

## **Bitter Gourd (*Momordica charantia* L.)**

### **I. Subject**

These test guidelines apply to all varieties, hybrids and parental lines of bitter gourd (*Momordica charantia* L.)

### **II. Seed material required**

1. The Protection of Plant Varieties and Farmers' Rights Authority (PPV&FRA) shall decide when, where and in what quantity and quality the seed material required for testing the variety is to be delivered. Applicants submitting material from a country other than India must make sure that all customs formalities are complied with.

2. The minimum quantity of seed to be supplied by the applicant should be:

Varieties, hybrids and parental lines

- For open field cultivation: 300g or 1500 seeds (in one submission only)

3. The seed should meet the minimum requirements for germination capacity (80%), moisture content (<8%) and physical purity (98%) prescribed for certified seed in India. Especially for storage, which requires a higher standard, the applicant should state the actual germination capacity, which should be as high as possible. The seed supplied should be visibly healthy, not lacking in vigour or affected by any important pest or disease.

4. The seed material must not have undergone any treatment unless the competent authorities allow or request such treatment. If it has been treated, full details of the treatment must be given.

### **III. Conduct of tests**

1. The minimum duration of tests should normally be two independent but similar growing seasons with reference to the eco-system of the variety submitted for DUS test.

2. The test should normally be conducted at two different locations. If any essential characteristics of the variety can not be observed at these places, the variety may be tested at an additional place.

3. The test should be carried out under conditions ensuring normal growth. The size of the plot should be such that plants or parts of plant may be removed for measuring and counting without prejudice to the observations which must be made up to the end of the growing period. Each test shall include 120 plants for open field cultivation, which should be divided among 3

replications. Separate plots for observations and for measuring can only be used if they have been subjected to similar environmental conditions.

#### 4. Test plot design

|                         |       |
|-------------------------|-------|
| Number of rows          | 5     |
| Row length              | 6.0 m |
| Plant to plant distance | 0.75m |
| Row to Row distance     | 2.0 m |
| Number of replications  | 3     |

5. Observations should not be recorded on plants in border rows.

6. Additional tests for special purpose may be established by the Authority.

#### **IV. Methods and observations**

1. The characteristics described in the table of characteristics (section VII) should be used for the testing of varieties for DUS.
2. For the assessment of distinctiveness and stability, observations should be made on 30 plants or parts of plants selected randomly, which should be divided among 3 replications (10 plants in each replication).
3. For the assessment of uniformity of characteristics on the plot as a whole (visual assessment by a single observation of a group of plants or parts of plants), a population standard of 0.5% with an acceptance probability of at least 95% should be applied. In the case of a sample size of 120 plants, the number of off-types should not exceed 3.
4. For the assessment of colour characteristics, it is recommended that Royal Horticultural Society (RHS) colour chart be used.
5. Observations of leaf will be recorded on one leaf above the first fruit set nodes.
6. Observations on the leaf blade should be made on a fully developed leaf blade, from the 15<sup>th</sup> node upwards to 20<sup>th</sup> node.
7. All observations on the flowers should be made on flowers between the 10th and the 20th node.

8. All observations on the fruit should be made on fruits around 8-14 days after anthesis, between the 10th and 20th node.
9. All observations on the seed should be made on fully developed and dry seed after washing and drying in the shade.
10. Intensity of green colour of cotyledon should be observed just before the development of the first true leaf.
11. The bitterness of the fruit should be observed by tasting the flesh of the middle part of the fruit at marketable maturity.
12. Colour of fruit skin at ripe stage should be observed when the fruit left on the plant has turned completely yellow, orange or reddish orange.
13. Stage of recording of different observation will be as follows:

| <b>Description</b>   | <b>Code</b> |
|--|-------------|
| a. Cotyledons completely unfolded  | 10          |
| b. Active vegetative phase   | 20          |
| c. 50% of the flowering stage (first pistillate flower appears in 50% plant) | 30          |
| d. Fruits attaining marketable maturity                                      | 40          |
| e. Full maturity (ripening stage)  | 50          |

