



Morphological description of brinjal genotypes under temperate conditions of Kashmir

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ABSTRACT

The objective of this study was to analyze the variation in morphological characteristics of brinjal genotypes (parents vs. crosses) for use as morphological markers. Morphological identification keys were employed on plant morphology and marked differences were observed among the genotypes. Morphological traits are thus widely accepted in plant variety protection, registration, inscription and patenting as descriptors that are capable of showing both identity and distinctness if new varieties are developed.

Key words: *Cultivar identification, onion, morphology, plant variety protection, DUS testing.*

Received 12.04.2018

Revised 11.06.2018

Accepted 21.07. 2018

INTRODUCTION

Government of India has enacted legislation on Protection of Plant Varieties and Farmers Rights (PPV &FR) in 2001 to provide legal framework for Plant Breeders' and Farmers Rights. The rules of this Act have been notified in September 2003. Plant variety authority in India came in to existence under this act, which is responsible for implementation of this act. Plant varieties seeking protection need to be registered with PVP authority. For registration, the varieties have to pass through DUS test (Distinctiveness, Uniformity and Stability of characters over generations. Descriptions thus define proprietary products of plant breeding and allow inscription or protection of novel varieties through plant variety protection (PVP) or utility patents. Accurate morphological descriptions of cultivars have proved reliable and provided the basis of assurance to farmers and merchants that they are being offered specific varieties or classes of product to certain minimum standards of quality and purity. Though many tools are now available to study relationship among cultivars including various types of molecular markers, however morphological characterization is the first step in description and classification. It is commonly known that morphological data can be of dubious taxonomic reliability because of environmental interaction and the largely unknown mechanisms of genetic control of these traits [1,2]. However, problems associated with the interpretation of morphological descriptions can be minimized by measuring traits in several environments or by limiting comparisons to those traits for which the effects of environmental interaction are smallest. Besides, continued usage of morphological features to describe varieties indicates that these morphological markers retain popularity as descriptors. It is likely that use of these descriptors will continue because they are omnipresent in agriculture [3] and measurement and careful observations of morphological data would give an initial indication of any materials that were very similar [4].

The intensive crop improvement programmes have resulted in diversification of varietal profile in the brinjal crop cultivated in India and one of the major thrusts at present is to maintain their purity besides registration (patents) and commercial release of new varieties. Therefore, an attempt was made to characterize most of the already released onion varieties over years so as to develop identification keys that are reliable and relatively easy to perform while implementing PVP legislation and DUS testing in onion under temperate conditions of Kashmir.

Brinjal (*Solanum melongena* L.), (2n=2x=24) belonging to Solanaceae family, is one of the major and principle vegetable crops widely grown in both temperate and tropical regions of the globe. It has been

known in India from ancient times and regarded as a native of Asia. The name brinjal is popular in Indian subcontinent and is derived from Arabic and Sanskrit whereas the name eggplant has been derived from the shape of fruit of some varieties, which are white and egg shaped. It is also called aubergine in Europe. The varieties of *Solanum melongena* L. display a wide range of fruit shapes from oval or egg-shaped to long club-shaped and colours, white, yellow, green through degrees of purple pigmentation to almost black. It is a highly nutritious vegetable being rich in vitamins A and C and minerals like calcium, magnesium and phosphorus. It is reported to stimulate the intrapeptic metabolism of food cholesterol and help in marked drop in blood cholesterol level. The de-cholesterolizing action is attributed to the presence of polyunsaturated fatty acid (linoleic and linolenic), which are present in flesh and seeds of the fruit in higher amount. It is a low calorie vegetable but a rich source of minerals which makes it ideal for diabetics, hypersensitive and obese patients. It is a rich source of phenolic compounds that function as antioxidant and help prevent cancer, cholesterol build-up and bacterial and viral infection besides being an important source of anthocyanin which have potent beneficial effect on a variety of health conditions like anti-inflammatory properties, which affect collagen and the nervous system, ability to protect both large and small blood vessels from oxidative damage including mitigating micro vessel damage from high blood-sugar levels that cause complications in diabetics. Evaluation of genotypes (parents versus crosses) by estimation of mean performance per se gives an idea about their suitability to a region and provides preliminary information before initiation of any planned breeding programme. The present investigation was therefore undertaken.

