

## Identification and Evaluation of Morpho-Physiological Variation in Spine Gourd (*Momordica dioica* Roxb.)

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### ABSTRACT

#### Keywords

Characterization, Cluster analysis, Morphological variation, Spine gourd.

#### Article Info

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The present investigation was conducted with thirty four spine gourd (*Momordica dioica* Roxb.) genotypes for evaluate their performance for various quantitative as well as qualitative characters. All the qualitative characters viz. fruit colour, fruit shape, leaf colour, leaf margin, leaf pubescence, stem colour, spine strength, conical spine density, pedicel attachment with the fruit, node colour, collection site showed wide variation. Among the genotypes studied. Wide range of variability was also noted with respect to days to first flowering. However, with regard to quantitative character like number of fruits per plant, the highest number (150) was obtained from the genotype PK-49 which was statistically similar to KRISNAPUR (138) while the lowest (54) was from PHULE MD 5-1. The genotype KRISNAPUR gave the highest yield (5982 kg/ha) and followed by the yield (5868 kg/ha). Performed well in respect of studied characters under the agro climatic conditions of north hill resign of Chhattisgarh.

### Introduction

Spine gourd (*Momordica dioica* Roxb.) belongs to the cucurbitaceous family with chromosome number  $2n=28$  (Raj *et al.*, 1993). It has originated from Indo-Malayan region (Rashid and Roy, 1976). It is distributed in Bangladesh, China, India, Malaysia, Nepal, Myanmar, Pakistan, and Sri Lanka (Rakh and Chaudhari, 2010). It is widely distributed in tropical and sub-tropical parts of India and adapted to different soil and climatic conditions (Basumatary *et al.*, 2014). In Chhattisgarh distributed in baster plateau zone and northern hill region in forest areas and largely cultivated in tribal regions farmer but no study in area and production and productivity. It is economically important

vegetable plant with high food and medicinal value, cultivated for its fruits, which is used as vegetable and is known by various names such as Kakrol, Kartoli, and Kankoda, Teasel gourd or Bhat Kerala. Per 100 g edible fruit was found to contain 84.1% moisture, 7.7 g carbohydrate, 3.1 g protein, 3.1 g fat, 3.0 g fiber and 1.1 g minerals. It also contained small quantities of essential vitamins like ascorbic acid, carotene, thiamin, riboflavin and niacin (Kushwaha *et al.*, 2005) This popular vegetable has high demand in market because of good nutritional, medicinal value, high keeping quality ability to withstand long distance transportation, high market price and good export potential (Rasul, 2003). In spite

of many advantages, there was no research thrust paid on Spine guard improvement, genetic diversity or genetic relatedness and its utilization in breeding programme based on morphological and physiological variation have been studied in many crops (Masud *et al.*, 1995; Chowdhury *et al.*, 1998; Rahman *et al.*, 2001; Sultana *et al.*, 2001; Grent *et al.*, 2001; Brown and Myers, 2002). The knowledge on nature and magnitude of genetic variability existed in Spine guard will provide the foundation of designing breeding programme. So, present investigation was carried out to evaluate morpho-physiological variation in spine guard.

## Materials and Methods

Tuberous roots of 34 genotypes namely included checked varieties Indira Kankoda-1, PK -5, PK -9, PK -26, PK-34, PK-35, PK -46, KRISHNAPUR, PK-49, RMF-1, RMF-17, RMF-27, RMF-P-4, RMF-7-P-1, PHULLE MD-5-1, PHULLE MD-5-2, NDM-1, NDM-5, RMDSG-1, PK -33, AMBIKA-K-12-1, AMBIKA 13-5, AMBIKA 13-6, RAIGARH, NDM-2, NDM-3, NDM-4, DHARMJAYGARH, RMF-G-39, RMF-G-49, AJSG-3, AJSG-4, AJSG-5, of *Momordica dioica* were collected from different agro-ecological regions of Chhattisgarh in during 1998 to July 2016. They were maintained at the experimental farm of Rajmohini Devi College of Agriculture and Research Station Ambikapur Chhattisgarh.