## **V. Grouping of varieties**

1. The collection of varieties to be grown in the trial should be divided into groups to facilitate the assessment of distinctiveness. Characteristics, which are suitable for grouping purpose, are those which are known from experience not to vary, or to vary only to lesser extent, within a variety. Their various states of expression should be fairly evenly distributed throughout the collection.
2. It is recommended that the competent authorities use the following characteristics for grouping varieties.
  - a. Fruit : Length (characteristic-15)
  - b. Fruit : Diameter (characteristic-16)

- c. Fruit : Color of skin (characteristic-18)
- d. Fruit : Shape in longitudinal section (characteristic-21)
- e. Fruit : Tubercles (characteristic-22)
- f. Fruit : Ridge (characteristic-24)

## VI. Characteristics and symbols

1. To assess distinctiveness, uniformity and stability, the characteristics and their states as given in the Table of Characteristics should be used.
2. Notes (1-9) should be used for the purposes of recording and electronic processing of data. Each state of expression is allotted a corresponding numerical note (1-9) for the different characteristics.
3. Legend
  - (\*) Characteristics that should be used in every growing season on all varieties and shall always be included in the description of the variety, except when the states of expression of any of these characters is rendered impossible by a preceding characteristic or by the environmental conditions of the testing region. Under such exceptional situation, adequate explanation shall be provided.
  - (+) See explanations on the table of characteristics in section-VIII.
4. Type of assessment of characteristics indicated in column-7 of table of characteristics is as follows:
  - MG : Measurement by a single observation of a group of plants or parts of plants
  - MS : Measurement of a number of individual plants or parts of plants
  - VG : Visual assessment by a single observation of a group of plants or parts of plants
  - VS : Visual assessment by observations of individual plants or parts of plants

## VII. Table of characteristics

| S. No.           | Characteristics   | States                  | Note | Example varieties  | Stage of observation | Type of assessment |
|------------------|---|-------------------------|------|--|----------------------|--------------------|
| 1                | 2   | 3                       | 4    | 5  | 6                    | 7                  |
| 1.               | Cotyledon: intensity of green color   | Light                   | 3    | -  | 10                   | VS                 |
|                  |   | Medium (GG-137d)        | 5    | Pusa Vishesh, Sel-5, Arka Harit  |                      |                    |
|                  |   | Dark (GG-137a)          | 7    | Pant Karela-1, KashiUrvashi  |                      |                    |
| 2.<br>(*)        | Plant: main vine length   | short viny (<2.0m)      | 3    | ArkaHarit, PusaVishesh, Punjab-14  | 50                   | MS                 |
|                  |   | medium viny (2 - 2.75m) | 5    | Pusa Do Mausami, CO-1, PhuleUjwala   |                      |                    |
|                  |   | long viny (>2.75m)      | 7    | Preethi, HABG-22, KalyanpurBaramasi  |                      |                    |
| 3.<br>(*)        | Stem: shape   | Rounded                 | 1    | -  | 20                   | VS                 |
|                  |   | Angular                 | 2    | Pusa Do Mausami, CO-1, PhuleUjwala   |                      |                    |
| 4.               | Stem: length of internodes of main stem (between 15 <sup>th</sup> -20 <sup>th</sup> node) | Short (<5cm)            | 3    | Pusa Do Mausami, Arka Harit, Punjab -14                                      | 20                   | MS                 |
|                  |   | Medium (5-8cm)          | 5    | Preethi, NDBT-7, KashiUrvashi, PusaVishesh                                   |                      |                    |
|                  |   | Long (>8cm)             | 7    | Hirkani, HABG-22   |                      |                    |
| 5.               | Stem: number of primary branches  | Less (<10)              | 3    | NDBT-7, PhuleUjwala  | 20                   | MS                 |
|                  |   | Medium (10-20)          | 5    | Preethi, PusaVishesh   |                      |                    |
|                  |   | Many (>20)              | 7    | Hirkani, ArkaHarit   |                      |                    |
| 6.               | Leaf blade: length  | Short (<6cm)            | 3    | PusaVishesh  | 20                   | MS                 |
|                  |   | Medium (>6-9cm)         | 5    | Arka Harit, Pusa Do Mausami  |                      |                    |
|                  |   | Long (>9cm)             | 7    | Preethi, Hirkani   |                      |                    |
| 7.               | Leaf blade: width   | Narrow (<6cm)           | 3    | Pusa Do Mausami, Arka Harit  | 20                   | MS                 |
|                  |   | Medium (6-10cm)         | 5    | PusaVishesh, NDBT-7  |                      |                    |
|                  |   | Broad (>10cm)           | 7    | Preethi, Hirkani, KalyanpurBaramasi  |                      |                    |
| 8.<br>(*)<br>(+) | Leaf blade: margin  | Entire                  | 1    | -  | 20                   | VS                 |
|                  |   | Serrate                 | 3    | -  |                      |                    |
|                  |   | Multifid                | 5    | PusaVishesh, Preethi, Hirkani, KalyanpurBaramasi                             |                      |                    |
| 9.<br>(+)        | Leaf blade: shape   | Obovate                 | 1    | -  | 20                   | VS                 |
|                  |   | Cordate                 | 2    | Kashi Urvashi, Arka Harit, Pusa Vishesh, Preethi, Hirkani, KalyanpurBaramasi |                      |                    |
|                  |   | Oblong                  | 3    | -  |                      |                    |

