

Genetic Diversity Analysis in Bitter Gourd (*Momordica charantia* L.) using Morphological Traits

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Abstract – Genetic diversity within Bitter gourd germplasm is a key to the genetic improvement of this high nutritional valued cucurbit crop. In the present study, 22 genotypes of bitter gourd collected from different parts of India were analyzed for diversity for fifteen morphological characters viz. Plant vigour, Stem pubescence, Stem shape, Leaf pubescence, Flower colour, Fruit shape, Fruit surface, Nature of tubercles, Blossom end fruit shape, Fruit skin colour, Lusture, Tendril branching, Leaf margin, Leaf size and Internodal length. Genetically divergent genotypes identified on the basis of morphological data will be used in future breeding programmes.

Keywords – Discriptors, Diversity, Germplasm, *Momordica Charantia*.

I. INTRODUCTION

Bitter gourd (*Momordica charantia* L) is an important vegetable crop in tropical countries, including China and India. It is mainly valued for its nutritional and medicinal properties (Behra, 1). The origin of this crop is probably India with secondary centre of diversity in China (Grubben, 4). A wide range of genetic diversity exists in India with respect to fruit morphology (growth habit, maturity and various fruit characters including shape, size, colour and surface texture (Robinson and Decker-Walters, 6). Morphological characters are the primary source of identification in most groups and for hypothesizing phylogenetic relationships.

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Morphological characterization of germplasm not only helps in the identification of lines with unique characteristics but also in the planning of inheritance studies. But, very little information is available on the genetic diversity in Indian bitter gourd species. In the present study, 22 genotypes of bitter gourd collected from different parts of India were analyzed for diversity for fifteen morphological characters viz. Plant vigour, Stem pubescence, Stem shape, Leaf pubescence, Flower colour, Fruit shape, Fruit surface, Nature of tubercles, Blossom end fruit shape, Fruit skin colour, Lusture, Tendril branching, Leaf margin, Leaf size and Internodal length. Data was collected on visual basis according to descriptor list (Srivastava *et al.*, 7). All the 22 genotypes belong to two species which differed with respect to flower colour, fruit shape, fruit colour, fruit size and leaf shape. Genetically divergent genotypes identified on the basis of morphological data will be used in future breeding programmes.

II. MATERIALS AND METHODS

The experimental materials comprised of twenty-two indigenous genotypes of bitter gourd. They were evaluated at the Vegetable Research Farm, Department of Vegetable Science, Punjab Agricultural University, Ludhiana, during 2013. Observations were recorded for the characters as per catalogue listed in Table 1. Following are the morphological characters which were recorded:

1. Plant vigour: Recorded after 30 days of sowing.
2. Stem pubescence: Recorded at peak fruiting stage.
3. Stem shape: Recorded at near maturity stage (recorded from the cross section)
4. Leaf pubescence: Recorded on fully grown leaf at fully foliage stage.
5. Flower colour: Recorded at flowering stage.
6. Fruit shape: Recorded at marketable stage.
7. Fruit surface: Recorded in cross section in marketable stage.
8. Nature of tubercles: Recorded at marketable stage.
9. Blossom end fruit shape: Recorded at marketable stage.
10. Fruit skin colour: Recorded at marketable stage.
11. Lusture: Recorded at marketable stage.
12. Tendril branching: Recorded at flowering stage.
13. Leaf margin: Recorded at full foliage stage.
14. Leaf size: Recorded at full foliage stage.
15. Internodal length: Recorded as average of distance between 4th and 5th node at full foliage stage.

Data was collected on visual basis according to descriptor list (Srivastava *et al.*, 7) which was used further for data analysis.

III. RESULTS AND DISCUSSION

Morphological characterization of each of the germplasm lines under investigation was accomplished as per the guidelines of Srivastava *et al* (7). Twenty two genotypes of bitter gourd were evaluated for 15 morphological characters (Table 2) and wide variability was observed (Fig 1, 2 and 3).

1.1 Plant vigour

Four genotypes exhibited poor plant vigour (CHBG-13, VR-1, CHBG-6 and Daspur) whereas rest 18 genotypes exhibit either medium and good plant vigour.

1.2 Stem pubescence

Stem pubescence was absent in *Momordica subangulata* whereas in rest of the genotypes it was present.

