THE STUDY OF SEVERAL GENOTYPES OF *ECHINACEA PURPUREA* (L.) MOENCH

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Abstract:. *Research aimed at the evaluation and selection of biological material, genetically valuable for several genotypes of Echinacea purpurea (L.) Moench. The experiment, that took place during the years 2008 şi 2009, aimed the phenological study and the content of active principles in several genotypes of Echinacea purpurea (L.) Moench received from 8 different locations in Europe and of a population from Cluj (acclimated since 1982 in our university). All the tested plants have been multiplied by means of seedlings. Among the investigated genotypes during both consecutive years, under the climatic conditions from Cluj – Napoca, the earliest (regarding the vegetation period) were: Porrentry (Switzerland) and the population from Cluj, related to the control variants (the average of the experimental plot).The aerial parts had a major contribution to the whole plant weight. It was noticed that, during each year of experience, the genotypes Warsaw-Poland, Műnchen-Germany, Siena-Italy, and Jena-Germany, compared to the control variant (field average).As related to the field average, in both experimental years, the higher content in phenyl propanic derivates was detected in the genotypes Porrentry-Switzerland, Műnchen-Germany, Gdansk-Poland, and within the population of Cluj. Concerning the content of immunostimulatory polysaccharides, the following variants were more valuable: Nantes-France, Porrentry-Switzerland, the populations of Cluj and Műnchen- Germany. A high degree of novelty characterizes this study, because such research was not performed in our country. Our research focused some genotypes we received from some European locations. The study of the Echinacea purpurea (L.) Moench genotypes in Cluj–Napoca environment, showed a variability of the productive morpho-physiological elements. This aspect is favourabkle for the improvement programmes. The paper is original and important in the field of the medicinal and aromatic plants.*

***Key words*:** *Echinacea purpurea (L.) Moench, varieties, biology, active principles*

INTRODUCTION

Echinacea species are medicinal plants which have the origin in North America, being used since old times by the native Indians to treat several diseases. The area for *Echinacea* species in North America is represented by the land from South Golf the central part of USA to the Great North Lakes, on the east being limitated by Apalas Mountains and to west by Rocky Mountain.

Medicinal vegetal products of *Echinacea radix* (roots) or *Echinacea herba* (aerial part) are included among the products with an imunistimulatory action, and depending on the active principles they belong to the products with fenil-propionic compounds and imunomodulatory polizaharides.

The favorable results obtained in the healing process for wounds, lead to some dermatological and cosmetically products belonging to RO range, having as a base *Echinacea purpurea* (L) Moench extracts.

MATERIALS AND METHOD

The research took place in the experimental field of USAMV Cluj-Napoca, the soil on which the experiences were placed is aluvial, a soil with a low alkaline reaction; average

carbonated on the surface, average supplied with humus, and well supplied with total nitrogenin the first 30 cm, with an average clay texture well supplied with free phosphorus and potasiu.

1. The study of *Echinacea purpurea* (L.) Moench fenology in the second year (2008) and third year (2009) of vegetation:

The experience took place during 2008 and 2009, and as followed he fenology of *Echinacea purpurea* (L.) Moench with different origin received from several areas from Europe (8) and a population from Cluj (adapted since 1982 within our university), plants bred by seedlings.

During vegetation, there were taken several observations concerning the fenology, observing the phenophases: vegetation starting-blooming, blooming– flowering, flowering–seed maturation, and also the duration of vegetation period for each *Echinacea species origin.*

The origin of *Echinacea purpurea* (L.) Moench taken into study are:

1 - *Echinacea purpurea* (L.) Moench Porrentry- Switzerland
2- *Echinacea purpurea* (L.) Moench Siena- Italy
3- *Echinacea purpurea* (L.) Moench Gera – Germany
4- *Echinacea purpurea* (L.) Moench Varşovia –Poland
5- *Echinacea purpurea* (L.) Moench Nantes – France
6- *Echinacea purpurea* (L.) Moench München –Germany
7- *Echinacea purpurea* (L.) Moench Jena –Germany
8- *Echinacea purpurea* (L.) Moench Gdansk- Poland
9- *Echinacea purpurea* (L.) Moench Cluj Napoca- Romania

