CORRELATIVE BINDINGS BETWEEN MMB AND SEEDS NUMBER GERMINATED TO *CALENDULA OFFICINALIS* L.

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Abstract: *Marigolds took place from the unstable and easy to entertain flowers of garden, with amazing properties ornamental and medical. In purpose of identification if seeds weight was correlated and influenced the germinal capacity, it had been study 16 of local population of Calendula officinalis L. From diffrent localities of Hunedoara district. It were analysed different categorie of seeds: big, medium and small. Local populations supposed for testing in laboratory conditions had germination over 50%. Germination might be minimum of 70-85% to can seeding in the field and to assure the necessar number of plant for arising. The immediately practical utility of the results investigation asserted very much the proposed theme work. In Romania relatively realised a few investigations concerning the correlation existance between seeds weight of Calendula crops and its germinal capacity. Being a success the ones mentioned, it was assessed to make some complex investigations for teoretical argumentation and methods advancement used in some correlations identification between germinal capacity of marigolds seeds and its weight, which constituted an actual matter for our country concerning the development of raw material quality, because that medical plant was one of those plants used in cosmetical production, natural medicines, pharmaceutic preparations, etc.Taking in view the diversity of matter, the observations, collected data in the field and laboratory, the paper had both big complexity degree and one of big visibility, the investigations being centered towards resolving some matters with small degree of knowledge and of presence in speciality literature of Calendula species and also with a great importance for pharmaceutic and cosmetical industry. Results conffirmed some data from speciality literature, thank to that one it existed a strong correlation between seeds weight and germinal capacity. The present paper belongs to a big work which had like study "Resistance testing of some species of Calendula officinalis L. to Thysanoptera pest attack through different methods/techniques of analysis concerning the improvement of raw material quality", that represented the theme of postdoctoral-dissertation.*

Key words: *Calendula officinalis, correlations, seeds, germination*

INTRODUCTION

Calendula species took place from *Asteraceae* genus and held approximate 25 annual and ageless species, and the most known was *Calendula officinalis L.*, (BRÂNZILĂ I., 2007), croped as ornamental plant, but, also, with multiple usages in pharmacology because of its rich contain in essential oils and pigments; the most used was the oil extracted from seeds and which had a rich contain in calendic acid (FROMENT ET AL., 2006).

Plantation, production, commercialization and using medical plants won a remarcable boom in the last years. At regional level, for instance, the market based on production of some medical plants species, one of those being also the marigolds. In addition, besides agro-technology, for its production was essential the germinal evaluation of the seeds (POSSO P., 1996; MARTINEZ A., BERNAL H. AND CACERES A., 2000).

Calendula officinalis L. had heterocarpia as characteristic, hat means seeds formation

of different shapes and forms- long big seeds, curved medium seeds and curved ringed small seeds.

Calendula seeds possessed some distinctly particularities concerning MMB and germination. The seeds germinated very well at a temperature of 20-30°C.

From speciality literature it was known the weight of 1000 seeds, namely, 6-18 g, and into a gramme entered 90-150 seeds. MMB at big seeds was of 17 g, at medium seeds - 11 g, and to small seeds - 7 g. (BRÂNZILĂ I., 2004).

Investigations concerning to that domain were made by: POSSO P., (1996); MARTINEZ A., BERNAL H. AND CACERES A., (2000); DUQUE A., (2001); CARDOZO C. I., (2003); FROMENT ET AL., (2006,); BRÂNZILĂ I., (2004, 2007); VATAVU ROXANA, LEONTE C., (2007); CONSTANTINOVICI DANA, DUȚU ELENA, PRICOP ADELA, (2008); BACIU ADRIANA-DANIELA, SESTRAS R., (2008, 2009).

MATERIAL AND METHODS

Inside the studies made on different *Calendula* crops, the present study proposed itself to follow MMB, energy and germinal faculty of seeds, the way in which those were correlated, also the way in which its weight influenced the germinal capacity.

In the experiment were studied seeds that were from16 localities of Hunedoara district as it followed: Batiz, Clopotiva, Galati, Hateg, Orastie, Paclisa, Plopi, Pui, Rau Alb, Rau de Mori, Rusi, Santamarie Orlea, Sarmizegetusa, Simeria, Subcetate, Totesti.

Study was realized to Teritorial Inspectorate for Seeds Quality and Seeding Material Timis.

It were analysed different categories of seeds: big, medium and small.

