



E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2019; 8(2): 1574-1578
Received: 17-01-2019
Accepted: 20-02-2019

Sasmita Priyadarsini Dash
Faculty of Horticulture,
MS Swaminathan School of
Agriculture, Centurion
University of Technology and
Management, Paralakhemundi,
Gajapati, Odisha, India

Jitendra Singh
Department of Vegetable
Science, College of Agriculture,
Raipur, Indira Gandhi Krishi
Vishwavidyalaya, Raipur,
Chhattisgarh, India

Dhananjaya Sharma
Department of Vegetable
Science, College of Agriculture,
Raipur, Indira Gandhi Krishi
Vishwavidyalaya, Raipur,
Chhattisgarh, India

Morphological characterization of brinjal (*Solanum melongena* L.) germplasm

Sasmita Priyadarsini Dash, Jitendra Singh and Dhananjaya Sharma

Abstract

Brinjal (*Solanum melongena* L.) is an important solanaceous vegetable in many countries of Asia and Africa. The crop is extremely variable in India, for this reason, the crop as being of Indian origin. Assessment of genetic resources is the starting point of any crop improvement programme. In the present study, 110 accessions of eggplant were maintained in All India Coordinated Research Project on Vegetable Crops, at Horticultural Research and Instruction Farm, Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.) during *kharif* 2015 and evaluated for sixteen quantitative and twenty qualitative characters. A highly significant difference was observed for all characters. Most of genotypes showed intermediate growth habit, intermediate leaf lobing and acute leaf blade tip angle. Development of prickles in different plant parts was a predominant features. Prickles appeared in stem, petiole, calyx including peduncle and leaf including veins. Most of genotypes were early to mid-early flowering and born in three patterns *i.e.* solitary, cyme and mixed (both solitary and cyme). Out of 110 genotypes, 61 genotypes were having purple colour flowers, 30 genotypes were with purple white, while 19 genotypes had white colour flowers. The fruit shape was observed to variable and found oblong (19.09%), round (15%), medium long (18%) and long (47.27%). The genotypes fell into six fruit colour groups namely green (37.27%), purple (25.45%), milky white (13.62%) purple black (12.72%), light purple or liliac grey (9.09%) and scarlet red (1.08%). The genetic differences among the genotypes are potentially relevant to breeding programmes in that the variability created through hybridization of the contrasting forms could be exploited.

Keywords: Morphological characterization, brinjal, germplasm

Introduction

Brinjal (*Solanum melongena* L. $2n = 24$), one of the important vegetable crops, belongs to the family Solanaceae referred by various names viz., Baigan (Hindi), Badanekai (Kannada), Vangi (Marathi), Katharikai (Tamil), Vankai (Telugu). Internationally, it is referred as egg plant (England) or Aubergine (France). According to De Candolle (1883) [3], egg plant was known to India from ancient times and is probably a native of India (Vavilov, 1928) [11]. Based upon its highest production potential and availability of the produce to consumers, it is also termed as poor man's vegetable. In India it is commercially cultivated in Orissa, Bihar, Karnataka, West Bengal, Andhra Pradesh, Maharashtra and Uttar Pradesh.

Germplasm is the basic raw material for any crop improvement programme. Conservation and use of genetic resources have a great significance. The precise evaluation of genetic stock and dissemination of findings is an important for their utilization in breeding programme. The crop is extremely variable in India substantiated by the presence of wild relatives of *Solanum melongena* which are perennial herb or shrub with bitter fruits (Bhaduri, 1951) [2]. Though the principal method used for improvement of this crop in India is selection from indigenous germplasm, yet comprehensive characterization of this crop has not been done. An evaluation of germplasm gives considerable data to classify the material. Germplasm collection, maintenance and its evaluation for economically important traits is a prerequisite for starting any breeding programme for the genetic improvement of the crop (Ansari et al., 2010) [1]. Therefore, the objective of this study was to characterized brinjal evaluating 110 entries for 20 descriptors which included morphological, floral and fruit growth habit.

