* HYBRIDS

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Abstract

The study effectuated during the period between 2014 and 2020 at seventeen Hemerocallis cultivars ('Arctic Snow', 'Aten', 'Black Prince', 'Bumble Bee', 'Campfire Embers', 'Cartwheels', 'Chicago Cardinal', 'Chicago Picotee Memories', 'Cologne Rocket', 'Custard Candy', 'El Desperado', 'Frans Halls', 'Mikado', 'Pandora's Box', 'Spits Beauty', 'Stella de Oro', 'Strawberry Candy') held in the collection of the University of Agricultural Sciences and Veterinary Medicine of Iasi had as purpose the analysis of some ornamental interest features, including of the flowers and of the phenology of the flowering. The results showed that from a morphometric point of view, the studied hybrids differ between them regarding the total size of the flowers and of the floral components. Also, the dimension, the colour and the form of the tepals differ in the cultivars, and also at the same cultivar (between the outer and the inner tepals). The flowering time at the Hemerocallis hybrids cultivated at Iasi was of approximately one month, except for the 'Arctic Snow' cultivar (approximately 3 weeks) and 'Stella de Oro' (7-8 weeks, through repeated prolonged flowering). The period in which most of the cultivars are blooming coincides with the month of July (with extensions in the last decade of June and the first decade of August).

Key words*: daylily, flower, morphometry, flowering, phenology.*

INTRODUCTION

Hemerocallis L. (daylilies) genus comprises about 20-30 species, native to Himalaya, East Europe, China, Japan and Korea (Toma, 2009; Chung and Kang, 1994; Lin et al., 2020). Other authors claims that the genus *Hemerocallis* consists of 14 wild species; 11 of them originated from China (Liu et al., 2017; Hsu et al., 2011). Numerous nomenclatural and taxonomic problems exist within the genus which have been attributed to the diverse factors (many species were described from cultivated plants of unknown origin, because the extreme differences in appearance between living plants and dried herbarium specimens, also many species of *Hemerocallis* are so variable ecologically and morphologically that a proper species concept requires morphological, ecological, and biosystematic studies (Chung and Kang, 1994; Kang and Chung, 2000). Placed in the Liliaceae family by Linnaeus (1753), recently, under Angiosperm Phylogeny Group IV (2016), it has been moved to the family Asphodelaceae. Many species and cultivars of the genus *Hemerocallis* are popular perennial plants, used along borders, wide edgings, or in mass plantings (https://plants.ces.ncsu.edu/plants/hemerocallis-hybrida/), widely grown in gardens in Asia, Europe and North America for their attractive flowers, ability to adapt to a wide range of soils and resistence to unfavourable conditions such as light or water deficiency climates (Yang et al., 2012; Chung and Kang, 1994; Kang and Chung, 2000; Podwyszyńska et al., 2015). As of May 2018, there are nearly 89.000 registered cultivars (https://daylilies.org).

Daylilies are perennials plants having short rhizomes, tuberous roots (globose, fusiform, or oblong) and basal, sessile, linear leaves. Flowers are large, hypogynous, of short duration (bloom for only a day) (Cantor et al., 2007; Chen and Noguchi, 2000). The floral coating is simple (perigon) petaloid, composed from 6 tepals disposed on two cycles. The base of the tepals is intergrown and it forms the perigonal tube, and at the upper part, over the perigonal tube, the tepal is free (perigonal lacinia, perigonal lobe). The androceum is made of 6 stamens shorter than the perigon, and the gynaeceum is made of an

inferiorly disposed ovary and an erect, thin style, longer than the stamens. At the base of the perigon lays the receptacle (with the superior ovary) and the short pedicel (Chen and Noguchi, 2000; Sîrbu and Paraschiv, 2005). Morphological characters of da flowers were performed for a taxonomic study of native species (Hwang and Kim, 2012; Chen and Noguchi, 2000; Krestova and Nesterova, 2013) or to re-evaluate the systematic position (Yan et al., 2017), biosystematic studies and evaluated phenotypic and genome size (Podwyszyńska et al., 2015; Kawano and Noguchi, 1975), evaluating how the tepal color, floral scent and floral morphology are selected by pollinators (Hirota et al., 2013) etc. Also, studies on the phenology of flowering in daylilies were performed in order to understand the circadian system that controls the closing and opening of flowers (Ren et al., 2019), the blooming and withering time in natural populations or taxonomical identity of native taxa (Hasegawa et al., 2006; Kawano and Noguchi, 1975), to classify floral fragrance (Jiao et al., 2016) etc. Similar studies have been performed on other perennial flowering species, such as *Gladiolus* (Cantor et al., 2007; Horţ et al., 2015), *Dahlia* (Ciobanu et al., 2017), *Iris* (Crișan et al., 2018), *Narcissus* (Cantor et al., 2013), *Paeonia* (Cazan et al., 2018).

The aim of this work is to study some characters of flowers and flowering phenology in the *Hemerocallis* cultivars under the cultivation conditions of north-eastern Romania (in Iasi).

MATERIALS AND METHODS

Seventeen daylilies cultivars ('Arctic Snow', 'Aten', 'Black Prince', 'Bumble Bee', 'Campfire Embers', 'Cartwheels', 'Chicago Cardinal', 'Chicago Picotee Memories', 'Cologne Rocket', 'Custard Candy', 'El Desperado', 'Frans Halls','Mikado', 'Pandora´s Box', 'Spits Beauty', 'Stella de Oro', 'Strawberry Candy') were used in this study and were field grown at the collection site of Faculty of Horticulture, University of Agricultural Sciences and Veterinary Medicine of Iasi, Romania (47°11′31″ N, 27°33′20″ E latitude, in temperate-continental climat with excessive nuances, chernozem cambic soil with sandy-loam texture and pH 7.8).

