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Morphological Characterization of Field Pea (*Pisum sativum* L.)

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Abstract

Present Experiment was conducted on forty genotypes of field pea germplasm were procured from Pea Improvement Project, JNKVV, Jabalpur (MP). All these genotypes were evaluated at Seed Breeding Farm, Department of Genetics and Plant Breeding, College of Agriculture, Jabalpur. The experiment was conducted during *Rabi* season 2019-20 in randomized complete black design with three replications. These germplasm were characterized for fourteen morphological traits *viz.,* (stem anthocyanin coloration, foliage color, foliage waxy bloom, leaflets, leaf axil color, stipule rabbit eared, flower opening, flower standard petal color and number of pods per axil etc.,) on the basis of DUS guidelines. Observations were recorded on stem, foliage, leaves, stipule rabbit eared, flower, pod and seeds of plant traits for all the genotypes were exhibited high amount of variability. Overall result revealed that sufficient amount of morphological difference were present in the germplasm and it showed that the genotypes utilized in this study are of diverse in origin.

Key words : *Field pea, DUS, morphological characterization.*

Introduction

Pea (*Pisum sativum* L.) belongs to the genus *Pisum* of Family Fabaceae (Leguminasae), subfamily Papillionaceae, and tribe Vicieae. Field pea (*Pisum sativum* L. *var arvense*) is widely grown around the world and it is the second most consumed legume after chickpea. This crop comprises two species, *Pisum fulvum* Sibth and Sm. and *Pisum sativum* L. There are two types of cultivated peas viz., garden pea (*Pisum sativum var.hortense*) and field pea (*Pisum sativum var.arvense*). Garden pea is used for table purpose. Hence, harvest at green pod condition and cooked as fresh or canned for subsequent uses. The immature peas are used as a vegetable, fresh frozen or canned, varieties of the species typically called garden pea. Field pea is used as dry, whole or split as dal or used as flour (besan) for various food preparations. Dry pea seed contains 22.5% protein, 56.5% carbohydrate, 1.1% fat, 2.2% minerals, 4.5% fiber and important vitamins like vitamin B1 and B5. The stalk broken cotyledons and seed coat are used as animal feed. Among the genus *Pisum* a species named *P. sativum ssp abyssinicumis* considered a possible candidate as progenitor and it resembles closely to the cultivated from. Genetic composition of pea is ca. 4800 Mbp spread across 2n=2x=14 chromosomes. Pea spread from the Fertile Crescent to Russia and westward into Europe and eastward into China and India. There are four centers of origin based on genetic diversity were proposed by (1), namely Central Asia, the near East, Abyssinia (Ethiopia) and the Mediterranean (2). It is grown in higher altitudes in tropical areas with temperature ranging between 7°C - 30°C. Pea has great nutrient value and contains vitamin A, B and C, along with minerals, dietary fiber and anti oxidant compounds. Now days, protein markets are shifting away from dairy, egg, soy, due to consumers? perceived fears about consuming animal-derived products basically for dietary choices.

Morphological characters are considered as genetic differences present in the germplasm, which deals differences of genetic components easily observed morphological of the material studied. This also acts as morphological markers for the identification of the flow of genes by out crossing or by other ways. Because these traits are less influenced by environmental changes so, that most common approach for utilization and to estimate relationships between genotypes (3). Several crop wise descriptions have been developed by the plant breeders for the accurate characterization of the visible differences present in the material. Many of the descriptors already accepted by the PPV and FR and now several crop breeders reviewed precisely for the cataloguing of the trait differences present in the crops. In this investigation DUS guidelines proposed by IIPR, Kanpur and accepted by PPV and FR authority was utilized for the cataloguing the field pea germplasm for the morphological differences.

Materials and Methods

The present investigation on morphological characterization of field pea germplasm were carried out during *Rabi* season 2019-20 under Pea Improvement Project at Seed Breeding Farm, Department of Genetics and Plant Breeding, College of Agriculture, JNKVV, Jabalpur, (MP) and AICRP on MULLaRP, IIPR Kanpur. Jabalpur is situated at 23.90^{0}N latitude and 79.58^{0}E

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Table-1 : Frequency distribution and per cent score of morphological traits.