The experiment was conducted consequently for two year during 2015 and 2016 under All India Coordinated Research Network Project on Potential crops at the research and instructional farm of Rajmohini Devi College of Agriculture and Research Station, Ambikapur. Experiment was conducted in Augmented Block design with four blocks; pits of 30 X 30 X 30 cm<sup>3</sup> were prepared in each plot with a spacing of 2m X 2m. The

tubers root was planted in earthen pots containing a 2:1:1 mixture of soil sand and decomposed cow dung on May 2015 and watered. They began to sprouted 20-25 days after potting. The male plants were planted in the field at 8:1 ratio (female: male). The plants were supported by bamboo sticks. When the plants were about 2.5 m. high, they were allowed to climb on rope net hanged vertically up to 2.5m from the soil surface.

Twenty eight parameters of morphological and physiological characteristics as listed in table 1 were reported from all plants. A data matrix was generated from the parameters of characteristics listed in table 1. Similarity matrix was generated using the SimQual programme NTSYSpc software version 2.02 (Rohlf, 1998). The similarity coefficients were used for cluster analysis and dendrogram was constructed by Unweighted Pair-Group Method with Arithmetic Average (UPGMA) (Mathew *et al.*, 2000) (Fig. 1).

## Results and Discussion

Twenty eight morphological traits recorded among spine guard genotypes are furnished in table 2. The stem colour for the spine guard genotypes from light green to green in colour. Genotypes INDIRA KANKODA-1, PK -5, PK -9, PK -26, PK-34, PK -46, KRISHNAPUR, PK-49, RMF1, RMF17, RMF-27, RMF-P-4, RMF-7-P-1, PHULLE MD-5-1, PHULLE MD-5-2, NDM-5, RMDSG-1, PK -33, AMBIKA-K12-1, AMBIKA, 13-5, AMBIKA 13-6, RAIGARH, NDM-2, NDM-3, NDM-4, DHARMJAYGARH, RMF-G-39, RMF-G-49, AJSG-3, AJSG-4, and AJSG-5 had light green stem colour while genotypes PK-35 and NDM-1exhibited to green colour.

The leaf intensity of green colour in leaf ranged from green to light green in different genotypes Indira Kankoda-1, PK -5, PK -26,

PK-34, PK -46, PK-49, RMF-1, RMF-17, RMF-27, RMF-P-4, RMF-7-P-1, PHULLE MD-5-1, PHULLE MD-5-2, NDM-5, RMDSG-1, PK -33, AMBIKA-K-12-1, AMBIKA,13-5,AMBIKA 13-6, RAIGARH, NDM-2, NDM-3, NDM-4, DHARMJAYGARH, RMF-G-39, RMF-G-49, AJSG-3, AJSG-4, and AJSG-5 had light green while, it was recorded as green genotypes in PK -9, PK-35, KRISHNAPUR, and NDM-1.

Leaf length highest in genotypes PK-46 and lowest leaves length PK-33. Leaf width highest recorded in genotypes PK-46 and lowest width PK-33. Leaves margin may be characterized serrated leaves (5 Lobes) PK-9, NDM-1, NDM-2, NDM-3, NDM-4, NDM-5, and RMF-G-49, dented leaves (4 Lobes) PK-34, PK- 49, DHARAMJAYGARH, RMF-G-39, and AJSG-5, slightly dented leaves coding (3 Lobes) PK-5, PK-26, PK-35, RMF-1 and AJSG-4, and leaf margin absent INDIRA KANKODA-1, PK -46, KRISHNAPUR, RMF-17, RMF-27, RMF-P-4, RMF-7-P-1, PHULLE MD-5-1, PHULLE MD-5-2, RMDSG-1, PK -33, AMBIKA-K-12-1, AMBIKA 13-5, AMBIKA 13-6, RAIGARH and AJSG-5.

