Characterization of Green Gram Genotypes for Qualitative Traits

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ABSTRACT

Seventy-three accessions of green gram collected from different sources along with three controls were studied for 20 qualitative characters at National Bureau of Plant Genetic Resources (NBPGR), Regional Station, Rajendranagar, Hyderabad, India during 2014–2015. Based on the plant growth pattern, green gram accessions were classified into determinate (10) and indeterminate (66). Based on pod color, the accessions were classified into brown (12) and black (64) colored pods. On the basis of seed luster, green gram accessions were grouped into dull (43) and shiny (33). Based on seed shape, green gram accessions exhibited diversity for seed shape, i.e., oval (43) and drum (33). Among the distinct morphological traits, seed luster may be used as an indicator in broad classification of genotypes into different groups rather than of individual genotype.

Keywords: Green gram, Morphological traits, Plant growth habit, Seed luster, Seed shape.

INTRODUCTION

Seed yield is a complex character and depends on various component agro-morphological characters some of which are highly influenced by the environment, while others are quantitatively inherited. In most of the crop breeding programs, major emphasis is given to the improvement of yield via agro-morphological traits. Hence, knowledge of the nature and extent of the diversity present in germplasm collection is of utmost importance. Recognition and exploitation of variation among genetically diverse groups of germplasm are therefore fundamental to plant breeding and genetic engineering. Consequently, the assessment of genetic diversity within and among germplasm accessions including landraces has assumed high priority in recent times. Smith and Smith (1989) considered morphological characterization as an important step in description and classification of crop germplasm as a breeding program mainly depends on the magnitude of genetic variability (Smith et al., 1991).

In the wake of granting rights to farmers and plant breeders for protection of plant varieties and to encourage the development of new varieties of plants in the light of “The Protection of Plant Varieties and Farmers’ Rights (PPV&FR) Act, 2001” testing for distinctness, uniformity, and stability (DUS) of any genotype has become mandatory in recent years. Morphological characterization of any crop variety/genotype is essential for granting protection under the PPV&FR Act, 2001. The PPV&FR Authority has established guidelines for the conduct of DUS testing and in green gram has listed out 24 essential morphological characters along with their character states. Any new variety of registration needs to conform to these essential guidelines. Hence, the importance of morphological characterization and evaluation lies in any breeding or registration program. Keeping this in view, an experiment was conducted to characterize green gram genotypes for various qualitative traits.

MATERIALS AND METHODS

Studies on characterization of green gram accessions were conducted at National Bureau of Plant Genetic Resources, Regional Station, Rajendranagar, Hyderabad during 2014–2015. Seventy-three accessions of green gram collected from different sources along with three controls for comparison (ML-267, LGG-460, and K-851) were studied for 20 qualitative characters viz., plant growth habit, plant habit, stem pubescence, leaf pubescence, leaflet lobes (terminal), leaf shape (terminal), leaf colour, leaf vein colour, petiole colour, leaf size (at 5th node from the base), colour of flower petal (standard), colour of premature pod, pod pubescence, pod position, pod colour, curvature of mature pod, seed colour, seed luster and seed shape. Seventy-six accessions of...
green gram were laid out in a randomized block design with two replications. Each accession was grown in three rows of 3 m length each with a spacing of 30 × 10 cm. Recommended package of practices was followed to raise a healthy crop. Observations on twenty qualitative characters were recorded for each accession on plot basis for each replication as per the DUS descriptor.

**Results and Discussion**

**Plant Growth Habit**

Qualitative characters like plant growth pattern, leaf pubescence, leaf color, petiole, etc., are important for plant description (Kurlovich, 1998). Based on the plant growth pattern, green gram accessions were classified into two categories, i.e., determinate and indeterminate. Of the 76 accessions, 66 accessions exhibited indeterminate growth habit and remaining ten accessions had a determinate habit (Table 1 and Graph 1).

Based on plant growth habit, green gram accessions were grouped into three classes, i.e., erect, semi-erect, and spreading. Out of 76 accessions, 6 accessions were erect, 56 accessions were semi-erect and the remaining 14 accessions were spreading (Table 1 and Graph 1). Bisht et al. (1998) reported variability in growth (erect, semi-erect) of green gram. Further high diversity in phenotypic traits like plant growth habit was also reported (Thomas et al., 2002).

