THE STUDY OF SOME SPECIES AND CULTIVARS OF *HEUCHERA* GROWING IN IAŞI CONDITIONS

STUDIUL UNOR SPECII ŞI SOIURI DE *HEUCHERA* CULTIVATE ÎN CONDIŢIILE DE LA IAŞI

DRAGHIA Lucia[1], BAHRIM C.[1],
CHELARIU Elena-Liliana[1], MUNTEANU Gianina[1]
e-mail: lucia@uaiasi.ro

Abstract. *The genus Heuchera (fam. Saxifragaceae) includes over 53 species of perennial herbaceous plants with persistent leaves. Plants of this genus form globular bushes with heights between 15 - 25 cm and the diameter between 15-50 cm. Although the main ornamental part of the species and cultivars of Heuchera is represented by leaves, because of their shape and color, the decorative value of the flowers can not be neglected. In this paper were studied some morphological characters that give ornamental value to Heuchera plants (bush diameter, leaf size, number and size of flowers and inflorescences). Observations were made on five Heuchera cultivars grown in the field, in conditions of Iaşi (H. sanguinea 'Coral Forest', H. hybrida 'Mini Monster', H. hybrida 'Venus', H. hybrida 'Marmalade' and H. hybrida 'Pewter Purple'). The highest number of leaves and most compact bushes stands out 'Mini Monster', and the best flowering capacity had 'Mini Monster' and 'Venus', while 'Marmelade' has formed fewest inflorescences.*
Key words: *Heuchera,* ornamental value, caractere morfologice

Rezumat. *Genul Heuchera (fam. Saxifragaceae) cuprinde peste 53 de specii de plante erbacee perene, cu frunze persistente. Plantele acestui gen formează tufe globuloase cu înălţimi de 15 - 25 cm şi diametrul de 15 - 50 cm. Deşi principala parte ornamentală a speciilor şi cultivarelor de Heuchera o constituie frunzele, prin forma şi coloritul acestora, nu poate fi neglijată nici valoarea decorativă a florilor. În lucrare sunt studiate o serie de caractere morfologice care dau valoare ornamentală plantelor de Heuchera (diametrul tufei, dimensiunile frunzelor, numărul şi dimensiunea florilor şi inflorescenţelor), observaţiile fiind efectuate la cinci cultivare de Heuchera cultivate în câmp, în condiţiile de la Iaşi (H. sanguinea 'Coral Forest', H. hybrida 'Mini Monster', H. hybrida 'Venus', H. hybrida 'Marmalade' şi H. hybrida 'Pewter Purple'). Cu numărul cel mai mare de frunze şi cu tufele cele mai compacte se remarcă 'Mini Monster', iar cea mai bună capacitate de înflorire au avut 'Mini Monster' şi 'Venus', în timp ce 'Marmelade' a format cele mai puţine inflorescenţe.*
Cuvinte cheie: *Heuchera,* valoare ornamentală, morphological characters

INTRODUCTION

The genus *Heuchera* contains at least 53 species of herbaceous perennial plants with persistent leaves, originating in North America and belonging to the family *Saxifragaceae*. The most popular name used is "coral bells" which refers

[1] University of Agriculture Sciences and Veterinary Medicine of Iaşi, Romania

to campanulate flowers, red as coral, of *Heuchera sanguinea* species. It is also used as "alum root", because the roots are rich in tannin and were used as alum pickling process or for medicinal purposes, to stop nose bleeding, to treat ulcers etc. (http://www.plantdelights.com/Article/Heuchera-Heucherella-Coral-Bells).

Heuchera plants form the globular clumps with heights between 15 and 25 cm and the diameter of the bush with values between 15 and 50 cm. The appearance and color of the leaves and flowers varies depending on the species and cultivar. *Heuchera* species and cultivars are decorative by both leaves and flowers. In order to obtain new forms, crosses were made between different species. The first were made between *Heuchera sanguinea* and *Heuchera americana*; to create hybrids for cut flowers there were used *Heuchera micrantha*, *H. americana* and *H. sanguinea;* to obtain hybrids with red flowers and resistance to low temperatures there were used *Heuchera sanguinea* and *Heuchera richardsonii*.