The pubescence of leaf surface was found to be weak PK -5, PK -9, PK -26, PK -46, KRISHNAPUR, PK-49, RMF-1, RMF-17, RMF-27, PHULLE MD-5-1, PHULLE MD-5-2, NDM-5, RMDSG-1, PK -33, RAIGARH, NDM-4, DHARMJAYGARH, RMF-G-39, RMF-G-49, and AJSG-4 and it was absent in INDIRA KANKODA-1, PK-34, RMF-P-4, RMF-7-P-1, AMBIKA-K12-1, AMBIKA 13-5, AMBIKA 13-6, NDM-2, NDM-1, NDM-3, AJSG-3 and AJSG-5.

There was no difference observed in green sepal and petal colors. Flower characteristics included pedicel length, ovary length and diameter, style length and pistil tip length, pedicel length divided into the three categories

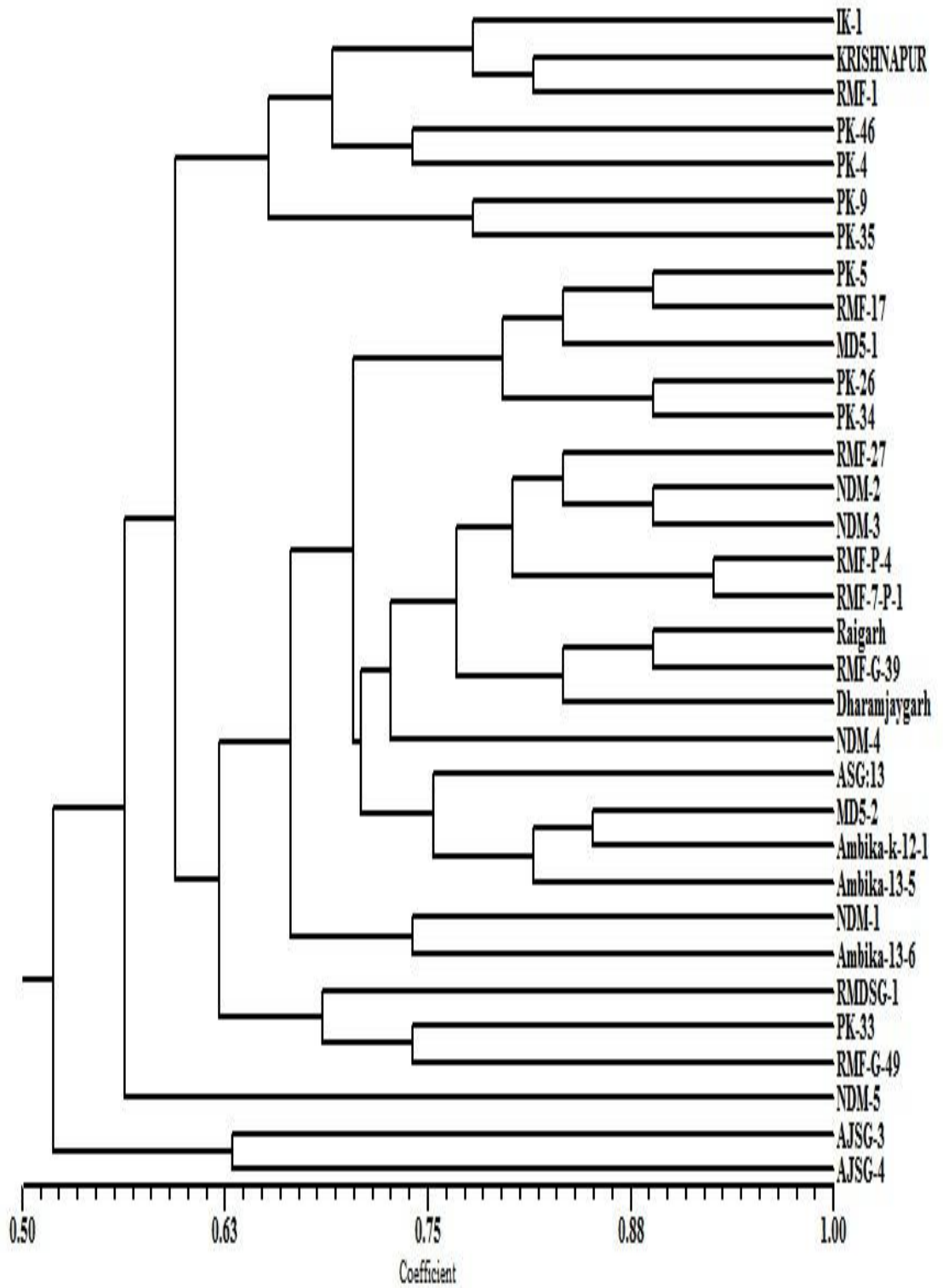
(Short, Medium, and Long) but result found in all genotypes short.