MATERIAL AND METHODS

The experimental material for the present investigation consisted of ten diverse parental lines that were crossed in a diallel fashion during *Kharif*2011 and 45 cross combinations were generated as per method II and Model-I of Griffing (1956 a,b). The parents and F₁ crosses were evaluated during *Kharif* 2012 in randomized complete block design with three replications at Vegetable Experimental Farm, Division of Vegetable Science, SKUAST-Kashmir, Shalimar for morphological descriptors.

RESULTS AND DISCUSSION

The morphological markers in brinjal genotypes (Parents vs. crosses) are presented in table1. Among parents P.Kranti, SBPL-27, A.Kusmakar, L.Long had cylindrical fruits, PPC and PPL had long fruits, GOB-1 had globular, SBW-11 had ovoid, GBL-1 had long curved and A.Nidhi had long thin fruits while among crosses PPC x A.Nidhi, PPC x P.Kranti, PPC x SBPL-27, PPC x A.Kusmakar, PPC x PPL, PPC x L.Long, A.Nidhi x P.Kranti, A.Nidhi x SBPL-27, A.Nidhi x A.Kusmakar, A.Nidhi x SBW-11, A.Nidhi x GBL-1, GOB-1, A.Nidhi x PPL, A.Nidhi x L.Long, P.Kranti x SBPL-27, P.Kranti x A.Kusmakar, P.Kranti x SBW-11, P.Kranti x GBL-1, P.Kranti x GOB-1, P.Kranti x PPL, P.Kranti x L.Long, SBPL-27 x GOB-1, SBPL-27 x PPL, SBPL-27 x L.Long, A.Kusmakar x SBW-11, A. Kusmakar x GBL-1, A. Kusmakar x GOB-1, A. Kusmakar x PPL, A. Kusmakar x L.Long, SBW-11 x GBL-1, GBL-1 x GOB-1, GBL-1 x PPL, GBL-1 x L.Long, GOB-1 x L.Long, PPL x L.Long had long fruits, SBW-11 x GOB-1, GOB-1 x PPL had round fruits, PPC x SBW-11, PPC x GOB-1, SBPL-27 x A.Kusmakar, SBPL-27 x SBW-11, SBPL-27 x GBL-1, SBW-11 x L.Long had oblong and PPC x GBL-1 had long thin fruits. Among parents, fruits size was small in SBW-11, medium in PPC, A.Nidhi, P.Kranti, SBPL-27, A.Kusmakar, GBL-1, GOB-1 and L.Long and long in PPL. While among crosses it was small in P.Kranti x SBPL-27, SBPL-27 x A.Kusmakar and SBW-11 x GOB-1, long in GOB-1 x PPL. Rest of the crosses showed medium fruit size. Fruit colour showed wide range. Among parents it was dark purple in A.Nidhi, GBL-1, GOB-1, PPL, purple in PPC, blackish purple in P.Kranti, pinkish purple in SBPL-27, creamy white in SBW-11, green in A.Kusmakar and pink in L.Long. Among crosses it was purple in PPC x SBPL-27, PPC x A.Kusmakar, PPC x GOB-1, PPC x PPL, PPC x L.Long, A.Nidhi x SBPL-27, A.Nidhi x A.Kusmakar, A.Nidhi x PPL, P.Kranti x SBPL-27, P.Kranti x SBW-11, P.Kranti x GBL-1, P.Kranti x GOB-1, P.Kranti x L.Long, SBPL-27 x A.Kusmakar, SBPL-27 x GBL-1, SBPL x L.Long, A. Kusmakar x GBL-1, A. Kusmakar x PPL, A. Kusmakar x L.Long, SBW-11 x GOB-1, SBW-11 x PPL, GBL-1 x PPL, GBL-1 x L.Long, GOB-1 x L.Long and PPL x L.Long, dark purple in PPC x A.Nidhi, PPC x P.Kranti, A.Nidhi x GBL-1, GOB-1, A.Nidhi x L.Long, P.Kranti x A.Kusmakar, P.Kranti x PPL, A. Kusmakar x SBW-11, A. Kusmakar x GOB-1, SBW-11 x GOB-1, GBL-1 x GOB-1, light purple in PPC x SBW-11, PPC x GBL-1, SBPL-27 x PPL and SBW-11 x L.Long, black purple in A.Nidhi x P.Kranti, A.Nidhi x SBW-11 and GOB-1 x PPL, medium purple in SBPL-27 x GOB-1 and dark pink in SBPL-27 x SBW-11. Nearly all parents as well as crosses were good in taste except A.Kusmakar (average). Among parents fruits were firm in PPC, A.Nidhi, SBPL-27, GBL-1, GOB-1, PPL, very firm in SBW-11, L.Long and soft in A.Kusmakar and P.Kranti. Among crosses it was soft in PPC x P.Kranti, PPC x GBL-1, A.Nidhi x GBL-1, P.Kranti x GOB-1, P.Kranti x L.Long, SBPL-27 x A.Kusmakar, GOB-1 x PPL, very soft in A.Nidhi x L.Long, very firm in A.Nidhi x GOB-1, SBPL-27 x GOB-1, SBW-11 x PPL and GBL-1 x GOB-1 and firm in rest of the crosses. Cooking was found easy in almost all parents as well as crosses. Among parents