Table 1.1

Fenological phases at *Echinacea purpurea(L)* Moench species, the second year of vegetation (Cluj- Napoca, 2008)

Species	Calendaristic Dates	Phenophases			
		Vegetation star –blooming	Blooming-flowering	flowering- seed maturation	Total
1. Porrentry-Switzerland	days %	32 20	27 18	98 62	157 100
2.Siena- Italy	days %	24 15	30 19	107 66	161 100
3. Gera -Germany	days %	30 19	32 20	98 61	160 100
4. Varsovia –Poland	days %	28 17	28 17	109 66	165 100
5. Nantes- France	days %	25 15	29 17	115 68	169 100
6. Műnchen-Germany	days %	27 16	29 17	110 67	166 100
7. Jena- Germany	days %	29 18	29 18	106 64	164 100
8. Gdansk- Poland	days %	27 16	33 20	107 64	167 100
9. Population of Cluj- Romania	days %	29 18	30 18	104 64	163 100
10. Field average	days %	28 17	30 18	106 65	164 100

2. The dynamic of vegetative organs formation, in the flowering stage, in the second and third year of vegetation, at *Echinacea purpurea* (L.) Moench

In the second (2008) and third (2009) year of vegetation were made quantitative determinations in flowering stage for each de *Echinacea purpurea* (L.) Moench, at the following characters:total weight, herba (aerial part) and radix (root) weight.

3. The study of active priciples content, in the flowering phase, at *Echinacea purpurea* (L.) Moench (fenil-propionic, imunostimulatory polizaharides)

The active principles content were made in the our department laboratory of de Botanical of Pharmacy Faculty of Cluj Napoca .

To appreciate the quality features, was determined thecontent of fenil-propionic from roots (expressed in g %coffeic acid) and imunostimulatory polyzaharides from roots (expressed in g %), inflowering stage.

Qualitative analyze of the isolated polizaharides, was made with the help of monoglucides, resulted from the acid hydrolyze through CSS (cromatography in thin layer), and the content in poloizaharides was determined spectophotometrically.

The content in fenil- propionic (expressed in % coffeic acid), was determined with the help of cromatographt in thin layer, column chromatography, liquid chromatography and UV spectrometry.

Table 1.2

The fenological phases of *Echinacea purpurea*(L.) Moench ,the third year of vegetation (Cluj- Napoca, 2009)

Species	Dates	Phenophases			
		Vegetation start - blooming	blooming- flowering	flowering- seed maturation	Total
1. Porrentry- Switzerland	days %	46 28	23 14	94 58	163 100
2.Siena- Italy	days %	29 17	43 24	105 59	177 100
3. Gera –Germany	days %	43 24	42 23	81 53	181 100
4. Varsovia – Poland	days %	37 21	35 20	107 59	179 100
5. Nantes- France	days %	33 18	42 22	114 60	189 100
6. Műnchen- Germany	days %	33 19	40 23	104 58	177 100
7. Jena- Germany	days %	31 17	46 25	106 58	164 100
8. Gdausk- Poland	days %	36 20	48 26	100 54	184 100
9. Population of Cluj- Romania	days %	40 23	36 21	98 56	174 100
10. Field average	days %	36 21	39 22	101 57	176 100

Table 1.3

The dynamic of organs formation at *Echinacea purpurea*(L.) Moench, in the second year of vegetation (2008) and third year of vegetation (2009), in flowering phase of vegetation (Cluj-Napoca, 2009)

Provenience	**Root weight at floweing (g)**		**Aerial weight al flowering (g)**		**Total weight at flowering (g)**	
	2nd year of vegetation	3rd year of vegetation	2nd year of vegetation	3rd year of vegetation	2nd year of vegetation	3rd year of vegetation
1. Porrentry – Switzeralnd	40	49,3	191,7	289,6	231,7	338,9
2. Siena –Italy.	45,6	55,1	210,1	313,3	255,7	368,4
3. Gera- Germany	37,4	48,7	205,4	293,5	242,8	342,2
4.Varşovia- Poland	47,5	59,9	222,6	333,3	270,1	393,2
5. Nantes France	40,5	50,0	203,3	300,4	243,8	350,4
6. München- Germany	42,7	58,9	217,1	323,0	259,8	381,9
7. Jena- Germany	43,2	56,9	220,3	311,8	263,5	368,7
8 Gdansk- Poland	40,1	51,7	198,7	299,3	238,8	351
9. Population of Cluj- România	42,2	54,3	205,5	301,7	247,7	356
10. Field average	42,1	53,8	208,3	307,3	250,4	361,1

Table 1.4.