The longer the pedicel length, the easier to pick the fruit up during harvest. Fruit with short pedicel usually are hidden under the leaves and cause problems during harvest (generally fruit are hanged under the net). All genotypes had small ovary length and diameter. Almost all the genotype showed medium style and pistil tip length while genotypes AMBIKA 13-5, RMDSG-1, NDM-4, PHULE MD-5-1, NDM- 5, PK-33, PK-34, RMF-G-49 and AJSG -4 has long style.

The color of fruit during edible maturity showed great variability among the genotypes and categorized into greenish yellow, yellow green, green, dark green, and light green. The number of genotypes fallen under each two groups 1<sup>st</sup> groups green fruit colour INDIRA KANKODA-1, PK- 5, PK-9, PK-26, PK-34, PK-46, KRISHNAPUR, RMF-1, RMF-7-P-1, PHULE MD 5-1, NDM-5, RMDSG-1, NDM-3, AJSG-3 and AJSG-5 genotypes and 2<sup>nd</sup> groups light green colour PK-35, PK-49, RMF-17, RMF-27, RMF P-4, PHULE MD-5-2, NDM-1, PK-33, AMBIKA K 12-1, AMBIKA 13-5, AMBIKA 13-6, RAIGARH, NDM-2, NDM-4, DHARAMJAYGARH, RMF-G-39, RMF-G-49 and AJSG-4 genotypes.

Fruit shape had also shown much variability among the genotypes such as round KRISHNAPUR, RMF-1, RMF-27, RMF-7-P-1, PHULE-MD-5-2, AMBIKA-13-5, RAIGARH, RMF-G-39, AJSG-3 AJSG-4 and AJSG-5 and oval genotypes INDIRA KANKODA-1, PK-5, PK-9, PK-26, PK-35, PK-35, PK-46, PK-49, RMF-17, RMF P-4, PHULE MD 5-1, NDM-1, NDM-5, RMDSG-1, PK-33, AMBIKA-K 12-1, AMBIKA-13-6, NDM-2, NDM-3, NDM-4, DHARAMJAYGARH, and RMF-G-49 (Fig. 2).

**Fig.1** Dendrogram of 34 genotypes constructed by morphological characterization using UPGMA based on Euclidean dissimilarity values





**Fig.2** Fruit spine guard



**Table.1** Parameters (descriptor) of morphological and physiological characters studies in spine gourd

S.N.	ITEM	PARAMETER	S.N.	ITEM	PARAMETER
1	Days of first flowering	1.Early (60-80 days) 3.Medium early (81-100 days) 5. Medium (101-120 days) 7.Late (121-140 days)	15	Style length	1. Short (<6mm) 5. Medium (6.1-9 mm) 9. Long (>9.1 mm)
		2			Number of first flowering node
3	Stem colour		1. Light green (L.G) 3. Green (G.) 5. Dark green(D.G.)	17	
		4	No. of ridge on stem		1. Persent (5 ridge) 9. Absence no ridge
5	Node colour at the attachment of the leaves			1. Light green (L.G) 3. Green (G.) 5. Dark green(D.G.) 7. Blackish green(B.G)	19
		6	No. stem per plant	1. Few(<10 stems) 5. Moderate (11-20 stems) 9. Many (>21 stems)	
7	Leaf color			1. Light green (L.G) 3. Green (G.) 5. Dark green(D.G.)	21
		8	Leaf length	1. Short (1-7 cm) 5. Medium (7.1-15 cm) 9. Long (>15.1 cm)	
9	Leaf width			1. Narrow(1-7 cm) 5. Medium (7.1-15 cm) 9. Wide (>15.1 cm)	23
		10	Leaf margin	1. Absence(no attachment) 3. Slightly dented (SD) 5. Medium dented (MD) 7. Dented(D) 9. Serrated (5 lobes)	
11	Leaf pubescence			1. Absence(Ab) 3. Few (F) 5. Medium(M) 7. More (Mo)	25
		12	Pedicel length	1. Short (1-7 cm) 5. Medium (7.1-15 cm) 9. Long (>15.1 cm)	
13	Ovary length			1. Short (>1-10 mm) 5. Medium (11-20 mm) 9. Long (>21 mm)	27
		14	Ovary diameter	1. Small (<7mm) 5. Large(>7.1mm)	

