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IDENTIFICATION OF INITIAL MATERIAL FOR ORGANIC BREEDING IN GARDEN PEA

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Abstract: *It was evaluated the productivity, disease and pest infestation and seed quality in four garden pea accessions, grown at four organic production systems. The attempt was performed in the experimental plot of the Maritsa Vegetable Crops Research Institute – Plovdiv, Bulgaria during the period 2009 – 2010. High productivity in mid-early line № K102 at four variants of organic growing was recorded. The mid-late line № 6/00 is suitable for growing in the conditions of natural fertility with biological plant protection. The productivity of variety Marsi is the highest in fertilization with biohumus and in application of bioinsecticides for plant protection. Productivity of the early variety Musala does not exceed the standard. The infestation of diseases and pests is stronger expressed in early group varieties (for Fusarium spp. up to 11.94 % and strong up to 63.50% for Bruchus pisi L. The percentage of the infestation is low in Laspeyresia spp. to 6.42% and to 3.44% in Pythium spp. Lower degree of infestation was recorded in organic production systems with application of bioinsecticides. Garden pea seeds that were obtained are with lower absolute weight towards those recorded in conventional production but the germination is kept the same from 90.25% to 98%.*

Key words: *Pisum stivum L., productivity, organic production systems.*

1. Introduction

The increasing interest in organic vegetables production in Bulgaria determines the need for the choice of suitable varieties and the creation of seeds and planting material which will meet the requirements of this production.

Agriculture and food industry are facing a number of problems related to global warming and climate changes, the crisis with natural resources, the disappearing of bio-diversity and others [1]. These challenges determine the strategic goals: Increasing the technological level of conventional and biological agriculture; increasing the average yield; integrating resource-saving technologies and reducing the expenses for obtaining a production unit. The provision of appropriate varieties with good nutritional and biological properties to the producers of biological production will be the first and deciding step in the biological production scheme.

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The purpose of the present investigation is to study and identify an initial garden pea material for organic breeding.

2. Material and Methods

During the period from 2009 to 2010, four systems of organic production of garden peas were studied: the **Ist variant** - growing plants in natural soil fertility without using plant-protection products; the **IInd variant** - growing in natural soil fertility, using biopesticides for plant protection; the **IIIrd variant** - growing plants by fertilization with organic products authorized for use in organic production without the use of biopesticides for plant protection and the **IVth variant -** growing plants by fertilization with organic products authorized for use in organic production and use of biopesticides for plant protection. The control variant of the experiment is conventional production – the **Vth variant** - growing through the use of herbicides, mineral fertilization and plant protection with fungicides and insecticides with chemical origin.

The fertilization rates with biohumus have been determined in the agrochemical laboratory of the Maritsa Vegetable Crop Research Institute. Specification of fertilizer rates was made according to the reserves of soil nutrient substances and the biological requirements of garden pea. Preliminary analysis of soil showed the following levels of reserves with nutrients: for the year **2009** - N - 15 ppm, P – 16.4 ppm, K - 33.2 ppm, Ca - 12.0 ppm and Mg - 12 ppm, with pH - 7.08 and ES (mS\cm) - 0.14; for the year **2010** - N - 22.0 ppm, P – 6.5 ppm, K – 31.5 ppm, Ca - 32.0 ppm и Mg - 19.2 ppm, with pH – 7.73 and ES (mS\cm) - 0.20.

The experiments were conducted in the experimental plot of the Maritsa Vegetable Crop Research Institute-Plovdiv, Bulgaria with four garden pea accessions: the early variety Musala, the middle-early lines № K 102 and № 6/00 and the late variety Marci on an area of 625 m^2. The sowing was made in the period from 27. 02. to 06.03. on high flat bed by scheme 80+20+40+20/4-5 cm. The experiment was set with four accessions in five variants with four repetitions (200 plants / repeat).

Before the blossoming stage of the third and the fourth variants, fertilization was conducted using biohumus within a rate of 150 l/da. The plant protection was carried out by applying bioinsecticides: Piros 0.08% (active ingredient - pirethrin) (twice), Bioneem Plus 0.3% (active ingredient - azadirachtin) and Pirethrum 0.05% (active ingredient - pirethrin), NeemAzal T/S 0.3% (active ingredient - azadirachtin) against pests of *Laeysperesia* spp. and *Bruchus pisi* L. The chemical products included in the scheme are: (**Vth** variant): Decis 2.5 EC 0.04% (active ingredient - deltametrin), Nurele Dursban 0.07% (active ingradient cipermetrin+chlorpirifosetil) and Mospilan 20 SP 0.0125% (active ingredient - acetamiprid).