The investigations were carried in period 2014-2020. All plants were grown under the same management of fertilization, watering, soil and disease control.

Establishment of experimental cultures in the field was made during the autumn of the year 2013, with biologic material purchased from the company HEGEDE KFT (Hungary), sold as plants in pots. The experience included 17 variants (each cultivar representing a variant) distributed in randomized blocks with three repetitions (10 plants/repetition). The examination of the morphological characters and phenology was made on the plants from the collection. The qualitative characters studied were the colour of the flowers, the form of the tepals (depending on the proportion between length and width), the duration and the period of the flowering. The quantitative characters studied were: the length and width of the exterior and interior perigonal lobes, the diameter of the perigonal tube and its length (including the ovary). The results were compared to the average of the variants (considered control), and the interpretation was made using the analysis of the variance, with the LSD test (Saulescu and Saulescu, 1967).

The symbols used to indicate the significance of the differences from the control are: ns = non significant; o/x = negative/positive significant difference; oo/xx = negative/positive distinct significant difference; ooo/xxx = negative/ positive very significant difference.

RESULTS AND DISCUSSIONS

The daylilies hybrids from the experimental variants have flowers which are different in form, dimension, colour. In this paper, a series of quantitative (the dimensions of the perigon and the dimensions of the pedicel) and qualitative (the form and colour of the tepals, the period and the duration of the flowering) features of the flowers from the studied cultivars are analyzed.

From the components of the flower, the perigonal lobes (inner and outer), the perigonal tube and the pedicel were morphometrically.

At the level of the lobes the length and the width were determined, both for the outer and for the inner ones, taking into consideration the morphological differences of the two tepals categories. Also, the report between the length

and the width of the lobes was calculated, the obtained value being an indicator of their form.
The length of the outer lobes varied between 10 and 3.8 cm (Table 1). Although at this feature most of the cultivars had values over 8 cm, the average of the variants was 7.34 cm because of some cultivars with shorter tepals (‘Pandora´s Box’ with 3.8 cm, ‘Bumble Bee’ and ‘Stella de Oro’ with 4.6 cm, ‘Custard Candy’ with 6.4 cm and ‘Strawberry Candy’ with 6.5 cm), which situated under the threshold with 11.5% up to 48.4%. The differences from the threshold were non significant at the cultivars with the length of the outer lobes of 7.2-7.8 cm (‘Black Prince’, ‘El Desperado’, ‘Frans Halls’, ‘Spits Beauty’).
The width of the outer perigonal lobes (Table 1) also represented a variety feature. The dimension varied between 1.3 cm (the variants V_{14} – ‘Pandora´s Box’ and V_{16} – ‘Stella de Oro’) and 3.3 cm (V_1 – ‘Arctic Snow’). The cultivar which registered the maximum values was the only one which fitted, statistically, in the category of very significant positive differences from the threshold, while, at the opposite pole, with very significant negative differences were the two cultivars with the narrowest tepals (‘Pandora´s Box’ and ‘Stella de Oro’). Seven cultivars came close to the average of the variants (2.39 cm) and the differences were non significant. With statistically ensured differences in a positive way were ‘Chicago Picotee Memories’, ‘Custard Candy’, ‘El Desperado’ and ‘Spits Beauty’, and in a negative way were ‘Black Prince’, ‘Bumble Bee’, ‘Frans Halls’, ‘Pandora´s Box’ and ‘Stella de Oro’.

Table 1. Dimensions of the outer perigonal lobes

Variants (cultivars)	Length			Width		
	Average (cm)	Relative values (%)	Difference (±cm)/ Significance	Average (cm)	Relative values (%)	Difference (±cm)/ Significance
V_1 - ‘Arctic Snow’	8.0	108.97	0.7^{xx}	3.3	138.18	0.9^{xxx}
V_2 - ‘Aten’	8.0	108.97	0.7^{xx}	2.3	96.31	-0.1^{ns}
V_3 - ‘Black Prince’	7.6	103.53	0.3^{ns}	1.7	71.18	-0.7^{00}
V_4 - ‘Bumble Bee’	4.6	62.66	-2.7^{000}	1.8	75.37	-0.6^{0}
V_5 - ‘Campfire Embers’	10.0	136.22	2.7^{xxx}	2.6	108.87	0.2^{ns}
V_6 - ‘Cartwheels’	8.9	121.23	1.6^{xxx}	2.8	117.24	0.4^{ns}
V_7 - ‘Chicago Cardinal’	8.7	118.51	1.4^{xxx}	2.7	113.05	0.3^{ns}
V_8 - ‘Chicago Picotee’	8.5	115.79	1.2^{xxx}	2.9	121.43	0.5^{x}
V_9 - ‘Cologne Rocket’	8.5	115.79	1.2^{xxx}	2.2	92.12	-0.2^{ns}
V_{10} - ‘Custard Candy’	6.4	87.18	-0.9^{000}	3.2	133.99	0.8^{xx}
V_{11} - ‘El Desperado’	7.8	106.25	0.5^{x}	3.0	125.62	0.6^{x}
V_{12} - ‘Frans Halls’	7.2	98.08	-0.1^{ns}	1.9	79.56	-0.5^{0}
V_{13} - ‘Mikado’	8.2	111.70	0.9^{xxx}	2.0	83.74	-0.4^{ns}
V_{14} - ‘Pandora´s Box’	3.8	51.76	-3.5^{000}	1.3	54.43	-1.1^{000}
V_{15} - ‘Spits Beauty’	7.5	102.16	0.2^{ns}	3.0	125.62	0.6^{x}
V_{16} - ‘Stella de Oro’	4.6	62.66	-2.7^{000}	1.3	54.43	-1.1^{000}
V_{17} - ‘Strawberry Candy’	6.5	88.54	-0.8^{00}	2.6	108.87	0.2^{ns}
Average (control)	***7.34***	***100.0***	***0***	***2.39***	***100.0***	***0***
$LSD_{5\%}$ = 0.5 cm $LSD_{1\%}$ = 0.6 cm $LSD_{0.1\%}$ = 0.9 cm		$LSD_{5\%}$ = 0.4 cm $LSD_{1\%}$ = 0.6 cm $LSD_{0.1\%}$ = 0.8 cm				

