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PHYSICO-MORPHOLOGICAL VARIATION IN HYACINTH BEAN [*Lablab purpureus* (L.) Sweet]

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Abstract

Forty-four hyacinth bean genotypes were evaluated for different qualitative and quantitative characters during July 2005 to February 2006 at Bangabandhu Sheikh Mujibur Rahman Agricultural University (BSMRAU), Gazipur. The genotypes showed considerable variations for most of the morpho-physical traits. Shape, size and colour of vein, leaf, petiole, stem, flower, pod and seed varied among the genotypes. Days to first flower ranged from 47.6 to 136.3 days indicating the presence of early variety. Individual pod weight varied from 1.47 (HB042) to 12.3g (HB009). The genotype HB027 produced the maximum number of pods/ plant (425) closely followed by HB001 (385). Similar trend was observed for pod yield/plant. The genotype HB027 produced the highest pod yield/plant (3.45kg) followed by HB001 (3.35kg). 100-green seed weight ranged from 4.0g to 73.33g, which indicated the presence of bold seeded genotypes. Among the genotypes, HB027 and HB007 produced very bold green seed and higher green pod yield/plant, therefore, they can be selected for both pod and green seed production purpose.

Keywords: Physico-morphological, hyacinth bean.

Introduction

Hyacinth bean is a major winter vegetable in Bangladesh. Its cultivation and use are wide in winter season and it is almost impossible to find a homestead in rural Bangladesh without a vine of hyacinth bean (Rashid, 1999). In Bangladesh, various types of hyacinth bean are grown in different parts of the country with various popular local names, such as suri, puti, bata, noldog, etc. Significant physico-morphological variation was found among the genotypes grown in Bangladesh (Islam *et al.*, 2002; Rahman *et al.*, 1985). Yield and yield attributes are also different among the genotypes (Mollah *et al.*, 1995). This variation is a useful material to plant breeders for crop improvement. Physico-morphological characterization should provide a standardized record of readily assessable plant characters, which go a long way to identify an accession. Because characterization and evaluation will provide a rapid, reliable and efficient means of information for proper utilization of germplasm. This is also helpful to select suitable parental line for further improvement programme. The present investigation was, therefore, undertaken to assess the physico-morphological variability among collected genotypes.

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Materials and Method

The experiment was conducted during July 2005 to February 2006 at the experimental Farm of Horticulture Department of Bangabandhu Sheikh Mujibur Rahman Agricultural University (BSMRAU), including 44 diverse genotypes of hyacinth bean. The experiment was laid out in a randomized complete block design with three replications. The unit plot size was 1.5m × 5.0m accommodating five pits/bed. Plants were spaced at 1.0 m in a bed and 2.0 m between two adjacent beds. Two seeds of all genotypes were sown in polybag and ten days old seedlings were transplanted in the experimental field on 1 August 2005. Out of two seedlings/pit, one was removed after 2 weeks of transplanting. The crop was fertilized with cowdung @10 ton, Urea 50 kg, TSP 150 kg and MoP 150/kg (Rashid, 1999). The full dose of cowdung, TSP and one half dose of MoP were applied basally during pit preparation one week before transplanting. The remaining MoP and urea were top dressed in the three equal installments at 15, 30, and 45 days after transplanting. Each plant was given bamboo sticks to climb on. Weeding was done whenever necessary. The plants were irrigated properly. The crop was protected from the attack of pest mainly aphids, jute hairy caterpillar, and pod borer by regular spraying of Maladan @ 2 ml/L. Data were recorded as per descriptor of AVRDC characterization sheet of hyacinth bean and Sultana (2001). Analysis of variance was made using MSTAT software.

