

ORNAMENTAL CHARACTERISATION OF SOME *HEMEROCALLIS* L. CULTIVARS

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Abstract

The genus *Hemerocallis* L. (Asphodelaceae) is native to temperate and sub-tropical Asia, especially in China, Korea and Japan. The *Hemerocallis* plants (daylilies) are herbaceous perennials that are used as ornamentals in worldwide for their attractive flowers. Originally, the only colours of flowers were yellow, orange and orange-red, but now, diversity is very high (white, pastel, pink, crimson, purple etc.). In this study are presented the ornamental characters (the length of scape, the number of flowers and numbers of branches per scape, flowers diameter, length of tepals, flowers color, the flowering period etc.) of the ten *Hemerocallis* cultivars ('Aten', 'Black Prince', 'Bumble Bee', 'Cartwheels', 'Chicago Cardinal', 'Mikado', 'Pandora's Box', 'Raspberry Candy', 'Spits Beauty', 'Stella de Oro') in conditions of Iași county (Northeast Romania). 'Chicago Cardinal', 'Cartwheels' and 'Aten' were remarked by scapes higher than 70 cm, 'Pandora's Box', 'Raspberry Candy', 'Spits Beauty' with scapes of 40-50 cm, and 'Stella de Oro' by short floral stems (20-30 cm); the number of flowers per scape ranged from 5 to 17 (maximum in 'Cartwheels' and 'Chicago Cardinal', minimum in 'Stella de Oro'); large flowers, more than 10-11 cm in diameter, can be seen in 'Aten', 'Black Prince', 'Mikado', 'Spits Beauty' and smaller flowers (6.5 cm) in 'Stella de Oro' cultivar.

Key words: *Hemerocallis*, morphology, ornamental characters, cultivars.

INTRODUCTION

Hemerocallis L. is a genus of about 15 species of herbaceous perennials, commonly known as daylilies. Originally, the genus *Hemerocallis* was placed in the Liliaceae family (by Linnaeus, 1753). According to other phylogenetic studies, *Hemerocallis* was placed in Hemerocallidaceae, then in Xanthorrhoeaceae.

More recently, under APG IV (Angiosperm Phylogeny Group IV, 2016), it has been moved to the family Asphodelaceae, which is substituting for Xanthorrhoeaceae (Chase et al., 2009; Rodriguez-Enriquez & Grant-Downton, 2012; Yan et al., 2017; McLay & Bayly, 2016; American Daylily Society).

Plants of *Hemerocallis* are distributed in East Asia (temperate and sub-tropical Asia), but the main diversity of the genus centred on China, Korea and Japan (Rodriguez-Enriquez & Grant-Downton, 2012; Manole, 2018). In general, the members of the genus are normally found in mountainous and grassland habitats, but some species grow in other habitats (Chung

& Kang, 1994, cited by Rodriguez-Enriquez & Grant-Downton, 2012).

Morphologically, the members of the genus *Hemerocallis* have long and linear leaves, strap-like, bright-green, distichously arranged, arising from a perennial, fleshy rhizome at or just below ground level. The rhizome produces fleshy roots, often forming highly thickened tuberous reserve structures. The large flowers are very spectacular and are borne on short pedicels, in erect inflorescences (Rodriguez-Enriquez & Grant-Downton, 2012). Flowers are typically, with six tepals forming a funnel-shaped perianth. There are hundreds of varieties with a large variety of colors (yellow, orange, orange-red, white, pastel, pink, crimson, purple, many blends etc.). One feature of this genus is the short duration of the blooms, typically only a day. However, the multiple buds on the terminal inflorescence create another flower. Daylilies are extremely adaptable perennials (to a wide range of soil and climates) and they are easy to grow (Li et al., 2009).

They are important medicinal, edible and ornamental plants (Yan et al., 2017). Daylilies

are beneficial for health and has been used for the treatment of a variety of diseases including inflammation, depression, insomnia, antifebrile, hemorrhoids, diuretic etc. (Yang et al., 2003; Zhao et al., 2017; Zhao et al., 2018). Also, daylilies are utilized as an important vegetables or condiments in traditional Asian cuisine (Cichewicz & Nair, 2002; Liu et al., 2018). As ornamental plants, daylilies are well-suited to many different uses in the garden and landscape: borders, mass over large areas or in clumps; dwarf cultivars are ideal for rock gardens or for container; can prevent soil erosion if planted in slopes. Some varieties produce many flower buds and stay in bloom for a longer period. If numerous varieties are grown together, it is possible to have an elegant and striking display of daylily flowers from May right through to October. Daylilies are not commonly used as cut flowers, yet they make good cut flowers otherwise as new flowers continue to open on cut stems over several days.

This paper present an analysis of the ornamental characters of some *Hemerocallis* cultivars, growing in conditions of the North East region of Romania (Iasi city).

