PHENOTYPICAL VARIABILITY OF SEVERAL IMPORTANT CHARACTERS AT SEVEN *ECHINACEA PURPUREA* CULTIVARS TESTED IN COLLECTION FIELD OF USAVM CLUJ NAPOCA

VARIABILITATEA FENOTIPICĂ A UNOR CARACTERE IMPORTANTE LA ŞAPTE CULTIVARE DE *ECHINACEA PURPUREA* ÎN CONDIŢIILE DE LA CLUJ-NAPOCA

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Abstract: *This paper aimed at determining the phenotypical variability between seven cultivars of Echinacea purpurea during three experimental years. The experimental data present the stems length, the number of stems and the number of leaves/shrub because of their medicinal importance and we analysed the shape index of flowers and leaves in order to determine the ornamental potential of these cultivars. According to the results, E. purpurea, originating in Arkansas USA, showed a very good medicinal potential while E. purpurea (Bydgoszcz,Poland) proved the best ornamental potential.*

Rezumat: *În această lucrare este studiată variabilitatea fenotipică a şapte cultivare de Echinacea purpurea pe parcursul a trei ani experimentali. Au fost supuse analizei următoarele caractere: numărul si înălţimea tulpinilor/tufă şi numărul de frunze/tufă datorită importanţei medicinale, dar au fost analizaţi şi indicii de formă ai frunzelor şi florilor pentru evidenţierea potenţialului ornamental al cultivarelor studiate. Cele mai bune cultivare s-au dovedit a fi E. purpurea (Arkansas, SUA) şi E. purpurea (Bydgoszcz, Poland) .*

***Key words*:** *Echinacea purpurea, phenotypical variability, cultivar*
Cuvinte cheie: *Echinacea purpurea, variabilitate fenotipică, cultivar*

INTRODUCTION

All species of Echinacea are herbaceous, perennial flowering plants of the composite family (*Asteraceae*). Generally, a basal rosette of petiolate leaves and one to several annual stems arise from an underground, perennial rootstock (VARBAN, 2001). A single taproot is characteristic of all species except for *Echinacea purpurea*, which has a fibrous root system (MCKEOWN, 1999). A detailed morphological classification of Echinacea was provided by MCGREGOR (1968) and recently revised by BINNS et. al. (2002). In this report MCGREGOR'S (1968) taxonomy is followed.

Echinacea angustifolia DC, *Echinacea pallida* (Nutt.) and *Echinacea purpurea* (L.) Moench, showed pharmacological potential activity (BAUER and WAGNER, 1991, cited by LUPING QU et. al., 2005). In addition to its possible medicinal uses, Echinacea has obvious ornamental potential. *Echinacea purpurea*, the only species for which ornamental cultivars have been bred, is both productive and profitable as a field grown species for cut flower (STARMAN et al. 1995).

The experimental data presents the development of stems length, the number of stems/shrub and the number of leaves/shrub because of their medicinal importance and we analyzed also the shape index of flowers and leaves in order to determine the ornamental potential of seven *Echinacea purpurea* cultivars organised in a collection field at UASVM Cluj Napoca, Romania.

MATERIALS AND METHOD

The plants used in this study were three years old, obtained from seeds, as presented in table 1:

Table 1

Seeds sources for *Echinacea purpurea* and the variants used in the experimental data

Variant	Cultivar	Provider	Origin	Type
V 1	*E. purpurea*	UASVM [1]	Cluj Napoca, Romania	Crop
V 2	*E. purpurea*	Botanical Garden	Bydgoszcz, Poland	Crop
V 3	*E. purpurea*	NCRPIS, USDA[2]	Arkansas, United States	Wild
V 4	*E. purpurea*	USM, HPM[3]	Lodz, Poland	Crop
V 5	*E. purpurea*	Botanical Garden	Tg. Mures, Romania	Crop
V 6	*E. purpurea*	RKV Rt.[4]	Rede, Hungary	Crop
V 7	*E. purpurea* „Magnus"	SS[5]	Holland	Hybrid

[1] University of Agricultural Sciences and Veterinary Medicine
[2] North Central Regional Plant Introduction Station, United States Department for Agriculture
[3] Universitas Studiorum Medicorum, Hortus Plantarum Medicinarum
[4] Redei Kertimag Vetomagkereskedelmi Rt.
[5] Syngenta Seeds

The collection field was set in the Botanical Garden, UASVM, Cluj Napoca, in the spring of 2005. For observations and measurements, each cultivar was represented by at least four shrubs in the third year of vegetation. The observations on the number and length of stems, the number of leaves/shrub and the number of inflorescences/shrub started on August 15th every year until the end of that month. There were counted all the stems, leaves and inflorescences/shrub and the length of at least ten stems was noted for each shrub. Choosing these particular characters is relevant to cover the potentiality of all cultivars from the field collection as medicinal and ornamental plants (BANGA et. al, 2007).

ANOVA for a series of experiments was used to reveal the significance of differences among variants. Because in 2005 only a part of the Echinacea plants produced stems and inflorescences, the statistical interpretation for the length of stems and the number of inflorescences/shrub characters is presented only for 2006 and 2007 experimental years. For the number of stems we used the transformation $x' = \sqrt{x+1}$ (ARDELEAN et al., 2005). *Echinacea purpurea*, Cluj Napoca cultivar was considered as control.

