RESULTS REGARDING YIELDING CAPACITY AND QUALITATIVE PARAMETERS OF MARIGOLD (CALENDULA OFFICINALIS L.) IN CLUJ NAPOCA, ROMANIA

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Abstract.

The marigold inflorescences are much appreciated for their medicinal purposes and they are used as healers, analgesic, bactericide, bile secretor and many other. In our study we have analyzed nine cultivars of marigold, as well as local populations and local selection from different geographic areas from Romania.

We have analyzed the total weight of 100 inflorescences, the yielding capacity, the total yield of inflorescences and dried yield.

The chemical analyses were focused on determining the poliphenolyc carboxyl acids, the flavonoids and carotenoids.

The quantification of phenyl-propane compounds was made using spectrophotometer method and Arnow reactive.

Flavonoids analyses was made using the following identification reactions: cyanides (R. Shinoda), oxalic-boric complex (R. Wilson-Tauböck), with hydroxide, ferric clorure and alkali acetate lead. The quantification was made using a spectrophotometer method based on colors modification of flavonoids with AlCl₃ solution.

The carotenoids were identified using coloring reactions with H_2SO_4 and pulverizing with hexane.

Key words: marigold, cultivars, yield, chemical composition.

INTRODUCTION

Calendula officinalis L. is a perennial plant with a very complex chemical structure. In the literature we can found a very big number of scientific papers about the chemical compounds of this plant and about their medicinal uses [Isaac, 1992; Pintea, 2001].

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MATERIAL AND METHODS

To achieve the purposes of this study, nine marigold varieties were ecological grown at Jucu experimental field, Cluj County, Romania. The experiment started in the springtime of 2007, by direct sowing marigold seeds keeping 50 cm between rows. The appearance of first plants was recorded to be 22.04.07, three weeks after sowing.

The marigold plants were well developed despite of drought summer of 2007 and they proved to have a good weather tolerance.

During the vegetative period were performed several quantitative and qualitative measurements. The first flowering was noted on 10 June 2007, after 60 days from springing plants.

The studied variants of marigold were: 1. Marigold of Someşeni; 2. Marigold of Bacău; 3. Marigold of Craiova; 4. Marigold of Biertan; 5. Melanj Mioplant; 6. Cluj 1 selection; 7. Cluj 2 selection; 8. Novi Sad and 9. Marigold of Timişoara.

ANOVA was computed for statistical interpretation of the results. The experimental field was organized in random blocks with 4 repetitions.

RESULTS AND DISCUSSION

We have analyzed the total weight of 100 inflorescences, the yielding capacity, the total yield of inflorescences and dried yield.

The results registered for mean weight of 100 inflorescences at nine marigold cultivars tested are presented in table 1.

Table 1

(Jucu experimental field, Cluj, Romania, 2007)								
Cultivar	Weight of 100 fresh flowers (g)					±		Difference
	R1	R2	R3	R4	Mean	(g)	(%)	signification
Mean value	198	191	164	183	184	0	173	-
1. Marigold of Someşeni	100	110	106	110	107	-78	100	00
2 Marigold of Bacău	130	140	142	140	138	-46	130	-
3. Marigold of Craiova	125	110	100	82	104	-80	98	00
4. Marigold of Biertan	95	100	97	98	98	-87	92	00
5. Melanj Mioplant	450	390	235	365	360	+176	338	***
6. Cluj 1 selection	150	170	165	174	165	-19	155	-
7. Cluj 2 selection	380	360	310	350	350	+166	329	***
8. Novi Sad	170	160	140	145	154	-30	144	-
9. Marigold of Timişoara	185	175	179	182	180	-4	169	-

The mean values weight for 100 inflorescences of marigold (Jucu experimental field, Cluj, Romania, 2007)

DL $_{5\%} = 49,45$; DL $_{1\%} = 66,78$; DL $_{0.1\%} = 88,93$

The larger diameter of inflorescences was noted at Melanj Mioplant and Selecția Cluj 2 cultivars. Melanj Mioplant cultivar is characterized by a large variability as regarding the colours of inflorescences, from pale yellow to orange. This character is very good for ornamental purposes but for ethno pharmacological purposes it is need it a bright orange for the colour of inflorescences and Cluj 2 only accomplish this criterion (Fig. 1).





Fig.1. Plants and inflorescences of Cluj 2 cultivar

The total yield of inflorescences, for all tested variants is presented in table 2.

The harvest of marigold inflorescences was performed **eight times**, starting at 20th of June and ending at 31th July, mainteining a break of 6 or 7 days between harvest. The hot summer of 2007 rushed the flowering of marigold. At the beginning of August the plants of marigold started to produce mass fruits.

The best yields of marigold inflorescences were obtained with Cluj 2 and Novi Sad cultivars.