MMB it was calculated to every category of seeds, through scaling to balance KERN-EG, with precission of 0.01. (fig. 1)

Figure 1 - Weighing MMB - balance KERN-EG

About determination of seeds number germinated, it were aimlessly counting 400 seeds and were used repetitions of 100 seeds sufficiently spaced to assure space for embryo nutrition and increasing, but also for uncontaminated seeds protection with diseases of contaminated seeds. In that experiment the method BP (roller) was used.

The seeds were put among paper bands of filter roller (germination bed), with pH- of 6.0-7.5 wet filter with free water of organic and inorganic impurities, after that it were covered with another paper for maintaining humidity and introduced them in plastic bags.

Seeds were supposed during 4 days of a treatment for germination interruption, as ante-cooling – to a temperature of 10°C.

After ante- cooling, plastic bags with samples were put in BINDER germinator in

vertical position to a temperature of 20°C-16h - 30°C-8h using thermorecorders for automatic reading and displaying of diagram's temperatures.

Marigolds' seed stayed in germinate apparatus during 4 days, period after which there were normal embryos (radicle well developed coleoptil same as the seed length, etc.). (figure 2).

Figure 2- *Calendula officinalis*-normal embryos
Abnormal embryos were removed to reduce the risk of secondary infection

RESULTS AND DISCUSSIONS

From the analysis of obtained results, the differences from local populations were observed not only in case of germinal capacity, but also from the point of view of MMB.

Thus, to collected samples from Totesti locatily of big seeds MMB was of 14.66 g, comparative with the seeds from Hateg and Paclisa localities, to which MMB was of 18.66 g.

To the seeds of a medium category from Totesti locality, MMB was of 10 g face to the seeds of same category in localities Galati and Hateg, which scaled 12.66 g.

Small seeds had MMB between 5.00 g, in case of Totesti locality and Plopi, and 7.66 g in case of Hateg locality (table 1).

Table 1

MMB, number of seeds germinated - *Calendula officinalis L.* – Hunedoara district

No. crt.	Local population (Hunedoara district)	Category of seeds					
		Small seeds(g)		Medium seeds (g)		Big seeds (g)	
		MMB (g)	No. of seeds germinated	MMB (g)	No. of seeds germinated	MMB (g)	No. of seeds germinated
1.	Batiz	7.33	120	11.66	186	15.33	240
2.	Clopotiva	7.00	266	12.33	280	16.66	306
3.	Galati	7.00	280	12.66	320	18.33	333
4.	Hateg	7.66	360	12.66	374	18.66	385
5.	Orastie	5.66	253	9.66	306	15.00	320
6.	Paclisa	7.33	280	10.66	306	18.66	320
7.	Plopi	5.00	13	10.33	40	15.33	93
8.	Pui	6.33	40	10.66	146	15.00	146
9.	Rau Alb	7.33	293	10.33	306	18.00	306
10.	Rau de Mori	5.33	226	10.33	226	15.33	240
11.	Rusi	7.33	253	12.33	320	18.33	346
12.	Santamarie Orlea	5.66	226	11.33	266	16.00	320
13.	Sarmizegetusa	5.33	293	10.33	346	18.00	346
14.	Simeria	7.00	186	11.00	280	16.66	360
15.	Subcetate	7.33	160	12.00	226	16.00	253
16.	Totesti	5.00	0	10.00	0	14.66	13

The minimum number of germinated seeds registered in Totesti locality (0 seeds), to small and medium seeds, and maximum number of germinated seeds was found to big seeds collected from Hateg locality (385 seeds).

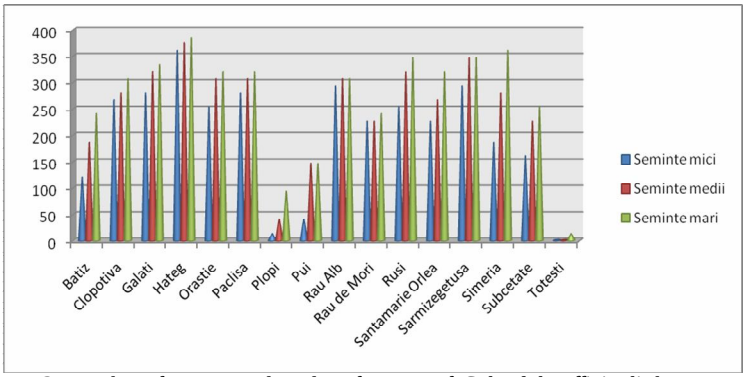

Figure 3- Number of germinated seeds in function of *Calendula officinalis* heterocarpia

From figure 3 it could observe that seeds of big category, of every local category germinated in a higher number comparative with seeds of medium and small category.