|                  |   |                           |   |  |    |    |
|------------------|---|---------------------------|---|--|----|----|
|                  |   | Reniform                  | 4 | -  |    |    |
| 10.<br>(*<br>(+) | Leaf blade: number of lobes             | 5 lobes                   | 3 | Kashi Urvashi, Arka Harit, Pusa Vishesh, Preethi, Hirkani, KalyanpurBaramasi | 20 | MS |
|                  |   | 7 lobes                   | 5 | -  |    |    |
| 11.              | Leaf blade: depth of lobing             | Shallow                   | 3 | ArkaHarit, Sel-5   | 20 | VS |
|                  |   | Medium                    | 5 | PusaVishesh, NDBT-7, HABG-22   |    |    |
|                  |   | Deep                      | 7 | Preethi, CO-1  |    |    |
| 12.              | Petiole: length                         | Short (<5cm)              | 3 | NDBT-7, Sel-5  | 20 | MS |
|                  |   | Medium (5-8cm)            | 5 | PusaVishesh, ArkaHarit   |    |    |
|                  |   | Long (>8cm)               | 7 | Pant Karela-1, Preethi, Punjab-14  |    |    |
| 13.<br>(*        | Flower colour                           | Light yellow (YG-3a & 3b) | 3 | Preethi, KalyanpurBaramasi, NDBT-9   | 30 | VG |
|                  |   | Yellow (YG-7d)            | 5 | ArkaHarit, HABG-22, Pusa Do Mausami  |    |    |
|                  |   | Deep yellow               | 7 | -  |    |    |
| 14.              | Ovary: length ( at the day of anthesis) | Short (<1.5cm)            | 3 | Arka Harit, Kashi Urvashi, Pusa vishesh                                      | 30 | MS |
|                  |   | Medium (1.5-2.5cm)        | 5 | Pusa Do Mausami, Phule Green Gold  |    |    |
|                  |   | Long (>2.5cm)             | 7 | KalyanpurBaramasi  |    |    |
| 15.<br>(*        | Fruit : length                          | Very short (<5cm)         | 1 | -  | 40 | MS |
|                  |   | Short (5-10cm)            | 3 | Punjab-14  |    |    |
|                  |   | Medium (10.1-15cm)        | 5 | Pusa Do Mausami, Arka Harit, Pant Karela-1                                   |    |    |
|                  |   | Long (15.1-20cm)          | 7 | Phule Green Gold   |    |    |
|                  |   | Extra long (>20cm)        | 9 | KalyanpurBaramasi  |    |    |
| 16.<br>(*        | Fruit: diameter                         | Thin (<3cm)               | 3 | KalyanpurBaramasi  | 40 | MS |
|                  |   | Medium (3-4.5cm)          | 5 | PhuleUjwala, ArkaHarit   |    |    |
|                  |   | Thick (>4.5cm)            | 7 | -  |    |    |
| 17.              | Peduncle: length                        | Short <5.0 cm             | 3 | PusaVishesh, Preethi   | 40 | MS |
|                  |   | Medium (5.0-10.0 cm)      | 5 | NDBT-7, Meghana-2, KashiUrvashi  |    |    |
|                  |   | Long (>10 cm)             | 7 | Hirkani, CO-1  |    |    |
| 18.<br>(*        | Fruit: colour of skin                   | White                     | 1 | -  | 40 | VG |
|                  |   | Creamy white (142B)       | 2 | Preethi  |    |    |
|                  |   | Light green (141C)        | 3 | ArkaHarit  |    |    |
|                  |   | Green (137A)              | 4 | Hirkani, Pusa Do Maushami, Sel-5   |    |    |

