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INVESTIGATION ON MORPHOLOGICAL TRAITS ON LEAF, POD AND SEED OF LOCAL BEAN (*Phaseolus vilgaris L.*) POPULATIONS IN MACEDONIA

A. Ibushoska [1*], S. Ivanovska [2], R. Agic [2], B. Drvoshanova [1]

[1]Institute of Agriculture, University of Ss.Cyril and Methodius in Skopje, Republic of Macedonia
[2]Faculty of Agricultural Sciences and Food - Skopje, University of Ss.Cyril and Methodius in Skopje, Republic of Macedonia

[*]e-mail**:** ibusoskaa@yahoo.com

Abstract
In this research there were analyzed forty-four (44) local bean populations from *ssp.nanus* (dwarf), sown on open field in randomized complete block design during 2008 at Institute of Agriculture, Skopje. Tested varieties were compared with two Slovenian varieties used as check variety. The objective was to identify some morphological parameters on leaf, pod and seed of these bean populations. The whole examined material was collected from eastern part of Macedonia from Malesregion, precisely from Pehchevo. Characterization and the determination of genetic variability were described according to the list of descriptors for beans of the International Commission on Genetic Resources– IBPGR (International Board for Plant Genetic Resources). Generally, all tested varieties showed differences in terms of the examined traits. Approximately half of the analyzed populations had a green leaf with a triangular shape and rare fibrous. The average values for length/ width of leaf range from 7.02-11.17cm and 4.59-8.16cm. The length and width traits of the leaf showed relatively low variability from 12.72% to 13%. In the analyzed collection the most of the landraces had a green color of pod, curved legumes, with round-oval and pear-shaped cross-section. The length of legumes ranged from 7.50 to13.27 cm. About 60% of local bean populations have white color of seed, 58% of populations have kidney shaped seed with outluster (matte). The average for dimensions of the seed, for entire collection ranged from 13, 5 mm length, 7 mm width and 3 mm for the thickness of the seed. Mass of 100 grains ranged from 28, 22-72, 59 g, with low variability of 9.9%. The results from the examinations confirmed a significant variation in all measured characteristics, but the highest variability was observed in the morphological traits of seed.

Key words: bean, *Phaseolus vulgaris*, landraces, morphological traits, diversity.

Introduction

Phaseolus vulgaris (syn. common bean) is an annual legume grown for its nutritional value. It is traditionally a basic food crop in many developing countries and serves as a major plant protein source for rural and urban areas (Atilla et al., 2010).In several countries, this species is characterized by a number of locally adapted landraces and many of them are at risk of extinction. Common beans are rich in protein (20-28%), especially the amino acids lysine and tryptophan, are an important source of minerals such as iron and zinc (Schoonhoven et al., 1991), (MoARD), Addis Ababa, Ethiopia,2006).Due to its relative early maturity, it is one of the major crops produced in areas with short rainy season and is suitable in intercropping and double-cropping (Tamado et al., 2007).Macedonia is among the countries with higher average yield, due to favorable conditions for the cultivation of this crop. Wide-ranging shapes of bean seeds grown in R. Macedonia occupy an important segment of the diversity of agricultural crops (Ivanovska et al., 2012).They usually have large white seed, according to consumer demand. We carried out an investigation of the morphological diversity in 44 common bean populations from *ssp. nanus* (dwarf bean) cultivated in the Institute of Agriculture-Skopje (IAS). We analyzed 17 quantitative traits following the IPGRI descriptors. Traditionally, plant genetic diversity is assessed by measuring variations in phenotypic or morpho-agronomic traits such as yield and stress tolerance among other traits

(Szilagyi et al., 2011). In the absence of selective program for this culture in our country, the motive for analyzing the diversity of beans increased by establishing a gene bank of plant genetic resources at the Institute of Agriculture in Skopje (Ибушоска .,2013).