growth habit varied from spreading in Kranti,SBPL-27,A.Kusmakar,SBW-11, GOB-1,semi-spreading in A.Nidhi,GBL-1,PPL and erect in PPC and L.Long.Among crosses it was spreading in PPC x A.Nidhi, PPC x SBW-11, PPC x GOB-1, PPC x PPL, A.Nidhi x SBPL-27, A.Nidhi x SBW-11, A.Nidhi x GBL-1,A.Nidhi x GOB-1, A.Nidhi x PPL, P.Kranti x SBPL-27, P.Kranti x A.Kusmakar, P.Kranti x SBW-11, P.Kranti x GBL-1, P.Kranti x GOB-1, P.Kranti x PPL, SBPL-27 x SBW-11, , SBPL-27 x PPL and GBL-1 x GOB-1,semi-spraeding in PPC x SBPL-27, PPC x A.Kusmakar, A.Nidhi x P.Kranti, A.Nidhi x A.Kusmakar, A.Nidhi x L.Long, P.Kranti x L.Long,SBPL-27 x A.Kusmakar, SBPL-27 x GBL-1, SBPL-27 x GOB-1, A.Kusmakar x GBL-1, A. Kusmakar x GOB-1, A. Kkusmakar x PPL, A. Kusmakar x L.Long,SBW-11 x GBL-1, SBW-11 x GOB-1, SBW-11 x PPL ,GOB-1 x L.Long, and erect in PPC x P.Kranti, PPC x GBL-1, PPC x L.Long, SBPL x L.Long,A. Kusmakar x SBW-11,SBW-11 x L.Long, GBL-1 x PPL, GBL-1 x L.Long,GOB-1 x PPL and PPL x L.Long.

Table 1:Morphological description of brinjal genotypes (Parents vs. crosses)