**Stem Characters**

Based on stem color, 76 green gram accessions were grouped into 3 classes, i.e., green, green with purple splashes and purple and all the accessions possessed green color stem (Table 1). Similar variation in stem pigmentation was reported by Pandian et al. (2012) in green gram, Pandey and Dubey (1972) in Dolichos lab and Thomas et al. (2002) in the country bean.

Based on stem pubescence, green gram accessions were categorized into 3 groups, i.e., sparse, moderate and dense. Out of 76 accessions, 14 accessions exhibited sparse stem pubescence, 49 accessions possessed moderate stem pubescence and 13 accessions had exhibited dense pubescence (Table 1 and Graph 2). These findings were in consonance with the reports of Bisht et al. (1998) and Pandian et al. (2012) in green gram.

**Leaf Characters**

Based on leaf pubescence, green gram accessions were distinguished into three categories, i.e., sparse, moderate and dense. Out of 76 accessions 53 exhibited sparse pubescence, 16 possessed moderate pubescence and the rest 7 possessed dense leaf pubescence (Table 1 and Graph 2). A wide variation in leaf pubescence (glabrous, very sparse, pubescence, moderately pubescence and densely pubescence) of green gram accessions was also reported by Bisht et al. (1998) and Pandian et al. (2012).

In general, green gram accessions did not exhibit diversity for leaflet lobes (terminal), leaf shape (terminal), leaf color and leaf vein color. All the 76 accessions possessed terminal leaflet lobes, ovate shaped and green color leaves with greenish purple leaf veins indicating lack of variability among the existing green gram accessions for leaf characters. However, variability in leaf color of green gram was reported by Bisht et al. (1998) and Pandian et al. (2012).

Similar to leaf characters no variability was noticed for petiole, and all the accessions exhibited green petiole with purple splashes. These results were in contrast with the findings of Bisht et al. (1998) and Pandian et al. (2012) who grouped green gram genotypes into six and three categories, respectively.

As per the DUS descriptor, leaf size recorded at the 5th node from the base of the plant is grouped into three classes, i.e., small, medium and large size. In the present study, out of 76 accessions, 8 exhibited small sized leaves, 43 possessed medium-sized leaves, and the remaining 25 had large sized leaves (Table 1 and Graph 3). Similar findings of variability in leaf size were reported by Bisht et al. (1998) and Pandiyan et al. (2012) in green gram. Thomas et al. (2002) reported greater diversity for leaf margin, leaf vein, nature of stipule, nature of petiole in country bean indicating that cultivar identification was distinctly possible on the basis of plant morphological characters.

**Flower and Pod Characters**

All green gram accessions possessed yellow colored standard flower petals; green colored immature pods with pigmented suture and pods with dense pubescence indicating lack of variability among the green gram accessions. Similar results of lack of variability in the color of premature pods were reported by Uma Rani et al. (2013). On the other hand, Pandiyan et al. (2012) observed variability for pod pubescence in green gram.

As per the DUS descriptor, based on pod position green gram accessions were grouped into 3 classes (above the canopy, intermediate and not visible). In the present study out of 76 accessions, 71 accessions exhibited above the canopy and the remaining 5 exhibited intermediate type (Table 2 and Graph 3).

Based on pod color, green gram accessions were classified into brown and black colored pods. Among 76 accessions, 64 possessed black colored pods, while 12 accessions had brown colored pods (Table 2 and Graph 3). Wide variation in pod color and its classification into three classes (straw, tan, brown) and five classes (straw, tan, brown, brown-black, black and others) was also reported by Bisht et al. (1998) and Pandiyan et al. (2012) in green gram.