Material and methods

Common bean populations along with control varieties were grown in field trials in IAS-Institute of agriculture-Skopje, in the crop year 2008. A total of 42 dwarf bean population collected in region of east part of Macedonia were evaluated for morphological characteristics and 2 control varieties from Slovenia.During the growing period, there were recorded: leaf characteristics as: shape of leaf (**SL)**; length of leaf (**LL)**; width of leaf (**WL)**; color of leaf **(CL)**.Surface was measured on ten normal leaves from the middle part of the plants following the IBPGR (1982) descriptors.At harvest time, data collected were: pod characteristic as: length of pod (**LP)**; color of pod(**PC)**; curvature of pod (**PC)**; pod cross-section (**PCS)**.As well asseed morphological traits as: color of seed (**CS)**; length of seed (**LS)**; width of seed(**WS)**; seed weight (**SW)**; shape of seed (**SS)**, brilliance of seed (**BS)**. Seed dimensions were measured as the mean of a sample of ten seeds, and seed weight was determined with one hundred seeds.

Results and discussion

The selected varieties in this trial showed different results in several investigated parameters. Based on the results, shown in Table 1 (leaf dimensions) we can conclude that the mean values for leaf length ranged from 7, 02(GN-15) to 11, 17cm (GN-25), and 4, 59 cm to 8,16 cm for width of leaf. According to the data in Table 2 the trait length of the pod showed values from 7,50cm to 13,27mm. Seed dimensions (length and width) were presented in Table 3.The average of length at dwarf populations oscillated from 5,10mm(GN-15) to 18,30mm(GN-1) and the coefficient of variation of studied genotypes (CV%) oscillated from 2,79% at GN-13 to11,13% at GN-15.The width of the seed among dwarf populations ranges from4,10mm to 9, 80 mm. Dwarf populations showed lower variability for this characteristic (6.55%). The thickness of seed amounted from 1,60mm-4,21mm (table 4).The variability within the populations for the thickness of seed CV% ranged from 2,27% to 24,59%. The mean values for weight of 100 grains ranged from 28,22g to 72,37g, where the lowest variability for this characteristic showed genotype GN-28 (3.49%).

Shenkut and Brick (2003) analyzed the 25 local populations from Ethiopia where determined far lower average (24,5 g) for the weight of 100 grains, which ranged from 15,4 g to 46,5 g. Lower values found and Meza et al., (2012) by analysis of 300 samples of beans Honduras, where the samples according to this characteristic grouped them into three groups: 7,9-21,5 g; 21,6-35,2 g and 35,3-48,9 g . During the analysis of 12 populations beans with dwarf growth and 38 bean populations with high growth Freitas et al., (2011) noted higher values compared to ours, or a mass of 100 grains of 39,8-62,9 g for the low and high 30,8-91,7 g for the beans.

Table1. Leaf dimensions in ssp.*nanus* (cm)

Length (cm)							Width (cm)						
Cod	$\bar{x}$	$S_{\bar{x}}$	**δ**	**Min**	**Max**	**V%**	**Cod**	$\bar{x}$	$S_{\bar{x}}$	**δ**	**Min**	**Max**	**V%**
GN-1	10,05	0,27	0,81	8,50	11,30	8,02	**GN-1**	7,00	0,42	1,25	4,00	8,3	17,79
GN-2	7,41	0,26	0,79	6,00	8,70	10,63	**GN-2**	5,67	0,14	0,43	5,00	6,50	7,53
GN-3	10,02	0,35	1,05	8,40	11,50	10,52	**GN-3**	7,25	0,27	0,80	6,20	8,30	11,02
GN-4	9,80	0,41	1,23	8,30	12,00	12,53	**GN-4**	6,57	0,25	0,76	5,50	8,00	11,64
GN-5	9,80	0,29	0,87	8,40	11,60	8,90	**GN-5**	6,89	0,19	0,56	5,80	7,80	8,14
GN-6	10,11	0,39	1,17	8,00	11,50	11,54	**GN-6**	6,76	0,32	0,96	5,20	8,50	14,19
GN-7	8,48	0,28	0,84	7,50	10,20	9,91	**GN-7**	6,52	0,28	0,83	5,60	8,00	12,71
GN-8	8,09	0,37	1,12	6,70	10,00	13,79	**GN-8**	6,54	0,26	0,78	5,50	7,80	11,87
GN-9	8,29	0,15	0,45	7,70	8,70	5,38	**GN-9**	5,34	0,16	0,47	4,60	6,30	8,88
GN-10	8,30	0,30	0,89	7,00	9,70	10,78	**GN-10**	6,02	0,21	0,62	5,00	7,00	10,32
GN-11	8,50	0,37	1,10	7,00	10,00	12,98	**GN-11**	6,29	0,28	0,83	5,00	7,80	13,21
GN-12	7,58	0,23	0,69	6,60	8,70	9,14	**GN-12**	5,71	0,21	0,63	4,50	6,70	11,03

