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The field yield of *Momordica charantia* L. regenerants obtained by in vitro cultures

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Abstract
Our research aimed at the cultivation in field conditions of regenerants from in vitro culture of 5 genotypes of bitter gourd (*Momordica charantia* L.). On the ground of the results we obtained, we can draw the conclusion that we can, through in vitro cultures, get variability of some yield characters in bitter gourd that can be exploited in order to improve the productive features of this species in temperate climate conditions areas.

Key words: *Momordica charantia* L., *in vitro* regenerants, field yield

Introduction
Bitter gourd (*Momordica charantia* L.), an important medicinal plant from the warm climate area of the Asian continent (India, China, and Malaysia), is cultivated in Romania but with low productivity. By applying indirect regeneration methods via the callus we can obtain plants that have higher productive features, which allow the selection of some genotypes valuable for the temperate climate area.

Material and method
In our experiments, we used 5 genotypes of bitter gourd representing 5 selections from a crop cultivated in Western Romania. The field experiment was organized in a complete randomized blocks design in three repetitions on 30 plants (70 x 40 cm) plots, during 2007-2009.
We obtained callus from cotyledons cultivated aseptically on a Murashige-Scoog medium supplemented with ANA (naphthalene acetic acid 1.5 mg/L) and BAP (benzylaminopurine 1 mg/L) phytohormones (Agarwal and Kamal, 2004; Malic et al., 2007; Sultana and Bari, 2003). Undifferentiated tissue was cultivated on the same basic medium, supplemented with AIA (indolyl-acetic acid 1 mg/L) and Kin (kinetin 0.2 mg/L) phytohormones (Manye et al., 2004; Botau and Frant, 2008). Regenerated plants were acclimated in normal conditions and transferred to the field. Their cultivation was done under normal conditions, with no chemical or organic fertilisers, ensuring the necessary water during periods of drought (Palada and Chang, 2003). We monitored fruit yield, fruit that were harvested upon maturity and we also monitored seed yield. The results concerning the productivity of the regenerants were compared to those of the donor plants, within three replications.
In the statistic interpretation of the results, we used the calculus of variance analysis and the *t* test.

Results and discussion
Features studied in the donor plants (A) and in the regenerants (R) are: the number of fruit per plant, the weight of fruit per plant, fruit weight, fruit size (length, diameter), the number of seeds per fruit, and seed weight per fruit. Tables 1 and 2 present the results concerning the values of yield features in the donor plants and in regenerants, respectively.
The studied genotypes recorded values of fruit yield per plant ranging between 1785.34 g in 5A and 2216.37 g in 1A with variation amplitude of 431.03 g, with significant differences between the yields of the genotypes 1A, 2A, and 4A compared to 3A and 5A.

Table 1. Estimates of the yield traits in the donor genotypes

	1A	2A	3A	4A	5A	LSD 5%
Fruit weight/pl.	2216,37±351,60a	2159,92±235,18a	1883,64±410,72b	2259,34±177,20a	1785,34±296,11b	274.81
Fruit nr/pl	21,86±1,92ab	23,28±3,86a	21,33±3,40bc	23,05±2,02a	19,61±2,86c	1.72
Fruit weight (g)	104,72±20,64b	135,12±10,28a	88,30±3,94b	98,37±5,36b	85,16±6,74b	23.16
Fruit lenght (cm)	13,50±1,44b	16,24±2,37a	13,49±0,94b	13,58±0,33b	12,96±1,39b	1.85
Fruit diameter(cm)	5,50±0,29a	5,72±0,25a	4,89±0,19b	5,24±0,13ab	4,82±0,69b	0.52
Seeds nr/fruit	22,05±4,04b	28,50±2,50a	20,44±2,09b	19,81±0,97b	21,74±2,38b	3.15
Seeds weight/fruit	3,85±0,87b	5,71±0,52a	3,71±0,41b	3,62±0,18b	4,12±0,72b	0.63