Traits	Shape	Size	Appearance/ Colour	Taste	Firmness	Cooking	Growth habit	Maturity (days to 1 st picking)	Number of pickings	Resistance to insect pests and diseases	Yield
PPC	Long	Medium	Purple	Good	Firm	Easy	Erect	33	15-20	Field Resistant	170
A.Nidhi	Long thin	Medium	Dark purple	Good	Firm	Easy	Semi spreading	34	15-20	Field Resistant	200
P.Kranti	Cylindrical	Medium	Blackish purple	Good	Soft	Easy	Spreading	34	15-20	Field Resistant	220
SBPL-27	Cylindrical	Medium	Pinkish purple	Good	Firm	Easy	Spreading	36	15-20	Field Resistant	210
A.Kusmakar	Cylindrical	Medium	Green	Average	Soft	Easy	Spreading	45	15-20	Field Resistant	230
SBW-11	Ovoid	Small	Creamy white	Good	Very firm	Easy	Spreading	32	15-20	Field Resistant	125
GBL-1	Long curved	Medium	Dark purple	Good	Firm	Easy	Semi spreading	35	15-20	Field Resistant	200
GOB-1	Globular	Medium	Dark purple	Good	Firm	Easy	Spreading	46	15-20	Field Resistant	230
PPL	Long	Long	Dark purple	Good	Fim	Easy	Semi- spreading	35	15-20	Field Resistant	230
L. Long	Cylindrical	Medium	Pink	Good	Very firm	Easy	Erect	39	15-20	Field Resistant	230
PPC x A.Nidhi	Long	Medium	Dark purple	Good	Firm	Easy	Spreading	35	15-20	Field Resistant	340
PPC x P. Kranti	Long	Medium	Dark purple	Good	Soft	Easy	Erect	38	15-20	Field Resistant	300
PPC x SBPL- 27	Long	Medium	Purple	Good	Firm	Easy	Semi- spreading	40	15-20	Field Resistant	350
PPC x A.Kusmakar	Long	Medium	Purple	Good	Firm	Easy	Semi- spreading	35	15-20	Field Resistant	440
PPC x SBW- 11	Oblong	Medium	Light purple	Good	Firm	Easy	Spreading	35	15-20	Field Resistant	430
PPC x GBL- 1	Long thin	Medium	Light purple	Good	Soft	Easy	Erect	35	15-20	Field Resistant	600
PPC x GOB- 1	Oblong	Medium	Purple	Good	Firm	Easy	Spreading	40	15-20	Field Resistant	490
PPC x PPL	Long	Medium	Purple	Good	Firm	Easy	Spreading	40	15-20	Field Resistant	430
PPC x L. Long	Long	Medium	Purple	Good	Firm	Easy	Erect	34	15-20	Field Resistant	450
A.Nidhi x P. Kranti	Long	Medium	Black purple	Good	Firm	Easy	Semi spreading	40	15-20	Field Resistant	480
A.Nidhi x SBPL-27	Long	Medium	Purple	Good	Firm	Easy	Spreading	40	15-20	Field Resistant	370
A.Nidhi x A.Kusmakar	Long	Medium	Purple	Good	Firm	Easy	Semi spreading		15-20	Field Resistant	190
A.Nidhi x SBW-11	Long	Medium	Black purple	Good	Firm	Easy	Spreading	40	15-20	Field Resistant	350
A.Nidhi x GBL-1	Long	Medium	Dark purple	Good	Soft	Easy	Spreading	40	15-20	Field Resistant	240
A.Nidhi x GOB-1	Long	Medium	Dark purple	Good	Very firm	Easy	Spreading	45	15-20	Field Resistant	450
A.Nidhi x PPL	Long	Medium	Purple	Good	Firm	Easy	Spreading	45	15-20	Field Resistant	350
A.Nidhi x L. Long	Long	Medium	Dark purple	Good	Very soft	Easy	Semi- spreading	45	15-20	Field Resistant	500
P.Kranti x SBPL-27	Long	Small	Purple	Good	Firm	Easy	Spreading	40	15-20	Field Resistant	220
P.Kranti x A.Kusmakar	Long	Medium	Dark purple	Good	Firm	Easy	Spreading	40	15-20	Field Resistant	430
P.Kranti x	Long	Medium	Purple	Good	Firm	Easy	Spreading	40	15-20	Field	220