Based on the curvature of mature pods, green gram accessions were distinguished into two classes, i.e., straight and curved. Out of 76 accessions, 73 accessions possessed the straight type of mature pods while three had a curved type (Table 2 and Graph 3). These results were in consonance with the findings of Uma Rani et al. (2013) in horse gram.
Table 1: Plant, leaf and flower morphometric traits in different accessions of green gram

| S. no. | Accession no. | Growth habit | Plant habit | Stem colour | Stem pubescence | Leaf pubescence | Leaf size (at 5th node from the base) | Pod position | Pod color | Curvature of mature pod | Seed colour | Seed lusture | Seed shape |
|-------|---------------|--------------|------------|-------------|----------------|----------------|-------------------------------------|--------------|-----------|------------------------|-------------|-------------|-----------|
| 1     | CN-8016       | Semi-erect  | Indeterminate | Green       | Moderate       | Sparse           | Small                               | Above-canopy | Black     | Straight               | Green       | Shiny       | Oval      |
| 2     | CN-8027       | Semi-erect  | Indeterminate | Green       | Moderate       | Moderately       | Medium                              | Above-canopy | Black     | Straight               | Green       | Dull        | Oval      |
| 3     | CN-8067       | Semi-erect  | Indeterminate | Green       | Moderate       | Sparse           | Large                               | Intermediate | Black     | Straight               | Green       | Dull        | Drum      |
| 4     | CN-8042       | Semi-erect  | Indeterminate | Green       | Sparse         | Sparse           | Medium                              | Above-canopy | Black     | Straight               | Green       | Dull        | Oval      |
| 5     | CN-9074       | Semi-erect  | Indeterminate | Green       | Moderate       | Moderate         | Small                               | Above-canopy | Black     | Straight               | Green       | Dull        | Oval      |
| 6     | KARS-104      | Semi-erect  | Indeterminate | Green       | Moderate       | Moderate         | Small                               | Above-canopy | Black     | Straight               | Green       | Dull        | Oval      |
| 7     | KARS-107      | Semi-erect  | Indeterminate | Green       | Moderate       | Dense            | Large                               | Above-canopy | Black     | Straight               | Green       | Dull        | Oval      |
| 8     | KARS-110      | Semi-erect  | Indeterminate | Green       | Moderate       | Sparse           | Medium                              | Above-canopy | Black     | Straight               | Green       | Dull        | Oval      |
| 9     | KARS-118      | Erect        | Indeterminate | Green       | Moderate       | Dense            | Medium                              | Above-canopy | Black     | Straight               | Green       | Dull        | Drum      |
| 10    | KARS-125      | Semi-erect  | Indeterminate | Green       | Moderate       | Sparse           | Medium                              | Above-canopy | Black     | Straight               | Green       | Dull        | Drum      |
| 11    | KARS-131      | Erect        | Indeterminate | Green       | Moderate       | Sparse           | Medium                              | Above-canopy | Black     | Straight               | Green       | Shiny       | Drum      |
| 12    | KARS-132      | Semi-erect  | Indeterminate | Green       | Sparse         | Sparse           | Medium                              | Above-canopy | Black     | Straight               | Green       | Shiny       | Drum      |
| 13    | KARS-135      | Semi-erect  | Indeterminate | Green       | Moderate       | Sparse           | Medium                              | Above-canopy | Black     | Straight               | Green       | Dull        | Drum      |
| 14    | KARS-137      | Semi-erect  | Indeterminate | Green       | Moderate       | Moderate         | Medium                              | Above-canopy | Black     | Straight               | Green       | Dull        | Drum      |
| 15    | KARS-138      | Semi-erect  | Indeterminate | Green       | Moderate       | Sparse           | Small                               | Above-canopy | Black     | Straight               | Green       | Shiny       | Oval      |
| 16    | KARS-147      | Erect        | Indeterminate | Green       | Dense          | Moderate         | Large                               | Above-canopy | Black     | Straight               | Green       | Shiny       | Drum      |
| 17    | KARS-149      | Semi-erect  | Indeterminate | Green       | Moderate       | Sparse           | Medium                              | Above-canopy | Black     | Straight               | Green       | Dull        | Drum      |
| 18    | KARS-169      | Semi-erect  | Indeterminate | Green       | Moderate       | Sparse           | Large                               | Above-canopy | Black     | Straight               | Green       | Dull        | Oval      |
| 19    | KARS-173      | Semi-erect  | Indeterminate | Green       | Moderate       | Sparse           | Large                               | Above-canopy | Black     | Straight               | Green       | Dull        | Oval      |
| 20    | KARS-177      | Semi-erect  | Indeterminate | Green       | Moderate       | Sparse           | Large                               | Above-canopy | Black     | Straight               | Green       | Shiny       | Drum      |
| 21    | KARS-191      | Semi-erect  | Indeterminate | Green       | Moderate       | Sparse           | Large                               | Above-canopy | Black     | Straight               | Green       | Shiny       | Oval      |
| 22    | KARS-212      | Semi-erect  | Indeterminate | Green       | Moderate       | Sparse           | Large                               | Above-canopy | Black     | Straight               | Green       | Shiny       | Oval      |