The report between the length and the width of the lobes gives clues referring to their form. At the outer tepals, the more elongated forms (the big values of the report between length and width) are in cultivars ‘Black Prince’, ‘Mikado’, ‘Cologne Rocket’, ‘Campfire Embers’, ‘Frans Halls’, ‘Aten’, ‘Stella de Oro’, ‘Cartwheels’, ‘Chicago Cardinal’, and more rounded forms in ‘Custard Candy’, ‘Arctic Snow’, ‘Spits Beauty’, ‘Strawberry Candy’, ‘Bumble Bee’, ‘El Desperado’ (Figure 1).

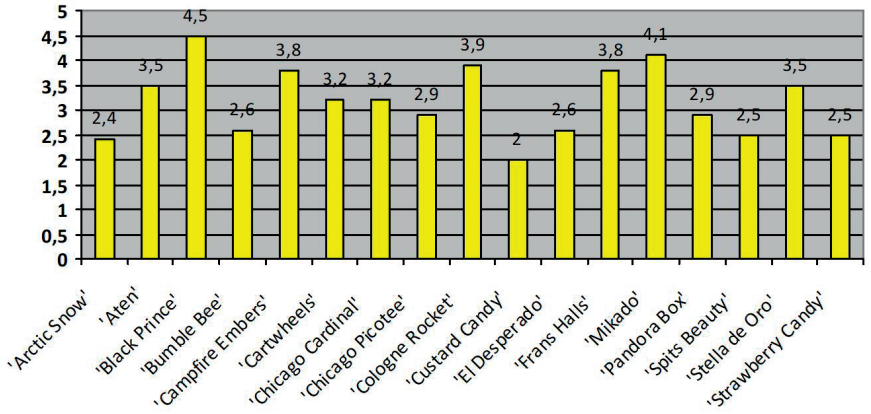


Figure 1. Ratio between the length/width of the outer lobes

Similar determinations were also made at the inner perigonal lobes, respectively their length and width. The length of the inner perigonal lobes (Table 2) situated at an average of the variants of 7.51 cm.

From the point of view of the differences from the control, the significances are similar to those from the outer lobes, except for the cultivar 'Black Prince' (with significant differences at the length of the outer tepals, but very significantly positive at the length of the inner tepals) and at the cultivar 'Mikado' (with non significant differences at the length of the inner tepals, but very significantly positive at the length of the outer tepals).

Table 2. Dimensions of the inner perigonal lobes

Variants (cultivars)	Length			Width		
	Average (cm)	Relative values (%)	Difference (±cm)/ Significance	Average (cm)	Relative values (%)	Difference (±cm)/ Significance
V_1 - 'Arctic Snow'	8.2	109.16	0.7^{xx}	5.0	131.99	1.2^{xxx}
V_2 - 'Aten'	8.3	110.49	0.8^{xx}	3.3	87.11	$-0,5^{0}$
V_3 - 'Black Prince'	8.4	111.82	0.9^{xxx}	2.7	71.27	$-1,1^{000}$
V_4 - 'Bumble Bee'	4.9	65.23	-2.6^{000}	3.1	81.83	$-0,7^{000}$
V_5 - 'Campfire Embers'	10.3	137.12	2.8^{xxx}	3.6	95.03	$-0,2^{ns}$
V_6 - 'Cartwheels'	8.9	118.48	1.4^{xxx}	4.1	108.23	0.3^{ns}
V_7 - 'Chicago Cardinal'	9.3	123.81	1.8^{xxx}	4.2	110.87	0.4^{x}
V_8 - 'Chicago Picotee Mem'	8.7	115.82	1.2^{xxx}	5.1	134.63	1.3^{xxx}
V_9 - 'Cologne Rocket'	8.6	114.49	1.1^{xxx}	3.5	92.39	-0.3^{ns}
V_{10} - 'Custard Candy'	6.2	82.54	-1.3^{000}	4.7	124.07	0.9^{xxx}
V_{11} - 'El Desperado'	8.0	106.50	0.5^{x}	4.9	129.35	1.1^{xxx}
V_{12} - 'Frans Halls'	7.3	97.18	-0.2^{ns}	3.1	81.83	-0.7^{000}
V_{13} - 'Mikado'	7.8	103.84	0.3^{ns}	3.3	87.11	-0.5^{0}
V_{14} - 'Pandora´s Box'	4.0	53.25	-3.5^{000}	1.8	47.52	-2.0^{000}
V_{15} - 'Spits Beauty'	7.5	99.84	0.0^{ns}	4.7	124.07	0.9^{xxx}
V_{16} - 'Stella de Oro'	4.6	61.24	-2.9^{000}	3.1	81.83	-0.7^{000}
V_{17} - 'Strawberry Candy'	6.7	89.19	-0.8^{00}	4.2	110.87	0.4^{x}
Average (control)	***7.51***	***100.0***	***0***	***3.79***	***100.0***	***0***

