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Morphological description of French bean varieties based on DUS characters

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ABSTRACT

The experiment was carried out during *Rabi* season of 2010-11 and 2011-12 to estimate the morphological variability of 18 French bean varieties collected from ICAR institutes and SAUs for 21 morphological traits (20 visual and 01 measurable). The varieties, *viz.,* Pusa Himalaya show circular to elliptic, Kentucky Wonder and Swarna Lata showed elliptic and rest 15 varieties showed kidney shaped seed however, none of the variety had round seed shape. Five varieties, *i.e.* Kentucky Wonder, Lakshmi, HAFB-3, HAFB-4 and Swarna Lata have small seed size moreover five varieties (Azad Rajmah-1, Kashi Param, Pusa Himalaya, RCFB-56 and RCMFB-1) expressed medium seed size while, Swarna Priya have very large seed size and rest seven varieties were categorized under large seed size. The results suggest that the characterization of these varieties were done in order to use these varieties as reference varieties for protection of other new varieties under PPV&FR Rules, 2001. The best strategy for this research is to collect the information about distinct features of these varieties. The database generated may be useful for the selection of suitable varieties to be compared against the candidate varieties. This investigation may also be helpful to the researchers with respect to breeding of French bean varieties for particular traits. Moreover, farmers can also get benefited with regards to selection of suitable varieties of their interest.

Key words: DUS, French bean, varieties, evaluation, characterization.

INTRODUCTION

French bean (*Phaseolus vulgaris* L.) originated from Central America and South Mexico, is an important vegetable legume crop used by human being as green pods and dry seeds. This crop is widely adapted to high altitude regions of the country particularly Himachal Pradesh, Uttarakhand and North Eastern region. Besides, this crop may also be grown in Eastern part of Uttar Pradesh. Seeds of French bean have about 22% protein and it is a principal source of protein for more than 500 million people in Latin America and Africa as well as India (Fageria, 2). The determination of genetic variability and its partitioning into various components is necessary to have an insight into the genetic nature of yield and its components. In the national and international bean breeding programmes, only a small proportion of the genetic variability has been utilized by bean breeders (Miklas, 4; Singh, 10). Morphological characterization of varieties was done with respect to DUS (distinctiveness, uniformity and stability) testing guidelines. The characterizations of these varieties were done in order to use these varieties as reference for protection of other new varieties under PPV&FR Rules, 2001. Therefore, the database of 18 French bean varieties, generated may be useful for the selection of suitable varieties to be compared against the candidate varieties developed in India. This investigation may also be helpful to the researchers with respect to improvement of French bean varieties for particular traits.

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MATERIALS AND METHODS

A total of 18 French bean varieties, *viz.* VL Boni Bean- 1, VL Bean- 2, Swarna Priya, Azad Rajmah-1, Arka Suvidha, Arka Komal, Kashi Param, VL Bean-3, Contender, Pusa Himalaya, Pusa Parvati, Lakshmi, HAFB-4, Kentucky Wonder, RCFB-56, HAFB-3, Swarna Lata, and RCMFB-1 were evaluated at Experimental Farm of IIVR, Varanasi in a randomized block design with three replications over two years (2010-11 & 2011-12). The plants are grown at the spacing of 40 cm × 15 cm (determinate type) and 80 cm × 15 cm (indeterminate type) on row length of 5 m on 4 rows along with plant population of 140 plants per replication. Varieties were evaluated for 21 descriptors, *viz*. time of flowering, stem anthocyanin colouration, leaflet size (at terminal leaflet of first flowering mode), plant growth type, plant twining habit, plant habit, intensity of green colour of leaf, shape of central leaflet, colour of standard petal, outer surface of standard petal, pod curvature, pod shape of cross section (through seed), pod shape (in relation to suture), pod shape of distal part (excluding beak), pod colour, pod stringiness, pod pigmentation on pod shell, seed shape, seed weight (weight of 1000-seeds), seed testa colour and seed testa variegation. The observations were recorded on 10 plants in each

replication at specified stages of crop growth period when the characters under study had full expression. The time of flowering was observed at 50% plant with atleast one open flower and other characters were observed according to DUS guidelines descriptor.