Materials and methods

The experimental material of present study comprised of a set of 110 genotypes of brinjal including four checks obtained from AICRP on Vegetable crops, Department of Vegetable Science, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh during *kharif* 2015. Raipur situated in the south eastern part of Chhattisgarh of 21°16' N latitude and 81°31'E longitude with an altitude of 289.56 meter above the mean sea level characterized by sub-tropical climate with an annual rainfall range of 1200-1400 mm. The germplasm lines were evaluated in a Randomized Block Design with three replications In each replication, each entry

Correspondence

Sasmita Priyadarsini Dash
Faculty of Horticulture,
MS Swaminathan School of
Agriculture, Centurion
University of Technology and
Management, Paralakhemundi,
Gajapati, Odisha, India

was raised in four rows and five columns with row to row and plant to plant spacing's of 75 cm and 60 cm, respectively. The recommended package of practices was followed for raising the entire germplasm. Necessary prophylactic plant protection measures were carried out to safeguard the entire germplasm from pests and diseases.

Genotypes were characterized for twenty qualitative characters viz., growth habit, leaf shape, colour, pigmentation, flower colour, flowering habit and fruiting habit according to brinjal descriptors (Anonymous, 1988). The data on sixteen quantitative characters were recorded on five competitive and randomly selected plants in each replication for all the characters under study except days to fifty percent flowering and days to first harvest, which were recorded on whole plot basis. Data were analyzed following Panse and Sukhatme (1985) [7].

Results and discussion

In the present investigation, out of 110 genotypes, 35.45% had intermediate or semi-spreading growth habit followed by 34.54% of genotypes had upright and 30% had spreading or prostrate growth habit. The variations in different growth habit of brinjal was also reported by Tambe *et al.* (1992), Hazra *et al.* (2003) [4] Shinde *et al.* (2012) and Khan and Singh (2014) [6]. According to number of branches per plant, very weak to very strong plant branching habit found in brinjal. Most of genotypes had intermediate (61.81%) to strong branching habit (31.81%), while 5.45% and 0.9% had weak and very strong branching habit, respectively.

Anthocyanin is the main pigment of brinjal producing mainly purple and violet colour in different plant parts and chlorophyll content has darkening effect on colour (Nothmann *et al.*, 1976). Pigment production and expression could be regarded as a common feature in brinjal, Out of 110 genotypes, 91 had green pigmentation followed by 11 genotypes had greenish-violet pigmentation and 8 genotypes had violet pigmentation. Expression of pigment in different plant parts is not same. Leaf blade colour was green in most genotypes (68.18%) followed by dark green (18.18%), greenish violet (9.09%), light green (2.72%) and violet (1.81%). Similar result was obtained by Khan and Singh (2014) [6]. Out of 110 genotypes, 65 genotypes had shortest leaf blade length (59.09%) followed by 40 genotypes had intermediate (36.36%) and 5 genotypes had long leaf blade length (4.54%). In respect to leaf blade width, most of genotypes had intermediate (~10 cm) 63.6%, narrow (~5 cm) 20% and wide (~15 cm) 16.3%, respectively. Out of 110 genotypes, 44 genotypes were found on class intermediate leaf blade lobing, whereas, 32 genotypes each found weak and strong leaf blade lobing, respectively. Out of 110 genotypes, 40 genotypes were found on class acute with a frequency distribution 36.36% followed by 39 genotypes had intermediate (35.4%), 21 genotypes had very acute (19.09%) and 10 genotypes had obtuse (9.09%). Development of prickles in different plant parts was a predominant character of brinjal. Most of genotypes were non spiny leaf (88.18%), while the remaining were spiny leaf (9.9%). Out of 110 genotypes, 36 genotypes had few hairs (32.72%) followed by 32 genotypes had intermediate (29.09%), 28 genotypes had very few (25.45%), 13 genotypes had many (11.81%) and 1 genotypes had very many (0.9%) hairs present in upper and lower surface of leaf.