$LSD_{5\%}$ = 0.5 cm
$LSD_{1\%}$ = 0.6 cm
$LSD_{0,1\%}$ = 0.8 cm

$LSD_{5\%}$ = 0.4 cm
$LSD_{1\%}$ = 0.5 cm
$LSD_{0.1\%}$ = 0.7 cm

The width of the inner perigonal lobes is a feature with pretty big fluctuations at the analyzed cultivars (Table 2). The average value of the variants was 3.79 cm, with variations from 1.8 cm (‘Pandora´s Box’) up to 5.1 cm (‘Chicago Picotee Memories’). Wider lobes, with higher values than 4.7 cm and with very significantly positive differences had the variants V_8 – ‘Chicago Picotee Memories’, V_1 – ‘Arctic Snow’, V_{11} – ‘El Desperado’, V_{10} – ‘Custard Candy’ and V_{15} – ‘Spits Beauty’. With the narrowest inner lobes (under 3.1 cm) were the variants V_3 – ‘Black Prince’, V_4 – ‘Bumble Bee’, V_{12} – ‘Frans Halls’, V_{14} – ‘Pandora´s Box’, V_{16} – ‘Stella de Oro’.

At the inner tepals, the report between the length and the width had values higher than 2 in ‘Black Prince’, ‘Campfire Embers’, ‘Aten’, ‘Cologne Rocket’, “Mikado’, ‘Frans Halls’, ‘Cartwheels’, ‘Chicago Cardinal’, and a smaller report at ‘Custard Candy’, ‘Stella de Oro’, ‘Bumble Bee’, ‘El Desperado’, ‘Arctic Snow’, ‘Spits Beauty’, ‘Strawberry Candy’ (Figure 2).

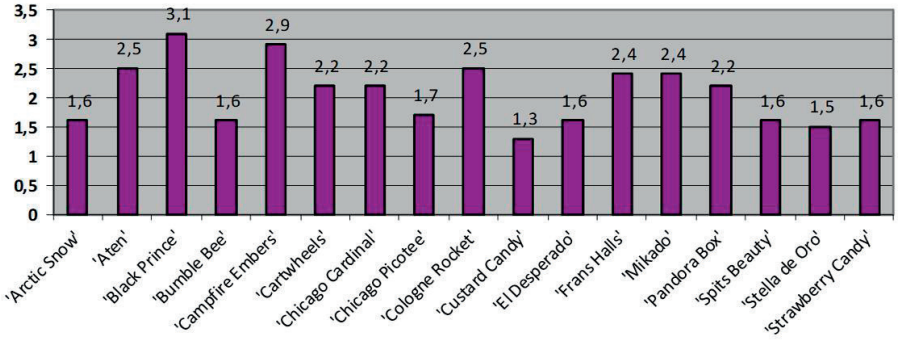


Figure 2. Ratio between the length/width of the inner lobes

The perigonal tube is another floral element which completes the morphology of the flower at daylilies, through two more important features, the length and the diameter. At the determination of the length of the perigonal tube was also included the portion occupied by the ovary.

The length of the perigonal tube was remarked with bigger differences than the average of the variants (2.18 cm) at some of the varieties (Table 3). Thus, ‘Aten’ and ‘Black Prince’ exceeded the control with 55.8%, respectively 32.9%, and ‘Campfire Embers’ with 19.1%. But, ‘Bumble Bee’, ‘Pandora´s Box’ and ‘Stella de Oro’ situated under the value of the control with 22.1-35.8%. The other 11 variants had values of the analyzed feature around the average and with non significant differences.

The diameter of the perigonal tube (expressed in millimetres, due to its reduced dimensions) registered an average of the variants of 5.6 mm, the maximum values being at the cultivar ‘Chicago Picotee’ (7.8 mm), and the minimum ones at ‘Pandora´s Box’ (3.8 mm). The cultivars ‘Arctic Snow’, ‘Custard Candy’, ‘Chicago Cardinal’, ‘Cologne Rocket’, ‘Chicago Picotee Memories’ and ‘El Desperado’ got remarked through a thicker perigonal tube, with the diameter between 6.7 and 7.8 mm, while, in the case of the cultivars ‘Black Prince’, ‘Bumble Bee’, ‘Frans Halls’, ‘Stella de Oro’, ‘Mikado’ and ‘Pandora´s Box’, the perigonal tube was thin, with a diameter of 3.8-4.2 mm (Table 3).

From the biometric evaluation of the floral elements, we can calculate the total (maximum) length of the perigon, as the sum of the maximum length of the lobes and the length of the perigonal tube (including the ovary).

In Figure 3 these results are presented graphically, and it shows the fact that the longest flowers are at ‘Campfire Embers’ (12.9 cm). With big values of the length of the flowers, over 10 cm, are also the cultivars ‘Arctic Snow’, ‘Aten’, ‘Black Prince’, ‘Cartwheels’, ‘Chicago Cardinal’, ‘Chicago Picotee Mem.’, ‘Cologne Rocket’, ‘El Desperado’, ‘Mikado’. The flowers with a short perigon (5.4-6.6 cm) are those from ‘Bumble Bee’, ‘Pandora´s Box’ and ‘Stella de Oro’.