**Table.2** Morphological characterization of spine guard genotypes based on descriptor

Parameters	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	
Days to first flowering	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
No of first flowering node	1	2	2	1	2	2	1	3	2	2	3	2	1	1	1	1	2	2	3	2	2	2	3	2	2	2	2	3	2	2	1	1	1	2	3
Stem colour	1	1	1	1	1	3	1	1	1	1	1	1	1	1	1	1	3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
No. of ridge on stem colour	1	9	1	1	9	9	1	9	9	9	1	1	1	1	1	9	1	1	1	9	9	1	1	9	1	9	9	1	9	9	1	1	1	9	
Node colour at the attachment of the leaves	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
No. of stem per plant	1	1	5	1	1	1	5	5	1	1	1	1	1	1	1	1	1	1	5	5	5	5	1	1	1	1	1	5	1	1	1	1	1	1	
Leaf colour	1	1	3	1	1	3	1	1	1	1	1	1	1	1	1	1	3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Leaf length (cm)	5	1	5	1	1	5	5	5	5	5	1	1	1	1	1	1	1	1	5	1	5	5	1	1	1	1	1	1	1	1	1	5	1	5	1
Leaf width (cm)	5	1	5	1	5	5	5	5	1	5	1	1	1	1	1	1	1	1	1	5	1	5	1	1	1	1	1	1	1	1	1	1	1	1	1
Leaf margin	1	3	9	3	7	3	1	1	7	3	1	1	1	1	1	1	1	9	9	1	1	1	1	1	1	1	9	9	7	7	7	9	7	3	1
Leaf pubescence	3	3	3	3	1	3	3	1	3	3	3	3	3	1	1	3	3	1	3	3	3	3	1	1	1	3	1	1	3	3	3	3	1	3	1
Pedicle length (cm)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Ovary length (cm)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Ovary diameter (cm)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Style length (cm)	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	9	5	9	9	9	9	5	9	5	5	5	5	5	9	1	9	9	5	9	5
Pistil length (cm)	1	5	1	5	5	1	5	5	5	1	9	9	1	5	9	1	5	1	9	5	1	1	1	1	5	5	5	5	5	5	5	9	5	5	5
Fruit colour	5	5	5	5	5	9	5	5	9	5	9	9	5	9	5	5	9	9	5	5	9	9	9	9	9	9	9	5	9	9	9	9	5	9	5
Fruit shape	3	3	3	3	3	3	3	1	3	1	3	1	1	3	1	3	3	3	3	3	3	3	3	1	3	1	3	3	3	1	3	1	1	1	1
Conical spine density	3	3	3	3	1	3	1	3	1	3	1	1	3	1	3	3	3	3	3	1	1	3	3	3	3	3	3	1	3	3	3	3	1	1	1
Conical spine strength	3	3	3	3	1	3	1	3	1	3	1	1	3	1	3	3	3	3	3	1	1	3	3	3	3	3	3	1	3	3	3	3	1	1	1
Pedicle attachment with the fruit	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Fruit length (cm)	1	1	1	1	3	1	1	1	3	1	1	1	1	1	1	1	1	1	3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Fruit diameter (cm)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Single fruit weight (g)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
No. of fruit per plant	5	3	1	1	3	3	3	5	5	3	5	1	5	3	5	3	1	3	3	3	3	3	5	5	5	3	3	3	3	5	3	1	3	3	5
Fruit yield per plant (g)	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	5	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
No. of seed per fruit	3	1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	3	3	3	3	3	3	3	3	3	3	3	1	1	1	3	3	3	3
100 seed weight (g)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

