

PHENOTYPICAL RESEARCH CONCERNING CLIMBING BEAN SEEDS

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Abstract

*Bean germplasm collection of Vegetable Research and Development Station Buzău, Romania, contain over 450 accessions. The maintenance of this collection must accomplish the following requirements: maintaining the variability of this species (*Phaseolus vulgaris* L.), creating new varieties and adaptability to the climate changes in what it concerns these accessions. In 2020, this collection was cultivated in green - house covered with polyethylene. This paper presents the comparative study of 10 climbing bean seeds accessions. The seeds of each accession were evaluated in what it concerns quantitative (100 seed weight, length, thickness and width) and qualitative characteristics (seed colour, brilliance, veining and shape). The seeds weight varied between 57.57 g (V_5) and 28.88 g (V_3). More than half of the seeds variants taken into study, presented white colour, except: V_1 and V_3 - different beige and V_5 presents 2 colours (half white, half dark red). The highest values regarding seeds length and width were registered at V_{10} (17.03 and 9.11 mm). All accessions presented are stabile and it presented stability during the last growing seasons.*

Key words: *Phaseolus vulgaris* L. var. *communis*, germplasm collection, accessions.

INTRODUCTION

Bean (*Phaseolus vulgaris* L.) has been grown in Romania for over 400 years (Rădulescu, 1940; Olaru, 1982) on large areas.

Collecting and conserving biodiversity, in what it concerns bean, represents one of the main activity objectives for the Vegetable Research and Development Station (V.R.D.S.) Buzău.

Thus, in 2010 started the collecting of local bean population from the main vegetable areas in Romania.

Bean germplasm collection of V.R.D.S. Buzău contains over 450 accessions.

Similar researches were made in Romania by Rădulescu I. M., Munteanu N., Stan N.; Leonte C.; Riviş I. and Nedelea G.; Giurcă D. M.; Danci O. and Madoşa E. (Rădulescu, 1940; Munteanu, 1985; Stan et al., 1993; Stan et al., 1995; Leonte et al., 2004; Riviş and Nedelea, 2008; Giurcă and Murariu, 2009; Danci O. et al., 2010; Madoşa et al., 2010; Madoşa et al., 2011).

The maintenance of this collection must accomplish the following requirements: maintaining the variability of this species (*Phaseolus vulgaris* L.), creating new varieties and adaptability to the climate changes in what it concerns these accessions.

MATERIALS AND METHODS

There were selected 10 accessions with undetermined growth and climbing habit (van Schoonhoven and Pastor-Corrales, 1994) from the V.R.D.S.

Buzău bean germplasm collection. Therefore, the experimental variants were the following:

V_1 – accession 31 BAA;

V_2 – accession 49 BE;

V_3 – accession 60 A;

V_4 – accession 60 CB;

V_5 – accession 93;

V_6 – accession 115 CA;

V_7 – accession 127 AA;

V_8 – accession 127 BD;

V_9 – accession 127 DBB;

V_{10} – accession 174.

The biological material (climbing accessions) was cultivated in green – house covered with polyethylene conditions, according to the common production technology recommended for this area by the specialty literature (Munteanu et al., 1989; Ciofu et al., 2003; Ruşti and Munteanu, 2008).

The determination of plants, pods and seeds characteristics was made according to U.P.O.V. guideline (2005), C.P.V.O. protocol (2009) and color scale (Genchev and Kiryakov, 2005).

This work presents the variability of the main seeds characteristics of 10 accessions of climbing bean from the germplasm collection. For determination, there were used 10 seeds from each accession, according to *Handbook on evaluation of Phaseolus germplasm* (De la Cuadra et al., 2001).

Length determination was made in mm measured in parallel with the hillum, width was measured from the hilum to the opposite side and thickness was measured perpendicular on width in cross section.

According to Descriptor for *Phaseolus vulgaris* (IBPGR, 1982), van Schoonhoven A. (1994) and Debouck D. (2009) there were used 100 seeds mass (g) randomly chosen.

In order to determine seeds weight there was used an analytic scale (Partner WAS220/x), and for data analysis there were used values with 4 decimals.

There was used variation coefficient because it allows the direct comparison of data sets variation (Ireland, 2010).

The coefficient of variation (CV) in a single sample with observations is defined as

$CV=s/m$, where m is mean and s is standard deviation (Forkman, 2009).

Variability appreciation according to the CV values (Munteanu and Fălticeanu, 2008; Giurcă and Murariu, 2009) was made this way: low variability (CV< 10%), mean (CV= 10 – 20%) and high (CV > 20%).

RESULTS AND DISCUSSIONS

The study was made in Romania (45°9'N and 26°49'E) in 2020. This paper presents the variability of the main seeds quantitative characteristics (100 seed weight, length, thickness and width) and qualitative characteristics (seed color, brilliance, veining and shape) of 10 accessions of climbing bean from the V.R.D.S. Buzău germplasm collection.

I Quantitative characteristics

Seeds weight (Table 1) varied from 28.88 g (V₃) to 57.57 g (V₅). The variability coefficient in what it concerns this characteristic, had the value equal to 24.61%; this shows a high variability for the experiment.