Due to the origin of climatic zones plant resistance to cold (4-9), *Heuchera* species and cultivars have resistance to low temperatures and it is recommended for growing in colder areas where they can overwinter in the field (Iles and Agnew, 1993; Dimke *et al*., 2008; Collicutt and Davidson, 1992) Multiplication of *Heuchera* species can be done by traditional methods but also through cell cultures and "in vitro" tissues (Hosoki and Kajino, 2003; Rout *et al.,* 2006).

Species of the genus *Heuchera* are also recommended to be grown on contaminated soils. Studies conducted for *H. parvifolia* showed a very good tolerance of plants to strongly acidic pH and to high content of heavy metals (King *et al*., 2009; Marty L., 2000). From *Heuchera sanguinea* seeds were isolated "plant defensins" type HsAFP1 (antimicrobial peptides), which inhibits a wide range of fungi (*Candida albicans, Candida krusei, Aspergillus flavus* etc.). They are not toxic to human cells, thus providing a possible source for fungal infections treatment (Aerts *et al.,* 2011).

In this paper were studied some morphological characters that give ornamental value to *Heuchera* plants growing in Iaşi conditions.

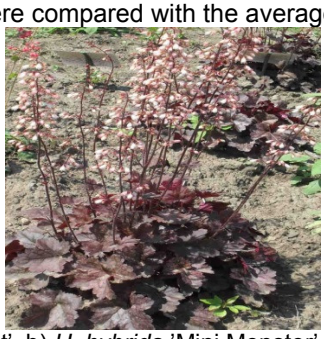
MATERIAL AND METHOD

Experimental cultures were established in October 2013 with *Heuchera* plants purchased from nurseries in Hungary. Each variant was represented by one cultivar, resulting five variants: V_1 - *H. sanguinea* 'Coral Forest'; V_2 - *H. hybrida* 'Mini Monster'; V_3 - *H. hybrida* 'Venus'; V_4 - *H. hybrida* 'Marmelade'; V_5 - *H. hybrida* 'Pewter Purple'. 'Coral Forest' has lobed leaves, rounded, bright green (fig. 1a); 'Mini Monster' has mottled pattern leaves and pale pink flowers (fig. 1b); 'Venus' shows large silver leaves with dark green ribs and yellowish-white flowers (fig. 1c); 'Marmelade' has the shape of maple leaves, bright colors varying from amber to bronze- peach and copper (fig. 1d); 'Pewter Purple' has silvery-gray leaves, mottled with gray and brown ribs (fig. 1e).

The experiment planning was made by the randomized blocks method with three replications. Biometric determinations were made: number and size of leaves, stems height, number of flowers or inflorescences per plant, number of flowers in inflorescence, flower size etc. The data was interpreted statistically by analysis of

variance and the results were compared with the average of the variants.


a) *H. sanguinea* 'Coral Forest'


b) *H. hybrida* 'Mini Monster'


c) *H. hybrida* 'Venus'


d) *H. hybrida* 'Marmelade'

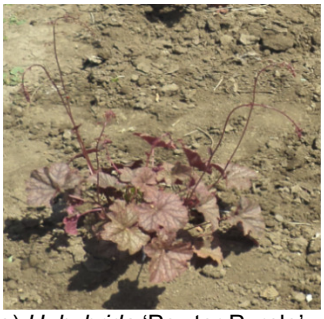

e) *H. hybrida* 'Pewter Purple'

Fig. 1 (a-e) - Experimental *Heuchera* species and cultivars

RESULTS AND DISCUSSIONS

Considering that *Heuchera* plants are appreciated especially due to the decorative appearance of the leaves, there were analyzed and compared a number of leaf characteristics of studied cultivars.

Table 1

Biometric characteristics of the leaves

Var.	Species / Cultivar	Total length (cm)	From which:		Rapport petiole/ lamina
			petiole	lamina	
V_1	*H. sanguinea* 'Coral Forest'	11,0	6,7	4,3	1,56
V_2	*H. hybrida* 'Mini Monster'	16,8	9,8	7,0	1,40
V_3	*H. hybrida* 'Venus'	17,6	9,2	8,4	1,10
V_4	*H. hybrida* 'Marmelade'	19,3	10,7	8,6	1,24
V_5	*H. hybrida* 'Pewter Purple'	14,2	8,1	6,1	1,33