Content of active principles at *Echinacea purpurea* (L.) Moench, in roots in the flowering vegetation phase, the second and third year of vegetation (Cluj -Napoca, 2009)

Provenience	Contact in fenil propionic in root (g % coffee acid)		The content of imunostimulatory polizaharides in roots	
	2nd year of vegetation	3rd year of vegetation	2nd year of vegetation	3rd year of vegetation
1. Porrentry –Switzerland	2,22	2,32	6,31	6,41
2. Siena –Italy	1,89	1,96	5,95	6,03
3. Gera- Germany	2,10	2,22	6,00	6,11
4.Varşovia- Poland	2,00	2,05	5,90	5,92
5. Nantes France	2,00	2,13	6,45	6,55
6. München- Germany	2,55	2,70	6,27	6,34
7. Jena- Germany	2,07	2,27	6,20	6,25
8 Gdansk- Poland	2,33	2,43	6,00	6,10
9. Population of Cluj- Romania	2,32	2,52	6,25	6,35
10. Field average	2,16	2,29	6,15	6,23

RESULTS AND DISCUSSION

1. The study of *Echinacea purpurea* (L.) Moench in the II and III year of vegetation (2008) (2009):

At *Echinacea purpurea* (L.) Moench from Cluj-Napoca, the vegetation period in the second year of vegetation (2008), as it results from **table 1.1,** was of 163 days and lasts from 20th April until 28th September: vegetation start – blooming lasts 29 days and represents 18 %, blooming-flowering lasts 30 days and represents 18%, and flowering- seed maturation lasts 104 days and represents 64%.

Among the species taken into study, *Echinacea purpurea* (L.) Moench from Porrentry-Switzerland has the shortest vegetation period, of 157 days, and *Echinacea purpurea* (L.) Moench from Nantes-France has the longest vegetation period, of 169 days.

The first vegetation stage (vegetation start -blooming) was between 24 days (Siena-Italy) and 32 days (Gera-Germany) and had a participation percentage of 15-20% from the total vegetation period.

The second stage (blooming-flowering) had a period of 27 days (Porrentry-Switzerland) and 33 days (Gdansk-Poland) and represents 18-20% from the total vegetation period.

The fastest flowering period was registered at *Echinacea purpurea* (L.) Moench from: Porrentry-Switzerland, Gera-Germany, The population of Cluj-România, and the slowest was at Varşovia-Poland.

The last phase (flowering-seed maturation) had the longest period at all *Echinacea purpurea* (L.) Moench species taken into study. This vegetation period had 98 days (Gera-Germany and Porrentry-Switzeralnd) and 117 days (Nantes-France), representing 61-68 % from the total of the days necessary to maturate.

In the second year of vegetation, among *Echinacea purpurea* (L.) Moench studied, the earlier than the variant control (164 days) were Porrentry-Switzerland (157 days), Gera-Germany (160 days), Siena-Italy (161 days) and Cluj population -România (163 days),being valuable to the growing of precocity in the breeding programs.

At *Echinacea purpurea* (L.) Moench from Cluj-Napoca, the vegetation period in the third year of vegetation (2009), as it results in the **table 1.2**, was of 174 days and lasts from 1th April until 22th September: the vegetation start – blooming lasts 40 days and represents 23 %, the blooming-flowering phase lasts 36 days and represents 21%, and flowering- seed maturation phase lasts 98 days and represents 56%.

Among the species taken into study, *Echinacea purpurea* (L.) Moench from Porrentry-Switzerland has the shortest vegetation period, of 163 days, and *Echinacea purpurea* (L.) Moench from Nantes-France has the longest vegetation period, of 189 days.

The first vegetation phase (vegetation star-blooming) was between 29 days (Siena-Italy) and 46 days (Porrentry-Switzerland) and had a participation percentage of 17-28% from the total vegetation period.