Flowering in brinjal was axillary and borne in three pattern: solitary, cyme (cluster) and mixed (both solitary and cyme). Most of the genotypes had mixed flowering habit 60.90%

while 25.45% produced only cyme and 13.36% solitary flowers were borne in 15 genotypes. Solitary flowers and the basal flowers of the cyme (connected with its pedicel directly to the stem) were either long styled with plump ovary (style protrudes over anther tip) or medium styled with developed ovary (style just below the anther tip), and were functionally fertile. However fruit settings were higher in the long styled compared to medium styled flower. Most of the additional flower of the cyme (other flowers of the same inflorescence borne on the separate axis) were functionally sterile by having pseudo-short styled flower with under developed ovary (style length almost half of that of anther) and short styled flower with rudimentary ovary (very small style). Out of 110 genotypes, 61 genotypes were having purple colour flowers, 30 genotypes were with purple white, while 19 genotypes had white colour flowers.

The fruit shape was observed to variable and found oblong (19.09%), round (15%), medium long (18%) and long (47.27%). Out of 110 genotypes, 49 genotypes were observed straight fruit followed by 38 genotypes slightly curved and 23 genotypes curved, respectively. Out of 110 genotypes, 50 genotypes were found to be round fruit apex (45.45%), 32 genotypes were found depressed type (29.09%) and 28 genotypes were found protruded (25.45%). Colour development in the fruits appeared to be a pronounced characters in brinjal as all the genotypes showed fruit coloration. However, intensity of the basic purple fruit colour varied with the genotypes presumably due to different final anthocyanin and chlorophyll contents in the fruits. The genotypes fell into six fruit colour groups namely green (37.27%), purple (25.45%), milky white (13.62%) purple black (12.72%), light purple or lilac grey (9.09%) and scarlet red (1.08%) (Table 1). The variations in different colour behaviour of brinjal fruits was also reported by Tambe *et al.* (1992); Singh *et al.* (1999), Hazra *et al.* (2003) [4], Shinde *et al.* (2012) and Khan and Singh (2014) [6]. Fruit colour distribution was observed uniform (43.63%), mottled (39.09%), netted (10%) and stripped (7.27%), respectively. Most of genotypes were non spiny fruit calyx (88.18%) whereas, spines varied from few to intermediate 8.81% and 2.72% respectively. Out of 110 genotypes, 53 genotypes were observed intermediate (~3mm) seed size with a frequency distribution of 48.18%, 52 genotypes were small seed (~2mm) with a frequency distribution of 47.27% and 5 genotypes were large seed (~4mm) with a frequency distribution of 4.54%.

All 16 quantitative characters embracing growth, floral and fruit characters varied significantly among the 110 germplasm (Table 2). The genotypes were dwarf to very tall (29.8 cm to 105.67 cm plant height) with a few to very high branching habit (4 to 13.33) exhibiting three different growth habits. Plant spread was loose to compact (29.2 to 107.0 cm South-North). Similar findings were also reported by Hazra *et al.*, (2003) [4] and Shinde *et al.*, (2012). Early fruiting is important trait in improvement of the crop. Some of the genotypes produced early fruits while others were producing late fruits as the days to 50% flowering varies between 34.46 to 62.67, with the average of 43.41 days and the days to first harvest and duration of harvesting depends upon earliness of the genotypes (Singh *et al.* 1999) [9].

The fruit size of various genotypes are in all small, medium and large ranges. The average fruit weight was range in between the 16.63 to 114.83 g, with the average of 57.26 g. Similar findings were also reported by Hazra *et al.*, (2003) [4] Shinde *et al.*, (2012) and Khan and Singh (2014) [6].