GN-13	10,15	0,42	1,27	8,50	12,70	12,52	**GN-13**	7,13	0,30	0,91	5,80	8,50	12,77
GN-14	7,58	0,27	0,81	6,00	8,60	10,73	**GN-14**	5,85	0,15	0,46	5,20	6,70	7,91
GN-15	7,02	0,29	0,86	5,50	8,00	12,20	**GN-15**	5,35	0,17	0,52	4,60	6,00	9,74
GN-16	8,03	0,23	0,68	7,00	9,00	8,43	**GN-16**	5,88	0,14	0,41	5,50	7,00	6,98
GN-17	8,86	0,33	1,00	7,50	10,50	11,33	**GN-17**	6,79	0,26	0,79	5,60	8,00	11,61
GN-18	8,00	0,34	1,03	6,80	9,50	12,86	**GN-18**	6,62	0,19	0,58	5,80	7,50	8,80
GN-19	10,15	0,46	1,39	8,30	13,50	13,69	**GN-19**	8,16	0,44	1,33	6,20	10,70	16,26
GN-20	8,38	0,53	1,59	6,00	10,90	18,97	**GN-20**	5,35	0,47	1,42	3,70	7,80	26,61
GN-21	9,52	0,32	0,96	8,20	11,60	10,10	**GN-21**	6,87	0,31	0,94	5,60	8,50	13,69
GN-22	10,03	0,32	0,96	8,50	11,20	9,55	**GN-22**	7,25	0,37	1,11	5,50	9,00	15,34
GN-23	8,90	0,34	1,03	7,00	10,50	11,57	**GN-23**	6,42	0,12	0,36	6,00	7,00	5,68
GN-24	8,98	0,33	1,00	7,00	10,50	11,13	**GN-24**	5,82	0,24	0,71	4,40	6,60	12,14
GN-25	11,17	0,21	0,64	10,00	12,30	5,73	**GN-25**	7,61	0,17	0,50	7,10	8,40	6,60
GN-26	10,48	0,36	1,07	9,50	13,00	10,24	**GN-26**	6,98	0,30	0,90	6,00	8,50	12,85
GN-27	10,30	0,45	1,34	8,50	13,30	13,03	**GN-27**	6,59	0,37	1,10	4,80	9,00	16,63
GN-28	8,74	0,47	1,42	7,00	10,80	16,20	**GN-28**	5,51	0,23	0,69	4,40	6,50	12,44
GN-29	11,12	0,32	0,96	10,00	13,00	8,62	**GN-29**	7,45	0,16	0,48	6,70	8,20	6,46
GN-30	10,41	0,48	1,44	8,10	12,00	13,86	**GN-30**	7,75	0,32	0,96	5,50	8,50	12,38
GN-31	8,87	0,40	1,21	6,60	10,50	13,65	**GN-31**	6,60	0,41	1,22	4,80	9,00	18,52
GN-32	7,39	0,22	0,67	6,20	8,50	9,12	**GN-32**	5,79	0,28	0,83	4,50	7,00	14,37
GN-33	8,56	0,57	1,71	6,30	12,00	19,98	**GN-33**	6,73	0,57	1,71	5,00	10,20	25,48
GN-34	7,96	0,32	0,95	7,00	9,50	11,88	**GN-34**	5,75	0,21	0,62	4,90	6,40	10,73
GN-35	9,52	0,45	1,34	7,70	11,70	14,03	**GN-35**	6,84	0,24	0,73	5,50	8,00	10,73
GN-36	8,74	0,36	1,09	6,80	10,50	12,44	**GN-36**	6,93	0,25	0,76	5,70	8,00	11,03
GN-37	9,52	0,50	1,51	7,00	12,00	15,82	**GN-37**	7,01	0,38	1,14	4,50	8,30	16,23
GN-38	8,34	0,28	0,83	7,00	9,60	9,92	**GN-38**	6,19	0,17	0,51	5,50	6,80	8,29
GN-39	9,44	0,28	0,85	8,00	10,80	9,01	**GN-39**	6,75	0,22	0,67	5,50	7,70	9,93
GN-40	9,84	0,34	1,02	8,00	11,30	10,32	**GN-40**	6,98	0,25	0,75	5,80	8,10	10,70
GN-41	8,64	0,19	0,56	7,50	9,40	6,53	**GN-41**	6,84	0,32	0,95	5,50	8,60	13,96
GN-42	10,77	0,43	1,28	9,00	12,20	11,88	**GN-42**	7,35	0,22	0,65	6,50	8,50	8,89
GN-43	7,30	0,50	1,51	5,00	10,00	20,64	**GN-43**	4,59	0,21	0,64	4,00	5,70	13,95
GN-44	8,71	0,37	1,10	7,00	10,20	12,64	**GN-44**	6,32	0,17	0,51	5,40	7,00	8,13