The measurements for the active chemical compounds were performed at the laboratory of Pharmaceutical Faculty from Cluj-Napoca, Romania. The results of these determinations are presented; both when were tested fresh samples and dried samples are presented in tables 3 and 4.

	5	0					5/ /
Cultivar	Mean yield at first harvest, (g/m²)		Drying output (%)	Total dried	±		Difference
Cultival				(kg/ha)	kσ	0/2	signification
	fresh	dried	, ,		кg	/0	
Mean value	65,2	8,94	13,7	716	-	100	-
1. Marigold of Someşeni	41,4	5,59	13,5	447	-269	62,4	000
2 Marigold of Bacău	39,6	5,43	13,7	434	-283	60,5	000
3. Marigold of Craiova	61,7	8,21	13,3	656	-60	91,6	-
4. Marigold of Biertan	66,2	8,87	13,4	710	-6	99,2	-
Melanj Mioplant	73,7	10,39	14,1	831	+115	116,1	**
6. Cluj 1 selection	36,4	5,31	14,6	425	-291	59,4	000
7. Cluj 2 selection	120,0	16,56	13,8	1325	+609	185,1	***
8. Novi Sad	92,5	12,67	3,7	1014	+298	141,6	***
9. Marigold of Timişoara	55,4	7,48	13,5	598	-118	83,5	00

The total yield of marigolds cultivars (Jucu experimental field, Cluj, 2007)

Table 2

DL 5% = 68,01; DL 1% = 91,84; DL 0,1% = 122,30

Table 3

	Caro	tenoids	Flavonoids	Phenyl-propane	
Cultivar	Wave (450nm)	mg/100g v.p.*	(mg/100g v.p.)	derivates (mg/100g v.p.)	
1. Marigold of Someşeni	0,4625*3	16,159	68,6	73,4	
2 Marigold of Bacău	0,4358*3	14,247	96,7	27,7	
3. Marigold of Craiova	0,5301*3	17,171	70,9	117,0	
4. Marigold of Biertan	0,4770*3	16,893	78,2	83,1	
5. Melanj Mioplant	0,6776*3	7,739	44,9	79,4	
6. Cluj 1 selection	0,3922*3	13,271	30,5	61,1	
7. Cluj 2 selection	0,5184*3	17,927	67,1	58,8	
8. Novi Sad	0,3942*3	12,505	41,8	142,7	
9. Marigold of Timişoara	0,3339*3	12,76	45,3	195,5	

Quantification values of carotenoids, flavonoids and phenyl-propane derivates obtained from fresh marigold inflorescences

* v.p. = vegetal product

The concentrations of phenyl – propane derivates (caffeic acid) from marigold samples were 0,004% - 0, 19% in the fresh material and 0, 02% - 1, 32% in the dried material. The flavonoids concentrations from the samples that we analyzed were between 0, 03%-0, 12% for fresh material and 0, 39%-0, 76% for the dried samples.

Table 4

Quantification values of carotenoids, flavonoids and phenyl-propane derivates obtained from dried marigold inflorescences

Cultivar	Carot	enoids	Flavonoida	Phenyl-propane
	Wave (450nm)	mg/100g v.p.*	(mg/100g v.p.)	derivates (mg/100g v.p.)
1. Marigold of Someşeni	0,6788*2	129,29	638,7	655,6
2 Marigold of Bacău	0,7448*2	118,69	761,7	172,2
3. Marigold of Craiova	0,7421*2	131,92	675,9	802,0
4. Marigold of Biertan	0,7356*2	130,77	717,1	692,3
5. Melanj Mioplant	0,6075*2	58,14	502,4	677,7
6. Cluj 1 selection	0,5413*2	104,09	407,0	492,5
7. Cluj 2 selection	0,6963*2	132,62	583,2	472,1
8. Novi Sad	0,5939*2	99,40	468,9	914,2
9. Marigold of Timişoara	0,5744*2	101,21	503,2	1325,4

The carotenoids concentrations varied etween 6,83 - 17,9 mg/100g vegetal product for the fresh samples and between 48,8 and 132,6 mg/100g vegetal product for the dried samples.

CONCLUSIONS

- ▶ Morphologically point of view the best tested variant was number 7 (Cluj 2).
- The same cultivar, Cluj 2 has registered the best yield of inflorescences, with a total yield of 1325 kg dried inflorescences /ha from 8 harvests.
- The maximum concentration of carotenoids, both in fresh and dried plant material was noted at Cluj 2 cultivar, the values beeing of 17,927 mg /100g v.p. fresh and of 132,62 mg c./100g v.p. in dried material. The maximum concentration of flavonoids was obtained in de Bertani cultivar, and the maximum concentration of phenyl propane compounds was registered at Timisoara cultivar.
- We are considering the "Cluj 2" cultivar as a good genitor for creating a new variety of marigold.

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