In table 1 there are presented the results of biometric measurements performed at *Heuchera* cultivars leaves, regarding length of petiole and lamina (fig. 2). The ratio between the length of the petiole and lamina indicates that all plant variants were characterized by leaves with long petiole (the ratio was over unity) and the highest values were recorded in V_1 and V_2 ('Coral Forest' and 'Mini Monster').

a) *H. sanguinea* 'Coral Forest' **b)** *H. hybrida* 'Mini Monster' **c)** *H. hybrida* 'Venus'

d) *H. hybrida* 'Marmelade' **e)** *H. hybrida* 'Pewter Purple'

Fig. 2 (a-e) - Aspects regarding leaves and inflorescences

Plants with the richest foliage were those of V_2 ('Mini Monster'), with an average of 106.5 leaf/plant, registering very significant positive differences (tab. 2).

Table 2

Number of leaves and bush diameter

Variants	Species / Cultivar	Nr. leaves/ plant		Bush diameter (cm)	
		Absolute	±D	Absolute	±D
V_1	*H. sanguinea* 'Coral Forest'	63,5	$-4,2^{000}$	22,0	$-9,9^{000}$
V_2	*H. hybrida* 'Mini Monster'	106,5	$38,8^{xxx}$	32,5	0,6
V_3	*H. hybrida* 'Venus'	68,0	0,3	35,3	$3,4^{xx}$
V_4	*H. hybrida* 'Marmelade'	53,0	$-14,7^{000}$	39,7	$7,8^{xxx}$
V_5	*H. hybrida* 'Pewter Purple'	47,6	$-20,1^{000}$	30,0	$-1,9^{o}$
Average (control)		67,7	0	31,9	0
LSD 5%			1,0		1,8
LSD 1%			1,4		2,6
LSD 0,1%			2,1		3,9

Significant negative differences compared to average had variants V_1, V_4 and V_5 ('Coral Forest', 'Marmalade' and 'Pewter Purple'). At cv. 'Venus' (V_3), the differences were not statistically assured. Bush diameter (tab. 2) is one of morphological characters that can give indications about the ability of ground cover plant. Bushes with the largest diameter and very significant positive differences from the average were those of cv. 'Marmalade', following with distinct positive significant differences cv. 'Venus'. The smallest diameter it was at cv. 'Coral Forest' plants (22 cm), from the average differences are negative, very significant. At the cv. 'Mini Monster' differences were not statistically assured.

At the studied cultivars there were analyzed aspects regarding the number of floriferous stems / plant and their length, inflorescence length and number of flowers / inflorescence (tab. 3). Data regarding the average number of floriferous stems/plant indicates variations between 3 inflorescences / plant at V_4 ('Marmelade') and 23.5 inflorescences / plant at V_2 ('Mini Monster'). The differences compared to average were very significant positive to the V_2 ('Mini Monster') and V_3 ('Venus'), and negative to variants V_1 ('Coral Forest'), V_4 ('Marmelade') and V_5 ('Pewter Purple'). Quite large variations were noted regarding the height of floriferous stems (tab. 3), from 34.0 cm ('Marmelade') to 79.2 cm ('Venus'). To variants V_3 and V_5 ('Venus' and 'Pewter Purple'), positive differences compared to average were very significant, while on the other three variants there were recorded values below average and highly negative significant differences to V_1 and V_4 ('Coral Forest' and 'Marmelade') and significantly distinct to V_2 ('Mini Monster').

Table 3

Characteristics of flowers and inflorescences

Var.	Nr. flowers/plant		Height of flowers (cm)		Length of inflorescence (cm)		Nr. flowers / inflorescence	
	Absolute	±D	Absolute	±D	Absolute	±D	Absolute	±D
V_1	5,7	$-5,6^{000}$	41,3	$-11,4^{000}$	12,4	$-10,3^{000}$	72,5	$-28,0^{000}$
V_2	23,5	$12,2^{xxx}$	50,4	$-2,3^{00}$	19,7	$-3,0^{000}$	93,8	$-6,7^{000}$
V_3	18,7	$7,4^{xxx}$	79,2	$26,5^{xxx}$	41,3	$18,6^{xxx}$	178,1	$77,6^{xxx}$
V_4	3,0	$-8,3^{000}$	34,0	$-18,7^{000}$	19,0	$-3,7^{000}$	74,0	$-26,5^{000}$
V_5	5,7	$-5,6^{000}$	58,7	$6,0^{xxx}$	20,9	$-1,8^{000}$	84,3	$-16,2^{000}$
Average control)	11,3	0	52,7	0	22,7	0	100,5	0
LSD 5%		0,2		1,4		0,7		1,6
LSD 1%		0,3		2,0		1,0		2,3
LSD 0,1%		0,5		3,0		1,6		3,4