|                  |                                      |                          |   |  |    |              |
|------------------|--------------------------------------|--------------------------|---|--|----|--------------|
|                  |                                      | Dark green (147C)        | 5 | Phule Green Gold, KalyanpurBaramasi              |    |              |
|                  |                                      | Glossy green (143C)      | 6 | PusaVishesh                                      |    |              |
| 19.<br>(*<br>(+) | Fruit: shape of base at peduncle end | Acute                    | 1 | HABG-22, Hirkani, Phule Green Gold               | 40 | VS           |
|                  |                                      | Obtuse                   | 2 | Preethi, ArkaHarit                               |    |              |
|                  |                                      | Rounded                  | 3 | -  |    |              |
|                  |                                      | Flattened                | 4 | -  |    |              |
| 20.<br>(*<br>(+) | Fruit: shape of apex at blossom end  | Acute                    | 1 | KalyanpurBaramasi, Preethi                       | 40 | VS           |
|                  |                                      | Obtuse                   | 2 | ArkaHarit, PusaVishesh                           |    |              |
|                  |                                      | Rounded                  | 3 | -  |    |              |
|                  |                                      | Flattened                | 4 | -  |    |              |
| 21.<br>(*<br>(+) | Fruit: shape in longitudinal section | Oblong                   | 1 | Hirkani  | 40 | VS           |
|                  |                                      | Ovate                    | 2 | ArkaHarit  |    |              |
|                  |                                      | Spindle shaped           | 3 | Preethi, HABG-1, KalyanpurBaramasi               |    |              |
|                  |                                      | Club shape               | 4 | -  |    |              |
|                  |                                      | Triangular               | 5 | -  |    |              |
| 22.<br>(*<br>(+) | Fruit: tubercles                     | Absent                   | 1 | Sel-1  | 40 | VS           |
|                  |                                      | Few                      | 3 | HABG-1, Pusa Do Mausami                          |    |              |
|                  |                                      | Medium                   | 5 | KalyanpurBaramasi, PhuleUjwala, Phule Green Gold |    |              |
|                  |                                      | Many                     | 7 | NDBT-9, Preethi, NDBT-7                          |    |              |
| 23.              | Fruit: tubercles prominence          | Conspicuous              | 1 | Pusa Do Mausami, Arka Harit, Pusa Vishesh        | 40 | VG           |
|                  |                                      | Non-conspicuous          | 2 | NDBT-7, NDBT-9, Preethi                          |    |              |
| 24.<br>(*<br>(+) | Fruit: ridge                         | Discontinuous            | 1 | Preethi, NDBT-7, NDBT-9                          | 40 | VG           |
|                  |                                      | Continuous               | 2 | Pusa Do Mausami, Arka Harit, Pusa Vishesh        |    |              |
| 25.              | Fruit: bitterness                    | Mild                     | 3 | Pusa Do Mausami                                  | 40 | VG (sensory) |
|                  |                                      | Strong                   | 5 | NDBT-9, Preethi                                  |    |              |
| 26.<br>(*        | Fruit: color of skin at ripe stage   | Yellow ( YG-9C)          | 1 | KalyanpurBaramasi                                | 50 | VG           |
|                  |                                      | Orange (OG-24a)          | 2 | Pusa Vishesh, NDBT-7, Arka Harit                 |    |              |
|                  |                                      | Reddish orange (OG-N25a) | 3 | KashiUrvashi                                     |    |              |
| 27.              | Seediness (no. of seeds/fruit)       | Very less (<10)          | 1 | -  | 50 | MS           |
|                  |                                      | Less (10-20)             | 3 | Punjab-14  |    |              |
|                  |                                      | Medium (21-30)           | 5 | HABG-21, Kashi Urvashi, Arka Harit               |    |              |
|                  |                                      | Many (>30)               | 7 | HABG-22, Hirkani, Pusa Do Maushami               |    |              |