Results and Discussion

Different physico-morphological characteristics of hyacinth bean genotypes are presented in Table 1. Colour of different plant parts varied among the genotypes. Most of the genotypes had green colour, cotyledon and hypocotyl. Maximum genotypes (70.5%) had green vein colour, while the rest were purple in colour. Sultana (2001) found only green and purple vein colour among 107 hyacinth bean genotypes. Leaf colour intensity varied as pale green, green or dark green. Dark green leaf colour was dominating among the genotypes (65.9%) followed by green (22.7%), and pale green (11.4%) leaf colour. In respect of leaf hairiness, most of the genotypes (52.3%) had glabrous leaf. Five different stem colour was noticed in this study, of which 43.2% genotypes had green stem colour followed by purple (22.7%), red purple (15.9%), and light green (15.9%). Only one genotype (2.3%) was found to have mixed (green with purple ridge) stem colour. In respect of stem colour, Sultana (2001) reported six types of stem colour among 107 genotypes, while Islam *et al.* (2002) divided stem colour of hyacinth bean in two groups, such as green and purple. Green, purple or mixed petiole colour was recorded among the grown genotypes where green colour was dominating (65.9%). Sultana (2001) reported that green colour petiole was dominating in hyacinth bean of Asian accession, while in Africa, purple was the major. Hyacinth bean is normally climbing in nature but existence of dwarf type of hyacinth bean was reported by several workers (Shivashankar *et al.,* 1977;

Sultana, 2001). In the present study, one determinate accession was recorded. In an Indian collection of 255 accessions of lablab bean, 11.37% determinate accessions were reported by Shivashankar *et al.* (1977).

Table 1. Frequency distribution (%) of physico-morphological characters of hyacinth bean genotypes.

Characters	Class	No. of accessions	Frequency	Range
1. Cotyledon colour	1. White	12	27.3	
	2. Green	32	72.7	
	3. Purple	0	0	
2. Hypocotyl colour	1. Purple	12	27.3	
	2. Green	32	72.7	
3 .Vein colour	1. Green	31	70.5	
	2. Purple	13	29.5	
4. Leaf colour intensity	3= Pale green	5	11.4	
	5= Green	10	22.7	
	7=Dark green	29	65.9	
5. Leaf hairiness	0= Glabrous	23	52.3	
	3=Slightly pubescent	19	43.2	
	5=Moderately pubescent	2	4.5	
	7=Highly pubescent	0	0	
6. Hypocotyl length	Short=<6 cm	2	4.5	3.6-14.0cm
	Intermediate=6-9 cm	4	9.1	
	Long>9 cm	38	86.4	
7. Stem colour	1=Light green	7	15.9	
	3=Green	19	43.2	
	5=Mixed (Green with purple)	1	2.3	
	7=Red purple	7	15.9	
	9=Purple	10	22.7	
8. Leaflet length	Small<9 cm	7	15.9	4.8-13.2cm
	Intermediate=9- 12 cm	31	70.5	
	Large= >12 cm	6	13.6	
9.Leaflet width	Small<6 cm	1	2.3	3.3-13.0cm
	Intermediate 6-9 cm	11	25.0	
	Large= >9 cm	32	72.7	
10. Petiole colour	1=Green	29	65.9	
	5. Mixed (Green with purple)	4	9.1	
	9=Purple	11	25.0	
11 .Growth habit	1=Determinate	1	2.3	
	9=Indeterminate	43	97.7	

Table 2. Frequency distribution (%) of inflorescence and fruit characters of hyacinth bean genotypes.

Characters	Class	No. of accessions	Frequency	Range
1 .Flower bud size	3=Small (<5 mm)	1	2.3	1.1-1 5.2mm
	7=Large (>5 mm)	43	97.7	
2. Keel colour	1= White	42	95.5	
	2=VioIet	2	4.5	
3.Colour of standard	1= White	21	47.7	
	2= Violet	20	45.5	
	3= Light pink	3	6.8	
4. Wing colour	1= White	21	47.7	
	2= Violet	21	47.7	
	3=Lightpink	2	4.6	
5. Raceme length	0=Very short (0-5 cm)	5	11.4	2.03-25.8cm
	1=Short (5.1-10.0cm)	5	11.4	
	3=lntermediate (10.1-15 cm)	4	9.1	
	5=Long(>l5cm)	30	68.1	
6. Node/raceme	2=Few (<5)	9	20.5	2.33-14.1
	4=Medium(5-10)	18	40.9	
	6=High (>10)	17	38.6	
7. Pod curvature	0=Straight	11	25.0	
	3=Slightly curved	28	63.6	
	5=Curved	5	11.4	
8. Pod beak shape	1= Short beak	6	13.6	
	2= Medium length beak	7	15.9	
	3=Long beak	11	25.0	
	4=Thick beak	20	45.5	
9. Pod colour	1=Light green	10	22.7	
	3=Green	23	52.3	
	5=Mixed	8	18.2	
	7=Red purple	3	6.8	
	9=White	0	0	
10. Pod length	1=Long (>10 cm)	24	54.5	3.96-18.2cm
	3=Medium (6-10 cm)	18	40.9	
	5=Short (<6 cm)	2	4.6	
11.Podwidth	1=Low(<2cm)	10	22.7	
	3= Medium (2-3 cm)	28	63.6	1.50-4.46cm
	5=High(>3cm)	6	13.7	