Table 2. Length of pod at local bean populations from ssp.*nanus* (cm)

Cod	$\bar{x}$	$S\bar{x}$	δ	Min	Max	V%
GN-1	10,73	0,38	1,14	9,10	12,20	10,65
GN-2	10,73	0,55	1,64	9,10	14,50	15,32
GN-3	10,31	0,64	1,91	8,00	13,40	18,53
GN-4	11,64	0,57	1,72	9,20	14,00	14,75
GN-5	12,98	0,57	1,72	11,00	16,00	13,25
GN-6	9,33	0,78	2,35	5,50	12,50	25,14
GN-7	11,07	0,63	1,89	8,20	14,70	17,08
GN-8	8,41	0,39	1,17	7,00	10,00	13,96
GN-9	13,25	0,58	1,73	10,70	16,00	13,05
GN-10	12,66	0,48	1,43	10,50	15,20	11,27
GN-11	11,20	0,36	1,08	10,00	13,00	9,68
GN-12	10,41	0,42	1,25	8,70	13,20	12,01
GN-13	11,23	0,46	1,38	9,50	13,50	12,33
GN-14	9,83	0,58	1,73	7,40	12,50	17,59
GN-15	7,50	0,17	0,52	6,70	8,30	6,97
GN-16	9,97	0,28	0,83	8,50	11,20	8,31
GN-17	10,55	0,46	1,37	8,70	13,00	12,96
GN-18	10,65	0,26	0,79	9,50	12,00	7,45
GN-19	11,05	0,36	1,09	9,20	12,50	9,87
GN-20	10,97	0,34	1,01	9,80	13,00	9,24
GN-21	10,07	0,53	1,59	8,00	13,00	15,83
GN-22	12,98	0,34	1,03	11,20	15,00	7,94
GN-23	11,92	0,30	0,89	10,50	13,00	7,48
GN-24	13,20	0,45	1,35	10,50	15,00	10,25
GN-25	12,27	0,72	2,16	9,00	15,00	17,64
GN-26	12,33	0,47	1,42	10,50	14,50	11,52
GN-27	10,63	0,54	1,62	8,50	14,20	15,24
GN-28	10,43	0,20	0,60	9,80	11,50	5,72
GN-29	10,16	0,26	0,79	8,50	11,40	7,82
GN-30	11,85	0,45	1,35	10,00	13,30	11,39
GN-31	10,4	0,7	2,0	7,8	15,0	19,2
GN-32	9,20	0,38	1,15	7,20	10,30	12,46
GN-33	9,39	0,44	1,32	6,90	11,00	14,01
GN-34	10,39	0,44	1,31	8,70	13,10	12,56
GN-35	9,95	0,33	1,00	9,00	12,00	10,05
GN-36	10,93	0,30	0,89	9,20	12,00	8,15
GN-37	10,31	0,58	1,74	7,00	12,10	16,85
GN-38	11,66	0,31	0,94	10,20	13,10	8,09
GN-39	11,05	0,34	1,01	9,30	12,00	9,15
GN-40	13,27	0,40	1,20	11,60	15,20	9,06
GN-41	10,53	0,55	1,64	8,10	12,80	15,57
GN-42	10,95	0,42	1,25	8,00	13,10	11,39
GN-43	7,94	0,22	0,65	7,00	9,00	8,23
GN-44	9,15	0,38	1,14	7,70	11,00	12,41

