

## THE CORRELATIONS BETWEEN PHENOTYPICAL CHARACTERS IN SELECTED FAMILIES BY *GENTIANA LUTEA* L. AND THE CHEMICAL COMPOUNDS OF UNDERGROUND ORGANS

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**Abstract.** The ground organs of *Gentiana lutea* L. contain active principles, which have certain properties recommended for anorexia or convalescence.

Along the year we tried to show cast the existent correlations between the main morphological characters and the productivity elements, such as the concentration in active principles. It is proved that the development of a character influence either the development of positive correlation or negative correlation [7].

Having in mind that the phenotypical expression is influenced by the phases of vegetation, a very important thing to know is the morph chemical characteristics of specie in different phases of vegetation.

The superior quality of the raw materials obtained by different sowing methods defined during our research, will decrease the crop from our country wild flora [10].

**Keywords:** *Gentiana lutea* L., active principles, correlations, selected families

### INTRODUCTION

*Gentiana lutea* L is herbaceous, perennial specie protected by law. This specie does not require high temperature. During winter the specie resists at temperatures between -20°C and -30°C [2]. It requires direct light, in meadows. In the same it needs a lot of water, both in the and also vegetation period. It prefers soils rich in calcium. In spontaneous conditions it grows on rocky soils, but also on soils rich in humus, where she evolves really well. Grown at high altitude it has a bigger concentration of bitter substances [8].

The root and the rhizome include bitter principles, among which a bitter principle that through degradation forms gentianin or gentiamarozida. Gentiopicroside [5]. Another principle very bitter is bittners-gentianin. It includes as well alkaloids, gentianin, tannins, volatile oil, sugars and other substances [3].

The importance of the morphological characters analyses comes from the fact that, having the phenotypical expression of and the correlation; we can obtain information about the concentration of active principles [9]. This information will be confirmed or infirmed by the identification and dosing chemical test (for example: the radish color of the plant during low temperature periods, indicates the presence and the concentration of in organs, thing that give a bigger to low temperature) [4]. Moreover morphological features at level (ramification angle, no. of ramification) and also ground organs level, can offer information about the resilience at shaking or falling [6].

### MATERIALS AND METHODS

The selection process for *Gentiana lutea* L specie was realized through a selection based on families groups. The argument for this decision is that if the

initial material is made by a family, not that much exposed to the amelioration process, the chosen method can put good use to the natural variability that this specie contains.

Taking into consideration that in the amelioration process can appear the consequences of a too drastic narrowing of genetic base and from here the possible effects of consanguine junction, it was preferred that the mass selection to be realized on families groups, made based on the morphological similarities.

With the help of the correlation coefficient were determined the relationship between two variables and the meaning of the calculated correlation coefficient, after that they were registered.

The formula for the simple correlation coefficient is the following:

$$\pm r = \frac{\sum (x-\bar{x}) \times (y-\bar{y})}{\sqrt{\sum (x-\bar{x})^2 \times \sum (y-\bar{y})^2}}$$

These elements were established looking at the methodological guidelines found in the specialty literature [1]. The meaning of the correlation coefficient was settled based on the limit set for p= 50% and p=1% and the freedom degree of the analyzed situations.

There were calculated simple correlations between the morphological characters and the productive features

### RESULTS AND DISCUSSIONS

Each morphological character, for each family studied, was analyzed in this study, both from the evolution point of view and also based on its reaction during the sowing period.

In **table 1** are synthesized the results of the observations made for the family *Gentiana lutea* L, when looking at the morphological features of the air organs.

**Table 1.** Results of morphological characteristics by organs from *Gentiana lutea* L. selected families

Nr. Crt.	Selected family	Height (cm)	No. of loops	No of cime	Total no. of fruits/plant
1.	G-1	106	8	5	117
2.	G-2	100	8	4	91
3.	G-3	112	11	5	112
4.	G-4	102	8	4	54
5.	G-5	103	9	5	70
6.	G-6	91	8	4	62
7.	G-7	86	8	4	88
8.	G-8	76	6	4	53
9.	G-9	99	8	4	67
10.	G-10	88	8	4	52
11.	Media	96,3	8,2	4,3	76,6

In what concerns the way in which was calculated the concentration of “**gentianin**”, gentiopicroside, bitter parameter, volatile oil and sugars on root system, this was done during the fruits cropping period. The

chemical tests were made on dried rhizomes, belonging to *Gentiana lutea* L. specie, after the crop. The results were the following:

**Table 2.** Variation of the chemical characteristics in the 10 studied families of *Gentiana lutea* L. species

Nr. crt.	Selected family	Chemical compounds				
		Gentianin (%)	Gentiopicroside	Bitterness Index	Volatile oil (%)	Sugars (%)
1.	G-1	0,03	2	11400	0,03	27
2.	G-2	0,01	1,9	8520	0,025	35
3.	G-3	0,015	3,5	10350	0,027	29
4.	G-4	0,02	3	12450	0,028	31
5.	G-5	0,027	2,8	13780	0,035	37
6.	G-6	0,026	2,3	7700	0,025	32
7.	G-7	0,023	2,7	9170	0,027	34
8.	G-8	0,022	2,1	11790	0,029	29
9.	G-9	0,01	2,6	12700	0,032	33
10.	G-10	0,027	2,2	8100	0,02	22
11.	MEDIA	0,021	2,51	10596	0,0278	30,9

A great number of researchers studied the existence of precise correlations between easy to notice quantitative characteristics, easy to notice, such as, total number of fruits, and hard to notice quantitative characteristic, like the concentration of different active principles: gentian, or volatile oil. These correlations help a lot to the person that makes the amelioration, because the way in which characters react is mainly influenced by the plant characteristics.

