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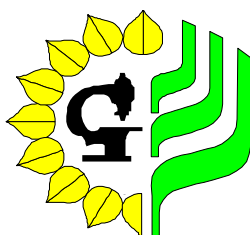
# **COLOR SCALES**

**for Identification Characters  
of Common Bean (*Phaseolus vulgaris* L.)**

**5**

**1. Plant: *anthocyanin* coloration of hypocotyl**

<b>Example Varieties</b>		
	<i>Abritus, Dobroudjanski ran, Elixir</i>	<i>Sataya 425</i>
<b>Note</b>	<b>1</b>	<b>9</b>
<b>Expression</b>	<i>absent</i>	<i>present</i>



**Dobroudja Agricultural Institute -  
General Toshevo  
2005**



Dobroudja Agricultural Institute - General Toshevo is situated in the central part of the South Dobroudja plain, at 43°40' N latitude and 20°10' E longitude, 27 km to the east of Dobrich and 7 km to the south of General Toshevo, at 236 m altitude.

This geographic and economic region of Republic of Bulgaria has the best soil and climatic conditions for development of wheat, triticale, sunflower, beans, lentil and peas.

The Institute was established in 1951 with two main tasks to carry out: breeding and technology of cultivation of the above crops.

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## **LIST OF ABBREVIATIONS**

**DAI** - Dobroudja Agricultural Institute - General Toshevo

**DUS** - Distinctness, Uniformity and Stability

**CPVO** - Community Plant Variety Office

**UPOV** - International Union for Protection of New Varieties of Plants

**DG** - Breeding lines of Dr. Dimitar Genchev

**Stage V1** - Germination

**Stage V2** - Primary leaves

**Stage V4** - Third trifoliate leaf

**Stage R6** - Flowering

**Stage R8** - Pod filling

**Stage R9** - Physiological maturity

**Stage R10** - Maturity

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## INTRODUCTION

To protect a variety, it is necessary to describe it thoroughly by a set of qualitative and quantitative characters (passportization). To carry out an essential expert evaluation for DUS, it is necessary to make a reliable assessment of the identification characters envisaged in the UPOV and CPVO protocols. The currently accepted rules of UPOV and CRVO require visual rating of each identification character and its various forms of expression. To make reliable evaluations, color photos and example varieties are used. Therefore to the scales TG/12/8 of UPOV and TP-/12/1/ of CPVO, suitable color photos and model varieties of DAI were added. Furthermore, the stages when it is most convenient to evaluate the individual characters are indicated, and some explanations for the evaluator are provided.

Germination stage (V1): response to anthracnose is registered following artificial inoculation.

Between the stages germination (V1) and first trifoliate leaf (V2) start of anthocyanin coloration of hypocotyl is registered.

Following stage third trifoliate leaf (V4) reading of start of climbing should begin.

Stage of flowering (R6) (stage begins when 50 % of the plants have their first flower open): the characters with No 7, 8, 9, 10, 11, 12, 13, 14, 45, BCMV, Xap - leaf, Psp -leaf, and 1, 2, 3 from the suggested characters are registered.

Stage pod filling (R8): BCMV, Xap - pod and Psp - pod are read following artificial inoculation.

Stage physiological maturity (R9) (stage starts when 90 % of the plants change the color of the first pod from green to yellow): the characters from the UPOV protocol TG 12/8/4 with numbers 2, 3, 4, 6, 16, 19, 21, 22, 23, 24, 25 and 26, as well as the suggested characters 4 and 5, are registered.

Stage full maturity (R10) (stage starts when moisture content in seeds is 14 % in 90 % of the plants), the characters from the UPOV protocol TG 12/8/4 with numbers 17.1, 17.2, 18, 20, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, and 44 are registered, as well as character 6 suggested by us.

In the near future, together with the visual description, an identification requirement for each variety will be the determination of a specific DNA marker.

The qualitative reading is possible in the following identification characters included in TG 12/8/4/ and TP-12/1/: 4, 5, 9, 13, 17.1, 17.2, 18, 20, 30, 34 and 38.

The following manuals and protocols were used for the compilation of this handbook: VIR - Leningrad, Debouck & Hidalgo (1986); Fernandez *et al.*, (1986), UPOV (TG/9/4, 1988; TG/12/8/, 1995; TG/1/3, 2002) IBPGR (1982), Debouck & Hidalgo (1986), Genchev & Kiryakov (1994), Genchev (1998).