Table 3. Seed dimensions in local bean populations from ssp. *nanus* (mm)

Length (mm)							Width (mm)						
Cod	$\bar{x}$	$S_{\bar{x}}$	**δ**	**Min**	**Max**	**V%**	**Cod**	$\bar{x}$	$S_{\bar{x}}$	**δ**	**Min**	**Max**	**V%**
GN-1	18,30	0,47	1,42	16,00	20,00	7,75	**GN-1**	8,00	0,22	0,67	7,00	9,00	8,33
GN-2	14,50	0,39	1,18	12,00	16,00	8,13	**GN-2**	7,50	0,18	0,53	7,00	8,00	7,03
GN-3	16,80	0,34	1,03	16,00	19,00	6,15	**GN-3**	7,60	0,17	0,52	7,00	8,00	6,79
GN-4	17,20	0,31	0,92	16,00	19,00	5,34	**GN-4**	7,50	0,28	0,85	6,00	9,00	11,33
GN-5	17,20	0,49	1,48	15,00	20,00	8,58	**GN-5**	7,20	0,14	0,42	7,00	8,00	5,86
GN-6	11,90	0,25	0,74	11,00	13,00	6,20	**GN-6**	5,50	0,18	0,53	5,00	6,00	9,58
GN-7	16,20	0,21	0,63	15,00	17,00	3,90	**GN-7**	6,70	0,22	0,67	5,00	7,00	10,07
GN-8	11,10	0,33	0,99	10,00	12,00	8,96	**GN-8**	7,70	0,16	0,48	7,00	8,00	6,27
GN-9	13,00	0,16	0,47	12,00	14,00	3,63	**GN-9**	5,86	0,11	0,34	5,00	6,10	5,87
GN-10	14,20	0,38	1,14	12,00	16,00	8,00	**GN-10**	7,43	0,17	0,52	7,00	8,10	6,95
GN-11	17,16	0,37	1,11	15,50	19,00	6,44	**GN-11**	7,90	0,11	0,32	7,00	8,00	4,00
GN-12	11,61	0,33	0,98	10,00	13,10	8,46	**GN-12**	8,10	0,19	0,57	7,00	9,00	7,01
GN-13	17,30	0,16	0,48	17,00	18,00	2,79	**GN-13**	7,73	0,17	0,51	7,00	8,20	6,57
GN-14	15,30	0,16	0,48	15,00	16,00	3,16	**GN-14**	7,60	0,17	0,52	7,00	8,00	6,79
GN-15	5,10	0,19	0,57	4,00	6,00	11,13	**GN-15**	4,10	0,11	0,32	4,00	5,00	7,71
GN-16	18,30	0,59	1,77	15,00	20,00	9,66	**GN-16**	8,30	0,16	0,48	8,00	9,00	5,82
GN-17	17,70	0,27	0,82	16,00	19,00	4,65	**GN-17**	8,10	0,11	0,32	8,00	9,00	3,90
GN-18	12,60	0,36	1,07	11,00	14,00	8,53	**GN-18**	8,30	0,16	0,48	8,00	9,00	5,82
GN-19	14,70	0,35	1,06	13,00	16,00	7,21	**GN-19**	8,20	0,21	0,63	7,00	9,00	7,71
GN-20	11,70	0,27	0,82	10,00	13,00	7,04	**GN-20**	5,10	0,11	0,32	5,00	6,00	6,20
GN-21	18,10	0,33	0,99	17,00	20,00	5,49	**GN-21**	8,80	0,14	0,42	8,00	9,00	4,79
GN-22	13,20	0,21	0,63	12,00	14,00	4,79	**GN-22**	7,90	0,11	0,32	7,00	8,00	4,00
GN-23	18,10	0,19	0,57	17,00	19,00	3,14	**GN-23**	8,40	0,17	0,52	8,00	9,00	6,15
GN-24	14,10	0,25	0,74	13,00	15,00	5,23	**GN-24**	8,20	0,26	0,79	7,00	9,00	9,62
GN-25	15,20	0,21	0,63	14,00	16,00	4,16	**GN-25**	8,70	0,16	0,48	8,00	9,00	5,55
GN-26	17,00	0,35	1,05	15,00	18,00	6,20	**GN-26**	7,40	0,17	0,52	7,00	8,00	6,98
GN-27	16,50	0,18	0,53	16,00	17,00	3,19	**GN-27**	7,70	0,16	0,48	7,00	8,00	6,27
GN-28	15,60	0,36	1,07	14,00	18,00	6,89	**GN-28**	9,80	0,14	0,42	9,00	10,00	4,30
GN-29	11,10	0,29	0,88	10,00	13,00	7,89	**GN-29**	7,30	0,16	0,48	7,00	8,00	6,62
GN-30	14,80	0,14	0,42	14,00	15,00	2,85	**GN-30**	7,40	0,23	0,70	7,00	9,00	9,45
GN-31	18,20	0,26	0,79	17,00	20,00	4,33	**GN-31**	7,40	0,17	0,52	7,00	8,00	6,98
GN-32	11,80	0,21	0,63	11,00	13,00	5,36	**GN-32**	7,95	0,05	0,16	7,50	8,00	1,99
GN-33	16,20	0,21	0,63	15,00	17,00	3,90	**GN-33**	8,20	0,14	0,42	8,00	9,00	5,14
GN-34	14,00	0,35	1,05	12,00	16,00	7,53	**GN-34**	7,50	0,18	0,53	7,00	8,00	7,03
GN-35	11,30	0,22	0,67	10,00	12,00	5,97	**GN-35**	7,40	0,17	0,52	7,00	8,00	6,98
GN-36	18,10	0,33	0,99	17,00	20,00	5,49	**GN-36**	8,70	0,16	0,48	8,00	9,00	5,55
GN-37	11,40	0,23	0,70	10,00	12,00	6,13	**GN-37**	7,50	0,18	0,53	7,00	8,00	7,03
GN-38	17,60	0,39	1,17	15,00	19,00	6,67	**GN-38**	8,10	0,19	0,57	7,00	9,00	7,01
GN-39	15,30	0,16	0,48	15,00	16,00	3,16	**GN-39**	6,80	0,21	0,63	6,00	8,00	9,30
GN-40	17,50	0,24	0,71	16,00	18,00	4,04	**GN-40**	8,20	0,14	0,42	8,00	9,00	5,14
GN-41	9,50	0,18	0,53	9,00	10,00	5,55	**GN-41**	6,80	0,14	0,42	6,00	7,00	6,20
GN-42	17,00	0,31	0,94	16,00	19,00	5,55	**GN-42**	7,80	0,14	0,42	7,00	8,00	5,41
GN-43	13,90	0,25	0,74	13,00	15,00	5,31	**GN-43**	7,75	0,14	0,42	7,00	8,00	5,48
GN-44	12,40	0,23	0,70	11,00	13,00	5,64	**GN-44**	8,30	0,16	0,48	8,00	9,00	5,82