Note: (1) Indira Kankoda-1 (2) PK-5 (3) PK-9 (4) PK-26 (5) PK-34 (6) PK-35 (7) PK-46 (8) KRISHNAPUR (9) PK-49 (10) RMF-1 (11) RMF-17 (12) RMF-27 (13) IK-1 (14) RMF-P-4 (15) RMF-7-P-1 (16) PHULE MD-5-1 (17) PHULE MD-5-2 (18) NDM-1 (19) NDM-5 (20) RMDSG-1 (21) NDM-2 (21) AMBIKA-K-12-1 (23) AMBIKA-13-5 (24) AMBIKA-13-6 (25) RAIGARH (26) NDM-2(27)NDM-3(28)NDM-4(29)RMF-G-39(30)RMF-G-49(31)PK-33(32)AJSG-3(33)AJSG-4(34)AJSG-5

Generally growers prefer round shaped fruit with green colour, sometime oval fruits, so there is ample scope to be bred to fulfill consumer choice using the existing fruit variability of kankoda in Chhattisgarh.

Fruit length was quit variable from (Short, Medium, Long and Very long) the short genotypes fruits coding in KRISHNAPUR, RMF-1, RMF-27, RMF-7-P-1, PHULE-MD-5-2, AMBIKA-13-5, RAIGARH, RMF-G-39, AJSG-3 AJSG-4, AJSG-5, INDIRA KANKODA-1, PK-5, PK-26, PK-35, PK-46, PK-49, RMF-17, RMF P-4, PHULE MD 5-1, NDM-1, NDM-5, RMDSG-1, PK-33, AMBIKA-K 12-1, AMBIKA-13-6, NDM-2, NDM-3, NDM-4, DHARAMJAYGARH, and RMF-G-49. Medium long fruits genotypes PK-34 and PK-9.

Conical spine density study revealed that fruits genotypes were found to be conical spine density (Thick and thin) while remaining thick spine density genotypes KRISHNAPUR, RMF-1, RMF-7-P-1, PHULE-MD-5-2, AMBIKA-13-5, RAIGARH, RMF-G-39, INDIRA KANKODA-1, PK-5, PK-26, PK-35, PHULE MD 5-1, NDM-1, NDM-5, AMBIKA-K 12-1, AMBIKA-13-6, NDM-2, NDM-4, DHARAMJAYGARH, RMF-G-49 and PK-9. Thin conical spine density genotypes coding in PK-34, PK-46, PK-49, RMF-17, RMF-27, RMF P-4, RMDSG-1, PK-33, NDM-3, AJSG-3 AJSG-4 and AJSG-5.

Were observed conical spine strength (soft and hard) in conical spine strength soft genotypes PK-34, PK-46, PK-49, RMF-17, RMF-27, RMF P-4, RMDSG-1, PK-33, NDM-3, AJSG-3 AJSG-4 and AJSG-5. Conical spine strength hard genotypes KRISHNAPUR, RMF-1, RMF-7-P-1, PHULE-MD-5-2, AMBIKA-13-5, RAIGARH, RMF-G-39, INDIRA KANKODA-1, PK-5, PK-26, PK-35, PHULE

MD 5-1, NDM-1, NDM-5, AMBIKA-K 12-1, AMBIKA-13-6, NDM-2, NDM-4, DHARAMJAYGARH, RMF-G-49 and PK-9.

The single fruit weight (g) varied from coding (Light, Medium, Heavy and Very heavy) were present in all genotypes as light weight (<50g), medium (51-100g), heavy (101-150g) and very heavy (>150g). No of fruits plant<sup>-1</sup> was classified, viz., (Few <20, Moderate 21-40, Many 41-60 and Profuse >60) genotypes PK-49 and KRISHNAPUR yielded fruits and fruits plant<sup>-1</sup> respectively.