MATERIALS AND METHODS

The present research was conducted on Floriculture collection of University of Agricultural Sciences and Veterinary Medicine Iași (North East of Romania), during 2017 and 2018. Ten daylily varieties ('Aten', 'Black Prince', 'Bumble Bee', 'Cartwheels', 'Chicago Cardinal', 'Mikado', 'Pandora's Box', 'Raspberry Candy', 'Spits Beauty', 'Stella de Oro') were used as plant material.

'Aten', a diploid cultivar obtained in 1951. Colour of tepals is light orange (Figure 1a).

'Black Prince' is a diploid cultivar (1942), dark red flowers, with gold throats (Figure 1b).

'Bumble Bee', diploid obtained in 1964; golden yellow flowers, with a rich chocolate-red throats (Figure 1c).

'Cartwheels', diploid (1956), golden-yellow flowers (Figure 1d).

'Chicago Cardinal', a red tetraploid (1972), with yellow-green center (Figure 1e).

'Mikado' is a diploid obtained in 1929. The flowers are yellow with purplish red blotch in the middle of each tepal (Figure 1f).

'Pandora's Box', diploid (1980), fragrant flowers, cream with a contrasting cranberry-purple eye and emerald green throat (Figure 1g).

'Raspberry Candy', tetraploid (1992), fragrant flowers, cream with raspberry red eye above green throat (Figure 1h).

'Spits Beauty', tetraploid cultivars, was introduced in Europe in 1994; yellow flowers with an orange eye zone and yellow throat (Figure 1i).

'Stella de Oro', diploid (1975), flowers fragrant, canary yellow with very small green throat (Figure 1j).

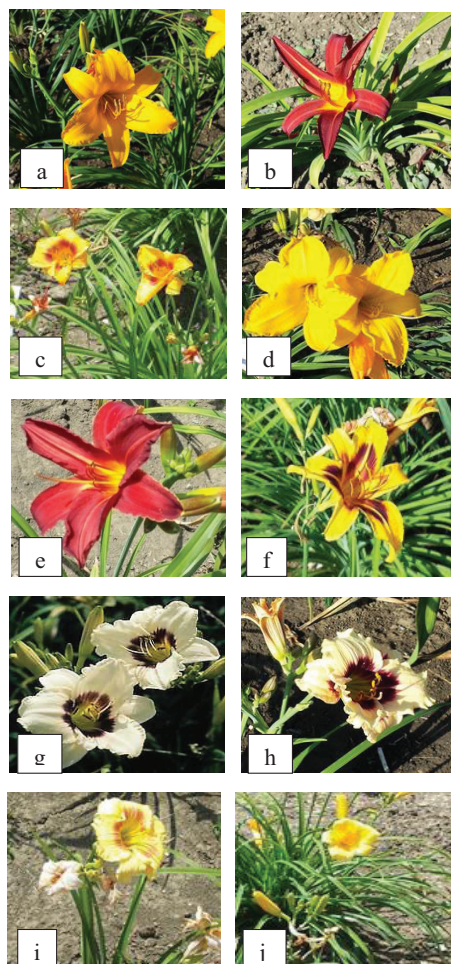
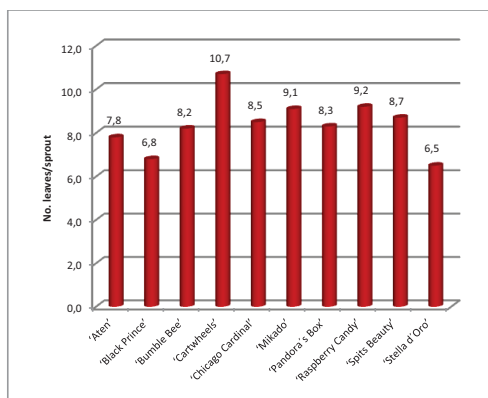


Figure 1(a-j). Plant material (*Hemerocallis* cultivars)

The experimental plot is located at 47°11'31" N and 27°33'20" E latitude, in temperate-continental climate with excessive nuances, characterized by multi-year average temperatures of 9.6°C, with average temperatures of -3.6°C in January, and 21.3°C in July.

Table 1 shows data on the length and width of the leaves. The length varies between 36.5 - 68.5cm, the average of the experience in the 10 cultivars being 50.8 cm. 'Chicago Cardinal' and 'Mikado' are cultivars that have an average leaf length over 60 cm, exceeding the average of the experience with approx. 35%, respectively 23% (very significant positive differences). Also with very significant positive differences are 'Cartwheels' (57.6 cm) and 'Black Prince' (56.5 cm). The lower limit of leaf length is recorded in 'Stella de Oro' (36.5 cm), followed by 'Pandora's Box' (38.3 cm), 'Raspberry Candy' (42.5 cm) and 'Spits Beauty' (43.5 cm), the differences from the control (average) being very significant negative.