Table 3. Dimensions of the perigonal tube

Variants (cultivars)	Length			Diameter		
	Average (cm)	Relative values (%)	Difference (±cm)/ Significance	Average (mm)	Relative values (%)	Difference (±mm)/ Significance
V_1 - 'Arctic Snow'	2.2	100.81	0.0^{ns}	6.7	119.64	0.1^{xxx}
V_2 - 'Aten'	3.4	155.80	1.2^{xxx}	5.3	94.44	-0.3^{ns}
V_3 - 'Black Prince'	2.9	132.88	0.7^{xxx}	3.9	69.64	-1.7^{000}
V_4 - 'Bumble Bee'	1.7	77.90	-0.5^{000}	4.1	73.21	-1.5^{000}
V_5 - 'Campfire Embers'	2.6	119.14	0.4^{xx}	5.7	101.79	0.1^{ns}
V_6 - 'Cartwheels'	2.3	105.39	0.1^{ns}	5.6	100.00	0.0^{ns}
V_7 - 'Chicago Cardinal'	2.1	96.23	-0.1^{ns}	7.4	132.14	1.8^{xxx}
V_8 - 'Chicago Picotee Mem.'	2.3	105.39	0.1^{ns}	7.8	139.29	2.2^{xxx}
V_9 - 'Cologne Rocket'	2.0	91.64	-0.2^{ns}	7.4	132.14	1.8^{xxx}
V_{10} - 'Custard Candy'	2.0	91.64	-0.2^{ns}	6,7	119,64	1.1^{xxx}
V_{11} - 'El Desperado'	2.0	91.64	-0.2^{ns}	7.1	126.79	1.5^{xxx}
V_{12} - 'Frans Halls'	2.1	96.23	-0.1^{ns}	4.2	75.00	-1.4^{000}
V_{13} - 'Mikado'	2.0	91.64	-0.2^{ns}	4.0	71.43	-1.6^{000}
V_{14} - 'Pandora´s Box'	1.4	64.15	-0.8^{000}	3.8	67.86	-1.8^{000}
V_{15} - 'Spits Beauty'	2.4	109.97	0.2^{ns}	5.8	103.57	0.2^{ns}
V_{16} - 'Stella de Oro'	1.5	68.73	-0.7^{000}	4.2	75.00	-1.4^{000}
V_{17} - 'Strawberry Candy'	2.2	100.81	0.0^{ns}	6.0	107.14	0.4^{ns}
Average (control)	***2.18***	***100.0***	***0***	***5.6***	***100.0***	***0***

$LSD_{5\%}$ = 0.3 cm
$LSD_{1\%}$ = 0.3 cm
$LSD_{0,1\%}$ = 0.5 cm

$LSD_{5\%}$ = 0.5 mm
$LSD_{1\%}$ = 0.7 mm
$LSD_{0.1\%}$ = 1.0 mm

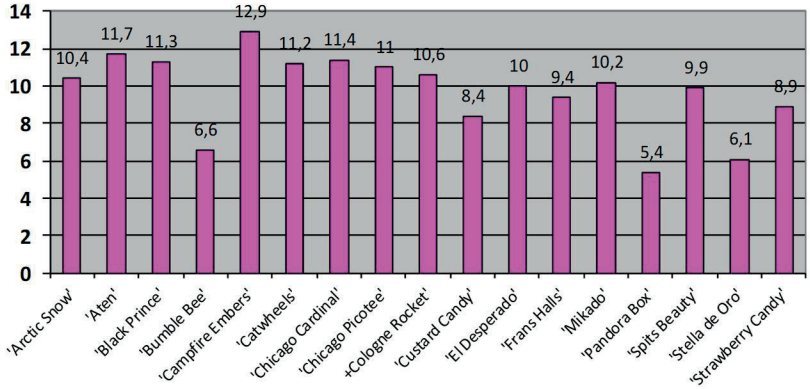
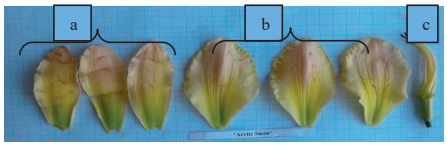
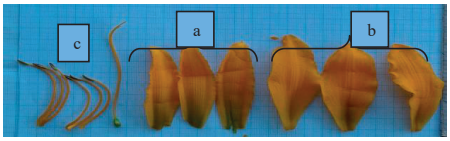


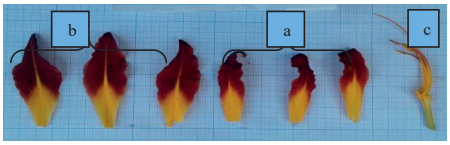
Figure 3. Total length of the perigon (cm)



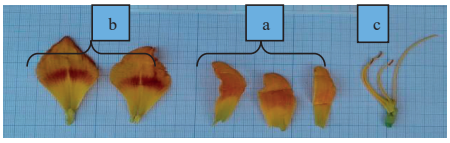
‘Arctic Snow’



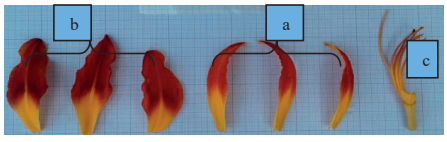
‘Aten’



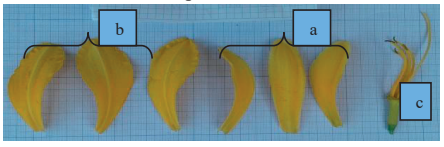
‘Black Prince’