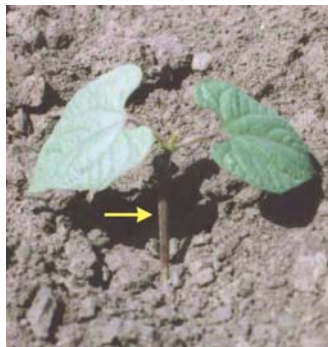
The identification characters marked with an asterisk in brackets (\*) are compulsory: 2, 7, 13, 14, 15, 17.1, 17.2, 19, 21, 23, 24, 26, 30, 34, 35, 39, 40, 41, 44, 45, 46, and 47.

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# IDENTIFICATION CHARACTERS INCLUDED IN UPOV-TG-/12/8/ AND CPVO-TP/12/1

## 1. Plant: *anthocyanin coloration of hypocotyl*






Evaluation is done in the first week after germination (V1-V2). Presence/absence of (deep violet) coloration of the hypocotyl is registered. This coloration is not influenced by the environmental conditions, unlike yellow-brown coloration of flavonoids, and therefore the presence of the latter is not taken into account but is registered as green.

Example varieties		
	<i>Abritus, Dobroudjanski ran, Elixir</i>	<i>Sataya 425</i>
Note	<b>1</b>	<b>9</b>
Expression	<i>absent</i>	<i>present</i>

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## 2. (\*) Plant: *growth type*

Evaluation is done at stage physiological maturity (R9). The varieties are divided in two groups according to the growth type: dwarf and climbing. The dwarf beans can have both a reproductive apical bud and a vegetative apical bud. To this type belong both varieties with erect and with lodging stem. Dwarf beans with vegetative apical bud can either have or have not a short tendril. The tendril is the part of stem that climbs around a stand pole or another stem.




Example varieties				
	Abritus	Hitovo 1	reproductive bud	
				
			vegetative bud	
	<i>Abritus, Hitovo 1,</i>		<i>Dobroudjanski ran, Elixir</i>	
Note	<b>1</b>		<b>2</b>	
Expression	<i>dwarf</i>		<i>climbing</i>	

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### 3. Dwarf beans only: plant: *dwarf types*




Evaluation is done visually at stage physiological maturity (R9). Inclination to climbing can be demonstrated by dwarf beans both with vegetative bud (DG 98-53-355) and with reproductive bud (Hitovo 1, cf. character 2).

<b>Example varieties</b>			
	Helis	Abritus	DG 98-53-355
	<i>Trakia, Abritus</i>		<i>DG 84-34, DG 98-53-355</i>
<b>Note</b>	<b>1</b>		<b>2</b>
<b>Expression</b>	<i>non – vining</i>		<i>vining</i>

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### 4. Dwarf beans only: plant: *plant height*

Evaluation is visual at stage physiological maturity (R9). Plants with height approximately 15-25 cm are given evaluation 3, with height 30-40 cm - evaluation 5, and taller than 50 cm - evaluation 7. Plant height is strongly influenced by the environmental conditions and therefore comparison to the example varieties is compulsory.


<b>Example varieties</b>			
	<i>DC 176</i>	<i>Abritus</i>	<i>Ludogorie</i>
<b>Note</b>	<b>3</b>	<b>5</b>	<b>7</b>
<b>Expression</b>	<i>low</i>	<i>medium</i>	<i>high</i>

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### 5. Climbing beans only: plant: *start of climbing (80 % of plants)*




The observations on this character begin after opening of third trifoliate leaf (V4). Reading starts at climbing of 80 % of the plants. This character is also strongly affected by environmental conditions and therefore comparison to example varieties is necessary to evaluate it properly.

<b>Example varieties</b>			
	<i>Radoil</i>	<i>Dobroudjanski 7</i>	<i>Vulkan</i>
<b>Note</b>	<b>3</b>	<b>5</b>	<b>7</b>
<b>Expression</b>	<i>early</i>	<i>medium</i>	<i>late</i>

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### 6. Climbing beans only: plant: *speed of climbing*






Assessment is made at physiological maturity (R9). In our opinion, speed of climbing is best evaluated visually by degree of climbing, i.e. through thickness of tendrils. There is a strong correlation between the moment of start of climbing and speed (degree) of climbing.

<b>Example varieties</b>			
	<i>Vulkan</i>	<i>Dobroudjanski 7</i>	<i>Radoil</i>
<b>Note</b>	<b>3</b>	<b>5</b>	<b>7</b>
<b>Expression</b>	<i>slow</i>	<i>medium</i>	<i>rapid</i>

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### 7. (\*) Leaf: *green color*




Assessment is made at flowering (R6). Attention should be paid to the fact that the evaluation of this character is influenced by many characters. The time of the day when the observation is made is important, as well as the position of sun according to the observer, the moisture available in soil and the agrotechnology used. Coloration different from green, such as anthocyanin, also impedes correct assessment. A future tendency will be to assess coloration with technical equipment.