The number of leaves formed on each sprout (Figure 2) was, in most cases, approx. 7-9. Cultivars that came out of this range had either a lower number of leaves (5-7 leaves per sprout, with a mean under 7), as is the case of 'Stella de Oro' and 'Black Prince', or a higher number (9-11 leaves per sprout, with an average over 9), as 'Cartwheels', 'Raspberry Candy'.



The length of the scape is one of the characters that contributes essentially to plant fitting, depending on the size, in different types of landscaping, and to the possibility of using them as cut flowers. All phenotypic and

The degree of branching at scape ranged from 2 to 4.8 (Table 2). To a large extent, the character correlated positively with the number of flowers per scape (Table 3). Thus, in cultivars with a large number of main branches, such as 'Cartwheels' (4.8 branches per scape) or 'Chicago Cardinal' (3.6 branches per scape), the differences from the mean are very significant positive for both number of branches and flowers per scape.

Variants (cultivars)	Length of scape			Number of branches/scape		
	Average (cm)	Relative values (%)	Difference (±cm)/ Significance	Average (no.)	Relative values (%)	Difference (±no.)/ Significance
V ₁ - 'Aten'	70.5	124.56	+13.9 ^{xxx}	3.8	131.03	+1.9 ^{xxx}
V ₂ - 'Black Prince'	64.4	113.78	+7.8 ^{xxx}	2.0	68.97	-0.9 ⁰⁰⁰
V ₃ - 'Bumble Bee'	52.7	93.11	-3.9 ⁰	2.1	72.41	-0.8 ⁰⁰⁰
V ₄ - 'Cartwheels'	74.5	131.63	+17.9 ^{xxx}	4.8	165.52	+1.9 ^{xxx}
V ₅ - 'Chicago Cardinal'	83.5	147.53	+26.9 ^{xxx}	3.6	124.14	+0.7 ^{xxx}
V ₆ - 'Mikado'	65.6	115.9	+9.0 ^{xxx}	2.9	100.00	0.0 ^{ns}
V ₇ - 'Pandora's Box'	43.5	76.86	-13.1 ⁰⁰⁰	3.0	103.45	+0.1 ^{ns}
V ₈ - 'Raspberry Candy'	40.5	71.55	-16.1 ⁰⁰⁰	2.8	96.55	-0.1 ^{ns}
V ₉ - 'Spits Beauty'	46.0	81.27	-10.6 ⁰⁰⁰	2.0	68.97	-0.9 ⁰⁰⁰
V ₁₀ - 'Stella de Oro'	24.3	42.93	-32.3 ⁰⁰⁰	2.0	68.97	-0.9 ⁰⁰⁰
Average		100.00	control	2.9	100.00	control
			LSD _{5%} = 2.9			LSD _{5%} = 0.4
			LSD _{1%} = 3.9			LSD _{1%} = 0.5
			LSD _{0.1%} = 5.3			LSD _{0.1%} = 0.7

Similar, in plants with lower branching (2 main branches), the number of flowers was smaller, and the differences from the average were very significant negative ('Stella de Oro', 'Spits Beauty', 'Bumble Bee', 'Black Prince') (Table 2). In some varieties ('Mikado', 'Pandora's Box', 'Raspberry Candy'), the degree of branching of scape was close to the average of the experience (2.9 branches per scape) and the differences were insignificant (Table 2). The number of flowers per scape was at some cultivars ('Cartwheels', 'Chicago Cardinal'), 50-60% above the average value of the experience (10.6 flowers per scape). In others, relative values to average reached 47.17% ('Stella de Oro'), respectively 5 flowers per scape, or

around 70-75% (7.5-7.7 flowers per scape), as is the case with 'Spits Beauty', 'Bumble Bee', 'Black Prince' (Table 3). Flower diameter is another indicator of appreciation of flower value, which was at an average of the experience of 10.7 cm (Table 3). At two cultivars ('Cartwheels', 'Chicago Cardinal'), the diameter of the fully open flowers was close to 15 cm, exceeding the average by 36-39% and recording very significant differences. Large flowers, more than 10-11 cm in diameter, can also be seen in cultivars 'Aten', 'Black Prince', 'Mikado', 'Spits Beauty'. Smaller flowers are in 'Stella de Oro' (6.5 cm), 'Bumble Bee' and 'Pandora's Box' (7.6 cm).