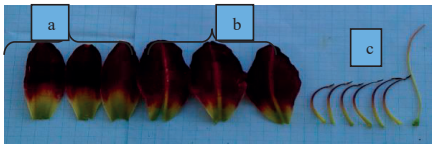
‘Bumble Bee’



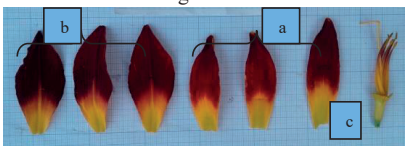
‘Campfire Embers’



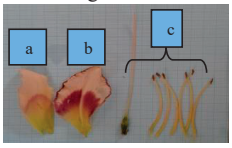
‘Cartwheels’



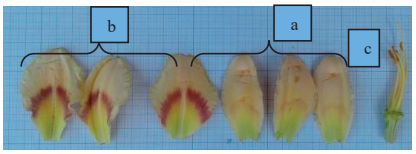
‘Chicago Cardinal’



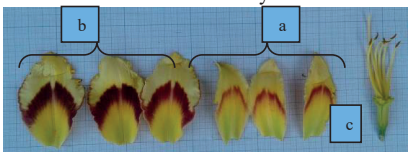
‘Cologne Rocket’



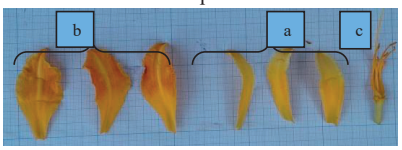
‘Chicago Picotee Memories’



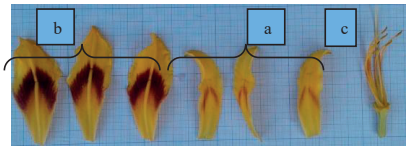
‘Custard Candy’



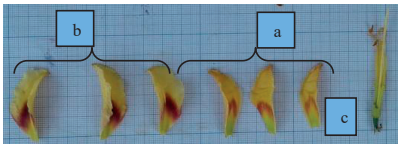
‘El Desperado’



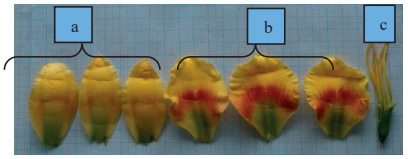
‘Frans Halls’



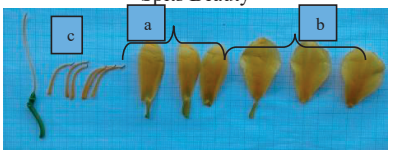
‘Mikado’



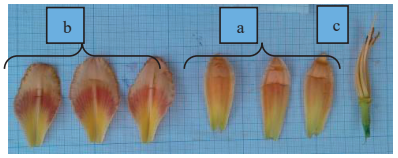
‘Pandora´s Box’



‘Spits Beauty’



‘Stella de Oro’



‘Strawberry Candy’

Figure 4. Components of the flowers in daylilies cultivars (original photo): a) outer perigonal lobes; b) inner perigonal lobes; c) stamens, pistil, perigonal tube, pedicel