<b>Example varieties</b>					
	<i>DC 176</i>	<i>Laker</i>	<i>Dobroudjanski 7</i>	<i>Prelom</i>	<i>DC 178</i>
<b>Note</b>	<b>1</b>	<b>3</b>	<b>5</b>	<b>7</b>	<b>9</b>
<b>Expression</b>	<i>very light</i>	<i>light</i>	<i>medium</i>	<i>dark</i>	<i>very dark</i>

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### 8. Leaf: *rugosity*




Assessment is done visually at flowering (R6). Leaf rugosity reflects in fact the degree of wrinkling. A more wrinkled leaf is more rugose and vice versa.

<b>Example varieties</b>			
	<i>Abritus</i>	<i>Dobroudjanski 7</i>	<i>DC 178</i>
<b>Note</b>	<b>3</b>	<b>5</b>	<b>7</b>
<b>Expression</b>	<i>weak</i>	<i>medium</i>	<i>strong</i>

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### 9. Terminal leaflet: *size*






Evaluation is done visually at flowering (R6). Leaf size is strongly affected by the technology of cultivation and the environmental conditions. Higher amount of soil moisture, higher nutrition area and nitrogen fertilization mean larger leaf size. Leaf size could be measured by leaf area in this case. For this purpose, leaf width and length are measured (as shown for variety Dobroudjanski 7). Area is calculated through multiplying leaf width by leaf length and the product is then multiplied by 0.75.

<b>Example varieties</b>			
	<i>NAB 69</i>	<i>Dobroudjanski 7</i>	<i>Dunav 1</i>
<b>Note</b>	<b>3</b>	<b>5</b>	<b>7</b>
<b>Expression</b>	<i>small</i>	<i>medium</i>	<i>large</i>

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### 10. Terminal leaflet: *shape*

Terminal leaflet shape is determined at flowering (R6). It is highly variable even in the same plant and therefore evaluation should be done only on the last fully developed leaves (in the upper parts of the plant). The predominant specific leaf shape is registered. The scale is based on the following: the shape varies from triangular to quadrangular with straight or round sides of these figures. The triangular or quadrangular shape is determined by the position of the widest part of the leaf. When it is close to the petiole (Kresna 18), the shape is triangular, and when it is in the middle of the leaf, it is either quadrangular (Abritus) or circular (NAB 69).




<b>Example varieties</b>					
	<i>Kresna 18</i>	<i>A 475</i>	<i>NAB 69</i>	<i>Dobroudjanski 7</i>	<i>Abritus</i>
<b>Note</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
<b>Expression</b>	<i>triangular</i>	<i>triangular to circular</i>	<i>circular</i>	<i>circular to quadrangular</i>	<i>quadrangular</i>

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**11. Terminal leaflet: *apex***




Evaluation is done visually at flowering (R6). The value of the note depends on the degree of elongation of the leaf apex.

<b>Example varieties</b>			
	<i>NAB 69</i>	<i>Dobroudjanski 7</i>	<i>Dunav 1</i>
<b>Note</b>	<b>3</b>	<b>5</b>	<b>7</b>
<b>Expression</b>	<i>short acuminate</i>	<i>medium acuminate</i>	<i>long acuminate</i>

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**12. Dwarf beans only: *Inflorescence: location at full flowering***




Evaluation is done visually only at flowering (R6).

<b>Example varieties</b>			
	<i>Abritus</i>	<i>Helis</i>	<i>A 475</i>
<b>Note</b>	<b>1</b>	<b>2</b>	<b>3</b>
<b>Expression</b>	<i>in foliage</i>	<i>partly in foliage</i>	<i>above foliage</i>

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**13. (\*) Flower: *size of bract***





Evaluation is visual during flowering (R6), before noon because in the afternoon the flowers lose their freshness and typical coloration. The size of bract could be determined quantitatively, as well, by measuring its length and width and calculating its area, similar to measuring leaf size.

<b>Example varieties</b>			
	<i>Dobroudjanski 7</i>	<i>Abritus</i>	<i>Prelom</i>
<b>Note</b>	<b>3</b>	<b>5</b>	<b>7</b>
<b>Expression</b>	<i>small</i>	<i>medium</i>	<i>large</i>

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#### 14. (\*) Flower: *color of standard*




Evaluation is done visually at flowering (R6). Coloration is white, pink or violet, independently or codominantly with green. In cases of codominant expression of green, the respective color should be noted together with green color. Green coloration is due to chlorophyll.

<b>Example varieties</b>				
	<i>Abritus</i>	<i>A 475</i>	<i>Sataya 425</i>	<i>DG 91-10</i>
<b>Note</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
<b>Expression</b>	<i>white</i>	<i>pink</i>	<i>violet</i>	<i>green</i>

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#### 15. (\*) Flower: *color of wings*



Assessment is visual at flowering (R6). Wings are colored in white, pink or violet.