Inflorescence and pod characteristics

Inflorescence and pod characteristics are given in Table 2. Only one genotype produced very small flower bud (<5.0 mm), while rest had bigger flower bud (>5.0 mm). In respect of keel colour, white was dominating (95.5%) over violet colour (4.5%). Colour of standard varied as white (47.7%), violet colour (45.5%) and light pink (6.8%). Wing colour was mostly white and violet. Raceme length ranged from 2.03 to 25.8 cm. Pengelly and Maass (2001) had similar observation of rachis length (6.0-33.0 cm) with 17.5 cm in average in Australian collection of hyacinth bean, while in Ethiopian collection, it ranged from 3.5 to 47.0 cm with an average of 28.8 cm. Nodes/raceme ranged from 2.33 to 14.1. Straight, slightly curved and curved pods were observed among the genotypes. Most of the genotypes (45.5%) had pod with thick beak followed by long beak and medium length beak. Out of 44 genotypes, 23 (52.3%) and 10 (22.7%) genotypes had green colour and light green colour pod, respectively. Eight genotypes (18.2%) produced pod with mixed in colour (green with red or purple ridge). While only 6.8% genotypes had red purple pods. Sultana (2001) also reported in her study that most of the accessions had green pod colour followed by mixed colour of green and purple. Pod length varied from 3.96 cm to 18.20 cm. Pengelly and Maass (2001) reported that pod length ranged from 2.5 to 14.0 cm among 249 genotypes. Similar variation in respect of pod length was also reported by Mollah *et al.* (1995) and Sultana (2001). Pod width ranged from 1.50 cm to 4.46 cm. Pengelly and Maass (2001) found variation in pod width, which ranged from l.6 to 3.2 cm among 249 genotypes with the average pod width of 2.1 cm.

Seed characteristics

Almost 10 fold range in seed weight (6.0-62.10g/100-seed) was recorded in this study. This result is in agreement with the findings of Pengelly and Maass (2001). Very few genotypes (6.8%) had the tendency of splitting of seed testa. According to the seed coat colour, genotypes were classified into five groups. These were black, red purple, rusty brown, white, and mixed. Among the genotypes, 47.7% genotypes had black seed coat colour followed by 29.6% genotypes with red purple seed coat colour. Seed length varied from 6.3 mm to 15.6 mm. For seed width, intermediate seed width (5-10 mm) was recorded from most of the genotypes (81.8%). Seed thickness was found to be thick to thin (3.12mm to 8.0mm). Seed shapes were classified into five groups; round, flat, oval, drum, and elongate. Among the genotypes, 31.8% had round shape seed, while 27.3%, 25% and 9.1% genotypes had oval, flat, and elongate type seed shape, respectively. Only 6.8% genotypes had drum shape seed. Islam *et al.* (2002) reported more than 58% genotypes with flat shape seeds.

Table 3. Frequency distribution (%) of seed characters of hyacinth bean genotypes.

Characters	Class	No. of accessions	Frequency	Range
1. Seed size	1=Big (>40 g/100-seed)	13	29.6	6.0- 62.10 g
	5= Medium (20-40 g)	28	63.6	
	9=Small (<20 g)	3	6.8	
2. Splitting of seed testa	0= Absent	41	93.2	
	*=Present	3	6.8	
3. Seed colour	1= Black	21	47.7	
	2=Red purple	13	29.6	
	3=Rusty brown	4	9.1	
	4=White	3	6.8	
	5=Mixed	3	6.8	
4. Cotyledon colour (ripe seed)	1=White	33	75.0	
	2=Light yellow	11	25.0	
5. Seed length	Short =<10mm	2	4.6	6.3-15.6 mm
	Intermediate= 10-13 mm	15	34.0	
	Long=>l3mm	27	61.4	
6.Seed width	Short=<5 mm	1	2.3	4.13-11.4 mm
	Intermediate=5- 10 mm	36	81.8	
	Long=>10mm	7	15.9	
7. Seed thickness	Thin=<5 mm	13	29.5	3.12-8.0 mm
	Intermediate=5-6 mm	18	40.9	
	Thick=>6mm	13	29.6	
8.Seed shape	1=Round	14	31.8	
	2= Flat	11	25.0	
	3=Oval	12	27.3	
	4=Drum	3	6.8	
	5=Elongate	4	9.1	