Table 4. Thickness and weight of 100grains in *ssp. nanus* (g)

Thickness(mm)							Weight of 100 seeds (g)						
Cod	$\bar{x}$	$S\bar{x}$	**δ**	**Min**	**Max**	**V%**	**Cod**	$\bar{x}$	$S\bar{x}$	**δ**	**Min**	**Max**	**V%**
GN-1	4,12	0,13	0,39	3,50	5,00	9,56	**GN-1**	61,27	1,07	3,22	55,30	66,29	5,26
GN-2	3,56	0,17	0,51	3,00	4,10	14,27	**GN-2**	47,92	1,60	4,81	40,00	55,62	10,04
GN-3	3,51	0,18	0,54	2,50	4,00	15,40	**GN-3**	52,11	2,05	6,15	42,36	59,37	11,80
GN-4	3,68	0,22	0,67	3,00	5,00	18,15	**GN-4**	57,40	0,95	2,85	53,74	62,40	4,96
GN-5	2,97	0,16	0,47	2,20	4,00	15,72	**GN-5**	55,62	1,64	4,92	48,60	61,40	8,85
GN-6	2,06	0,07	0,20	1,80	2,50	9,49	**GN-6**	36,01	1,56	4,67	28,60	45,00	12,96
GN-7	3,02	0,05	0,15	2,80	3,40	4,89	**GN-7**	53,80	1,94	5,82	39,90	60,00	10,83
GN-8	3,73	0,22	0,65	3,00	5,00	17,33	**GN-8**	43,77	1,73	5,19	38,00	55,50	11,87
GN-9	2,09	0,12	0,37	1,50	3,00	17,82	**GN-9**	34,74	1,12	3,36	28,70	39,40	9,67
GN-10	2,87	0,23	0,68	2,00	4,00	23,58	**GN-10**	53,40	1,81	5,44	42,40	59,60	10,18
GN-11	3,34	0,19	0,57	2,50	4,00	17,01	**GN-11**	66,34	0,41	1,22	64,50	68,20	1,84
GN-12	3,96	0,14	0,41	3,00	4,50	10,25	**GN-12**	50,24	2,05	6,14	40,00	59,70	12,22
GN-13	3,47	0,20	0,59	2,50	4,50	16,86	**GN-13**	72,37	0,92	2,77	69,00	77,30	3,83
GN-14	2,91	0,10	0,31	2,20	3,20	10,68	**GN-14**	56,32	1,16	3,48	50,10	62,50	6,18
GN-15	1,60	0,17	0,52	10,00	11,00	4,87	**GN-15**	8,44	0,45	1,34	6,30	10,00	15,87
GN-16	2,32	0,16	0,47	2,00	3,00	20,40	**GN-16**	62,54	1,09	3,28	56,67	68,10	5,24
GN-17	3,41	0,17	0,50	3,00	4,30	14,59	**GN-17**	63,43	1,17	3,51	54,51	66,50	5,54
GN-18	3,62	0,21	0,64	3,00	4,50	17,70	**GN-18**	49,39	2,14	6,43	40,70	57,90	13,02
GN-19	2,79	0,14	0,41	2,00	3,10	14,77	**GN-19**	49,03	1,15	3,44	42,90	55,70	7,02
GN-20	1,95	0,05	0,16	1,50	2,00	8,11	**GN-20**	28,22	0,87	2,61	24,70	33,40	9,24
GN-21	3,32	0,16	0,47	3,00	4,30	14,26	**GN-21**	62,22	1,15	3,44	56,90	68,95	5,53