|            |                             |                                     |   |   |    |    |
|------------|-----------------------------|-------------------------------------|---|---|----|----|
| 28.        | Seed: length                | Short (<1.4cm)                      | 3 | PusaVishesh, NDBT-7, Sel-1                    | 50 | MS |
|            |                             | Long (>1.4cm)                       | 5 | ArkaHarit                                     |    |    |
| 29.        | Seed: colour                | Light brown (GY-161A,B,C & GO-164B) | 1 | ArkaHarit, Preethi                            | 50 | VG |
|            |                             | Brown (GO-164A & GO-167C)           | 2 | KalyanpurBaramasi, KashiUrvashi, Punjab-14    |    |    |
|            |                             | Dark brown (GO-165B)                | 3 | HABG-22, Phule Green Gold, Kalyanpur Baramasi |    |    |
|            |                             | Yellow                              | 4 | -   |    |    |
|            |                             | Black                               | 5 | -   |    |    |
| 30.<br>(+) | Seed: indentation of margin | Small                               | 3 | PusaVishesh                                   | 50 | VS |
|            |                             | Medium                              | 5 | Hirkani, Phule Green Gold, Pusa Do Mausami    |    |    |
|            |                             | Large                               | 7 | ArkaHarit, Preethi, Meghana-2                 |    |    |
| 31.        | Seed surface                | Smooth                              | 3 | -   | 50 | VG |
|            |                             | Rough                               | 5 | HABG-1, Preethi, Phule Green Gold             |    |    |

### VIII. Explanation of table of characteristics

Ch.8: Leaf blade: margin



Entire (1)



Serrate (2)



Multifid(3)

Ch.9: Leaf blade: shape



Obovate (1)



Cordate (2)



Oblong (3)



Reniform (4)



Ch.10: Leaf blade: number of lobes



5 lobes (1)



7 lobes (3)

Ch.19: Fruit: shape of base at peduncle end



Acute (1)



Obtuse (2)



Rounded (3)



Flattened (4)

Ch.20: Fruit: shape of apex at blossom end



Acute (1)



Obtuse (2)



Rounded (3)



Flattened (4)

Ch.21: Fruit: shape in longitudinal section



Oblong (1)



Ovate (2)



Spindle



Club shape (4)

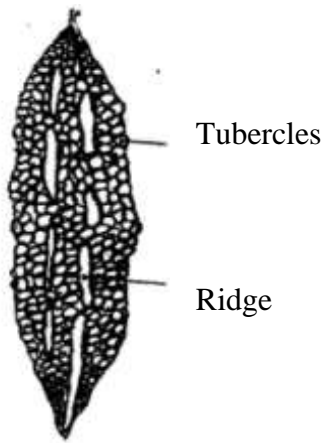


Triangular 95)

shaped (3)

Ch.22: Fruit: tubercles

Ch.24: Fruit: ridge



Ch. 30: Seed: indentation of margin



Small (3)



Medium (5)



Large (7)

### IX. DUS test centres

| <b>Nodal Centre</b>  | <b>Other Centre</b>  |
|--|--|
| Indian Institute of Vegetable Research, P.B. No.- 01, P.O. -Jakhini (Shahanshahpur), Varanasi-221 305 (U.P.) | 1. Indian Institute of Horticultural Research, Hessarghatta, Lake Post, Bengaluru-560089 (Karnataka).<br>2. Indian Agricultural Research Institute, Pusa, New Delhi-110012 |