Yield and yield attributes are presented in Table 4. A wide range of variation was observed for all the characters. The genotype HB003 required only 47.6 days to first flower, while it was the highest for the genotype HB023 (136.3 days). Purseglove (1977) reported that some of the hyacinth bean varieties could produce flower at about 6 weeks after sowing. Rashid (1976) stated that some of the varieties do not flower until December irrespective of date of sowing. The individual pod weight varied 1.47g (HB041) to 12.30 g (HB009). This might be inherent characteristic of the genotypes. Mollah *et al.* (1995) also recorded

Table 4. Yield and yield attributes of 44 hyacinth bean genotypes.

Genotypes	Days to first flower	Individual pod wt (g)	No. of pods/plant	Pod yield/ plant (kg)	100-green seed wt (g)
HB001	89.3p	8.53f-h	385.0ab	3.35ab	45.67d-k
HB002	63.3r	5.581m	355.3a-d	1.96i-q	43.40d-1
HB003	47.6s	7.87gi	275.0d-k	2.16h-p	30.83k-n
HB004	50.3s	5.87k-rn	315.6b-g	1.83k-r	36.70h-m
HB005	61.0r	8.83e-h	291.3c-j	2.58c-k	27.20mn
HB006	104.6m	10.40b-d	317.6b-g	3.28a-c	17.73n-o
HB007	106.31m	10.50b-d	292.0c-j	3.04a-f	71.00ab
HB008	108.6k-rn	8.97e-h	302.5c-i	2.67b-i	55.10ce
HB009	111.0i-1	12.30a	190.lk-q	2.31f-n	25.00mn
HB010	99.6n	8.80e-h	206.0j-q	1.801-r	63.33a-e
HB011	112.3h-k	9.91c-f	159.2o-q	1.55o-t	29.501-n
HB012	99.0n-o	9.30d-g	237.0f-o	2.19h-p	58.00b-d
HB013	94.3o	8.5sf-h	376.0a-c	3.22a-d	40.43e-rn
HB014	110.3j-1	8.lg-I	277.0d-k	2.23h-p	37.87g-rn
HB015	107.31-rn	8.44gh	295.0c-i	2.50d-1	47.00d-j
HB016	95.3n-o	8.62e-h	223 .0h-o	1.90j-r	35.501-rn
HB017	109.6j-1	9.10d-h	170.0rn-q	1.03s-u	48.00d-j
HB018	1l1.0i-1	8.81e-h	218.5i-p	1.90j-r	49.00d-1
HB019	120.0b-f	8.lg-I	192.lk-q	1.53o-t	53.00c-g
HB020	117.6e-g	9.14d-h	269.0d-l	2.43e-rn	73.33a
HB021	113.6g-j	8.2d-g	192.0k-q	1.751-s	52.33c-g
H8022	115.3f-i	8.l7gi	350.0a-e	2.84a-h	27.73mn
HB023	136.3a	8.42gh	190.lk-q	1.60n-s	38.33g-m
HB024	120.0b-f	6.65j-1	259.2f-m	1 .68m-s	29.331-n
HB025	118.6d-g	8.51f-h	326.0b-f	2.75a-h	34.33i-rn
HB026	118.6d-g	9.17d-h	327.0b-f	3.0la-g	35.33i-rn
HB027	121.0b-e	8.07gi	425.0a	3.45a	70.00ab
HB028	116.6e-h	8.87eh	276.0d-k	2.43e-m	53.67c-f
HB029	118.0e-g	8.57f-h	312.0b-h	2.60c-j	51.57d-h
HB030	110.0j-l	8.5sf-h	168.0n-q	1.33q-t	55.00c-e
HB031	117.0e-h	10.2c-e	304.0ci	3.12a-e	40.00e-m
HB032	117.6e-g	9.13d-g	l32.0pq	1.20r-t	38.00g-rn
HB033	119.6b-f	7.77gh	197.0k-q	1.51o-t	25.00mn
HB034	123.0b-d	8.23gh	182.01-q	1.49p-t	36.33h-m
HB035	123.6b-d	11.00bc	223.0h-o	2.44e-rn	33.33j-rn
HB036	118.6d-g	10.60bc	170.0rn-q	1.771-s	29.671-n
HB037	124.0b	1l.40ab	229.0g-o	2.60c-j	39.67f-rn
HB038	99.0no	6.87ik	122.0q	0.82t-u	36.67h-rn
HB039	99.3n	5.90k-rn	2l9.0i-p	1.47p-t	36.67h-m
HB040	97.3no	7.77gh	l55.0o-q	1.20r-t	48.00d-j
HB04I	65.0r	2.17n	220.0i-p	0.46u	l7.00op
HB042	106.61rn	1.47n	313.0b-q	0.46u	4.00op
HB043	123.3b-d	8.63eh	264.0e-l	2.26g-o	38.60g-rn
HB044	72.6q	4.83m	358.0a-d	1.90j-r	32.67j-m
F-test	**	**	**	**	**
CV (%)	2.5	2.5	17.61	18.48	19.2