The fruit girth was also important character and it ranged in between 6.59 to 25.83 cm. The fruit length and breadth are importance parameters for a marketable fruit. Small and medium fruits have better acceptance for culinary purpose while big fruits have value for preparation of bharta (roasting purpose). Fruit length ranged from 3.93 to 24.83 cm. Brinjal is a fruit vegetable, so the yield is an important characteristic governing the income to farmers. It ranged from 0.37 to 2.97 kg/plant and 80.8 to 459.27 q/ha depending on genotypes. The yield variation in brinjal genotypes was also observed by Tambe et al. (1992), Shinde *et.al.*, (2012) and Khan and Singh (2014) [6].

The crop is extremely variable in India because of highly differential selection pressures according to regional

preferences for plant and particularly fruit characters. Hence, it is necessary to characterise the genotypes of brinjal having better acceptance and wide adoptability in the country. The geographical situations for brinjal adaptability should be essentially considered while characterizing brinjal genotypes. The elite varieties, land races, local types, wild relatives, stable breeding lines, indigenous cultivars should be characterized for different qualitative and quantitative characters and utilized for breeding programme in brinjal. The characters which govern the quality of brinjal viz., fruit colour, fruit shape, spyness, less seeds in fruit, higher yield, erect and compact growth habit, solitary fruiting habit, earliness, resistance to biotic and abiotic stress should be considered for improvement of the brinjal in future.

Table 1: Morphological descriptors, descriptor scales and distribution of brinjal germplasm

S. No.	The trait/descriptor	Descriptor state	Class or scale of descriptor	Distribution by classes of descriptor
01.	Plant growth habit	~100	3= Upright	38 (34.54%)
		70-100	5= Intermediate	39 (35.45%)
		~70	7= Prostrate	33 (30.0%)
02.	Plant branching	~2	1= Very weak	0 (0%)
		~5	3= Weak	6 (5.45%)
		~10	5= Intermediate	68 (61.81%)
		~20	7= Strong	35 (31.81%)
03.	Pigmentation	~30	9= Very Strong	1 (0.9%)
		Green	1= Green	91 (82.72%)
		Greenish Violet	3= Greenish Violet	11 (10%)
		Violet	5= Violet	8 (7.27%)
		Dark Violet	7= Dark Violet	0 (0%)
04.	Leaf blade colour	Dark Brown	9= Dark Brown	0 (0%)
		Light green	1= Light green	3 (2.72%)
		Green	3= Green	75 (68.18%)
		Dark green	5= Dark green	20 (18.18%)
		Greenish violet	7= Greenish violet	10 (9.09%)
05.	Leaf blade length	Violet	9= Violet	2 (1.81%)
		~10 cm	3= Short	65 (59.09%)
		~20 cm	5= Intermediate	40 (36.36%)
		~30 cm	7= Long	5 (4.54%)
06.	Leaf blade width	~5 cm	3= Narrow	22 (20%)
		~10 cm	5= Intermediate	70 (63.6%)
		~15 cm	7= Wide	18 (16.36%)
07.	Leaf blade lobing	Very weak	1= Very weak	0 (0.00%)
		Weak	3= Weak	32 (29.09%)
		Intermediate	5= Intermediate	44 (40.0%)
		Strong	7= Strong	32 (29.09%)
		Very strong	9= Very strong	2 (1.8%)
08.	Leaf blade tip angle	Very acute	1= Very acute	21 (19.09%)
		Acute	3= Acute	40 (36.36%)
		Intermediate	5= Intermediate	39 (35.45%)
		Obtuse	7= Obtuse	10 (9.09%)
		Very obtuse	9= Very obtuse	0 (0.00%)
09.	Leaf prickles	1-2	0= None	97 (88.18%)
		3-5	1= Very few	1 (0.9%)
		6-10	3= Few	8 (7.27%)
		11-20	5= Intermediate	3 (2.72%)
		>20	7= Many	1 (0.9%)
10.	Leaf hairs	<20	1= Very few	28 (25.45%)
		20-50	2= Few	36 (32.72%)
		50-100	3= Intermediate	32 (29.09%)
		100-200	5= Many	13 (11.81%)
		>200	7= Very many	1 (0.9%)
11.	Flowering habit	Cyme	3= Cluster or cyme	28 (25.45%)
		Mixed	5= Mixed (cyme + solitary)	67 (60.90%)
		Solitary	7= Solitary	15 (13.63%)
12.	Corolla colour	White	3= White	19 (17.27%)
		Pale violet	5= Pale violet	30 (27.27%)
		Violet	7= Violet	61 (55.45%)