SBW-11											Resistant	
P.Kranti x GBL-1	x	Long	Medium	Purple	Good	Fim	Easy	Spreading	35	15-20	Field Resistant	250
P.Kranti x GOB-1	x	Long	Medium	Purple	Good	Soft	Easy	Spreading	45	15-20	Field Resistant	250
P.Kranti x PPL	x	Long	Medium	Dark purple	Good	Firm	Easy	Spreading	45	15-20	Field Resistant	360
P.Kranti x L. Long	x	Long	Medium	Purple	Good	Soft	Easy	Semi-spreading	40	15-20	Field Resistant	220
SBPL-27 x A.Kusmakar	x	Oblong	Small	Purple	Good	Soft	Easy	Semi-spreading	35	15-20	Field Resistant	55
SBPL-27 x SBW-11	x	Oblong	Medium	Dark pink	Good	Firm (3)	Easy	Spreading	40	15-20	Field Resistant	350
SBPL-27 x GBL-1	x	Oblong	Medium	Purple	Good	Firm	Easy	Semi-spreading	30	15-20	Field Resistant	420
SBPL-27 x GOB-1	x	Long	Medium	Medium Purple	Good	Very firm	Easy	Semi-spreading	35	15-20	Field Resistant	330
SBPL-27 x PPL	x	Long	Medium	Light purple	Good	Firm	Easy	Spreading	45	15-20	Field Resistant	440
SBPL-27 x L. Long	x	Long	Medium	Purple	Good	Firm	Easy	Erect	40	15-20	Field Resistant	470
A.Kusmakar x SBW-11	x	Long	Medium	Dark purple	Good	Firm	Easy	Erect	40	15-20	Field Resistant	340
A.Kusmakar x GBL-1	x	Long	Medium	Purple	Good	Firm	Easy	Semi-spreading	40	15-20	Field Resistant	310
A.Kusmakar x GOB-1	x	Long	Medium	Dark purple	Good	Firm	Easy	Semi-spreading	40	15-20	Field Resistant	200
A.Kusmakar x PPL	x	Long	Medium	Purple	Good	Firm	Easy	Semi-spreading	40	15-20	Field Resistant	330
A.Kusmakar x L. Long	x	Long	Medium	Purple	Good	Firm	Easy	Semi-spreading	35	15-20	Field Resistant	580
SBW-11 x GBL-1	x	Long	Medium	Dark purple	Good	Firm	Easy	Semi-spreading	35	15-20	Field Resistant	390
SBW-11 x GOB-1	x	Round	Small	Purple	Good	Firm	Easy	Semi-spreading	35	15-20	Field Resistant	390
SBW-11 x PPL	x	Long	Medium	Purple	Good	Very firm	Easy	Semi-spreading	35	15-20	Field Resistant	380
SBW-11 x L. Long	x	Oblong	Medium	Light purple	Good	Firm	Easy	Erect	35	15-20	Field Resistant	470
GBL-1 x GOB-1	x	Long	Medium	Dark purple	Good	Very firm	Easy	Spreading	35	15-20	Field Resistant	440
GBL-1 x PPL	x	Long	Medium	Purple	Good	Firm	Easy	Erect	30	15-20	Field Resistant	1050
GBL-1 x L. Long	x	Long	Medium	Purple	Good	Firm	Easy	Erect	35	15-20	Field Resistant	550
GOB-1 x PPL	x	Round	Long	Black purple	Good	Soft	Easy	Erect	30	15-20	Field Resistant	520
GOB-1 x L. Long	x	Long	Medium	Purple	Good	Firm	Easy	Semi-spreading	40	15-20	Field Resistant	520
PPL x L. Long	x	Long	Medium	Purple	Good	Firm	Easy	Erect	40	15-20	Field Resistant	280