GN-22	2,98	0,13	0,40	2,00	3,50	13,31	**GN-22**	47,56	2,14	6,41	33,50	54,90	13,47
GN-23	3,55	0,16	0,48	3,00	4,00	13,49	**GN-23**	69,04	0,86	2,59	64,58	72,45	3,75
GN-24	3,55	0,22	0,65	2,80	4,50	18,22	**GN-24**	50,74	2,34	7,03	36,78	61,90	13,86
GN-25	3,21	0,21	0,63	2,20	4,00	19,56	**GN-25**	57,40	1,42	4,26	50,00	65,30	7,43
GN-26	3,23	0,13	0,39	3,00	4,00	12,04	**GN-26**	61,82	1,29	3,86	56,00	68,10	6,24
GN-27	3,78	0,26	0,79	2,00	5,00	20,93	**GN-27**	66,77	2,31	6,93	55,90	76,00	10,38
GN-28	3,88	0,19	0,57	3,00	5,00	14,62	**GN-28**	67,73	0,79	2,37	64,58	72,00	3,49
GN-29	3,56	0,17	0,51	3,00	4,10	14,27	**GN-29**	36,36	0,77	2,30	33,40	40,00	6,32
GN-30	3,05	0,12	0,37	2,50	4,00	12,10	**GN-30**	50,34	0,76	2,28	46,00	55,00	4,53
GN-31	2,34	0,15	0,46	2,00	3,00	19,76	**GN-31**	53,92	2,11	6,32	39,87	61,50	11,71
GN-32	4,21	0,25	0,75	3,00	5,00	17,86	**GN-32**	51,35	1,96	5,89	41,50	59,00	11,47
GN-33	2,75	0,14	0,42	2,00	3,00	15,45	**GN-33**	57,82	1,99	5,96	45,20	66,80	10,30
GN-34	3,41	0,28	0,84	2,00	5,00	24,59	**GN-34**	65,79	1,43	4,30	60,00	72,30	6,54
GN-35	3,05	0,12	0,37	2,50	4,00	12,10	**GN-35**	39,04	1,57	4,70	30,00	44,20	12,04
GN-36	3,50	0,22	0,67	2,00	4,00	19,05	**GN-36**	71,89	1,06	3,17	65,30	74,96	4,41
GN-37	3,20	0,14	0,42	3,00	4,00	13,18	**GN-37**	38,22	0,97	2,90	33,40	43,00	7,59
GN-38	3,58	0,29	0,88	2,50	5,00	24,59	**GN-38**	66,67	1,69	5,06	60,00	73,41	7,60
GN-39	2,97	0,02	0,07	2,80	3,00	2,27	**GN-39**	53,75	1,16	3,48	49,50	59,32	6,47
GN-40	2,30	0,14	0,41	2,00	3,00	17,63	**GN-40**	66,71	1,14	3,43	62,10	72,10	5,15
GN-41	2,87	0,12	0,35	2,00	3,20	12,30	**GN-41**	38,12	1,27	3,80	30,00	42,30	9,97
GN-42	3,88	0,22	0,66	3,00	5,00	16,91	**GN-42**	65,76	1,50	4,51	60,00	73,50	6,86
GN-43	3,50	0,22	0,67	2,00	4,00	19,05	**GN-43**	44,20	2,60	7,80	38,21	59,64	17,65
GN-44	3,16	0,13	0,40	2,50	4,00	12,68	**GN-44**	42,07	1,15	3,45	38,56	49,52	8,20