13.	Stigma colour	White	1= White	4 (3.63%)
		Green	3= Green	97 (88.18%)
		Dark purple	5= Dark Purple	9 (8.18%)
14.	Fruit shape	Round	3= Round	17 (15%)
		Oblong	5= Oblong	21 (19.09%)
		Medium long	7= Medium long	20 (18.18%)
		Long	9= Long	52 (47.27%)
15.	Fruit curved	Straight	3= Straight	49(44.54%)
		Slightly curved	5= Slightly curved	38 (34.54%)
		Curved	7= Curved	23 (20.9%)
16.	Fruit apex shape	Protruded	3= Protruded	28 (25.45%)
		Rounded	5= Rounded	50 (45.45%)
		Depressed	7= Depressed	32 (29.09%)
17.	Fruit colour distribution	Uniform	1= Uniform	48 (43.63%)
		Mottled	3= Mottled	43 (39.09%)
		Netted	5= Netted	11 (10%)
		Stripped	7= Stripped	8 (7.27%)
18.	Fruit colour	Green	1= Green	41 (37.27%)
		Milk white	2= Milk white	15 (13.62%)
		Scarlet red	3= Scarlet red	2 (1.8%)
		Liliac grey	4= Liliac grey	10 (9.09%)
		Purple	5= Purple	28 (25.45%)
19.	Fruit calyx prickle	Black purple	6= Black purple	14 (12.72%)
		<3	0= None	97 (88.18%)
		3-5	1= Very few	6 (5.45%)
		5-10	3= Few	4 (3.36%)
		10-20	5= Intermediate	3 (2.72%)
		20-30	7= Many	0 (0.00%)
20.	Seed size	>30	9= Very many	0 (0.00%)
		~2 mm	3= Small	52 (47.27%)
		~3 mm	5= Intermediate	53 (48.18%)
		~4 mm	7= Large	5 (4.54%)

Table 2: Quantitative characteristics of 110 germplasms of brinjal

Sr. No	Characters/Parameters	Range		Mean (X)	SEd	CV%
		Minimum	Maximum			
01	Plant hight (cm)	29.8	105.67	65.13	6.07	11.38
02	Plant Spread (cm)	29.2	107.0	70.64	5.82	10.10
03	No. of primary branches	4.0	13.33	7.9	1.4	21.73
04	Days to 50% flowering	34.46	62.67	43.41	1.9	5.62
05	Days to first harvest	51.66	93.33	64.07	3.8	7.40
06	No. of cluster/plant	6.33	37.13	13.24	1.95	18.06
07	No. of inflorescence/plant	1.0	7.33	3.47	0.69	21.45
08	No. of fruit/cluster	1.0	7.43	2.19	0.38	21.68
09	No. of fruit/plant	2.93	25.23	11.05	1.26	14.04
10	Fruit Length	3.93	24.83	11.94	1.43	14.71
11	Fruit Girth	6.59	25.83	13.6	1.52	13.76
12	Average Fruit Weight	16.63	114.83	57.26	8.6	18.58
13	Pericarp thickness (mm)	2.25	6.14	4.02	0.14	3.49
14	No. of fruits/plant/picking	1.0	18.6	4.82	0.74	18.81
15	Fruit yield (kg/plant)	0.37	2.97	1.06	0.11	12.74
16	Fruit yield (q/ha)	80.8	459.27	231.88	23.41	12.36

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