| 23    | KARS-222      | Semi-erect  | Indeterminate | Green       | Moderate       | Sparse           | Large                               | Above-canopy | Black     | Straight               | Green       | Shiny       | Oval      |
| S. no. | Accession no. | Growth habit | Plant habit | Stem colour | Stem pubescence | Leaf pubescence | Leaf size (at 5th node from the base) | Pod position | Pod colour | Curvature of mature pod | Seed colour | Seed lusture | Seed shape |
|-------|---------------|--------------|-------------|-------------|----------------|----------------|-------------------------------------|-------------|------------|------------------------|-------------|-------------|-----------|
| 24    | KARS-24       | Semi-erect   | Indeterminate | Green       | Dense          | Moderate       | Large                               | Above-canopy | Black      | Above-canopy            | Green       | Dull        | Oval      |
| 25    | KARS-26       | Semi-erect   | Indeterminate | Green       | Dense          | Moderate       | Medium                              | Above-canopy | Black      | Above-canopy            | Green       | Shiny       | Oval      |
| 26    | KARS-27       | Semi-erect   | Indeterminate | Green       | Sparse         | Sparse         | Large                               | Above-canopy | Brown     | Above-canopy            | Green       | Shiny       | Oval      |
| 27    | KARS-28       | Semi-erect   | Indeterminate | Green       | Moderate       | Sparse         | Medium                              | Above-canopy | Black      | Above-canopy            | Yellow      | Dull        | Drum      |
| 28    | KARS-29       | Semi-erect   | Indeterminate | Green       | Moderate       | Dense          | Medium                              | Above-canopy | Black      | Above-canopy            | Green       | Dull        | Oval      |
| 29    | KARS-30       | Semi-erect   | Indeterminate | Green       | Moderate       | Moderate       | Medium                              | Canopy       | Black      | Canopy                | Green       | Dull        | Oval      |
| 30    | KARS-31       | Semi-erect   | Indeterminate | Green       | Moderate       | Sparse         | Medium                              | Canopy       | Black      | Canopy                | Green       | Dull        | Oval      |
| 31    | KARS-32       | Semi-erect   | Indeterminate | Green       | Moderate       | Moderate       | Medium                              | Canopy       | Black      | Canopy                | Green       | Dull        | Oval      |
| 32    | KARS-33       | Semi-erect   | Indeterminate | Green       | Moderate       | Sparse         | Large                               | Canopy       | Black      | Canopy                | Green       | Dull        | Drum      |
| 33    | KARS-34       | Semi-erect   | Indeterminate | Green       | Moderate       | Moderate       | Large                               | Canopy       | Brown     | Canopy                | Green       | Dull        | Oval      |
| 34    | KARS-35       | Semi-erect   | Indeterminate | Green       | Sparse         | Sparse         | Medium                              | Canopy       | Black      | Canopy                | Green       | Dull        | Oval      |
| 35    | KARS-36       | Semi-erect   | Indeterminate | Green       | Sparse         | Moderate       | Medium                              | Canopy       | Black      | Canopy                | Green       | Dull        | Oval      |
| 36    | KARS-37       | Semi-erect   | Indeterminate | Green       | Dense          | Sparse         | Medium                              | Canopy       | Black      | Canopy                | Green       | Dull        | Oval      |
| 37    | KARS-38       | Semi-erect   | Indeterminate | Green       | Sparse         | Sparse         | Medium                              | Canopy       | Black      | Canopy                | Green       | Dull        | Oval      |
| 38    | KARS-39       | Semi-erect   | Indeterminate | Green       | Sparse         | Sparse         | Large                               | Canopy       | Black      | Canopy                | Green       | Dull        | Oval      |
| 39    | KARS-40       | Semi-erect   | Indeterminate | Green       | Dense          | Sparse         | Medium                              | Canopy       | Black      | Canopy                | Green       | Dull        | Oval      |
| 40    | KARS-41       | Semi-erect   | Indeterminate | Green       | Moderate       | Sparse         | Medium                              | Canopy       | Black      | Canopy                | Green       | Dull        | Oval      |
| 41    | KARS-42       | Semi-erect   | Indeterminate | Green       | Moderate       | Sparse         | Medium                              | Canopy       | Brown     | Canopy                | Green       | Dull        | Oval      |
| 42    | KARS-43       | Semi-erect   | Indeterminate | Green       | Moderate       | Sparse         | Medium                              | Canopy       | Black      | Canopy                | Green       | Shiny       | Oval      |
| 43    | KARS-44       | Semi-erect   | Indeterminate | Green       | Moderate       | Sparse         | Medium                              | Canopy       | Black      | Canopy                | Green       | Dull        | Oval      |
| 44    | KARS-45       | Semi-erect   | Indeterminate | Green       | Moderate       | Sparse         | Medium                              | Canopy       | Black      | Canopy                | Green       | Shiny       | Oval      |
| 45    | KARS-46       | Semi-erect   | Indeterminate | Green       | Moderate       | Dense          | Medium                              | Canopy       | Black      | Canopy                | Green       | Shiny       | Drum      |
| 46    | KARS-47       | Semi-erect   | Indeterminate | Green       | Moderate       | Dense          | Medium                              | Canopy       | Black      | Canopy                | Green       | Shiny       | Drum      |