Means followed by same letter(s) in a column do not differ significantly at 1% level.

variation in individual pod weight. The genotype HB027 produced the highest number of pods/plant (425) followed by HB001 (385), while it was the lowest for HB038 (122). The variation in number of pods/plant might be due to differences in number of inflorescences/plant, pods/raceme, flower dropping tendency of the genotypes (Khan, 2003). Similarly pods/plant ranged from 180 to 330 among nine country bean lines as was recorded by Halim and Ahmed (1992). The highest pod yield/plant was recorded from the genotype HB027 (3.45 kg/plant), which was closely followed by HB001 (3.35 kg/plant). This higher/plant yield was attributed due to higher number of pods/plant and higher individual pod weight. The lowest pod yield/plant was recorded from the genotypes HB041 and HB042 (0.46 kg/plant for each). Halim and Ahmed (1992) reported yield of nine country bean lines, which varied from 1.62 to 2.81 kg/plant. The seed size i.e., 100-green seed weight varied from 4.0g to 71.0g. The genotype HB020 produced very bold seed (73.33g/100-green seed) followed by HB007 (71.0g) and HB027 (70.0g). Since the genotypes HB007 and HB027 produced very bold green seed along with corresponding pod yield, therefore, these genotypes can be taken under consideration for both pod and green seed production.

References

Halim, G. M. A. and S. Ahmed. 1992. Study of the morphogenetic divergence in country bean. *Bangladesh Hort.* **20** (2): 103-107.

Islam, T., M. M. Haque and M. M. Rahman. 2002. Catalogue on hyacinth bean germplasm. PGRC., BARI, Gazipur. p55.

Khan, M. M. R. 2003. Performance of lablab bean genotypes under different supports. M.S. Thesis, Department of Horticulture, BSMRAU, Salna, Gazipur-76p.

Mollah, M. S., S. R. Saha and M. S. Islam. 1995. Effect of method of support on the yield performance of some advanced lines of hyacinth bean. *Bangladesh J. Crop Sci.*, **6**(1&2): 37-40.

Pengelly, B. C. and B. L. Maass. 2001. *Lablab purpureus* (L.) Sweet-diversity, potential use and determination of a core collection of this multi-purpose tropical legume. *Genetic Resources and Crop Evolution* **48:** 261-272.

Purseglove, J. W. 1977. Tropical Crops. Dicotyledons. Longman, London, pp. 273-276.

Rahman, M. S., M. S. Ahmed and K. R. Haque. 1985. Study on the morphological characters of twenty local collections of country bean. *Bangladesh Hort.* **13** (1+2): 51-55.

Rashid, M. M. 1976. Bangladesher Sabji (Vegetables of Bangladesh). 1st Ed. Bangla Academy, Dhaka, Bangladesh. pp. 313-323.

Rashid, M. M. 1999. Sabji Biggan (In Bengali). Rashid Publising House, 94, Old DOHS, Dhaka-1206. pp.307-409.

Shivashankar, G. Chikkadevaiah and S. R. Hiremath. 1977. Germplasms of field bean. *Indian J. Genet. Plant Breed.* **37:** 353-371.

Sultana, N. 2001. Genetic variation of morphology and molecular markers and its application to breeding in lablab bean. A Ph. D. Thesis, Kyushu University, Fukuoka, Japan. 143p.