1.3 Stem shape

In all genotypes stem shape was round except in

genotypes *Momordica subangulata* which possess angular stem shape.

1.4 Leaf pubescence

Leaf pubescence showed a wide variation among the genotypes evaluated. Ten genotypes showed sparse stem pubescence whereas in genotype PBBG-4 leaf pubescence was dense. Intermediate type of pubescence was present in CHBG-4 and BG-K4. It was absent in 3 genotypes.

1.5 Flower colour

Colour of the flower was white in *Momordica subangulata* whereas all other genotypes possess yellow flower colour.

1.6 Fruit shape

Eleven genotypes possess oblong fruit shape and rest all genotypes possess elliptical fruit shape.

1.7 Fruit surface

Fruit surface was found to be light in CHBG-4 and CHBG-6 and rest all the genotypes possess deep tubercles.

1.8 Nature of tubercles

Nature of tubercles was medium in two genotype and rest all other genotypes has dense tubercles.

1.9 Blossom end shape

Shape of blossom end was blunt in two genotypes (*Momordica subangulata* and Long Chandra) and rest 20 genotypes exhibits acute blossom end shape.

1.10 Fruit skin colour

Colour of fruit skin is light green in seven genotypes whereas all other genotypes possess either green or dark green fruit skin colour.

1.11 Lusture

Lusture was matty in CHBG-13 whereas all other genotypes exhibits intermediate and glossy lusture.

1.12 Tendril branching

Tendril branching was found to be unific in all the 22 genotypes.

1.13 Leaf margin

Leaf margin was entire in *Momordica subangulata* and multifid in rest 21 genotypes.

1.14 Leaf size

Leaf size was found to be large in *Momordica subangulata* and Green long, medium in 13 genotypes and small in rest of the genotypes.

1.15 Internodal length

Internodal length was found to be in range of 1.0-3.5cm in all the 22 genotypes.

M charantia var *charantia* and one of *M. charantia* var *muricata* as the variety *muricata* differed from var *charantia* by larger fruit size, whereas specie *M. subangulata* differed from *M. charantia* as in the former case the size of flower is large, more number of tubercles on fruit and the shape and size of the fruit is also different. Fruit size was small in case of *M. charantia* var *muricata* and large in case of *M. charantia* var *charantia*. Flower colour was yellow in *charantia* whereas white in case of *subangulata*. Leaf shape was multifid in *charantia* and entire in *subangulata*. Genetic diversity based on morphological characters has also been studied by Dey *et al.* (3) and Paul *et al.* (5). Chakravarty (2) reported that plants belonging to species *charantia*, *balsamina*, *cymbalarea* and *subangulata* showed differences in

morphological characters such as flower colour, fruit shape, fruit colour, fruit size and leaf shape.

IV. CONCLUSION

In the present study 22 genotypes based on 15 morphological characters belong to two species which differed with respect to flower colour, fruit shape, fruit colour, fruit size and leaf shape. Genetically divergent genotypes identified on the basis of morphological data will be used in future breeding programmes



Fig. 1. Variability in shape, size and colour of bitter gourd fruits.



Momordica subangulata



Momordica charantia var *muricata*



Momordica charantia

Fig. 2. Diversity In Bitter Gourd Fruits



Momordica subangulata



Momordica charantia



Momordica charantia var muricata



Momordica charantia



Momordica subangulata

Fig. 3. Diversity In Bitter Gourd Leaves And Flowers

Table 1. Morphological Characters recorded along with their categories

S. No.	Character	Category
1.	Plant vigour	Poor/good/Very good/Others
2.	Stem pubescence	Absent/Present
3.	Stem shape	Round/Angular/Others
4.	Leaf pubescence	No hairs/Sparse/Intermediate/Dense/Others
5.	Flower colour	White/Light yellow/Yellow/Deep yellow/Others
6.	Fruit shape	Tapering/Elliptical/Oblong/Long cylindrical/Top shaped/Globular/Others
7.	Fruit surface	Smooth/Light tubercle/Deep tubercle/Others
8.	Nature of tubercles	Sparse/Medium/Dense/Others
9.	Blossom end fruit shape	Blunt/Acute/Others
10.	Fruit skin colour	White/Milky white/Light green/Green/Dark green/Others
11.	Lusture	Matt/Intermediate/Glossy/Others
12.	Tendril branching	Unifid/Bifid/Multifid/Others
13.	Leaf margin	Entire/Serrate/Multifid/Others
14.	Leaf size	Small/Medium/Large/Others
15.	Internodal length(cm)	Quantitative