By calculating the correlation coefficient “r” (see **table 3**), there were obtained a serial of important data for the amelioration process of this specie. The values of the simple correlation coefficients are presented in table 3.

There were noticed positive correlation, both and significant and distinct, between the parameters of the air organs. For example the height of the plant

correlates, both significant and distinct, with the number of loops ( $r=0.79$ ), number of chime ( $r= 0.68$ ) and total number of fruits per plant ( $r= 0.65$ ). Total numbers of fruits per plant also correlates, both significant and distinct, with the number loops of ( $r= 0.63$ ) and with the number of chime ( $r= 0.66$ ). The value of “r” between the number of loops and the number of chime is 0.64, having a distinct significant level.

In the same time were noticed negative correlations, both significant and distinct, between the concentration of gentian and the height of the plant ( $r= -0.23$ ), number of loops ( $r= -0.18$ ) and the number of fruits ( $r= -0.09$ ). The concentration of gentian negatively correlates with the gentiopicroside ( $r = -0.21$ ), with the bitter parameter ( $r = -0.04$ ), with volatile oil value ( $r= -0.04$ ) and with the sugars value ( $r= -0.36$ ).

**Table 3.** The correlations established between the organs characters and the contains of active principles of the *Gentiana lutea* L. family, selected in Bravos – 2007

Character	Stalk			Chemical compounds (%)					
	Height (cm)	No of loops	No chime	Total no of fruits	Gentianin	Gentiopicroside	Bitterness Index	Volatile oil	Sugars
Height (cm)		0,79**	0,68*	0,65*	-0,23	0,48	0,29	0,31	0,16
No loops			0,64*	0,63*	-0,18	0,73	0,01	0,05	0,09
No chime				0,66*	0,29	0,35	0,41	0,63*	0,02
Total no. of fruits					-0,09	0,13	-0,07	0,14	0,06
Gentian						-0,21	-0,04	-0,04	-0,36
Gentiopicroside							0,34	0,25	0,18
Bitterness Index								0,88**	0,31
Volatile oil									0,63*

Moreover we can see the positive distinctive and significant correlation between the bitter parameter and the volatile oil value ( $r=0.88$ ) and the positive and significant correlation between the volatile oil value and sugars ( $r=0.63$ ).

## CONCLUSIONS

- *Gentiana lutea* L. is both a herb and a plant. Its ground organs represent its main productive weight where active principles are accumulated. Due to these things the selection and amelioration process it's much harder because the value of the active organ (expressed in volatile oil) can be determined just by killing the plant.
- Knowledge about correlations it's needed because it could assure the success of amelioration programs, because for the development for new plants, studied genotypes can be eliminated or retained. The main reason of creating this correlation was to create a framework that allows the identification of potential genotypes of bigger quantities of active principles.
- The correlation analysis outlines that the productivity and quality features are antagonist. In our opinion, the outline that the person that makes the amelioration uses in the selection process morphological characters of the air organ positively correlate, so to be able to realize supra productive genotypes, to compensate the negative aspects between the productivity features of active principles and the ones of the ground organs.

## REFERENCES

- [1] Ardelean, M., R. Sestraș, (1996). *Ameliorarea plantelor și tehnică experimentală, partea a II-a, Tehnică experimentală, îndrumător de lucrări practice*, Tipografia Agronomia, Cluj-Napoca
- [2] Grieve, M., (1971). *A Modern Herbal* vol. I-II, Dover Publication Inc., New-York.
- [3] Huxley, A., (1992). *The New RHS Dictionary of Gardening*, MacMillan Press, Basingstoke Hampshire, England.
- [4] Kohlein, F., (1991). *Gentians*. Portland, United States, Timber Press Inc.
- [5] Launert, (1981). *Edible and Medicinal Plants*. Hamlyn
- [6] Păun, E.A., Dumitrescu, M.A., Verzea, M., Cosocariu, O., (1986) (1988). *Tratat de plante medicinale și aromatice cultivate*, vol. I-II, Editura Academiei RSR, București.
- [7] Pop, M., Sand, C., Barbu, C.H., (2008). *The establishment of the correlation between underground organs in selected family by Gentiana lutea L. and their chemical compounds*, Cercetări științifice, Seria a XII-a, Horticultură / Inginerie Genetică, Editura Agroprint, Timișoara, ISSN 1453-1402.
- [8] Muntean, L., (1996). *Cultura plantelor medicinale și aromatice*, Editura Dacia, Cluj-Napoca.
- [9] Sand, C., Pop, M.R., Bobiț, D., Barbu, C.H., 2006. *Integration of medicinal and aromatic plant species with repellent and insecticide action into the potato crop rotations, for the biological control of the main pests*, *Journal of Central European Agriculture*. Volume 7, Number 3, Proceedings from the First International Conference on Agriculture and Rural Development Topusko, ISSN 1332-9049, Croatia
- [10] Savatti, M., Nedelea, G., Ardelean, M., (2004). *Tratat de ameliorarea plantelor*, Editura Marineasa, Timișoara.