Table 3. Flowers characteristics

Variants (cultivars)	Number of flowers per scape			Flower diameter		
	Average (no.)	Relative values (%)	Difference (±no.)/ Significance	Average (cm)	Relative values (%)	Difference (±cm)/ Significance
V ₁ - 'Aten'	10.9	102.83	+0.3	11.5	107.48	+0.8
V ₂ - 'Black Prince'	7.7	72.64	-2.9 ⁰⁰	12.0	112.15	+1.3 ^x
V ₃ - 'Bumble Bee'	7.6	71.70	-3.0 ⁰⁰⁰	7.6	71.03	-3.1 ⁰⁰⁰
V ₄ - 'Cartwheels'	16.8	158.49	+6.2 ^{xxx}	14.9	139.25	+4.2 ^{xxx}
V ₅ - 'Chicago Cardinal'	17.0	160.38	+6.4 ^{xxx}	14.6	136.45	+3.9 ^{xxx}
V ₆ - 'Mikado'	13.2	124.53	+2.6 ^{xx}	12.5	116.82	+1.8 ^{xx}
V ₇ - 'Pandora's Box'	9.7	91.51	-0.9	7.6	71.03	-3.1 ⁰⁰⁰
V ₈ - 'Raspberry Candy'	10.6	100.00	0.0	8.6	80.37	-2.1 ⁰⁰
V ₉ - 'Spits Beauty'	7.5	70.75	-3.1 ⁰⁰⁰	11.2	104.67	+0.5
V ₁₀ - 'Stella de Oro'	5.0	47.17	-5.6 ⁰⁰⁰	6.5	60.75	-4.2 ⁰⁰⁰
Average	10.6	100.00	control	10.7	100.00	control
			LSD _{5%} = 1.6			
			LSD _{1%} = 2.1			
			LSD _{0.1%} = 2.9			
						LSD _{5%} = 1.2
						LSD _{1%} = 1.7
						LSD _{0.1%} = 2.3

To measure the size of the flowers, consider the height of the flower bud, given by the length of the tepals. From Figure 3 it can be noticed that the tepals longer than 9 cm are at the flowers of 'Chicago Cardinal', 'Mikado', 'Cartwheels', 'Black Prince', and about 4-6 cm at 'Pandora's Box' (4.3 cm), 'Stella de Oro' (5.2 cm), 'Bumble Bee' (5.5 cm) and 'Raspberry Candy' (5.7 cm). Each daylily has a typical time of the year at which it flowers (Dow, 2012). Daylilies cultivars bloom from early summer until late summer. The first (May - June) are 'Bumble Bee', 'Raspberry Candy', 'Stella de Oro', 'Mikado', 'Pandora's Box' and the last (July - August) are 'Cartwheels', 'Chicago Cardinal'. Some cultivars bloom more than one time during a single season ('Black Prince',

'Bumble Bee', 'Mikado', 'Pandora's Box', 'Stella de Oro').

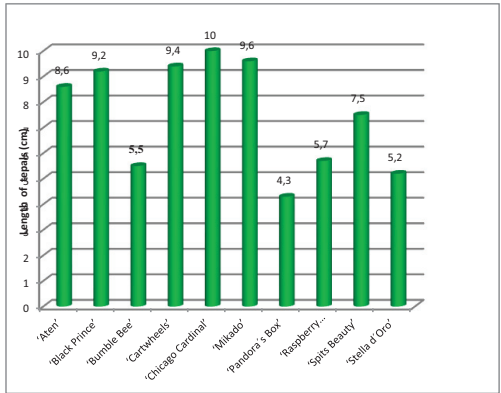


Figure 3. Length of tepals

CONCLUSIONS

In the conditions of Iasi, *Hemerocallis* cultivars analyzed have distinctive ornamental characters and can be used in various ways.

'Chicago Cardinal' and 'Mikado' are cultivars that have an average leaf length over 60 cm. The lower limit of leaf length is recorded in 'Stella de Oro' (36.5 cm).

The length of the scape recorded large variations, from 20-35 cm in 'Stella de Oro', to 70-90 cm in 'Chicago Cardinal' and 'Cartwheels'.

The degree of branching at scape ranged from 2 to 4.8. To a large extent, the character correlated positively with the number of flowers per scape.

The number of flowers per scape was 16.8-17 in 'Cartwheels' and 'Chicago Cardinal'. In 'Stella de Oro' are 5 flowers per scape.

At two cultivars ('Cartwheels', 'Chicago Cardinal'), the diameter of the fully open flowers was close to 15 cm. Large flowers, more than 10-11 cm in diameter, can also be seen in cultivars 'Aten', 'Black Prince', 'Mikado', 'Spits Beauty'. Smaller flowers are in 'Stella de Oro' (6.5 cm), 'Bumble Bee' and 'Pandora's Box' (7.6 cm).

As cut flowers are recommended cultivars with high scapes and large number of flowers, especially 'Chicago Cardinal', 'Cartwheels', 'Mikado' and 'Aten'. The cultivars of low height are recommended in decorative pots ('Stella de Oro').

For landscaping, all the cultivars are very interesting and are blooming a long time (May-August).

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