<b>Example varieties</b>			
	<i>Abritus</i>	<i>85103</i>	<i>Sataya 425</i>
<b>Note</b>	<b>1</b>	<b>2</b>	<b>3</b>
<b>Expression</b>	<i>white</i>	<i>pink</i>	<i>violet</i>

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#### 16. White seeded varieties only: Grain: *color of immature seed (at beginning of pod swelling)*






Assessment is done visually at physiological maturity (R9). Initially, the forming seed and cotyledons are colored in green due to the chlorophyll contained in their cells. Chlorophyll disintegration and change into the color characteristic for the mature seed of the different varieties occurs at different stages of seed formation. The green color changes to white or other. In some cases green color remains in the mature seed as well (Vrania 1, cf. character 44).

<b>Example varieties</b>		
	<i>Dobroudjanski ran</i>	<i>DG 91-10</i>
<b>Note</b>	<b>1</b>	<b>2</b>
<b>Expression</b>	<i>white</i>	<i>green</i>

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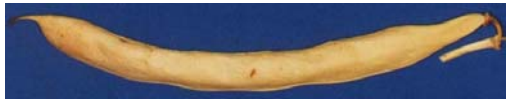


**17.1.(\*) Dwarf beans only: Pod: length, including beak**

Evaluation is done visually at stage full maturity (R10).

Note	Expression	Example varieties	
1	<i>very short</i>	<i>Michelite 62</i>	
3	<i>short</i>	<i>Abritus</i>	
5	<i>medium</i>	<i>Sin 11</i>	
7	<i>long</i>	<i>Tarnovo 13</i>	
9	<i>very long</i>	<i>Declivis Romulus</i>	




[Back to contents](#)**17.2. (\*) Climbing beans only: Pod: length, including beak**

Evaluation is done visually at stage full maturity (R10).

Note	Expression	Example varieties	
1	<i>very short</i>	<i>Moldova 13208</i>	
3	<i>short</i>	<i>BAT 477</i>	
5	<i>medium</i>	<i>Dobroudjanski 7</i>	
7	<i>long</i>	<i>Prisad</i>	
9	<i>very long</i>	<i>KW 814</i>	

[Back to contents](#)**18. Pod: median width**

Evaluation is visual at stage full maturity (R 10).





Note	Expression	Example varieties	
3	<i>narrow</i>	<i>Abritus</i>	
5	<i>medium</i>	<i>Dobroudjanski 7</i>	
7	<i>broad</i>	<i>Kristal 137</i>	

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### 19. (\*) Pod: *shape of cross section (through seed)*







Evaluation is done visually on cross sections through seed at stage pod swelling (R8) about two weeks prior to physiological maturity (R9).

Note	Expression	Example varieties	
1	<i>elliptic to ovate</i>	<i>Dobroudjanski ran, Dobroudjanski 7</i>	
2	<i>cordate</i>	<i>Dunav 1</i>	
3	<i>circular</i>	<i>Abritus</i>	
4	<i>eight - shaped</i>	<i>Golden Gate Wax</i>	

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### 20. Pod: *ratio transverse thickness/median width*




Evaluation is done either visually or metrically by calliper-gauge at full maturity (R10).

Note	Expression	Example varieties		
3	<i>small</i>	<i>Dobroudjanski ran, Dobroudjanski 7</i>		
5	<i>medium</i>	<i>Abritus</i>		
7	<i>large</i>	<i>Riltsi 7</i>		

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### 21. (\*) Pod: *ground color*




Evaluation is either visual or metrical from end of pod swelling (R8) till beginning of physiological maturity (R9).

Note	Expression	Example varieties	
1	<i>yellow</i>	<i>PPBW</i>	
2	<i>green</i>	<i>Abritus</i>	
3	<i>violet</i>	<i>Nila</i>	

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### 22. Pod: *intensity of ground color*



Evaluation is visual at stage physiological maturity (R9) or a little earlier. The intensity of ground color expression is noted.

Note	Expression	Example varieties	
3	<i>light</i>	<i>Abritus</i>	
5	<i>medium</i>	<i>Dobroudjanski ran</i>	
7	<i>dark</i>	<i>A 195</i>	

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### 23. Pod: *secondary color*



Evaluation is visual at physiological maturity (R9) or a little earlier. Presence or absence of secondary color is noted.

Note	Expression	Example varieties	
1	<i>absent</i>	<i>Dobroudjanski ran</i>	
9	<i>present</i>	<i>Vrania 7</i>	

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### 24. (\*) Pod: *hue of secondary color*


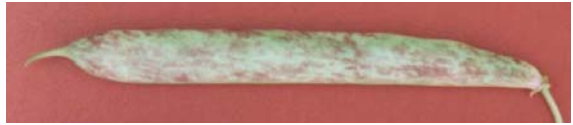

Assessment is made visually at stage physiological maturity (R9) or a little earlier. In case secondary color is present, red or violet hue is noted.