Fruit yield varied from 702g (RMF-G-49) to 2691g (KRISHNAPUR). Number of seed fruit<sup>-1</sup> classified in (Few, Less, Medium, and Many) the genotypes produce 1-15 seeds fruits<sup>-1</sup> genotypes PK-5, PHULE MD-5-2, DHARAMJAYGARH, RMF-G-39 and RMF-G-49 and 16 to 30 seed produced genotype PK-34, PK-46, PK-49, RMF-17, RMF-27, RMF P-4, RMDSG-1, PK-33, NDM-3, AJSG-3 AJSG-4, AJSG-5, KRISHNAPUR, RMF-1, RMF-7-P-1, AMBIKA-13-5, RAIGARH, INDIRA KANKODA-1, PK-26, PK-35, PHULE MD 5-1, NDM-1, NDM-5, AMBIKA-K 12-1, AMBIKA-13-6, NDM-2, NDM-4, and PK-9. Consumers do not prefer the presence of large no of seeds in fruit because it decreases the fruit palatability. So breeder should developed cultivar having fruits with less number of seeds.

Cluster I consisted of genotype namely Indira Kankoda-1, PK -5, PK -9, PK-26, PK-34, PK-35, PK-46, KRISHNAPUR, PK-49, RMF-1, RMF-17, RMF-27, RMF-P-4, RMF-7-P-1, PHULLE MD-5-1, PHULLE MD-5-2, NDM-1, NDM-5, RMDSG-1, PK -33, AMBIKA-K-12-1, AMBIKA 13-5, AMBIKA 13-6, RAIGARH, NDM-2, NDM-3, NDM-4, DHARMJAYGARH, RMF-G-39, RMF-G-49 and AJSG-5 having 55 percent similarities whereas, cluster II consisted of AJSG-3 and AJSG-4 having 58 percent similarity with



cluster I. Cluster II again partitioned into two sub cluster in which first sub cluster of cluster II PK -5, PK-26, PK-34, RMF-17, RMF-27, RMF-P-4, RMF-7-P-1, PHULLE MD-5-1, PHULLE MD-5-2, NDM-1, NDM-5, RMDSG-1, PK -33, AMBIKA-K12-1, AMBIKA 13-5, AMBIKA 13-6, RAIGARH, NDM-2, NDM-3, NDM-4, DHARMJAYGARH, RMF-G-39, RMF-G-49 and AJSG-3. Cluster second sub cluster INDIRA KANKODA-1, PK -9, PK-35, PK -46, KRISHNAPUR, PK-49, RMF-1 having 63% similarities with cluster II.

Among 29 morphological characters studied, the variation exhibited in day to first flowering, stem and leaf characteristics, fruit and seed size and finally seemed to play major role in separating the genotypes. Sultana *et al.*, (2001) also reported such separation between wild and cultivated species using morphological variation in lablab bean. Based on morphological variation, Hubbard and Garbary (2002) also classified seaweed (*Codium* spp.) in different subspecies using cluster analysis and principle component analysis. The dissimilarity order present study as observed in dissimilarities matrix. The present study similarities found that Bhadra and Akhtar (1991) in black gram, Natarajan *et al.*, (1998) in green gram, Rasul and Okubo (2004) in kakrol found no relationship with geographical isolation and genetic diversity of the crop.

The basic objective of spine guard characterization is to test the occurrence of traits that help in identifying a particular genotypes. Morphological traits are not influenced by the environment; transfer of those characters is fully governed by genes and could be plant breeder use in hybridization program. From this point of view, morphological characterization of leaf, fruit, flower and seed characters were performed (Rahman, 2015). The genetic

variation suggested that a positive response to direct selection is possible for all the traits studies (Tiwari and Tigga, 2015). Morphological characterization indicated the selection for number of stem per plant, number of fruit per plant, single fruit weight could be selection criteria for simultaneously increasing fruit yield. However morphological description alone may be not sufficient for characterization, their some other description based on biochemical and molecular marker called be considered for robust result and development of selection criteria.

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