Of the total length of floriferous stems, inflorescences represented 30.0% for *H. sanguinea* 'Coral Forest', 39.1% for *H. hybrida* 'Mini Monster', 52.1% for *H. hybrida* 'Venus' and 55, 9% for *H. hybrida* 'Marmelade'. Inflorescence length was between 12 and 20 cm, except for *H. hybrida* 'Venus', to which the length of inflorescence was 41,3cm, the medium difference being highly significant positive. For the other 3 cultivars, significant differences were very negative. The average number of flowers/ inflorescence on the 5 cultivars was 100.5 (tab. 3).

Detached however with 178.1 flowers / inflorescence, was *H. hybrida* 'Venus' (V_3), where medium differences were highly significant positive. At the remaining cultivars, differences from average were very significant negative.

CONCLUSIONS

1. Morphological characters analyzed at five cultivars of *Heuchera* plants indicate a profile with special decorative features that can be valued both for the appearance of leaves and flowers.

2. The highest number of leaves (106 leaves / plant) and most compact bushes stands out 'Mini Monster'. Plants with long leaves formed large bushes ('Venus' and 'Marmelade'), while plants with small leaves formed bushes with reduced diameter ('Coral Forest').

3. The best flowering capacity had 'Mini Monster' and 'Venus', while 'Marmelade' has formed fewest inflorescences.

REFERENCES

1. **Aerts An M., Bammens L., Govaert G., Carmona-Gutierrez D., Frank Madeo F., Cammue B.P.A., Thevissen K., 2011** - *The antifungal plant defensin HsAFP1 from Heuchera sanguinea induces apoptosis in Candida albicans.* Frontiers in microbiology, vol. 2, pp: 1-9, www.frontiersin.org
2. **Collicutt L.M., Davidson C.G., 1992** - *Landscape Plant Improvement for Cold Climates*. Acta Horticulturae 320
3. **Dimke K.C., Still S.K., Gardner D.S., 2008 -** *Effect of Overwintering Environment on the Survival of 30 Species of Herbaceous Perennials.* J. Environ. Hort. 26(4), pp:222–228
4. **Hosoki T., Kajino E., 2003** - *Shoot regeneration from petioles of coral bells (Heuchera sanguinea Engelm.) cultured in vitro, and subsequent planting and flowering ex vitro*. In Vitro Cellular Developmental Biology—Plant 39, pp:135–138.
5. **Iles J. K., Agnew N.H., 1993** - *Determining Cold Hardiness of Heuchera sanguinea Engelm. 'Chatterbox' Using Dormant Crowns.* Hortscience, vol. 28(11), pp:1087–1088
6. **King Sandra, King M., Jennings S., Neuman D., 2009** - *Using Plant Tissue Culture to Develop Plants with Acid Soil, Heavy Metal Tolerance (AHMT), Potentially Useful for Hard-Rock Mine Land Reclamation*. pp: 673-692. In: Proceedings of the 2009 National Meeting of the American Society of Mining and Reclamation, Billings, MT. Published by ASMR, 3134 Montavesta Rd., Lexington, KY 40502.
7. **Marty L., 2000 -** *The Use of Local Ecotypes for the Revegetation of Acid/Heavy Metal Contaminated Lands in Western Montana*. pp. 216-229. *In*: 2000 Billings Land Reclamation Symposium. Billings, MT. March 20-24, 2000. Reclamation Research Unit Publication No. 00-01. Montana State University, Bozeman.
8. **Rout G.R., Mohapatra A., Mohan Jain S., 2006** - *Tissue culture of ornamental pot plant: A critical review on present scenario and future prospects*. Biotechnology Advances, vol 24, pp: 531-560.
9. http://www.plantdelights.com/Article/Heuchera-Heucherella-Coral-Bells