Note	Expression	Example varieties	
1	<i>red</i>	<i>Raikin 1</i>	
2	<i>violet</i>	<i>Vrania 7</i>	

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**25. Pod: density of flecks of secondary color**



Assessment is done visually at physiological maturity (R9) or a little earlier. The degree of expression of secondary color is noted.

Note	Expression	Example varieties	
3	<i>slight</i>	<i>Vrania 7 (at the beginning of secondary color expression)</i>	
5	<i>medium</i>	<i>Raikin 1</i>	
7	<i>dense</i>	<i>Vrania 7 (at the end of expression the whole pod has coloration)</i>	

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**26. (\*) Pod: stringiness**



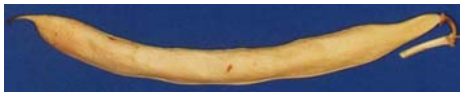


Evaluation is visual and is done at stage physiological maturity (R9). The pod is broken manually in two halves and presence/absence of stringiness is noted.

Example varieties		
	<i>PPBW</i>	<i>Dobroudjanski ran</i>
Note	1	9
Expression	<i>absent</i>	<i>present</i>

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**27. Pod: degree of curvature**




Evaluation is done at full maturity (R10).

Note	Expression	Example varieties	
1	<i>absent or very slight</i>	<i>Vulkan</i>	
3	<i>slight</i>	<i>Abritus</i>	
5	<i>medium</i>	<i>Dobroudjanski 7</i>	
7	<i>strong</i>	<i>Tiger</i>	
9	<i>very strong</i>	<i>Belo pole 9</i>	

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**28. Pod: degree of curvature**




Assessment is visual, at full maturity (R10). Pod is concave when the curve is at dorsal suture, and convex - vice versa.

Note	Expression	Example varieties	
1	<i>concave</i>	<i>Dobroudjanski 7</i>	
2	<i>S-shaped</i>	<i>Riltsi 7</i>	
3	<i>convex</i>	<i>Korona</i>	

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**29. Pod: shape of distal part (excluding beak)**




Assessment is done at full maturity (R10). At note 1 the distal part of the pod without the beak is most distant from the last seed, and at note 3 it is immediately next to the seed.

Example varieties			
	<i>Dunav 1</i>	<i>Dobroudjanski 7</i>	<i>Zlaten</i>
Note	1	2	3
Expression	<i>acute</i>	<i>acute to truncate</i>	<i>truncate</i>

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**30. Pod: length of beak**






Evaluation is done at stage full maturity (R10). It is either visual or the curve of the beak is followed on graph paper.

Example varieties			
	<i>Vulkan</i>	<i>Dobroudjanski 7</i>	<i>Dunav 1</i>
Note	3	5	7
Expression	<i>short</i>	<i>medium</i>	<i>long</i>

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### 31. Pod: *bean curvature*




Assessment is done at full maturity (R10). Curvature of beak may either follow the dorsal suture curve, or the opposite, which more typical.

<b>Example varieties</b>					
	<i>Trakia</i>	<i>Beslet</i>	<i>Elixir</i>	<i>Harsovo 5</i>	<i>Raikin peshak</i>
<b>Note</b>	<b>1</b>	<b>3</b>	<b>5</b>	<b>7</b>	<b>9</b>
<b>Expression</b>	<i>absent or very weak</i>	<i>weak</i>	<i>medium</i>	<i>strong</i>	<i>very strong</i>

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### 32. Pod: *texture of surface*




Assessment is done at full maturity (R10). Rough or smooth pod surface is noted.

<b>Note</b>	<b>Expression</b>	<b>Example varieties</b>	
<b>3</b>	<i>smooth</i>	<i>Abritus</i>	
<b>5</b>	<i>medium rough</i>	<i>Declivis Romulus</i>	
<b>7</b>	<i>rough</i>	<i>Oreol</i>	

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### 33. Pod: *constrictions*






Evaluation is done at stage full maturity (R10). It can be done at pod swelling (R8) as well, but it is more convenient and realistic to do it at full maturity. A larger sample of seeds is taken and percent of seeds with the impression pointed out is determined; if necessary, the size (area) of the impression left can be calculated. Index of constriction can be calculated on the basis of the two evaluations.