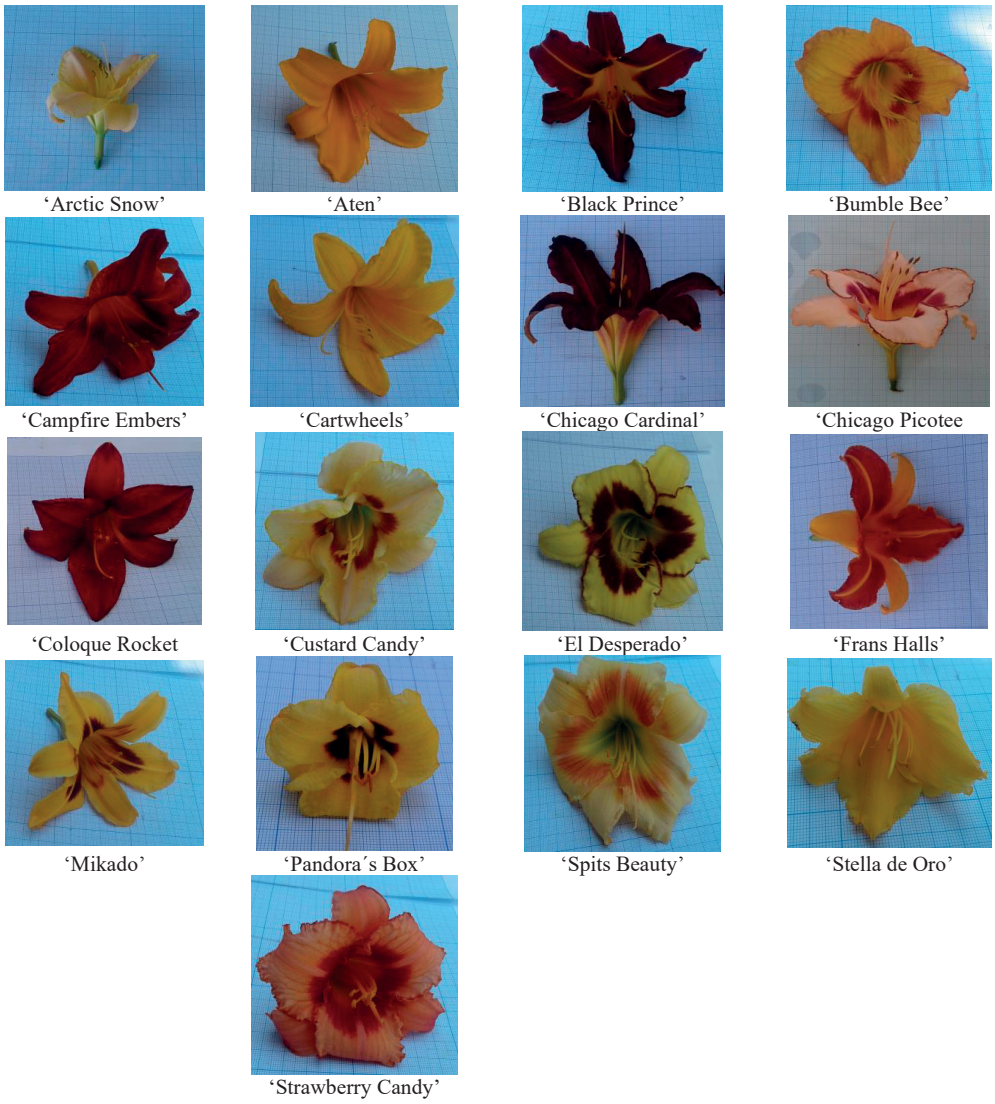


Figure 5. Aspect of the flowers in daylilies cultivars

The daylilies hybrids present a remarkable range of colours, the only colours which are not present being the pure white and the blue. The tepals can be in one colour, two colours (the outer tepals differently coloured from the inner ones) or they may present variations given by the colour of the “neck” of the flower’s cup, and also by the patch from the central area of the tepals, which compose a ring in close or powerfully different shades from the main colour of the tepals (Figure 5). Depending on the colour of the tepals, the analyzed cultivars can be grouped as follows:

- tepals in approximately one colour or with variations very close to the basic colour: ‘Arctic Snow’ (cream-coloured or light yellow tepals, eventually with a slightly green neck); ‘Aten’ (yellow-orange tepals), ‘Stella de Oro’ (powerful bright yellow tepals);
- tepals without patch, but with the neck of the cup in contrasting colours: ‘Black Prince’ (red-purple tepals, with black reflexes and a yellow-golden neck), ‘Campfire Ember’ (red-scarlet or red-orange tepals with a yellow-golden neck), ‘Chicago Cardinal’ (bright red tepals and yellow-

green neck), 'Cologne Rocket' (red tepals and yellow golden neck of the flower);
- tepals with patch to the median area, where they form a contrasting ring: 'Bumble Bee' (yellow-golden tepals, with a contrasting red-brown or brown ring), 'Chicago Picotee Memories' (cream- tepals with violet patch), 'Custard Candy' (bright yellow tepals with a brownish ring), 'El Desperado' (yellow-butter tepals, with an obvious violet or purple ring), 'Mikado' (yellow tepals and a red-brick center of the cup), 'Pandora´s Box' (yellow-cream to ivory tepals, with a purple ring), 'Spits Beauty' (yellow tepals, with a pink-red ring), 'Strawberry Candy' (pink to pink-salmon tepals, with red ring);
- bicolored tepals (different colours of the outer and inner tepals): 'Frans Halls' (golden outer tepals, red-orange inner tepals).

The decor duration of the ornamental plants represents one of the major interest features concerning their use. From this point of view, the most appreciated are the plants which have the capacity to decorate for a longer period of time, regardless the way in which the decor is provided. It is well known that the plants with flowers may decorate through flowers, leaves, flowers and leaves, fruits, aspect, etc. The daylilies species and cultivars are known as plants which decorate both through the flowers arranged in composed inflorescences, and also through the linear leaves, slightly bent, elegant, which ensure the maintenance of a beautiful aspect of the bushes since early spring until late in the autumn, when the coldness comes. The decorative effect provided not only by the flowers, but also by the leaves, represent an advantage for the daylily, if we take into account that the flowering period is of approximately one month (in June-August); during the rest of the vegetation period, since early spring until autumn, the leaves are the ones that remain as the ornamental element.

Although the meteorological conditions from the analyzed period (especially the spring and summer beginning temperatures) registered differences from one year to another, the main phenophases of the daylilies varieties fitted in quite close intervals, with very little variations, from one year to another. In the years 2014-2020, the averages of the temperatures from March, when the summer daylilies start in vegetation, are, in most cases, over the multi-annual average (3.9^0C), with values between 1.9 and 7.2^0C (the biggest difference being registered in 2020, when the average temperature of March was 11.1^0C). Only in 2018 the average temperature of March was under the multi-annual average (with 2.8^0C). Also, April has the same tendency of exceeding the multi-annual temperature which characterizes the conditions from Iasi (10.5^0C), but with smaller differences (0.2-4.8^0C). The months of April from 2015 and 2017 were colder. Regarding the precipitations form March and April, in March were quantities of precipitations which exceeded the multi-annual only in 2015, 2017 and 2018, in other years the weather was drier. The biggest deficit was registered in 2019, with only 8.1 mm as opposed to 30.9 mm the multi-annual average. April was more dry, especially during the last three years, when the precipitations had a total of 6.4 mm in 2018, 6.9 mm in 2019 and 1.8 mm in 2020, as opposed to the multi-annual of 46.1 mm. With all these thermal and precipitations fluctuations, the phenology of daylilies took place within close limits, without major deviations. Thus, during the seven years of study, the start in vegetation at all the varieties took place in the interval 15-20 of March.