Regarding the shape index for flowers and leaves, in order to indicate the ornamental potential for the tested cultivars, we performed the measurements in the same time, using at least ten inflorescences/shrub measured for the diameter of capitulum and the length of ray florets and at least ten leaves/shrub measured for the length and the width of it. The value of the index was calculated performing the report between the obtained data. The values for shape index of leaves was calculated using the averages data collected in all three experimental years, while the shape index for the flowers was calculated only for 2006 and 2007 experimental years. As control value we considered 1 which represents the ball-shaped flower or leaf.

RESULTS AND DISCUSSION

The results of statistical interpretation show that the length of stems does not depend on the year of experiment, suggesting that the cultivar is rather stable regarding the phenotypic expression of this character (table 2). The analyzed data reveal that *E. purpurea*, provided by the Botanical Garden Bydgoszcz, Poland has the greatest length of stems as

compared with *E. purpurea*, Cluj Napoca cultivar, considered as control. The V3, V4 and V6 cultivars have the same size regarding this character with the control.

On inspecting the number of inflorescences (table 2), *E. purpurea* (V3) originated in Arkansas, USA presents at least six inflorescences every year, both when the comparison was made with the variance of error and with the interactions between the variant and the experimental year.

Regarding the number of stems and the number of leaves, the highest ranked cultivar is also *E. purpurea* (V3) which presents at least 3 stems /shrub and 400 leaves/shrub every year (table 3). These results suggest a good adaptability and yielding capacity of this cultivar as compared to control.

According to the values of shape index for inflorescences (table 4), the cultivar represented by *E. purpurea*, Cluj Napoca, has the most ball-shaped flowers, which indicate that the diameter of capitulum is only 2.5 times larger than the length of ray florets while the *E. purpurea*, Tg. Mures cultivar presented the most flat inflorescences.

The most elongated leaves were found at *E. purpurea* cultivar, provided by USM, HPM, Lodz, Poland, which present a value for the index shape of leaves of 5.47 while the most ball-shaped leaves were found at *E. purpurea*, Bydgoszcz, Poland with a value of index shape of 3.70 (table 4).

Table 2

The length of stems and the number of inflorescences/shrub of *Echinacea purpurea* cultivars- measurements performed at UASVM collection field, Cluj Napoca, Romania, 2006-2007

Variant	Cultivar	Length of stems (mm)	SD (E)	SD (I)	No. of inflorescences	SD (E)	SD (I)
V 1 - C	*E. purpurea*	479.03	-	-	3.55	-	-
V 2	*E. purpurea*	754.14	***	ns	3.44	-	-
V 3	*E. purpurea*	520.50	ns	ns	6.41	***	**
V 4	*E. purpurea*	588.87	ns	ns	4.41	-	-
V 5	*E. purpurea*	699.71	**	ns	4.16	-	-
V 6	*E. purpurea*	605.88	ns	ns	4.54	(*)	-
V 7	*E. purpurea*	712.13	**	ns	4.38	-	-
			143.71	340.04		1.07	1.94
			192.55	514.92		1.42	2.73
			254.14	827.20		1.85	3.85

Table 3

The number of stems and the number of leaves/shrub of *Echinacea purpurea* cultivars- measurements performed at UASVM collection field, Cluj Napoca, Romania, 2005-2007

Variant	Cultivar	No. of stems	SD (E)	SD (I)	No. of leaves	SD (E)	SD (I)
V 1 - C	*E. purpurea*	2.10	-	-	105.33	-	-
V 2	*E. purpurea*	2.33	ns	ns	145.33	ns	ns
V 3	*E. purpurea*	3.01	*(*)	ns	408.25	***	***
V 4	*E. purpurea*	2.69	ns	ns	174.25	ns	ns
V 5	*E. purpurea*	2.56	ns	ns	157.25	ns	ns
V 6	*E. purpurea*	2.61	ns	ns	155.67	ns	ns
V 7	*E. purpurea*	2.43	ns	ns	153.75	ns	ns
			0.74	1.27		132.06	127.91
			0.98	1.78		176.08	179.54
			1.28	2.52		229.30	253.47

Table 4

The value of shape index for flowers and leaves - *Echinacea purpurea* cultivars

Variant	Cultivar	Shape index for flowers	Shape index for leaves
V 1 - C	*E. purpurea*	2.46	3.98
V 2	*E. purpurea*	3.56	3.70
V 3	*E. purpurea*	3.83	4.07
V 4	*E. purpurea*	2.47	5.47
V 5	*E. purpurea*	4.66	4.15
V 6	*E. purpurea*	2.50	4.12
V 7	*E. purpurea*	2.51	4.11

CONCLUSIONS

Experimental research showed the following:

1. During this study, it was confirmed that *Echinacea purpurea* cultivars have a great medicinal and ornamental value.

2. The best medicinal potential of the cultivars used in this study was shown by *E. purpurea*, Arkansas, USA, which presented the highest number of stems and of leaves, as well as the best number of inflorescences.

3. The best ornamental potential of the cultivars used in this study regarding the shape of leaves and flowers as well as the length of stems was proved by *E. purpurea*, Bydgoszcz, Poland, which presented the most appropriate values of 1 for both index shapes.

4. Knowing the phenotypic variability of characters of interest in breeding, it is useful for breeders to select the right cultivars and to improve their qualities.

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