Qualitative characteristics for leaf, pod and seed are introduced intable5.According to the results presented in Table 5 about 59,1% of the surveyed populations are with triangular shape of leaf, 56,8% have green color of leaf, and 20,5% of all collection have dense fibrousness of leaf surface**.** Color of pod was green in 63,6%, of all analyzed varieties. The predominant seed color was white (table 5), including 58,7 % of the accessions. This is the

preferred color of beans by farmers and consumers in Macedonia. Data in tab.5 also showed the differences of morphological characteristics of seed where 56,8% of the seed has kidney shape of seed and is free of shine (matte seed).

Table 5.Morphological traits on leaf, pod and seed on local bean populations in RM *(Phaseolus vulgaris L.) ssp.nannus*

Morphological traits	Average (%)	Average (%)	Average (%)	Average(%)	Average (%)
Leaf shape	59,01% T	36,04% R	4,05% Q		
Leaf Color	56,08% G	25,00 %PG	18,02 %DG		
Leaf Fiber	79,05% RF	20,05% F	—	—	—
Pod Color	63,6% G	29,5% PG	4,5% DG	2,3% GCS	
Pod curvature	40,9%C	38,6%SC	9,1%R	11,4%S	
Pod cross-section	56,8%RE	43,2%PS	—	—	—
Seed color	58,7%W	13,0%PC	8,7%B	4,3%BR	4,3%PG
Seed shape	56,8%KS	9,1%R	25,0%C	6,8%TF	2,3%O
Brilliance of seed	56,8%MT	27,3%M	15,9%SH	—	—

*leaf shape(**T**-triangular; **R**-round; **Q**-quadrangular);leaf color(**G**-green; **PG**-pale green; **DG**-dark green);leaf fiber(**RF**-rare fiber;**F**-fibroid); pod color(**GCS**-green with carmine stripes; **G**-green; **PG**-pale green; **DG**-dark green);pod curvature(**C**-curved; **SC**-slightly curved ;**R**-recurving; **S**-straight);pod cross-section(**RE**-round elliptic;**PS**-pear shaped);seed color(**W**-white;**PC**-palecream;**B**-black;BR-brown;**PG**-pale green);seed shape(**KS**-kidney shape;**R**-round;**C**-cuboid;**TF**-truncatefastigiated;**O**-oval);seed brilliance (**MT**-matt;**M**-medium;**SH**-shiny).*

Conclusions

According to the results presented in this paper the following conclusion can be made:

Average values for length and width of leaf are almost equal with relatively low variability for this parameters. Most of the analyzed populations had green color of pod.The diversity of the collection was mostly reflected through the properties of seeds.The results of this research can be used for proper planning of conservation of germ-plasm in the gene bank.Assessment of potential bean population in Republic of Macedonia.

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