| 47    | KARS-48       | Semi-erect   | Indeterminate | Green       | Sparse         | Sparse         | Large                               | Canopy       | Black      | Canopy                | Green       | Shiny       | Drum      |
| S. no. | Accession no. | Growth habit | Plant habit | Stem colour | Stem pubescence | Leaf pubescence | Leaf size (at 5th node from the base) | Pod position | Pod colour | Curvature of mature pod | Seed colour | Seed lusture | Seed shape |
|-------|---------------|--------------|------------|-------------|-----------------|----------------|-------------------------------------|-------------|------------|------------------------|-------------|-------------|-----------|
| 48    | KVS-SA 1738   | Semi-erect  | Indeterminate | Green       | Sparse          | Sparse         | Small                 | Above-canopy | Black      | Straight              | Green       | Shiny       | Drum      |
| 49    | KVS-SA 1741   | Semi-erect  | Indeterminate | Green       | Dense           | Moderate       | Large                 | Above-canopy | Brown     | Straight              | Green       | Dull        | Drum      |
| 50    | KVS-SA 1748   | Semi-erect  | Indeterminate | Green       | Sparse          | Sparse         | Medium                | Above-canopy | Brown     | Straight              | Green       | Shiny       | Oval      |
| 51    | KVS-SA 1760   | Semi-spreading | Indeterminate | Green       | Dense           | Sparse         | Medium                | Above-canopy | Black     | Straight              | Green       | Shiny       | Oval      |
| 52    | KVS-SA 1761   | Semi-spreading | Indeterminate | Green       | Dense           | Sparse         | Large                 | Above-canopy | Black     | Straight              | Green       | Shiny       | Oval      |
| 53    | KVS-SA 1762   | Semi-spreading | Indeterminate | Green       | Dense           | Moderate       | Large                 | Above-canopy | Brown     | Straight              | Green       | Shiny       | Drum      |
| 54    | KVS-SA 1779   | Semi-spreading | Indeterminate | Green       | Moderate        | Moderate       | Large                 | Above-canopy | Black     | Straight              | Green       | Shiny       | Oval      |
| 55    | KVS-SA 1784   | Semi-spreading | Indeterminate | Green       | Moderate        | Sparse         | Small                 | Above-canopy | Brown     | Straight              | Green       | Shiny       | Drum      |
| 56    | KVS-SA 1787   | Semi-spreading | Indeterminate | Green       | Moderate        | Sparse         | Medium                | Above-canopy | Black     | Straight              | Green       | Shiny       | Oval      |
| 57    | KVS-SA 1789   | Semi-spreading | Indeterminate | Green       | Moderate        | Sparse         | Large                 | Above-canopy | Black     | Curved                | Green       | Shiny       | Oval      |
| 58    | KVS-SA 1790   | Semi-spreading | Indeterminate | Green       | Moderate        | Sparse         | Medium                | Above-canopy | Black     | Straight              | Yellow      | Shiny       | Oval      |
| 59    | NSKMS 111     | Semi-determinate | Indeterminate | Green       | Sparse          | Sparse         | Large                 | Above-canopy | Black     | Straight              | Green       | Dull        | Oval      |
| 60    | NSKMS 148     | Semi-determinate | Indeterminate | Green       | Moderate        | Sparse         | Large                 | Above-canopy | Black     | Straight              | Mottled     | Dull        | Drum      |
| 61    | NSKMS 161     | Semi-determinate | Indeterminate | Green       | Moderate        | Sparse         | Large                 | Above-canopy | Black     | Curved                | Green       | Dull        | Oval      |
| 62    | NSKMS 177     | Semi-determinate | Indeterminate | Green       | Moderate        | Moderate       | Small                 | Above-canopy | Black     | Straight              | Yellow      | Shiny       | Drum      |
| 63    | NSKMS 48      | Semi-spreading | Indeterminate | Green       | Dense           | Sparse         | Medium                | Above-canopy | Black     | Curved                | Green       | Dull        | Oval      |
| 64    | NSKMS 72      | Semi-spreading | Indeterminate | Green       | Moderate        | Moderate       | Medium                | Above-canopy | Black     | Straight              | Green       | Shiny       | Oval      |
| 65    | SKMS 91       | Erect       | Indeterminate | Green       | Dense           | Sparse         | Medium                | Above-canopy | Brown     | Straight              | Green       | Dull        | Oval      |
| 66    | SKMS 11       | Semi-erect  | Indeterminate | Green       | Moderate        | Moderate       | Medium                | Above-canopy | Brown     | Straight              | Green       | Shiny       | Oval      |
| 67    | SKMS 37       | Semi-erect  | Indeterminate | Green       | Dense           | Sparse         | Medium                | Above-canopy | Brown     | Straight              | Green       | Shiny       | Oval      |
| 68    | SKMS 41       | Semi-erect  | Indeterminate | Green       | Moderate        | Dense          | Medium                | Above-canopy | Brown     | Straight              | Green       | Shiny       | Oval      |
| 69    | SKMS 137      | Semi-spreading | Indeterminate | Green       | Moderate        | Sparse         | Medium                | Above-canopy | Black     | Straight              | Green       | Shiny       | Oval      |
| 70    | SKMS 139      | Semi-spreading | Indeterminate | Green       | Moderate        | Sparse         | Medium                | Above-canopy | Black     | Straight              | Green       | Shiny       | Oval      |
| 71    | SKMS 155      | Erect       | Indeterminate | Green       | Sparse          | Sparse         | Medium                | Above-canopy | Black     | Straight              | Green       | Shiny       | Oval      |