The individual productivity (g/plant), the degree of infestation of some diseases (%) (*Pythium* spp. and *Fusarium* spp.) during the phenophase of "initiation of technological maturity" and the percentage of pods/seeds attacked by pests (pea moths of the genus *Laspeyresia* spp. and *B. pisi*) in the "technological maturity" phenophase were recorded [4].

We studied the seed quality obtained from the organic production systems – absolute seed weight (g) and seed germination (%). The absolute seed weight was analyzed for 1000 dry seeds. The seed germination was recorded in two samples of 100 seeds (25 seeds from a repetition) on the 12th day of the experiment.

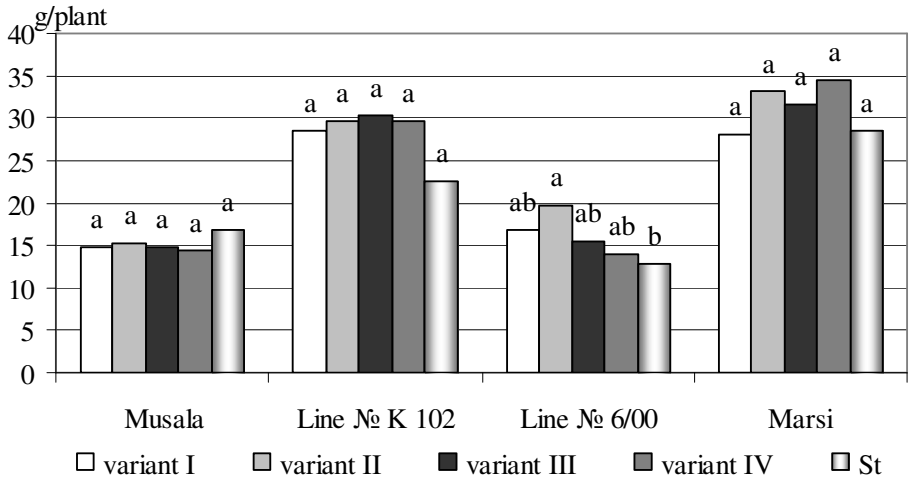
The obtained experimental data was statistically processed using computer

software MS Excel (Microsoft Office 2002) for Windows XP.

3. Results and discussion

The studied garden pea genotypes which were tested in the organic production systems have different manifestations of individual productivity - Figure 1. It is noteworthy the reaction of middle-early lines № K 102 and № 6/00 which have betted productivity in all four organic production systems compared to the productivity registered in the conventional production – variant V. The differences between the studied variants are insignificant for line № K 102 and the highest yield capacity is observed for the third variant – growing plants by fertilization with biohumus without the use of biopesticides for plant protection.

Line № 6/00 was proven to have the highest individual productivity compared to the control variant in natural soil fertility, using biopesticides for plant protection. In the conditions of traditional organic production – growing by applying biohumus and biopesticides the late variety Marci shows the highest level of productivity. This variety was characterized by bigger values of this character for the second and third variants compared to the registered values of the control. The early variety Musala also has a good production capacity, which is less than that recorded by growing plants in conventional production.



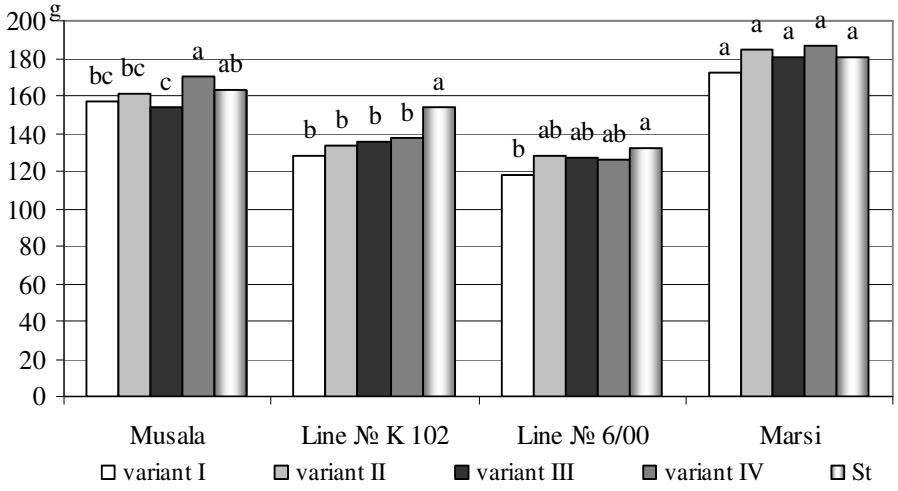
St - conventional production, **Variant I** - natural soil fertility without the use of plant-protection products, **Variant II** – natural soil fertility, using biopesticides, **Variant III** - fertilization with biohumus without the use of biopesticides, **Variant IV** - fertilization with biohumus and plant protection with biopesticides.
a,b…Duncan's multiple range test ($p<0,05$)

Fig. 1. *Individual productivity of garden pea genotypes in different systems of organic production, g*

With reference to the production of organic seeds, we studied the quality seeds obtained from organic growing – absolute seed weight and seed germination. The absolute seed weight is the highest in conventional production for

line № K 102 as there are reliably distinguish of obtained values in organic systems and also for line № 6/00 with proven differences only for natural soil fertility without plant protection – Figure 2.