Traits	Classes/ Strategies	Number of genotypes	Percentage (%)
Stem anthocyanin coloration	Present (9)	7	17.5
	Absent (1)	33	82.5
Foliage colour	Light Green (3)	4	10
	Dark Green (7)	15	37.5
	Green (5)	21	52.5
Foliage waxy bloom	Present (9)	15	37.5
	Absent (1)	25	62.5
Leaflets	Present (9)	32	80
	Absent (1)	8	20
Leaf axil colour	Purple (2)	6	15
	Green (1)	34	85
Stipule: rabbit eared	Present (9)	15	37.5
	Absent (1)	25	62.5
Flower opening (Days)	Extra Early (1)	1	2.5
	Early (2)	3	7.5
	Medium (3)	35	62.5
	Late (4)	1	2.5
Flower standard petal colour	Purple (5)	7	17.5
	White (1)	33	82.5
Number of pod per axil	Single (1)	10	25
	Double (2)	29	72.5
	Multiple (3)	1	2.5
Pod curvature	Weak (3)	21	52.5
	Medium (5)	3	7.5
	Absent (1)	16	40
Pod shape of distal part	Pointed (1)	13	32.5
	Blunt (9)	27	67.5
Seed shape	Cylindrical (2)	3	7.5
	Dimple (3)	6	15
	Spherical (1)	31	77.5
Seed surface	Wrinkle (2)	9	22.5
	Smooth (1)	31	77.5
Seed cotyledon colour	Green (5)	7	17.5
	Yellow (7)	8	20
	Creamy (3)	25	62.5

longitudes at an altitude of 411.87 m above the mean sea level. This region has subtropical, semi-arid climate with hot and dry summer and cold winter with occasional showers. The average annual rainfall of Jabalpur district is 1279.50 mm and it receives maximum rainfall about 90% during south west monsoon period i.e. June to September, only 10% occasional showers take place during October to May. Temperature vary from 18.68^{0}C being minimum in January to 46^{0}C being maximum in May and June. This area is under "Kymore Plateau and Satpura Hills Agro-Climatic Zone" as per norms of National Agricultural Research Program. This area as per National Bureau of Soil Science and Land Use Planning of ICAR comes under agro-ecological sub region number 10.1 named as sub-humid dry eco-region. The soil of experimental area was clay loam with uniform topography. The data related to weekly maximum and minimum temperature, relative humidity, wind velocity, rainfall, number of rainy days, sunshine hours and evaporation of entire crop growing period of experiment has been recorded.

The experiment material for the present investigation was comprised of 40 field pea germplasm. These germplasm were sown in randomized complete block

Table-2 : Morphological Characterization of field pea germplasm according to DUS guidelines.