The second phase (blooming-flowering) had a duration of 23 days (Porrentry-Switzerland) and 48 days (Gdansk-Poland) and represents 14-26% from the total vegetation period.

The fastest flowering phase was registered at *Echinacea purpurea* (L.) Moench from: Porrentry-Switzerland, Varşovia-Poland, Population of Cluj-Romania, and the latest at Gera-Germany.

The last vegetation phase (flowering- seed maturation) had the longest period at all *Echinacea purpurea* (L.) Moench studied. This vegetation period had 81 days (Gera-Germany) and 114 days (Nantes-France), representing 53-60 % from the total of days necessary to maturate.

In the third year of vegetation , among *Echinacea purpurea* (L.) Moench studied species, earlier than the variant control (176 days) was Porrentry-Switzerland (163 days), Population of

Cluj-România (174days),being valuable for the growing of precocity in the breeding programs.

2. The dynamic of vegetative organs formation, in flowering vegetative phase, second and third year of vegetation, at *Echinacea purpurea* (L.) Moench

It is shown from **table 1.3.,** that, the total weight of *Echinacea purpurea* (L.) Moench taken into study, in the second and also in the third year of vegetation, between 231,7g - Porrentry-Switzerland and 270,1 g - Varşovia-Poland (in 2008) and between 338,9 g and 393,2 g (in 2009). Towards variant control (the field average), in all the experimental years, the plants remarked y their total weight at those from Siena-Italy, Varşovia-Poland, Műnchen- Germany and Jena-Germany.

In both years of experience, aerial weight (*herba*) had a major contribution at the total plants weight, being of 191,7g at Porrentry-Switzerland and 222,6g at Varşovia- Poland (in 2008) and 289,6 g and 333,3 g (in 2009). Toward ariant control was noticed, in each year taken into study, by high weight of *herba* Siena-Italy, Varşovia- Poland, Műnchen- Germany and Jena-Germany.

Towards the field average, in both years of experience, was noticed the high root weight at the species from Siena-Italy, Varşovia- Poland, Műnchen- Germany, Jena-Germany, Population of Cluj-Romania, aspect on which we have to be careful in breeding programs.

3. The study of active principles content, in flowering vegetation phase, at *Echinacea purpurea* (L.) Moench (fenil-propionic, imunostimulatory polizaharides)

At the studied species, in the years of experience, there weren't any major differences concerning the content in fenil-propionic and imunostimulatory polizaharides.

Towards the field average, in the experience years studied, with a higher content in fenil-propionic are distinguished the species from Porrentry-Switzerland, Műnchen- Germany, Gdansk-Poland and population of Cluj-Romania (**table 1.4.**).

Towards variant control, in the two experimental years, root of the plants from Nantes- France has the highest content in imunostimulatory polizaharides, followed by Porrentry-Switzerland, Population of Cluj-Romania and Műnchen- Germany.

CONCLUSIONS

The study and research concerning the *Echinacea purpurea*`s biology (L.) Moench species received from several cities in Europe, allows the following conclusions:

1. As a result of *Echinacea purpurea* (L.) Moench study in condition of Cluj-Napoca was noticed a variability of morpho physiological elements, productive, an favorable aspect for breeding programs.

2. Among the species taken into study, in the experimental years studied, *Echinacea purpurea* (L.) Moench, in climatic conditions from Cluj- Napoca, the earlier proved to be: Porrentry-Switzerland and Population of Cluj-România, representing value for precocity growing in breeding programs.

Aerial parts had a major contribution to the total plants weight. It was noticed that, in each years studied, the species from Varşovia-Poland, Műnchen-Germany, Siena- Italy and Jena-Germany.

Among the studied species, in the two years of the experience, there weren`t any major differences concerning the content of fenil-propionic and imunostimulatory polizaharides. Towards field average, in both experimental years, with a higher content in fenil-propan distinguished the species from Porrentry-Switzerland, Műnchen- Germany, Gdansk-Poland and Population of Cluj-Romania, and concerning the content in imunostimulatory

polizaharides are noticed Nantes- France, Porrentry-Switzerland, Population of Cluj-Romania and Műnchen- Germany.

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