RESULTS AND DISCUSSION

Among the 18 French bean varieties, considerable variation was observed for all the important traits under study. The characterization of French bean varieties are presented in Table 1. In the present study, among the 18 varieties, 13 showed early flowering behavior and five varieties, *viz*., Kentucky Wonder, RCFB-56, HAF B-3, Swarna Lata, RCMFB-1 showed medium flowering behavior. The stem anthocyanin colouration was not expresed in most the varieties except Azad Rajmah-1, RCFB-56, Swarna Lata and RCMFB-1. The leaflet size of terminal leaflet of first flowering node was expressed large for three varieties namely Azad Rajmah-1, Arka Komal and Kashi Param, however, 6 varieties was medium, *i.e*., VL Boni Bean-1, Pusa Himalaya, Pusa Parvati, Lakshmi, RCFB-56, HAFB-4 and 9 varieties had small size of terminal leaflet of first flowering node. On the basis of plant growth habit, French bean varieties have been grouped into three categories, *viz.*, erect, semi-erect and spreading. In case of plant growth type, 5 varieties showed erect plant growth type, *i.e.*, VL Boni Bean-1, Swarna Priya, Arka Suvidha, Arka Komal and Kashi Param and five varieties were semi-erect type namely VL Bean-2, Azad Rajmah-1, VL Bean-3, Contender and Pusa

Table 1. Description of morphological DUS descriptors of French bean varieties.

Variety	Morphological character									
	1	2	3	4	5	6	7	8	9	10
VL Boni Bean-1	3	1	5	3	2	1	3	1	4	1
VL Bean-2	3	1	3	5	2	1	7	2	3	1
Swarna Priya	3	1	3	3	2	1	3	2	1	1
Azad Rajmah-1	3	9	7	5	2	1	7	2	4	1
Arka Suvidha	3	1	3	3	2	1	7	2	3	1
Arka Komal	3	1	7	3	2	1	7	1	3	1
Kashi Param	3	1	7	3	2	1	7	2	3	1
VL Bean-3	3	1	3	5	1	2	3	1	4	1
Kentuky Wonder	5	1	3	7	1	2	3	1	1	1
Pusa Himalaya	3	1	5	7	2	1	7	1	1	1
Pusa Parwati	3	1	5	5	1	2	7	2	4	1
Lakshmi	3	1	5	7	1	2	7	1	1	1
RCFB-56	5	9	5	7	1	2	3	1	3	1
HAFB-3	5	1	3	7	1	2	3	2	1	1
HAFB-4	3	1	5	7	1	2	3	2	3	2
Swarnalata	5	9	3	7	1	2	7	1	3	2
RCMFB-1	5	9	3	7	1	2	7	2	1	1
Contender	3	1	3	5	2	1	7	2	4	1
State	3. Early (<50 days) 5. Medium (50-75 days) 7. Late (76-100 days) 9. Very late (>100 days)	1. Absent 9. Present	3. Small 5. Medium 7. Large	3. Erect 5. Semi-erect 7. Spreading	1. Viny 2. Non-viny	1. Determinate 2. Indeterminate	3. Light 7. Dark	1. Cordate 2. Ovate 3. Rhombohedric 4. Hastate	1. White 2. Yellow 3. Pink 4. Violet	1. Stripped 2. Non-stripped

Contd...

Contd...

Variety	Morphological character										
	11	12	13	14	15	16	17	18	19	20	21
VL Boni Bean-1	7	4	1	3	1	1	9	4	7	2	9
VL Bean-2	7	4	1	3	2	1	9	4	7	5	9
Swarna Priya	5	1	1	5	2	9	1	4	9	4	1
Azad Rajmah-1	1	4	1	5	2	9	1	4	5	5	1
Arka Suvidha	5	4	1	5	1	1	1	4	7	2	1
Arka Komal	5	1	1	3	2	9	9	4	7	2	1
Kashi Param	5	4	1	3	1	9	1	4	5	2	1
VL Bean-3	7	2	1	3	2	1	9	4	7	5	9
Kentuky Wonder	5	2	1	3	2	1	1	3	3	2	1
Pusa Himalaya	5	2	1	5	2	9	1	2	5	1	1
Pusa Parwati	5	4	1	3	2	1	1	4	7	2	1
Lakshmi	5	4	1	5	2	1	1	4	3	1	1
RCFB-56	5	4	1	3	1	1	9	4	5	5	1
HAFB-3	7	4	1	3	1	9	1	4	3	1	1
HAFB-4	5	4	1	3	2	1	1	4	3	2	1
Swarnalata	5	4	1	3	2	1	9	3	3	2	1
RCMFB-1	7	4	1	3	1	1	1	4	5	5	1
Contender	7	4	1	3	2	1	1	4	7	2	1
State	1. Absent 5. Medium 7. Strong	1. Cordate 2. Circular 3. Eight shaped 4. Oval	1. Concave 2. S shaped 3. Convex	3. Acute 5. Acute to truncate 7. Truncate	1. Pale green 2. Green 3. Purple	1. Absent 9. Present	1. Absent 9. Present	1. Circular 2. Circular to elliptic 3. Elliptic 4. Kidney shaped	3. Small (<250 g) 5. Medium (250-350 g) 7. Large (351-450 g) 9. Very large (>450 g)	1. White 2. Brown 3. Red 4. Dark red 5. Black	1. Absent 9. Present