The 16 local populations evaluated after two parameters, MMB and the number of germinated seeds, and in base of obtained results it passed to number correlation degree among those.

Correlation coefficient could indicate the binding power between two values, the more the bindings were closed so as coefficient value of correlation had the value 1; the values of r^2 were between 1 and -1.

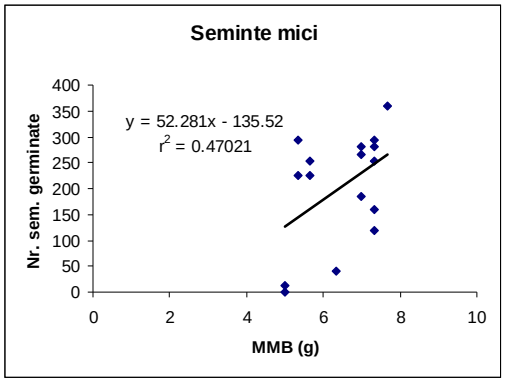

Figure 4 - Correlation between MMB and number of germinated seeds - category of small seeds

If r^2=0.40-0.60 correlation between the two indices is moderate, as can be seen in the case of categories of small and medium seeds. (fig. 4 si 5).

Correlation coefficient indicated proportion of the variant, as the percentage where the relation germinated seeds- MMB appeared. In our study r^2=0.47, namely 47% from the variant observed was met in reality, so the relation between the number of small germinated seeds and MMB was present to 47% from local populations with seeds of small category's seeds taken in study.

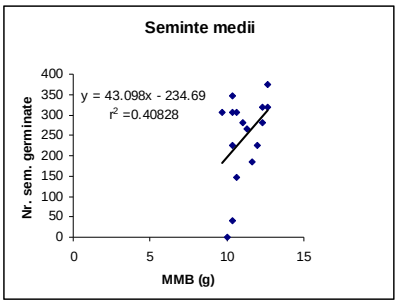

Figure 5 - Correlation between MMB and number of germinated seeds- category of medium seeds

In case of medium seeds it could observe that r^2=0.40, that meant it had exist a positive, directly, moderated between MMB and number of germinated seeds.

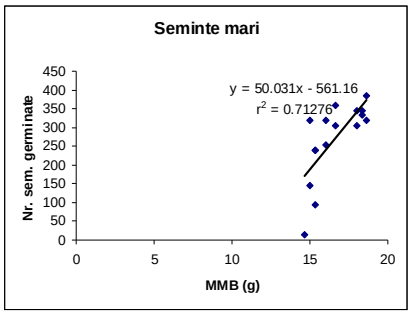

Figure 6 - Correlation between MMB and number of germinated seeds- category of big seeds

From figure 6 it could observe the diagram of dispersion was ascending. The dependence between the number of seeds of big category germinated and MMB was positive, a MMB increasing meant an increasing of the number of germinated seeds. 71% from variation of germinated seeds' number thanked to linear relation with MMB. Residual variation of number of germinated seeds was 29%. The right of regression had an ascendant trend.

CONCLUSIONS

To big seeds MMB was the highest in case of local populations in Hateg and Paclisa, such as 18.66 g, and the lowest to local population of Totesti, 14.66 g.

MMB of medium seeds was the same in case of Hateg and Galati localities, 12.66 g, respectively the maximum, and to local populations of Totesti registered the minimum of 10.00g.

Small seeds had MMB between 5.00 g to populations of Totesti and Plopi and 7.66 g to collected seeds from Hateg.

From the populations taken in study Hateg' locality had the biggest number of germinated seeds (385 big seeds), followed by Sarmizegetusa locality (346 medium and big seeds) and Rau Alb (306 medium and big seeds).

In Totesti locality the number of germinated seeds was the smallest, followed by Plopi and Pui localities.

Intensity of binding between the two index (number of small and medium seeds germinated and MMB) was moderated because r^2=0.47 in the first case, respectively r^2=0.40 in the second case.

Because r^2=0.71, in case of category with big seeds and MMB, we appreciated that

had existed a linear binding, strong and direct between the two variables.

Finally, we concluded that it had meant a significant correlation between number of germinated seeds and MMB to local populations of *Calendula* taken in study.

ACKNOWLEDGEMENT

The work was sustained by the project POSTDOCTORAL - DISSERTATION SCHOOL IN DOMAIN OF AGRICULTURE AND VETERINARY MEDICIN, financed by European Social Field, Operational Sectorial Program Human Resources Development 2007-2013, contract no. POSDRU/89/1.5/S/62371.

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