Cont...
Seed Characters

As per the DUS descriptor, based on seed color, green gram accessions were categorized into four groups, i.e., yellow, green, mottled and black. In the present study, out of 76 accessions, 67 accessions had green colored seeds, five were yellow colored and remaining four exhibited the mottled type of seed color (Table 2 and Graph 4). Similar variability in seed color was also reported by Bisht et al. (1998) in green gram, Ghafoor et al. (2001) in Bengal gram, Nisar et al. (2008) in pea, Pandiyan et al. (2012) in green gram and Uma Rani et al. (2013) in horse gram.

Seed luster is an important criteria in green gram which can be used as an indicator for characterization. Based on seed luster, green gram accessions were grouped into dull and shiny. Out of 76 green gram accessions, 43 were dull type and the remaining 33 had the shiny type of luster (Table 2 and Graph 4). Similar variability in seed luster was reported by Pandiyan et al. (2012).

Based on seed shape, green gram accessions exhibited diversity for seed shape, i.e., oval and drum. Among 76 accessions, 43 exhibited oval seed shape and the remaining 33 were drum-shaped (Table 2 and Graph 4). Similar variability in seed shape was reported by several scientists (Bisht et al., 1998 and Pandiyan et al., 2012 in green gram and Uma Rani et al., 2013 in horse gram).