<b>Example varieties</b>	 At physiological maturity seeds are constricted thus causing impressions (Moldova 13208)		 At full maturity seeds are not touched (Moldova 13208)		 Impression resulting from constriction (Moldova 13208)
	<i>Declivis Romulus</i>	<i>Abritus</i>	<i>Alubia</i>		Moldova 13208
<b>Note</b>	<b>1</b>	<b>3</b>	<b>5</b>	<b>7</b>	<b>9</b>
<b>Expression</b>	<i>absent or very slight</i>	<i>slight</i>	<i>medium</i>	<i>pronounced</i>	<i>very pronounced</i>

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### 34. (\*) Seed: *size*

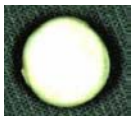



Assessment is visual or by measuring weight at full maturity (R10).

<b>Example varieties</b>					
	<i>Abritus</i>	<i>Astor</i>	<i>Dobroudjanski 2</i>	<i>Dobroudjanski ran</i>	<i>Radoil</i>
<b>Note</b>	<b>1</b>	<b>3</b>	<b>5</b>	<b>7</b>	<b>9</b>
<b>Expression</b>	<i>very small</i>	<i>small</i>	<i>medium</i>	<i>large</i>	<i>very large</i>

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### 35. (\*) Seed: *shape of median longitudinal section*




Evaluation is visual at full maturity (R10).

<b>Example varieties</b>				
		<i>Vulkan</i>	<i>Abritus</i>	<i>Dobroudjanski 7, Dunav 1</i>
<b>Note</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
<b>Expression</b>	<i>circular</i>	<i>circular to elliptic</i>	<i>elliptic</i>	<i>kidney - shaped</i>

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### 36. Varieties with kidney-shaped seeds only: Seed: *degree of curvature*

Assessment is done visually at stage full maturity (R10).






<b>Example varieties</b>			
	<i>Mx 1834-1</i>	<i>Dobroudjanski 7</i>	<i>Dunav 1</i>
<b>Note</b>	<b>3</b>	<b>5</b>	<b>7</b>
<b>Expression</b>	<i>weak</i>	<i>medium</i>	<i>strong</i>

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### 37. Seed: *shape of median cross section*.




Evaluation is done visually at stage full maturity (R10).

<b>Example varieties</b>					
	<i>G 2883</i>	<i>Dobroudjanski ran</i>	<i>Dobroudjanski 2</i>	<i>Abritus</i>	<i>Vulkan</i>
<b>Note</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
<b>Expression</b>	<i>flat</i>	<i>narrow elliptic</i>	<i>elliptic</i>	<i>broad elliptic</i>	<i>circular</i>

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### 38. Seed: *width in cross section*





Evaluation is visual, at full maturity (R10).

<b>Example varieties</b>			
	<i>Prelom</i>	<i>Dobroudjanski 7</i>	<i>Dobroudjanski 2</i>
<b>Note</b>	<b>3</b>	<b>5</b>	<b>7</b>
<b>Expression</b>	<i>narrow</i>	<i>medium</i>	<i>broad</i>

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### 39. (\*) Seed: *number of colors*










Evaluation is done visually at stage full maturity (R10).

Example varieties				
	<i>Abritus</i>	<i>DG 80-7-11-12</i>	<i>Zlaten</i>	<i>DG 84-34-1</i>
Note	1		2	3
Expression	One		Two	More than two

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**40. (\*) Seed: *main color (with largest area)***

Evaluation is done visually at full maturity (R10).

Note	Expression	Example varieties	
1	<i>white</i>	<i>Abritus</i>	
2	<i>green, greenish</i>	<i>IIRR 7585</i>	
3	<i>grey</i>	<i>Medkovets 1</i>	
4	<i>yellow</i>	<i>Sin 11</i>	
5	<i>dark yellow</i>	<i>DG 80-7-11-12</i>	
6	<i>brown</i>	<i>A 195</i>	
7	<i>red</i>	<i>Canadian Wonder</i>	
8	<i>violet</i>	<i>KW 765</i>	
9	<i>black</i>	<i>Sataya 425</i>	

[Back to contents](#)**41. (\*) Seed: *predominant secondary color***





Assessment is visual at full maturity (R10).

Note	Expression	Example varieties	
1	<i>white</i>	<i>Abritus</i>	
2	<i>grey</i>	<i>Medkovets 1</i>	
3	<i>yellow</i>	<i>Sin 11</i>	
4	<i>dark yellow</i>	<i>DG 80-7-11-12</i>	
5	<i>brown</i>	<i>A 195</i>	
6	<i>red</i>	<i>Canadian Wonder</i>	
7	<i>violet</i>	<i>KW 765</i>	
8	<i>black</i>	<i>Sataya 425</i>	

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#### 42. Seed: *distribution of predominant secondary color*




Evaluation is done visually at stage full maturity (R10).