S. No.	Germplasm	Stem Anthocyanin Colouration	Foliage Colour	Foliage Waxy Bloom	Leaflets	Leaf Axil Colour	Stipule Rabbit Eared	Flower: Opening (days)	Flower Standard Petal Colour	Number of Pod/axil	Pod Curvature	Pod shape of distal part	Seed shape	Seed surface	Seed Cotyledon Colour
1.	FP-14-32	1	7	9	9	1	1	3	1	2	3	9	1	1	7
2.	FP-14-34	1	5	1	9	1	1	3	1	3	3	9	1	1	3
3.	FP-14-36	1	5	1	9	1	1	3	1	1	1	9	1	1	3
4.	FP-14-39	1	5	1	9	1	1	3	1	1	3	9	3	2	3
5..	FP-14-41	1	7	9	9	1	1	3	1	1	1	9	2	2	7
6.	FP-14-44	1	3	1	9	1	1	3	1	1	5	9	1	1	3
7.	FP-14-50	1	7	9	9	1	9	3	1	1	1	9	1	1	5
8.	FP-14-51	1	3	1	1	1	1	3	1	1	1	9	1	1	3
9.	FP-14-54	1	7	1	9	1	1	3	1	1	3	9	1	1	5
10.	FP-14-67	9	7	9	9	2	1	3	5	2	3	1	2	2	5
11.	FP-14-69	1	5	1	9	1	9	3	1	2	1	9	1	1	3
12.	FP-14-71	1	5	1	9	1	1	3	1	2	3	1	1	2	3
13.	FP-14-73	1	5	1	9	1	1	3	1	2	3	1	1	2	3
14.	FP-14-75	1	7	1	9	1	1	3	1	2	3	9	1	1	3
15.	FP-14-76	1	5	9	1	1	9	3	1	2	3	1	1	1	7
16.	FP-14-81	1	3	9	1	1	9	3	1	2	3	1	1	1	3
17.	FP-14-87	9	5	1	1	1	9	4	5	2	1	9	1	1	3
18.	FP-14-88	9	5	1	9	2	1	3	5	2	1	9	3	1	5
19.	FP-14-90	1	7	9	9	1	9	3	1	1	3	9	1	1	7
20.	FP-7-562	1	5	1	9	1	1	3	1	2	3	9	1	1	3
21.	P-81-10	1	5	1	9	1	1	3	1	2	5	9	1	1	3
22.	JP-885 (Purple)	9	7	9	9	2	1	2	5	2	1	9	3	2	5
23.	KPMR-502	1	7	9	9	1	9	3	1	1	3	9	1	1	7
24.	IFP-99-25	1	5	1	9	1	1	3	1	2	1	9	1	1	3
25.	LEP-227	1	5	9	9	1	1	3	1	2	1	9	1	1	3
26.	KFP-151	1	5	1	9	1	9	3	1	2	3	1	1	1	3
27.	DDR-52	1	7	9	9	1	1	2	1	2	1	9	2	2	7
28.	DDR-54	9	7	1	9	2	9	3	5	2	3	1	3	1	3
29.	P-3	1	7	1	1	1	9	2	1	2	1	9	1	1	3
30.	LEP-260	1	5	9	9	1	1	3	1	2	3	1	3	1	3
31.	Kalamatar	9	5	1	9	2	9	1	5	1	5	1	3	1	5
32.	Desi pilibatari	1	5	9	1	1	9	3	1	2	1	9	1	1	7
33.	Somnath pili batri	1	5	1	9	1	1	3	1	2	3	9	1	1	3
34.	Chatru matar	1	5	9	9	1	9	3	1	2	1	9	1	1	3
35.	Double branching	1	3	1	1	1	1	3	1	2	3	1	1	1	3
36.	Batri chhoti adwah	1	7	1	1	1	1	3	1	2	3	1	1	1	5
37.	Batana moolchand	1	5	1	9	1	1	3	1	2	1	9	1	1	3
38.	Kesav batana	9	7	1	9	2	9	3	5	2	1	9	1	1	3
39.	Golbatri (Amar)	1	5	1	9	1	1	3	1	2	3	1	1	2	3
40.	Batri patiram	1	7	9	9	1	9	3	1	2	3	1	1	2	7