Table 1. Main quantitative characteristics of the seeds

Variants	100 seeds mass (g)	Seeds dimensions (mm)			Length/Width	Width/Thickness
		Length	Width	Thickness		
V ₁	39.41 cd*	13.03 d	7.50 c	5.84 b	1.74	1.28
V ₂	46.39 b	15.04 b	7.82 b	5.20 c	1.92	1.51
V ₃	28.88 e	13.02 d	6.57 e	4.86 c	1.98	1.35
V ₄	46.85 b	15.42 b	7.01 d	5.40 b	2.20	1.30
V ₅	57.57 a	13.17 d	8.82 a	7.56 a	1.49	1.17
V ₆	32.52 e	12.92 d	6.54 e	4.77 c	1.98	1.37
V ₇	40.89 bc	14.20 c	7.91 b	4.76 c	1.80	1.66
V ₈	33.89 de	12.88 d	6.47 e	5.38 b	1.99	1.20
V ₉	31.48 e	12.77 d	6.79 de	4.84 c	1.88	1.40
V ₁₀	56.39 a	17.03 a	9.11 a	4.84 c	1.87	1.88
Mean	41.43	13.95	7.45	5.34	1.88	1.41
CV%	24.61	10.37	12.80	16.01	9.88	15.48
Min	28.88	12.77	6.47	4.76	1.49	1.17
Max	57.57	17.03	9.11	7.56	2.20	1.88

LSD 5% = 5.9386

LSD 1% = 8.1444

LSD 0.1% = 11.0854

LSD 5% = 0.8377

LSD 1% = 1.1488

LSD 0.1% = 1.5636

LSD 5% = 0.3210

LSD 1% = 0.4402

LSD 0.1% = 0.5992

LSD 5% = 0.5871

LSD 1% = 0.8051

LSD 0.1% = 1.0958

*Different letters between variants denote significant differences (Duncan's test, p<0.05).

According to van Schoonhoven A. (1994) five accessions have medium size (25 g to 40 g) and five accessions (V₅, V₁₀, V₄, V₂ and V₇) have large size (more than 40 g).

Seeds length (Figure 1) registered the maximum value at V₁₀ (17.03 mm) and the minimum value at V₉ (12.77 mm).

The variability coefficient in what it concerns this characteristic for the studied accessions was 10.37 %, which shows a mean variability. Width varied between 6.47 mm (V₈) and 9.11 mm (V₁₀), having a mean variability coefficient equal to 12.80% (mean variability).



Figure 1. The largest (V_{10}) and the smallest (V_9) length

A mean variability (16.01%) is also observed in what it concerns the thickness of the seeds studied. This characteristic varied between 4.76 mm (V_7) and 7.56 mm (V_5).

The highest values (Figure 2) in the experience was registered at V_5 (100 seeds mass, thickness) and V_{10} (length, width).



Figure 2. Seeds belonging to V_{10} and V_5

The variability coefficient for the three quantitative characteristics (length - 10.37%, width - 12.80 % and thickness - 16.01%) was mean.

Regarding seed length/width ratio (L/W) and seed width/ thickness ratio (W/T), the lowest values were recorded at V_5 .

The biggest value of L/W was 2.20 (V_4) and of W/T - 1.88 (V_{10}).

A similar situation is described by Sinkovic et al., 2019: high variability of weight and mean variability of length, width, thickness, L/W and W/T. In that case the lowest value was at W/T 12.64% (mean variability); in this case the lowest value is at L/W (9.88% - low variability).

II Qualitative characteristics

More than half of the seeds variants taken into study presented white colour, except (Figure 3): V_1 and V_3 – which presented a different beige and V_5 which presented 2 colours (half white, half dark red).



Figure 3. Seeds with 2 colors and different beige

Around the hilum many variants present a different color (Figure 4).

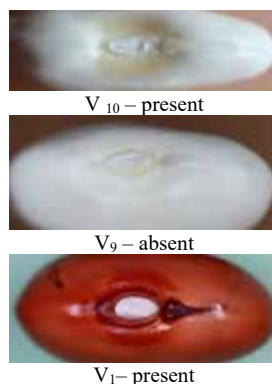


Figure 4. Different color around the hilum

Seeds shape was determined by median longitudinal section (Figure 5).

According to U.P.O.V. guideline (2005), C.P.V.O. protocol (2009) and color scale (Genchev and Kiryakov, 2005: five variants had kidney – shaped (V_2 , V_3 , V_4 , V_6 and V_{10}); three variants were elliptic (V_1 , V_8 and V_9), V_5 was circular to elliptic and V_7 was rectangular.

According to Debouck 2009 almost all variants had a medium brilliance.

Regarding (CPVO) seed veining, biological material taken into studying present weak and medium intensity (Figure 5).



Figure 5. Medium veining at V_{10}

CONCLUSIONS

The highest values in the experience was registered at V₅ (100 seeds mass, thickness) and V₁₀ (length, width).

The highest coefficient of variation was calculated for the 100 seed weight (24.61%) and the lowest for L/W (9.88%).

More than half of the seeds variants taken into study presented white colour, except: 2 variants which presented a different beige and V₅ which presented 2 colours (half white, half dark red).

Regarding shape of the seeds: five variants had kidney – shaped, three variants were elliptic, one – circular to elliptic and another was rectangular.

All accessions presented are phenotypic stabile and it presented stability during the last growing seasons.

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