Table 2. Morphological characterization of bitter melon germplasm lines

Variety Name	Plant Vigour	Stem Pubescence	Stem Shape	Tendrils Branching	Leaf Margins	Leaf size	Leaf Pubescence	Internode Length (inches)	Flower Colour	Fruit shape	Fruit Surface	Nature of Tubercles	Blossom End	Fruit Skin Color	Lusture
CHBG 8	Medium	Present	Round	Single	Multifid	Medium	Sparse	2	Yellow	Oblong	Deep	Dense	Acute	Light G	Intermediate
<i>M subangulata</i>	Medium	Absent	Angular	Single	Entire	Large	Absent	3.5	White	Oblong	Deep	Dense	Blunt	Light G	Intermediate
CHBG 10	Medium	Present	Round	Single	Multifid	Medium	Sparse	2	Yellow	Elliptical	Deep	Dense	Acute	Dark G	Intermediate
CHBG 4	Medium	Present	Round	Single	Multifid	Small	Intermediate	1	Yellow	Elliptical	Light	Medium	Acute	Green	Glossy
Green long	Good	Present	Round	Single	Multifid	Large	Medium	2	Yellow	Oblong	Deep	Dense	Acute	Dark G	Intermediate
Meghna 1	Good	Present	Round	Single	Multifid	Medium	Medium	3.5	Yellow	Elliptical	Deep	Dense	Acute	Green	Intermediate
Meghna 2	Good	Present	Round	Single	Multifid	Medium	Medium	3	Yellow	Elliptical	Deep	Dense	Acute	Green	Intermediate
Bolder UCC	Good	Present	Round	Single	Multifid	Medium	Absent	2.8	Yellow	Oblong	Deep	Dense	Acute	Green	Intermediate
CHBG 13	Poor	Present	Round	Single	Multifid	Medium	Sparse	1.7	Yellow	Oblong	Deep	Dense	Acute	Light G	Matty
BG-K 4	Medium	Present	Round	Single	Multifid	Small	Intermediate	2	Yellow	Oblong	Deep	Medium	Acute	Cream	Intermediate
CHBG 14	Medium	Present	Round	Single	Multifid	Medium	Sparse	2	Yellow	Elliptical	Deep	Dense	Acute	Dark G	Glossy
VR 1	Poor	Present	Round	Single	Multifid	Medium	Sparse	2.2	Yellow	Elliptical	Deep	Dense	Acute	Dark G	Glossy
Long Chandra	Good	Present	Round	Single	Multifid	Small	Medium	1.5	Yellow	Oblong	Deep	Dense	Blunt	Green	Glossy
CHBG 6	Poor	Present	Round	Single	Multifid	Medium	Sparse	2	Yellow	Oblong	Light	Medium	Acute	Light G	Glossy
Nakhra	Good	Present	Round	Single	Multifid	Medium	Sparse	2.5	Yellow	Elliptical	Deep	Dense	Acute	Light G	Intermediate
PBBG 4	Medium	Present	Round	Single	Multifid	Large	Dense	2.3	Yellow	Elliptical	Deep	Dense	Acute	Green	Glossy
WBBG 28	Good	Present	Round	Single	Multifid	Medium	Sparse	1.3	Yellow	Elliptical	Deep	Dense	Acute	Green	Glossy
CHBG 11	Medium	Present	Round	Single	Multifid	Medium	Sparse	2.5	Yellow	Elliptical	Deep	Dense	Acute	Light G	Intermediate
PBBG 12	Good	Present	Round	Single	Multifid	Small	Medium	2.5	Yellow	Elliptical	Deep	Dense	Acute	Green	Glossy
<i>M charantia var muricata</i>	Medium	Present	Round	Single	Multifid	Small	Sparse	2.8	Yellow	Oblong	Deep	Dense	Acute	Green	Intermediate
Long collection small fruited	Good	Present	Round	Single	Multifid	Large	Absent	1.8	Yellow	Oblong	Deep	Dense	Acute	Green	Intermediate
Daspur	Poor	Sparse	Round	Single	Multifid	Medium	Medium	2	Yellow	Oblong	Deep	Dense	Acute	Light G	Intermediate



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