Stem anthocyanin coloration

Purple

Green

Leaf axil color

Purple

Green

Leaflets

Tendrils

Stipule rabbit eared

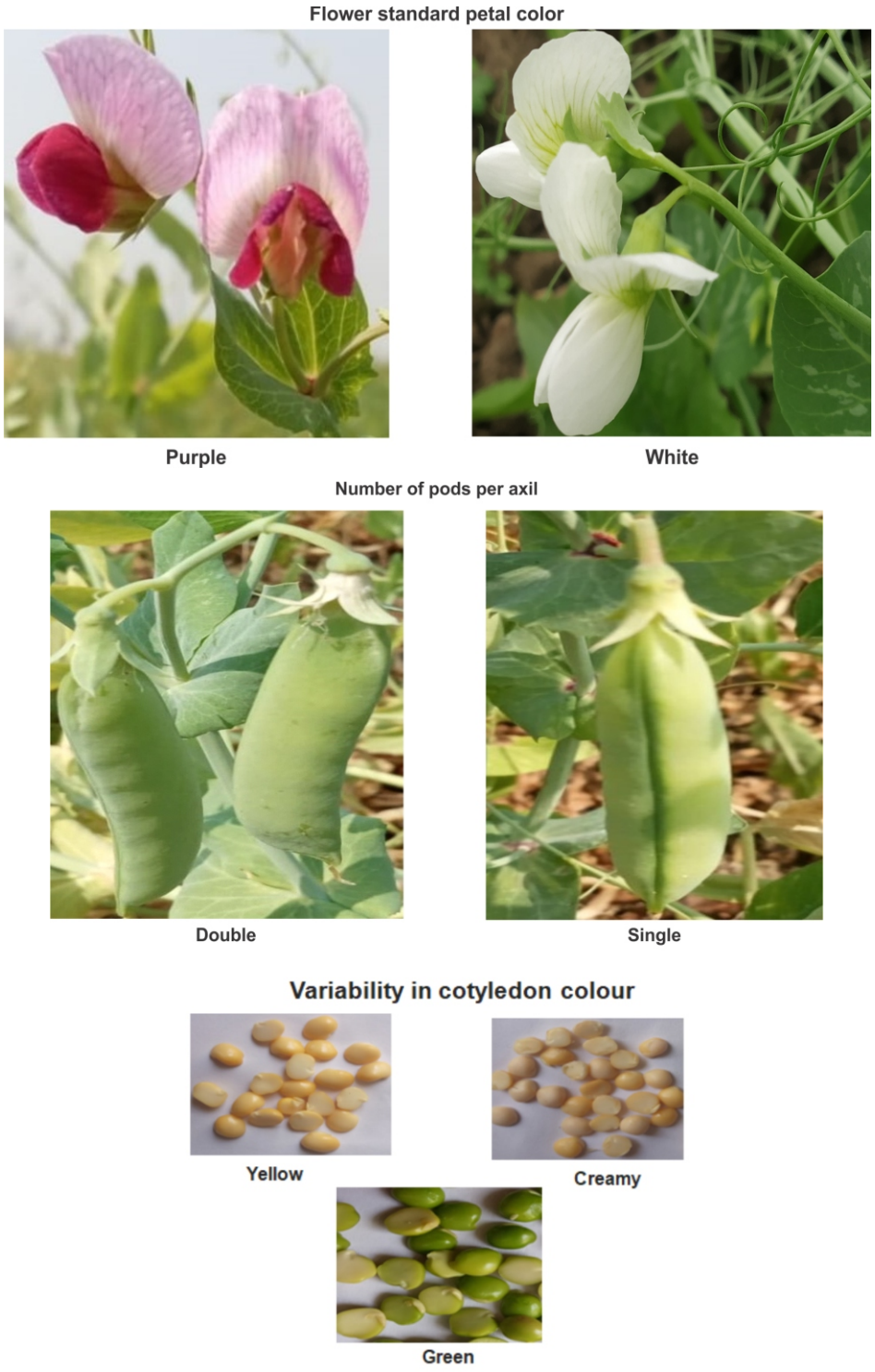


Fig-1 : Different Morphological traits of field pea according to DUS guidelines.

design (RBCD) with three replications. All these genotypes were sown in single row pattern keeping 30 cm distance from row to row and 10 cm distance from plant to plant, row length is 4m and number of genotypes per row is 6. On the basis of DUS guidelines, a total of 14 morphological traits viz., stem anthocyanin coloration, foliage color, foliage waxy bloom, leaf lets, leaf axil color, stipule rabbit eared, flower opening in days, flower standard petal color, number of pod per axil, pod curvature, pod shape of distal part, seed shape, seed surface and seed cotyledon color were considered for the identification of visible difference in the field pea germplasm. Observations were recorded on the basis of five random competitive plants selected from each