The seeds of varieties Musala and Marci grown by fertilization with biohumus and applying biopesticides have absolute seed weight exceeding that of the control variant. The obtained values of the absolute seed weight for the first variety are different from those of the other organic systems and slightly exceed the values obtained in conventional production. For the second variety there are no proven differences between the tested types.



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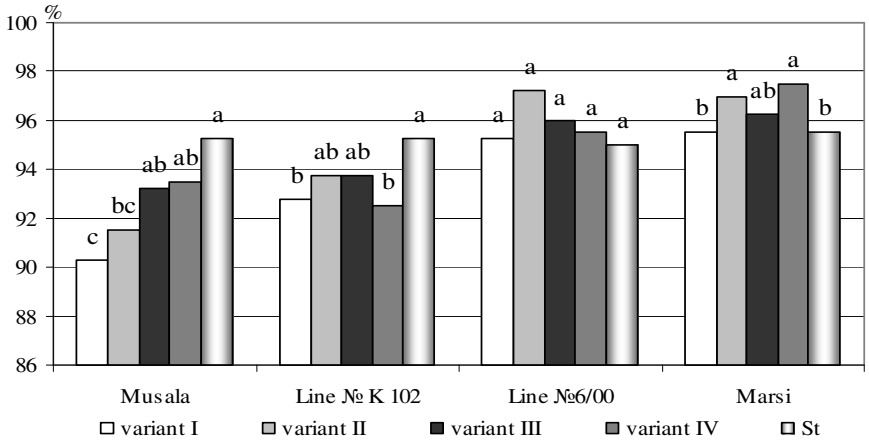
a,b…Duncan's multiple range test ($p<0,05$)

Fig. 2. *Absolute seed weight obtained in different systems of organic production, g*

The studied garden pea genotypes retain their high seed germination, which varies form 90.25% to 97.50% - Figure 3. The seed germination of variety Musala and line № K 102 is the highest in conventional production; for line № 6/00 it is slightly higher in the systems of organic production, while variety Marci has a proven higher values of seed germination when grown in natural soil fertility with plant protection and variant IV - fertilization with biohumus and use of biopesticides for plant protection.

The obtained organic seeds from garden pea differ with lower absolute weight and high germination regardless of the production system.



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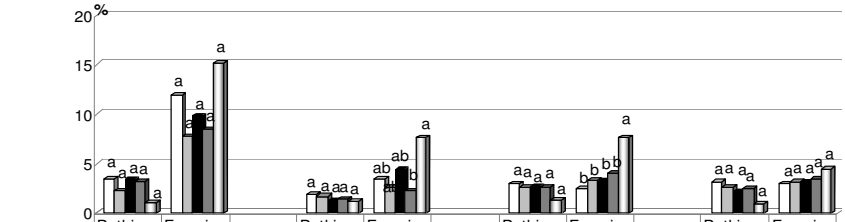
a,b…Duncan's multiple range test (p<0,05)

Fig. 3. *Seed germination obtained in different systems of organic production, %*

We also observed the emergence of some diseases like *Pythium* spp., *Fusarium* spp. and the pests *Laspeyresia* spp. and *Bruchus pisi* L. The results show a lower level of infestation by *Pythium* spp. during the summarized period - Figure 4.



	Musala		Line № K 102		Line № 6/00		Marsi	
	Pythium	Fusarium	Pythium	Fusarium	Pythium	Fusarium	Pythium	Fusarium
variant I	3,44	11,94	1,88	3,38	3,00	2,50	3,13	2,91
variant II	2,22	7,78	1,69	2,62	2,63	3,31	2,56	3,13
variant III	3,44	9,88	1,31	4,44	2,69	3,25	2,25	3,18
variant IV	3,19	8,44	1,38	2,19	2,63	4,00	2,44	3,38
St	1,00	15,16	1,13	7,63	1,25	7,57	0,94	4,44

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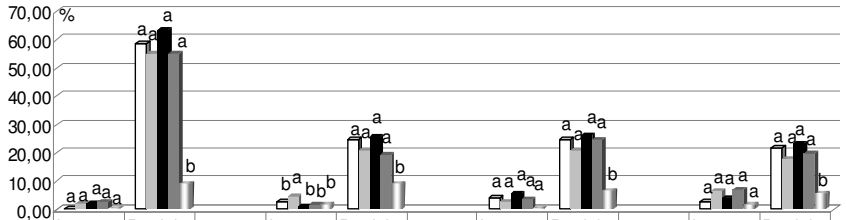
a,b…Duncan's multiple range test (p<0,05)