<b>Example varieties</b>				
	<i>Padesh 1</i>	<i>Zlaten</i>	<i>Samoranovo 2</i>	<i>Kavrakirovo 1</i>
<b>Note</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
<b>Expression</b>	<i>around hilum</i>	<i>in streaks</i>	<i>on half of grain</i>	<i>in patches</i>

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#### 43. Seed: *veining*

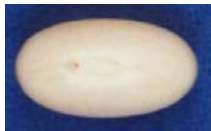

Evaluation is done visually at stage full maturity (R10).

<b>Example varieties</b>			
	<i>Abritus</i>	<i>Elixir</i>	<i>Dunav 1</i>
<b>Note</b>	<b>3</b>	<b>5</b>	<b>7</b>
<b>Expression</b>	<i>weak</i>	<i>medium</i>	<i>strong</i>

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#### 44. Seed: *color of hilar ring*

Evaluation is done visually at stage full maturity (R10).

<b>Example varieties</b>		
	<i>Abritus</i>	<i>Vrania 1, DG 80-7-11-12, Aprilovo 1</i>
<b>Note</b>	<b>1</b>	<b>2</b>
<b>Expression</b>	<i>same color as seed</i>	<i>not same color as seed</i>

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**45. (\*) Time of flowering: (50 % of the plants have at least one open flower).**

As well known, bean is a plant of the short daylight, although there already are many varieties that can develop normally at both short and long daylight. Other varieties develop normally at long daylight but at short daylight they do not grow normally. Response of bean to photoperiod is combined with air temperature.

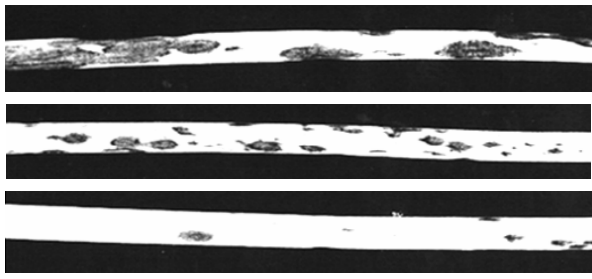
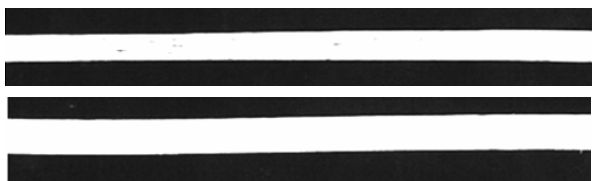


Note	1	3	5	7	9
Expression	<i>very early</i>	<i>early</i>	<i>moderate</i>	<i>late</i>	<i>very late</i>
Example varieties		<i>G 2883</i>	<i>Dobroudjanski 7</i>	<i>Abritus</i>	<i>Raikin 1</i>

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#### 46. (\*) Resistance to anthracnose (*Colletotrichum lindemuthianum*)




Reading is done 7 to 10 days after artificial inoculation of one-day old seedlings (V1) under greenhouse conditions (Genchev, 1983).

Example varieties	Note	Expression
	1	susceptible
	9	resistant

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#### 47. Resistance to Bean Common Mosaic Virus (BCMV)

Reading is done under field conditions at stages beginning of flowering (R6) and pod swelling (R8) (Schoonhoven & Pastor-Corrales, 1987).

		
1	2	3
<i>Dobroudjanski 2, Plovdiv 10</i>	<i>Abritus, Prelom</i>	<i>Helis, Elixir</i>
susceptible – not developing necrosis	resistant - developing necrosis	resistant - not developing necrosis




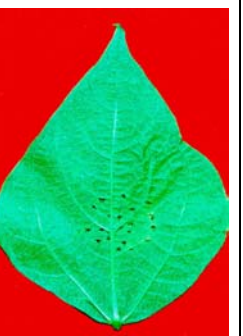

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#### 48. Resistance to Halo Blight (*Pseudomonas savastanoi* pv. *Phaseolicola*)

Reading is done at stage beginning of flowering (R6) following artificial inoculation of leaves and pods at stage pod swelling (R8) (Kiryakov & Genchev, 2002).

##### a) Leaf

				
<i>Trakia, Misia</i>			<i>Dobroudjanski ran, Elixir</i>	
<b>1</b>			<b>9</b>	
susceptible (S)			resistant (R)	

##### b) Pod





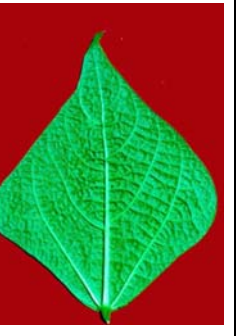
Example varieties	Note	Expression
    	<b>Halo blight</b> <i>Dunav 1, Zornitsa</i>  <b>Common blight</b> <i>Dobroudjanski ran, Abritus</i>	1
 	<b>Halo blight</b> <i>Elixir, Oreol</i>  <b>Common blight</b> <i>Elixir, Oreol</i>	9
		resistant (R)

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#### 49. Resistance to Common Bacterial Blight (*Xanthomonas axonopodis* pv. *phaseoli*)

Reading is done at stage beginning of flowering (R6) following artificial inoculation of leaves, and pods at stage pod swelling (R8) (Kiryakov & Genchev, 2002).