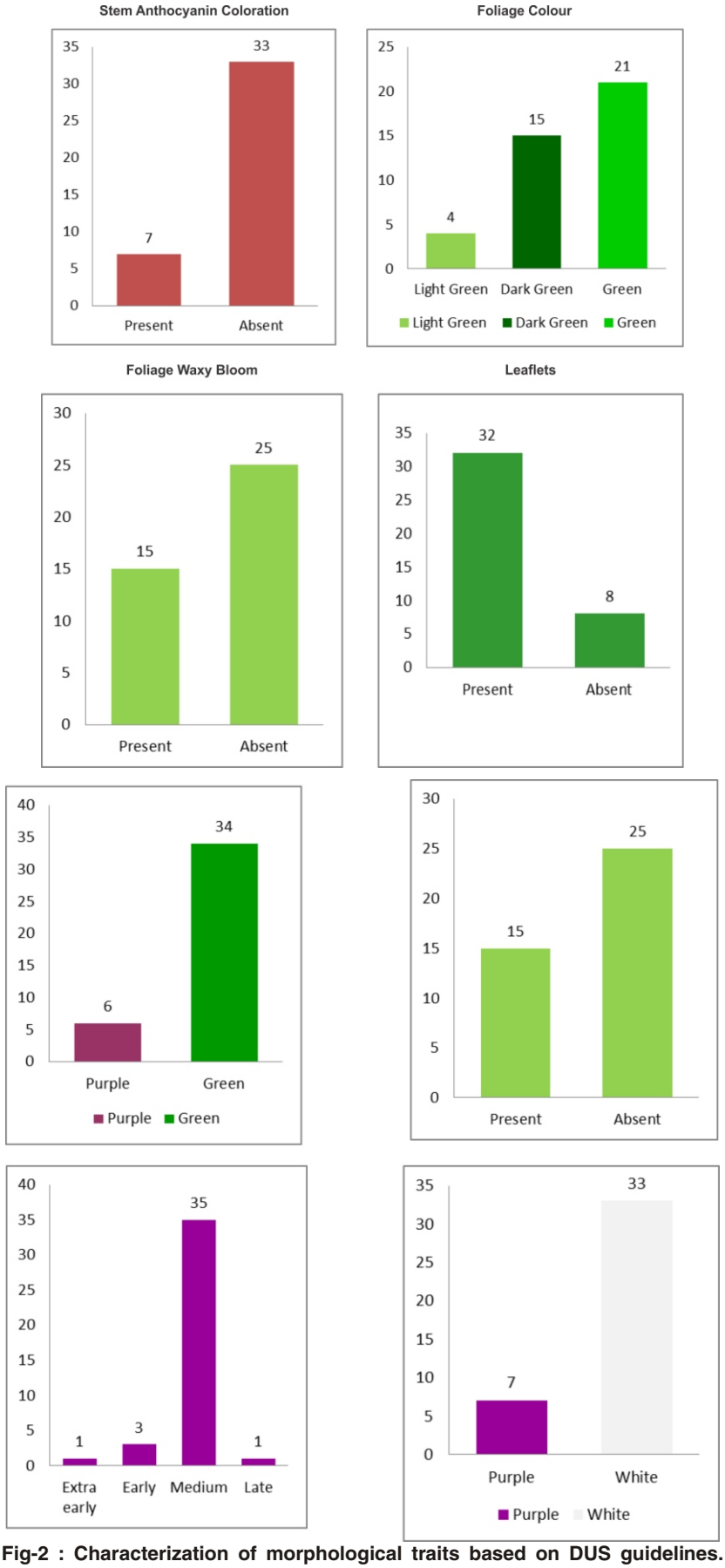
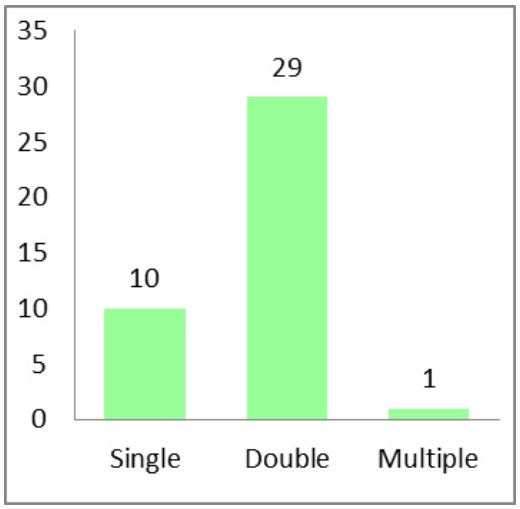
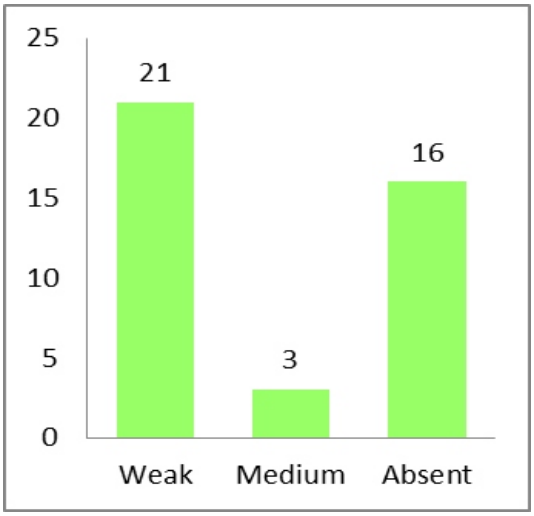


Fig-2 : Characterization of morphological traits based on DUS guidelines.