Qualitative characters are important for plant descriptors (Kurlovich, 1998) and are influenced by consumers preference, socioeconomic conditions, and natural selection. Some of the qualitative traits are related to some biotic/abiotic stresses. A hairy plant is more tolerant against insect pests, whereas glabrous cultivars are easy to harvest and trample. Similarly, pod characters like pod position, pod wall thickness, hairiness of the pods and seed coat thickness contribute to pre-harvest sprouting. Pod hairiness, seed luster, seed shape, and seed size are the distinct morphological characters which aid in the identification of off-types; thereby maintaining the varietal genetic purity.

Green gram is a self-pollinated crop, and the existing variability for various qualitative characters in the crop is very limited. Characterization of different accessions with a single morphological character would be difficult. Therefore, a group of morphological characters may help in better classification. Plant morphological characters have been used for the classification of several crop varieties like lettuce, chilli, cabbage (Harris and Beever, 2004) and French bean (Sajjan et al., 2006).

Classification of green gram accessions for various qualitative characters serves as a key for the identification of different accessions on the basis of growth habit, stem pubescence, leaf pubescence, leaf size (at 5th node from the base), pod position, pod colour, curvature of mature pod, seed lustre, seed colour and seed shape. Among the distinct morphological traits, seed luster may serve as a key character and useful in broad classification of genotypes into different groups rather than of individual genotype.
Characterization of Green Gram Genotypes for Qualitative Traits