Comparison of parents for maturity(days to 1st picking) revealed that GOB-1 recorded maximum of 46 days followed by A.Kusumakar (45) L.Long(39) ,GBL-1,PPL(35) and minimum days were recorded by SBW-11(32) followed by PPC(33),A.Nidhi and P.Kranti (34) whereas among crosses maximum number of days to maturity was 45 days recorded by A.Nidhi x GOB-1,A.Nidhi x L.Long,A.Nidhi x GBL-1,A.Nidhi x PPL and P.Kranti x GOB-1, P.Kranti x PPL, SBPL-27 x PPL followed by 40 days in PPC x SBPL-27, PPC x GOB-1, PPC x PPL, A.Nidhi x P.Kranti, A.Nidhi x SBPL-27, A.Nidhi x SBW-11, A.Nidhi x GBL-1,P.Kranti x SBPL-27, P.Kranti x A.Kusmakar, , P.Kranti x SBW-11, P.Kranti x L.Long, SBPL x L.Long,A. Kusmakar x SBW-11, A. Kusmakar x GBL-1, A. Kusmakar x GOB-1, A. Kusmakar x PPL, GOB-1 x L.Long,PPL x L.Long ,35 days in PPC x A.Nidhi, , PPC x A.Kusmakar, PPC x SBW-11, PPC x GBL-1, P.Kranti x GBL-1, SBPL-27 x A.Kusmakar, SBPL-27 x GOB-1, A. Kusmakar x L.Long ,SBW-11 x GBL-1, SBW-11 x GOB-1, SBW-11 x PPL, SBW-11 x L.Long,GBL-1 x GOB-1, , GBL-1 x L.Long,34 days in PPC x L.Long and minimum number of 30 days was recorded by SBPL-27 x GBL,GBL-1 x PPL,GOB-1 X PPL.Number of pickings ranged from 15-20 which was uniform in all parents and crosses. All parents as well as crosses showed field resistance against insect pests and diseases.Yield varied considerably both in parents and crosses,among parents highest yield of 230 q/ha was recorded by GOB-1),PPL,GBL-1 and A.Kusumakar followed by 220 q/hain P.Kranti, 200q/ha in A.Nidhi and GBL-1,210q/ha in SBPL-27 and minimum yield of 125q/ha was recorded by SBW-11 followed by 170q/ha in PPC whereas among crosses highest yield of 1050q/ha was recorded by GBL-1 x PPL which was significantly higher than rest of the crosses and parents.It was followed by 600q/ha in PPC x GBL-1,580q/ha in A. Kusmakar x L.Long,550q/ha in GBL-1 x L.Long,520q/ha in GOB-1 x PPL, GOB-1 x L.Long,500q/ha in A.Nidhi x L.Long,490q/ha in PPC x GOB-1,480q/ha in A.Nidhi x P.Kranti,470q/ha in SBPL x L.Long, SBW-11 x L.Long,450q/ha in A.Nidhi x GOB-1,PPC x L.Long,440q/ha

in PPC x A.Kusmakar, GBL-1 x GOB-1, SBPL-27 x PPL,430q in PPC x SBW-11,PPC X PPL, P.Kranti x A.Kusmakar,420q in SBL-27 x GBL-1,390q in SBW-11 x GBL-1, SBW-11 x GOB-1,380q/ha in SBW-11 X PPL,370q/ha in A.Nidhi x SBPL-7,360q/ha in P.Kranti x PPL,350q/ha in PPC x SBPL-27,A.Nidhi x SBW-11, SBPL-27 x SBW-11,340q/ha in PPC x A.Nidhi,A.Kusmakar x SBW-11,330q/ha in SBPL-27 x GOB-1,A.Kusmakar x PPL,310q/ha in A. Kusmakar x GBL-1,300 q/ha in PPC x P.Kranti,280q/ha in PPL x L.Long,250q/ha in P.Kranti x SBW-11, P.Kranti x GBL-1, P.Kranti x GOB-1,240q/ha in A.Nidhi x GBL-1,220q/ha in P.Kranti x SBPL-27, P.Kranti x SBW-11, P.Kranti x L.Long,200 q/hain A. Kusmakar x GBL-1,190 q/ha in A.Nidhi x A.Kusmakar. SBPL-27 x A.Kusmakar recorded lowest yield of 55q/ha among all crosses.Morphological description based on standard descriptors helps to easily describe the morphological features of a genotype and thus helps exchange of information about new accessions. Ten accessions of brinjal and there crosses upon characterization showed distinct variations with respect to vegetative, fruit and quality parameters.

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CITATION OF THIS ARTICLE

K. Hussain, S.H.Khan., Kouser Parveen., S.Narayan.,B.Afroza., M.I. Mukhdoomi., Qurat ul Ain., G.Nazir., Syeda Farwah., S.M.Hussain., Seerat Rizvi., Z.A.Dar and K.Bhat. Morphological description of brinjal genotypes under temperate conditions of Kashmir. *Bull. Env. Pharmacol. Life Sci.*, Vol 7 [9] August 2018: 60-64