Descriptor characters- 1 = Time of flowering, 2 = Stem: anthocyanin colouration, 3 = Leaflet: size, 4 = Plant: growthtype, 5 = Plant: tiwining habit, 6 = Plant habit, 7 = Leaflet: intensity of green colour, 8 = Leaflet: shape of central leaflet, 9 = Colour of standard petal, 10 = Outer surface of standard petal, 11 = Pod: curvature, 12 = Pod: shape of cross section (through seed), 13 = Pod: shape (in relation to suture), 14 = Pod: shape of distal part (excluding beak), 15 = Pod: colour, 16 = Pod: stringiness, 17 = Pod: pigmentation on pod shell, 18 = Seed: shape, 19 = Seed: size (Weight of 1000 seeds), 20 = Testa colour, 21 = Testa varigation.

Parvati and 8 varieties expressed spreading type of plant growth habit. In favour of the plant twining habit characters, eight varieties expressed viny type, *i.e.* Kentucky Wonder, Pusa Himalaya, Lukshmi, RCFB-56, HAFB-3, HAFB-4, Swarna Lata and RCMFB-1 and other 10 varieties showed non-viny type plant twining habit. Among the 18 varieties, 11 had dark green color of leaf and 7 varieties were showed light green leaf colour. The shape of central leaflet in 8 varieties was found cordate leaflet and ten varieties were showed ovate shape, while none was found for rhombohedric shape of central leaflet. Among the 18 French bean varieties 6 varieties expressed white petals colour, *viz*., Swarna Priya, Kentucky Wonder, Pusa Himalaya, Lakshmi, HAFB-3 and RCMFB-1, five varieties showed violet colour, *i.e.*, VL Boni Bean-1, Azad Rajah-1, VL Bean-3, Contender and Pusa Parvati and seven varieties showed pink petal colour, *viz*., VL Bean-2, Arka Savidha, Arka Komal, Kashi Param, RCFB-56, HAFB-4 and Swarna Lata, while, none of the varieties have yellow colour of standard petals. Sixteen varieties showed striped flower centre surface of standard petal, while only two varieties, *viz.*, HAFB-4 and Swarna Lata showed non-striped flower centre surface of standard petal. For the pod curvature, six varieties found strong pod curvature, while, 11 varieties were showed medium pod curvature and one variety Azad Rajmah-1 showed absent pod curvature. Pod shape of cross section (through seed) is cordate for Swarna Priya and Arka Komal, whereas circular for VL Bean-3, Kentucky Wonder and Pusa Himalaya and rest 13 were oval shape, however eight shaped was not found in any varieties. Shape of distal part of pod is

acute to truncate for Swarna Priya, Azad Rajmah-1, Arka Suvidha, Pusa Himalaya, Lakshmi, RCFB-56 and rest 12 were acute and none was found for truncate. Pale green colour of pod were found in 6 varieties, *i.e*. VL Boni Bean-1, Arka Suvidha, Kashi Param, RCFB-56, HAFB-3, RCMFB-1 and rest 12 varieties were green colour pod however none have purple colour of pod. Six varieties, *viz*., Swarna Priya, Azad Rajmah-1, Arka Komal, Kashi Param, Pusa Himalaya and HAFB-3 showed pod stringiness presentation and rest were absent. For seed shape, Pusa Himalaya show circular to elliptic; Kentucky Wonder and Swarna Lata showed elliptic, while, other 15 varieties showed kidney shaped however, none of the varieties was found to sow circular seed shape. Five varieties, *i.e.* Kentucky Wonder, Lakshmi, HAFB-3, HAFB-4 and Swarna Lata have small seed size and five varieties expressed medium, while only one variety Swarna Priya had very large and rest seven were categorized having large seed size. The studies of Singh *et al.* (9), Rai *et al*. (6), Samal *et al.* (8), Raffi and Nath (5), and Rai *et al*. (7) also described the variability in French beans in respect of yield and yield contributing traits. Chiorato *et al.* (1) proposed that characterization of germplasm in respect of economic traits, which would help in the quantification and organization of genetic diversity.

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