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RESEARCH ARTICLE

Characterization and evaluation of hyacinth bean genotypes at Central Terai region of Nepal

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Abstract

Hyacinth bean is an underutilized crop of great economic importance which belongs to Leguminosae family used for vegetable as well as pulse in Nepal. Ten genotypes were collected and evaluated for different qualitative and quantitative physico-morphological characteristics during 2022 at Central Terai of Nepal. The genotype showed some resemblance and variation among them for most of the morpho-physical character. The objectives of study were to find genotype with superior agronomic traits so that would further select in cultivation practice. Cotyledon, leaf color, leaflet length, leaflet width, vein color, stem color, petiole color, pod curvature, seed color, seed length and some other traits were observed which were varied among different genotype. Cotyledon color in unripe condition varied from light green, green to white. All of them were glabrous leaf surface and indeterminate in growth habit. The pod length varies from 3.5 cm to 12 cm and pod width varies from 1.1cm to 3cm. The genotype CNRMB-HB-1009 has highest flower bud size, pod length, seed per pod, seed length so was superior among them whereas CNRMB-HB-1008 has lowest pod length, pod width, seed length. The diversity of these crops can be used for hybridization and crop improvement in future days. Among these genotypes, simple selection might be used to create high-yielding cultivars.

Key words: Hyacinth bean, diversity, traits, seed, high yield

Introduction

Hyacinth bean [Lablab purpureus (L.) Sweet] is a diverse domesticated legumes speciesbelong to the family Leguminosae which is native to Africa and it is cultivated through the tropics for food (Naeem *et al.*, 2020).The major problem addressed in consuming the bean is that it is poisonous to health due to the presence of cyanogenic glucosides and it may contain many anti nutritional factors such as trypsin inhibitors, haemagglutinin, saponins, tannins, phytic acids, alkaloids, and polyphenolic substances that may have a deleterious effect on performance and digestion (Ragab and Abdel 2015). Significant physico-morphological variation was found among the genotype grown in Bangladesh (Vaijayanthi and Ramesh, 2019). This is also helpful to select suitable parental line for further improvement program. The present investigation was, therefore undertaken to assess the physico-morphological variability among collected genotype. They are considered as an under-utilized crops so there is a problem in finding any related information about the crop since

very less research papers have been published yet (Naeem *et al.,* 2020). Thus, this research was aimed to investigation the diversity of Hyacinth bean through agro-morph traits and possible selection for getting higher yield varieties for farmers.

Materials and methods

The research was conducted on March 13 and 14 on farmers field around College of Natural Resource Management Bardibas, Agricultural and Forestry University, including ten genotypes of hyacinth bean. The genotypes used in the research were locally available with no passport data and farmers didn't knew the name. So, we used hypothetical name (CNRMB-HB-1001,CNRMB-HB-1002, CNRMB-HB-1003 to CNRMB-HB-1010) to denote those beans. The different parts of plant like leaf, stem, flower, pods were separated from plant for the study of quantitative and qualitative characters of different genotypes and further the parts like petal, wings, keel, and standard were separated from flowers and seeds were separated from pod for individual study. Data that were observed were recorded in microsoft excel to make the study easier. Every character of the plant was assigned a specific code with the help of a published paper on physico-morphological variation in hyacinth bean (Islam *et al.,* 1970).