Differences between the varieties appear at the other phenophases, but at the same variety the starting of the phenophases fits within the limits of a maximum of one week. The periods in which the floral buds rods appear may be grouped as follows:
- 22-28 March - for the varieties 'Stella de Oro', 'Chicago Picotee Mem.';
- 5-10 June - for the varieties 'Campfire Embers', 'Custard Candy', 'Pandora´s Box', 'Spits Beauty', 'Strawberry Candy';
- 10-15 June - for the varieties 'Cartwheels', 'Chicago Cardinal';
- 12-18 June - for the varieties 'Bumble Bee', 'Cologne Rocket', 'Mikado';
- 16-20 June - for the varieties 'Arctic Snow', 'Black Prince', 'El Desperado';
- 20-25 June - for the varieties 'Aten', 'Frans Halls'.

One of the most important phenophases from an ornamental point of view is represented by the flowering. The start of the flowering defines the varieties as being early-flowering or late-flowering. At the analyzed varieties, the period of flowering lasted since the beginning of June until

the beginning of July. The most early-flowering was 'Stella de Oro', with a flowering from the first decade of June (1-10 of June), sometimes even from the last part of May, followed at approximately one week by 'Chicago Picotee Memories', varieties from the first group depending on the period of formation of the floral buds rods. During the period 20-27 of June, more cultivars start their flowering, namely the ones from the second group: 'Campfire Embers', 'Custard Candy', 'Pandora´s Box', 'Spits Beauty', 'Strawberry Candy'. Starting with 23-25 of June 'Bumble Bee', 'Cologne Rocket' and 'Mikado' start their flowering, and after the 1st of July, the rest of the varieties ('Arctic Snow', 'Black Prince', 'El Desperado', 'Aten', 'Frans Halls').

The flowering ended during the interval form the half of July until the first decade of August.

The cultivar 'Chicago Picotee Memories', one of the varieties with early flowering, is the first to end its flowering, around the 12th-15th of July. The cultivar 'Stella de Oro' which, although it fits in the first group of flowering, after the first wave of flowering keeps on flowering until after the 1st of August (but with a reduced number of flowers). With an abundant flowering until the first decade of August were observed the varieties 'Aten', 'Frans Halls', 'Chicago Cardinal', 'Black Prince', 'El Desperado'.

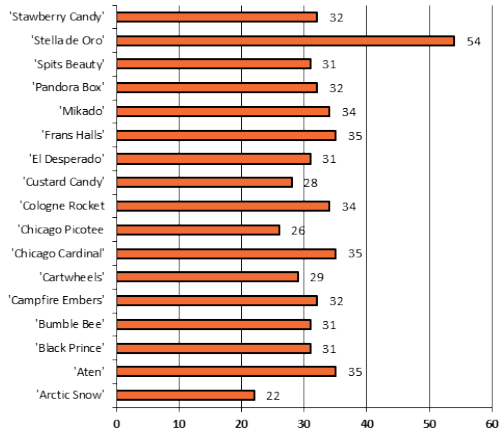


Figure 6. Flowering time of daylilies cultivars

The average of flowering time, respectively since the opening of the first flowers and until the complete fading of the last flowers varied between 22 and 54 days (Figure 6). But if we consider that 'Stella de Oro' registers 54 days of flowering through the extension with the second stage, generally weaker, we may notice that the common duration for the 17 varieties does not exceed 34-35 days. The shortest flowering period (22 days) was that of 'Arctic Snow'; a flowering duration of up to 30 days had 'Cartwheels', 'Chicago Picotee Mem.' and 'Custard Candy'. The longest flowering duration was that of 'Aten', 'Chicago Cardinal', 'Frans Halls'. The period in which most of the cultivars are flowered coincides with the month of July, with extensions in the last decade of June and the first decade of August. Also, as it was mentioned, the longest period of the vegetation season the plants decorate through their leaves.

CONCLUSIONS

At all the analyzed hybrids differences between the dimensions of the interior and the exterior lobes were noticed. The biggest differences were regarding the width, the exterior lobes being always wider than the interior ones (1.4-1.8 times, and at 'Stella de Oro' 2.4 times). The length registered smaller differences (0.2-0.8 cm), and in three cases (the cultivars 'Cartwheels', 'Spits Beauty' and 'Stella de Oro') the interior and the exterior lobes had the same length.

The total length of the perigon varied between 5.4 cm ('Pandora´s Box') and 12.9 cm ('Campfire Embers').

The exterior lobes fitted, at most of the cultivars, in spear-shaped or spear-shaped-elongated forms, with the proportion length/width over 3-4. More rounded (ovate) forms, with values of the proportion length/width 2-2.6 were registered at 'Custard Candy', 'Arctic Snow', 'Spits Beauty', 'Strawberry Candy', 'Bumble Bee', 'El Desperado'. The form of the interior lobes was more similar to the ovate one, the proportion between length and width being from 1.3 to 2.5 (except for the 'Black Prince' and 'Campfire Embers' cultivars with 3.1, respectively 2.9).

Bigger differences in colour between the interior and the exterior tepals were noticed, generally, at the cultivars with two coloured cultivars ('Frans Halls') and at those characterized through the presence of the median patch, more intensely coloured at the

interior ones (‘Bumble Bee’, ‘Chicago Picotee Memories’, ‘Custard Candy’, ‘El Desperado’, ‘Mikado’, ‘Pandora´s Box’, ‘Spits Beauty’, ‘Strawberry Candy’).

The flowering time at the daylilies hybrids was of approximately one month, shorter (approx. three weeks) at the ‘Arctic Snow’ cultivar. At ‘Stella de Oro’ cultivar, although approximately 7-8 weeks were registered until the last flowers faded (due to the repeated flowering), the quality of the flowering in the second part of the interval was much diminished.

The period in which most of the cultivars were blooming coincides with the month of July (with extensions in the last decade of June and the first decade of August).

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