##### a) Leaf

				
<i>Dobroudjanski ran, Abritus</i>			<i>Elixir, Beslet</i>	
<b>1</b>			<b>9</b>	
susceptible (S)			resistant (R)	

##### b) Pod (cf. identification character 48).

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## SUGGESTED IDENTIFICATION

## CHARACTERS

1. **Plant** - habit type. Assessment is done at stage physiological maturity (R9).



Helis - Ia

**Note 1. Ia** - Main stem and its branches end with reproductive buds. Plant is erect and non-climbing.

**Example varieties:** Helis, Trakia, Mizia

**Note 2. Ib** - same as Ia, but climbing bean type.

**Example varieties:** Hitotvo 1, Pukliv 1

**Note 3. IIa** - Main stem and branches end with vegetative buds. Plant is erect and non-climbing.

**Example varieties:** Abritus, Prelom, Ludogorie

**Note 4. IIb** - Same as IIa, but the bean type is climbing.

**Example varieties:** DG 98-53-116, DG 98-53-355, DG-84-34-1



Pukliv 1 - Ib



Abritus - IIa

**Note 5. IIIa** - Main stem and branches end with vegetative buds. Plant is lodging and non-climbing. Pods are in the lower part of the plant.

**Example variety:** BAT 477

**Note 6. IIIb** - Same as IIIa but climbing type.

**Example varieties:** Dobroudjanski ran, Dobroudjanski 7, Elixir



DG 98-53-355 - IIb



Elixir - IIIb

**Note 7. IVa** - Main stem and branches end with vegetative buds. Plant is climbing. Pods are located along the whole plant.

**Example varieties:** Radoil, Zlaten, Korona.

**Note 8. IVb** - Same as IVa but pods are located in the upper 2/3 part of the plant.

**Example varieties:** Raikin 1, Raikin 2





Radoil - IVa





Raikin 2 - IVb

**2. Leaf: pilosity on surface.** Assessment is done visually at flowering (R6). Evaluation is performed on terminal leaves just open. It is recommended to first fold slightly the leaf and using a magnifying glass, evaluate it according to the scale below:

 3	 9	Note	Expression	Example varieties
		1	absent	
		3	weak	<i>Dobroudjanski ran</i>
		5	medium	<i>Abritus</i>
		7	strong	<i>DG 89-1-164-15</i>
		9	very strong	<i>DG 84-34-1</i>



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**3. Leaf: pilosity on back side.** Assessment is made visually at flowering (R6). Evaluation is performed on terminal leaves just open. It is recommended to first fold slightly the leaf and using a magnifying glass, evaluate it according to the scale below:

 3	 9	Note	Expression	Example varieties
		1	absent	
		3	weak	<i>Dobroudjanski ran</i>
		5	medium	<i>Abritus</i>
		7	strong	<i>DG 89-1-164-15</i>
		9	very strong	<i>DG 84-34-1</i>




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**4. Flower : green coloration of last curve of keel.** Evaluation is done at flowering (R6) by the following scale:

 1	 2	Note	Expression	Example varieties
		1	green	<i>Ludogorie</i>
		2	white	<i>Abritus</i>



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**5. Pod: type of secondary color.** Assessment is made at physiological maturity (R9). There are three cases of secondary coloration: 1) presence of streaks; 2) presence of hue; 3) streaks and hue together (codominant). In some varieties secondary coloration is the same during the entire expression. In others the streaks appear first, their intensity increases (*Vrania 7*, *Mastilen*), then a hue occurs and in the final stage the whole pod colors in violet. In the third case the streaks and hue occur almost simultaneously with constant intensity. These peculiarities should be taken into account or the same variety could be evaluated with 3, 5, 7, etc. depending on the time of reading the character, as is the case with example variety *Vrania 7*.

  	Note	Expression	Example varieties
	1	presence of streaks	<i>Raikin 1</i>
	2	presence of hue	<i>TU, Vulkan</i>
	3	simultaneous presence of streaks and hue (co-domination)	<i>BAT 477</i>

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**6. Seed: glossiness.** Assessment is made at stage maturity (R10).

 Abritus 3	 Isabella 7	Note	Expression	Example varieties
		1	very weak glossiness	
		3	slight glossiness	<i>Abritus</i>
		5	medium glossiness	<i>Ludogorie</i>
		7	strong glossiness	<i>Kristal 137, Isabella</i>
		9	very strong glossiness	

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