Results and discussion

Frequency distribution of different physio-morphological characters of hyacinth bean genotypes are presented in table 1. The stem color varied among different genotypes. Most of the genotypes included green and red purple color but Light green color was also observed. Mostly green colored vein was observed and hairy pubescent leaves was most prevalent followed by moderately pubescent and slightly pubescent (Table 1).According to (Islam *et al.*, 1970), a significant percentage (43.2%) of the vines in Bangladesh were green in colour. The colour of the vines that we found in our current findings was similar to his findings. Moreover, small leaflet length and width were recorded according to the observation. Three different stem colors was noticed in this study, of which 40% genotypes had green color, 40 % genotypes had purple and 20 %. In a study he found only green and purple vein color among twenty three hyacinths bean genotypes (Joshi and Dahal 2016). Frequency distribution of inflorescence and fruit characters of hyacinth bean genotypes are included in table 2. Large flowers with white keel color were observed and recorded. Slightly curve curvature was most prevalent among straight, slightly curve and curve pod curvature. According to color of standard and wing of the genotype were classified into four group i.e white, violet, purple and light pink. Among them (40%) genotype had white color followed by light pink (30%), violet (20%), and purple (10%). Other characters like raceme length, node, pod beak shape, pod color, pod width and pod length were included (Table 2). This finding was supported by result of (Kabir *et al.,* 2005). Frequency distribution of seed characters of hyacinth bean genotypes are presented in Table 3. Frequency of medium sized seed was dominant over big sized and small sized seeds. All the testa of seeds was splitted. Oval thick seed with white cotyledon color were also observed. Seed length varied from 8.2 mm to 14.3mm. For seed width, intermediate seed width was recorded from most of the genotype (70%). According to immature seed color, genotypes were classified into four group; white, light green, green and brown. Among the genotype, light green was recorded from most of the genotype (70%). For seed per pod, five seed per pod was found from most of the genotype (90%). The finding was similar to (Hossain *et al.,* 2014) reported that the number of seed per pod varied among nine country bean lines, ranging from 6 to 7 per genotypes.

Table 1: Frequency distribution (%) of physio-morphological characters of hyacinth bean genotypes

Characters	Description with code	No. of accessions	Frequency
Unripe Cotyledon color	1. White 2. Light green 3.Green	1 7 2	10 70 20
vein color	1.Green 2.Purple	10 0	100 0
leaf color intensity	3=Pale green 5=Green 7=Dark green	3 1 6	30 10 60
Leaf hairiness	0= Glabrous 3=Slightly pubescent 5=Moderately pubescent 7= Highly pubescent	10 0 0 0	100 0 0 0
Stem color	1= Light green 3= Green 5= Mixed (green with purple) 7= Red purple	2 4 0 4	20 40 0 40
Leaflet length	Small (<9cm) Intermediate=9-12cm Large (>12cm)	10 0 0	100 0 0
Leaflet width	Small (<9cm) Intermediate=9-12cm Large (>12cm)	10 0 0	100 0 0
Petiole color	1= Green 5= Mixed(green with purple) 9= Purple	7 3 0	70 30 0
Growth habit	1= Determinate 9= Indeterminate	0 10	0 100

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

Characters	Description with code	No. of accessions	Frequency
Flower bud size	3= Small (<5mm)	0	0
	7= Large(>5mm)	10	100
Keel color	1= White	10	100
	2= Violet	0	0
Color of standard	1= White	4	40
	2=Violet	2	20
	3=Light pink	3	30
	4= Purple	1	10
Color of standard	1= White	4	40
	2=Violet	2	20
	3=Light pink	3	30
	4= Purple	1	10
Wing color	1= White	4	40
	2=Violet	2	20
	3=Light pink	3	30
	4= Purple	1	10
Raceme length	0= Very short(0-5cm)	4	40
	1= Short(5.1-10cm)	4	40
	3=Indeterminate(10.1-15cm)	2	20
	5= Long(>15cm)	0	0
Node/raceme	2= Few(<5)	9	90
	4=Medium(5-10)	1	10
	6=High(>10)	0	0
Pod curvature	0=straight	1	10
	3= Slightly curve	7	70
	5= Curve	2	20
Pod beak shape	1= Short beak	0	0
	2=Medium beak	0	0
	3= Long beak	10	100
	4= Thick beak	0	0
Pod color	1= Light green	1	10
	3= Green	3	30
	5= Mixed	3	30
	7= Red purple	1	10
	9= White	2	20
Pod length	1= Long(>10cm)	2	20
	3= Medium(6-10cm)	3	30
	5= Short(<6cm)	5	50
Pod width	1= Low(<2cm)	7	70
	3= Medium(2-3cm)	3	30
	5= High(>3cm)	0	0

Yield attributes of hyacinth bean genotypes are presented in Table 4. A wide range of variation was observed in yield attributes of bean among the different genotypes. Highest pod length (12 ± 1 cm) was found from CNRMB-HB-1009 while lowest (3.5 ± 0.5 cm) was found from CNRMB-HB-1008. The genotype CNRMB-HB-1004 has highest 100-ripe seed weight (47.33 gm) whereas genotype CNRMB-HB-1007 has lowest 100-ripe seed weight (18). The genotype CNRMB-HB-1009 has highest flower bud size, pod length, seed per pod, seed length so was superior among them whereas CNRMB-HB-1008 has lowest pod length, pod width, seed length (Table 4).This finding was similar to (Hossain *et al.*, 2014) reported weight of 10-dry seed weight varied from 4.8 gm to 3.07 gm.