Graph 1: Plant morphometric traits in different green gram accessions

Graph 2: Stem and leaf morphometric traits in different green gram accessions

Graph 3: Leaf and pod morphometric traits in different green gram accessions
| S. no. | Accession no. | Pod position | Pod colour | Curvature of mature pod | Seed colour | Seed lusture | Seed shape |
|-------|---------------|--------------|------------|-------------------------|-------------|--------------|------------|
| 1 | CN-8016 | Above-canopy | Black | Straight | Green | Shiny | Oval |
| 2 | CN-8027 | Above-canopy | Black | Straight | Green | Dull | Oval |
| 3 | CN-8067 | Intermediate | Black | Straight | Green | Dull | Drum |
| 4 | CN-9042 | Above-canopy | Black | Straight | Green | Dull | Oval |
| 5 | CN-9074 | Above-canopy | Black | Straight | Green | Dull | Oval |
| 6 | KARS-104 | Above-canopy | Black | Straight | Mottled | Dull | Oval |
| 7 | KARS-107 | Above-canopy | Black | Straight | Green | Dull | Oval |
| 8 | KARS-110 | Above-canopy | Black | Straight | Green | Dull | Oval |
| 9 | KARS-118 | Above-canopy | Black | Straight | Green | Dull | Drum |
| 10 | KARS-125 | Above-canopy | Black | Straight | Green | Dull | Drum |
| 11 | KARS-131 | Above-canopy | Black | Straight | Yellow | Shiny | Oval |
| 12 | KARS-132 | Above-canopy | Black | Straight | Green | Shiny | Drum |
| 13 | KARS-135 | Above-canopy | Black | Straight | Green | Dull | Drum |
| 14 | KARS-137 | Above-canopy | Black | Straight | Green | Dull | Drum |
| 15 | KARS-138 | Above-canopy | Black | Straight | Green | Shiny | Oval |
| 16 | KARS-147 | Above-canopy | Black | Straight | Green | Shiny | Oval |
| 17 | KARS-149 | Above-canopy | Black | Straight | Green | Dull | Drum |
| 18 | KARS-169 | Above-canopy | Black | Straight | Green | Dull | Drum |
| 19 | KARS-173 | Above-canopy | Black | Straight | Green | Dull | Oval |
| 20 | KARS-177 | Above-canopy | Black | Straight | Green | Dull | Oval |
| 21 | KARS-191 | Above-canopy | Black | Straight | Green | Shiny | Drum |
| 22 | KARS-212 | Above-canopy | Black | Straight | Green | Shiny | Oval |
| 23 | KARS-222 | Above-canopy | Black | Straight | Green | Dull | Oval |
| 24 | KARS-24 | Above-canopy | Black | Straight | Green | Dull | Oval |
| 25 | KARS-240 | Above-canopy | Black | Straight | Green | Shiny | Oval |
| 26 | KARS-263 | Above-canopy | Brown | Straight | Green | Shiny | Oval |
| 27 | KARS-279 | Above-canopy | Black | Straight | Yellow | Dull | Drum |
| 28 | KARS-295 | Above-canopy | Black | Straight | Green | Dull | Oval |
| 29 | KARS-30 | Above-canopy | Black | Straight | Green | Dull | Oval |
| 30 | KARS-39 | Above-canopy | Black | Straight | Green | Dull | Oval |
| 31 | KARS-44 | Above-canopy | Black | Straight | Green | Dull | Drum |
| 32 | KARS-47 | Above-canopy | Black | Curved | Green | Dull | Drum |
| 33 | KARS-51 | Above-canopy | Brown | Straight | Green | Dull | Oval |
| 34 | KARS-53 | Above-canopy | Black | Straight | Green | Dull | Oval |
| 35 | KARS-69 | Intermediate | Black | Straight | Green | Dull | Oval |
| 36 | KARS-72 | Above-canopy | Black | Straight | Green | Dull | Drum |
| 37 | KARS-74 | Above-canopy | Black | Straight | Green | Dull | Oval |
| 38 | KARS-77 | Above-canopy | Black | Straight | Green | Dull | Drum |
| 39 | KARS-84 | Above-canopy | Black | Straight | Green | Dull | Oval |
| 40 | KARS-96 | Above-canopy | Black | Straight | Mottled | Dull | Drum |
| 41 | KDRS-226 | Above-canopy | Brown | Straight | Green | Dull | Drum |
| 42 | KSAS-06/140 | Above-canopy | Black | Straight | Green | Dull | Oval |
| 43 | KSAS-06/235 | Above-canopy | Black | Straight | Green | Shiny | Oval |
| 44 | KSAS-06/287 | Above-canopy | Black | Straight | Green | Dull | Oval |
| 45 | KSAS-06/319 | Above-canopy | Black | Straight | Green | Dull | Oval |
| 46 | KSAS-06/359 | Above-canopy | Black | Straight | Green | Shiny | Drum |
| 47 | KSAS-06/91 | Above-canopy | Black | Straight | Green | Shiny | Drum |
| 48 | KVSA-1738 | Above-canopy | Black | Straight | Green | Shiny | Drum |
| 49 | KVSA-1741 | Above-canopy | Brown | Straight | Green | Dull | Drum |
| 50 | KVSA-1748 | Above-canopy | Brown | Straight | Green | Shiny | Oval |
| 51 | KVSA-1760 | Above-canopy | Black | Straight | Green | Shiny | Oval |
| 52 | KVSA-1761 | Above-canopy | Black | Straight | Green | Shiny | Oval |
| 53 | KVSA-1762 | Intermediate | Black | Straight | Green | Shiny | Drum |
| 54 | KVSA-1779 | Above-canopy | Brown | Straight | Green | Shiny | Drum |
| 55 | KVSA-1784 | Above-canopy | Black | Straight | Green | Shiny | Oval |
| 56 | KVSA-1787 | Above-canopy | Black | Straight | Green | Shiny | Drum |
| 57 | KVSA-1789 | Above-canopy | Black | Straight | Green | Shiny | Oval |
| 58 | KVSA-1790 | Above-canopy | Black | Straight | Green | Shiny | Oval |
| 59 | NSKMS-111 | Above-canopy | Black | Straight | Yellow | Shiny | Oval |
| 60 | NSKMS-148 | Above-canopy | Black | Straight | Green | Dull | Oval |
| 61 | NSKMS-161 | Above-canopy | Black | Straight | Mottled | Dull | Drum |
| 62 | NSKMS-177 | Above-canopy | Black | Straight | Yellow | Dull | Drum |
| 63 | NSKMS-148 | Intermediate | Black | Curved | Green | Dull | Oval |
| 64 | NSKMS-72 | Intermediate | Black | Curved | Green | Dull | Oval |
| 65 | NSKMS-91 | Above-canopy | Black | Straight | Yellow | Shiny | Drum |
| 66 | SK-11 | Above-canopy | Brown | Straight | Green | Dull | Oval |
| 67 | SK-37 | Above-canopy | Brown | Straight | Green | Shiny | Oval |
| 68 | SK-41 | Above-canopy | Brown | Straight | Green | Dull | Drum |

Cont...
Therefore the study suggested that some of these distinct morphological traits can be considered as key characters and useful for seed production programs in varietal identification and identification of off-types in seed plots of different classes of seed.

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