As for the number of fruit per plant, the highest values were recorded in the genotypes 2A and 4A, which proved to be significantly superior to the number of fruit in the genotype 5A. The average weight of fruit had a variation amplitude of about 50 g, with values ranging between 135.12 in the genotype 2A and 85.16 in the genotype 5A. In the case of this feature there were statistically ensured differences only in the case of the genotype 2A compared to 3A, 4A, and 5A. As for fruit size, there was a low variability between the studied genotypes, with no significant differences, except for the genotype 2A which yielded fruit significantly larger than other studied genotypes. The number of seeds per fruit had values ranging between 19.81 in the genotype 4A and 28.50 in the genotype 2A, in conditions in which seed weight per fruit had a variation amplitude of about 1.86 g.

Table 2. Estimates of the yield traits in the regenerants genotypes

	1A	2A	3A	4A	5A	LSD 5%
Fruit weight/pl.	1584,19±346,74b	1566,18±144,79b	2099,66±457,18a	1931,08±343,16a	2239,01±385,56a	324.61
Fruit nr/pl	16,50±4,74c	17,25±1,57c	20,67±3,44b	20,14±3,61b	24,33±3,71a	2.53
Fruit weight (g)	96,01±4,39a	93,70±3,99a	101,60±3,50a	94,82±3,48a	92,01±3,91a	12.48
Fruit lenght (cm)	16,36±1,44a	15,47±0,44ab	14,27±0,28b	14,06±0,30b	13,47±0,29ab	1.94
Fruit diameter(cm)	4,96±0,12b	4,77±0,12b	5,19±0,12b	4,98±0,08b	6,41±1,18a	0.76
Seeds nr/fruit	22,09±0,94a	21,34±1,02a	22,65±0,93a	21,72±0,95a	22,21±0,98a	1.82
Seeds weight/fruit	4,05±0,18a	4,57±0,39a	4,54±0,19a	3,66±0,16b	4,19±0,19ab	0.54

In the case of regenerants, fruit yield per plant had values ranging between 1566.18 g in the genotype 2R and 2239.01 g in the genotype 5R with a variation amplitude of about 772.83 g. The genotypes 3R and 4R also had values of this significant feature superior to those of the genotypes 1R and 2R.
The number of fruit per plant in regenerants had, in general, values inferior to those of the source genotypes ranging between 16.50 in the genotype 1R and 24.33 in the genotype 5R, which proved significantly superior to those of the other genotypes from this point of view.
The average weight of the fruit in the case of regenerants had a low variability, i.e. variation amplitude of 9.59 g. We could also notice close values between regenerant genotypes from the point of view of fruit size, i.e. from the point of view of the number and weight of seeds per fruit. As for the comparative study of yield features in regenerants and donor genotypes, there is a significant superiority of the yielding potential in the genotypes 1A, 2A and 4A compared to their regenerants.

Table 3. Comparison between the main yield traits of the donor and regenerants genotypes

Trait	Fruits weight/pl (g)		Fruits number/pl		Fruit weight (g)	
Genotype	A/R (%)	A-R	A/R (%)	A-R	A/R (%)	A-R
1	139.90	632.18*	132.48	5.36*	109.08	8.71
2	137.91	593.74*	134.95	6.03*	144.20	41.42*
3	89.71	-216.02	103.19	0.66	86.91	-13.30^{0}
4	116.99	328.26*	114.44	2.91*	103.74	3.55
5	76.33	-453.67^{0}	80.60	-4.72^{0}	92.55	-6.85
		$LSD_{5\%} = 314.58$		$LSD_{5\%} = 4.27$		$LSD_{5\%} = 12.71$

In the case of the regenerants of the genotype 3A, there is a superiority of these regenerants compared to the source from the point of view of three yielding features, but there were statistically ensured differences only in the case of average weight of the fruit.
There was significant superiority in the case of the regenerants of the genotype 5A for the weight and number of fruit per plant, compared to the donor genotype.

Conclusions

According to the results presented above, we can see that it is possible to obtain variability of yielding features in bitter gourd through *in vitro* cultures that can be exploited in order to improve yielding features in this species.

Aknowlegement

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