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

Characters	Description with code	No. of accessions	Frequency
Seed size	1= Big (>40g/100 seed)	2	20
	5= Medium (20-40 g)	7	70
	9= Small(<20g)	1	10
Splitting of seed testa	0= Absent	0	0
	1=Present	10	100
Seed color	1= Black	5	50
	2= Red purple	0	0
	3= Rusty brown	4	40
	4= White	1	10
Cotyledon color (Ripe seed)	1= White	10	100
	2= Light yellow	0	0
Seed length	Short= <10mm	5	50
	Intermediate=10-30mm	5	50
	Long =>30mm	0	0
Seed width	Short=<5mm	3	30
	Intermediate=5-10mm	7	70
	Long=>10mm	0	0
Seed thickness	Thin= <5mm	8	80
	Intermediate=5-6mm	1	10
	Long=>6mm	1	10
Seed shape	1=Round	0	0
	2=Flat	0	0
	3=Oval	10	100
	4=Drum	0	0
	5= Elongate	0	0
Immature seed color	1=White	1	10
	2=Light green	7	70
	3=Green	1	10
	4=Brown	1	10
Seed per pod	Few (<3)	0	0
	Medium (3)	1	10
	High(>3)	9	90

Table 4: Yield attributes of 10 hyacinth bean genotypes

Varieties	Pod length (cm)	Pod width (cm)	Seed per pod	Seed length (cm)	Seed width (cm)	Seed thickness (cm)	100-ripe seed weight (gm)
CNRMB-HB-1001	5 ± 0.27	1.8 ± 0.1	4.4 ± 1.14	0.82 ± 0.084	0.72 ± 0.15	0.52 ± 0.05	31.2
CNRMB-HB-1002	10 ± 0.33	1.5 ± 0.2	4 ± 1	1 ± 0.05	0.8 ± 0.1	0.8 ± 0.1	27.5
CNRMB-HB-1003	9.67 ± 1.25	2.5 ± 0.2	4.4 ± 0.9	1.23 ± 0.25	0.93 ± 0.11	0.4 ± 0.05	41.33
CNRMB-HB-1004	7.5 ± 0.5	1.17 ± 0.29	3 ± 0.82	1 ± 0.11	0.86 ± 0.12	0.3 ± 0.01	47.3
CNRMB-HB-1005	4.6 ± 0.1	1.2 ± 0.2	4.67 ± 3.05	0.7 ± 0.1	0.4 ± 0.1	0.4 ± 0.02	22.6
CNRMB-HB-1006	8.5 ± 0.5	2 ± 0.5	4 ± 1	1.03 ± 0.15	0.5 ± 0.1	0.3 ± 0.01	38.9
CNRMB-HB-1007	4.5 ± 0.5	1.5 ± 0.1	3.33 ± 0.58	0.8 ± 0.1	0.45 ± 0.05	0.3 ± 0.05	18
CNRMB-HB-1008	3.5 ± 0.5	1.1 ± 0.1	3.33 ± 0.58	0.7 ± 0.1	0.33 ± 0.06	0.3 ± 0.02	23.3
CNRMB-HB-1009	12 ± 1	3 ± 0.5	5 ± 1	1.43 ± 0.58	0.8 ± 0.1	0.4 ± 0.1	30
CNRMB-HB-1010	4.5 ± 0.5	1.67 ± 0.15	4 ± 1	0.9 ± 0.1	0.5 ± 0.1	0.3 ± 0.01	28

Hence, in conclusion the evaluated genotype showed significant variations in qualitative and quantitative traits. Large flowers with white keel color and slightly curve curvature which was most prevalent among straight, slightly curve and curve pod curvature were observed. Most of the genotypes included green and red purple color but light green color was also observed and green colored vein was observed along with hairy pubescent leaves which was most prevalent followed by moderately pubescent and slightly pubescent. The vein coloration can be used as marker for the identification of the genotype as suggested by Dudhe *et al.*, (2020). Among these genotypes, simple selection might be used to create high-yielding cultivars.

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