Fig. 4. *Degree of infestation of Pythium spp.and Fusarium spp. of genotypes of garden peas in different systems of organic production, %*

The level of infestation of the pathogen is higher in the four systems of organic production and varies from 1.31% for line № K 102 to 3.44% for variety Musala, while the values of the control sample vary from 0.94% to 1.25%. We also detected a higher level of infestation by *Fusarium* spp. in conventional production (4.44% - 15.16%). The damages caused by this pathogen in organic systems vary from 2.19% to 11.94% as the early variety Musala proved to be the most sensitive one.

A slight infestation by pea moths of the genus *Laspeyresia*, order *Lepidoptera* was also detected - Figure 5. Variety Musala and line № 6/00 grown in conventional conditions have zero values and so does the first variant of organic growing of Musala – natural fertility without plant protection. The highest percentage of damaged pods was established for: organic production with biohumus without protection (line № 6/00 – 5.52%) and with plant protection using biopesticides (variety Marci – 7.22%) and natural fertility with plant protection (Marci – 6.42% and line № K 102 – 4.71%).



	Musala		Line № K 102		Line № 6/00		Marsi	
	Laspeyre	B. pisi	Laspeyre	B. pisi	Laspeyre	B. pisi	Laspeyre	B. pisi
variant I	0,00	58,50	2,51	24,70	4,19	24,60	2,44	21,70
variant II	2,37	55,10	4,71	21,00	2,85	20,60	6,42	17,90
variant III	2,33	63,50	1,25	25,50	5,52	26,30	4,12	23,40
variant IV	2,80	55,10	1,82	19,30	3,86	24,60	7,22	19,90
St	0,00	9,10	1,74	8,80	0,00	6,50	1,83	5,40

St - conventional production, **Variant I** - natural soil fertility without the use of plant-protection products, **Variant II** – natural soil fertility, using biopesticides, **Variant III** - fertilization with biohumus without the use of biopesticides, **Variant IV** - fertilization with biohumus and plant protection with biopesticides.

a,b…Duncan's multiple range test ($p<0,05$)

Fig. 5 *Percentage of the pods damaged by Laspeyresia spp. and seeds damaged by Bruchus pisi L. of the genotypes of garden peas in different systems of organic production*

In contrast to the first pest, the infestation of *B. pisi* varies widely – from 5.4% to 63.5%. With all studied genotypes, the percentage of damaged seeds in the systems of organic production is higher than the one registered in conventional growing. The early variety Musala shows the highest degree of susceptible towards the tested pest – over 55.1%. What is of interest in the traditional system of organic production (using biohumus and biopesticides) is the reaction of slight susceptibility towards the infestation of *B. pisi* manifested by selection line № K 102 (19.3%) and variety Marci (19.9%). In the systems of organic production, a lower

percentage of seeds infested by *B. pisi* has been registered when in the process of growing bioinsecticides were used. The lowest percentage of damaged seeds was registered for variety Marci (17.9%) when the plants were grown in the conditions of natural soil fertility using biopesticides. These results confirm those reported by other authors practical results on the use bioinsecticides in pest control [3].

The comparative analysis of the obtained results shows that of all tested garden pea genotypes, the one which is suitable to be used as an initial material for organic selection is variety Marci and lines № K 102. This choice has been conformed with the manifestations of the genotypes only in conditions in the classic system of organic production – growing plants by fertilization with organic products authorized for use in organic production and use of biopesticides for plant protection and the variety and the line show relatively high productivity combined with a high level of non-receptivity towards the main factors of biotic stress – *Pythium* spp., *Fusarium* spp., *Laspeyresia* spp. and *B. pisi*. The obtained results for the other variants in the experiment can also be used but only as evaluation criteria of the biological capacity of the genotypes under unspecific conditions of growing similar to those in organic production.

The purpose of organic production of vegetables is to keep and expand the natural relationships in the system soil-plant-animal-man if it is possible so that the polluting fertilizers and plant-protective agents to become unnecessary [5]. This material shows potential for organic garden pea seed production and breeding, as required for the creation of varieties for organic production [2].

4. Conclusions

An initial garden pea material for organic breeding is identified in variety Marsi, line № K 102 and line № 6/00.

Selected genotypes are with high degree of adaptability and stability to the organic production conditions and they are described with good productivity, combined with manifestations of field resistance and tolerance to the complex of economically important diseases and pests.

Potential possibilities for production of organic seeds with good economic and sowing properties from Bulgarian garden pea genotypes are established.

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