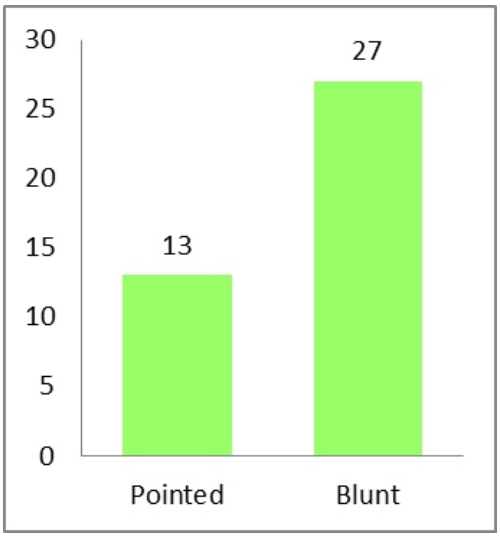
Number of Pods per Axil



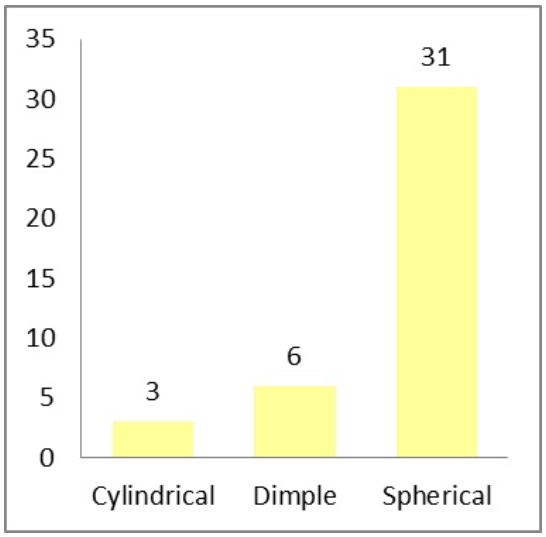
Pods Curvature



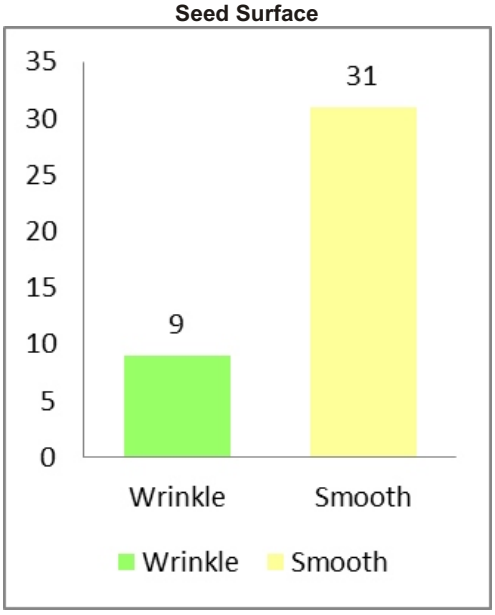
Pods Shape of Distal Part



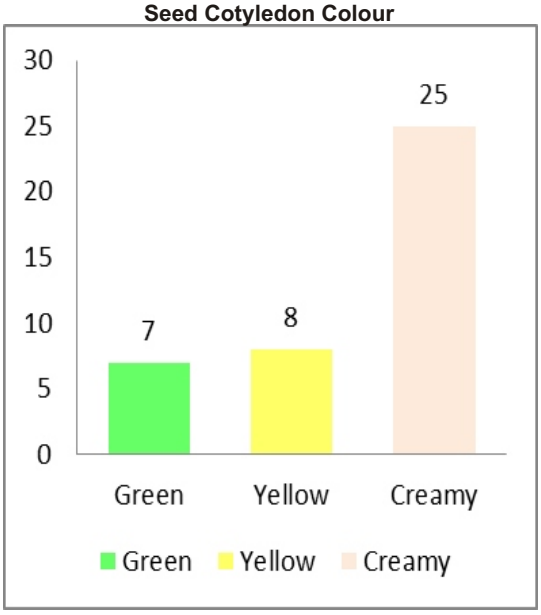
Seed Shape



Seed Surface



Seed Cotyledon Colour



germplasm and per each replication separately. Data were recorded according to the National Test Guidelines for DUS test of pea which is developed by PPV & FR Authority, GOI, New Delhi.

Results and Discussion

Morphological characterization of forty field pea genotypes were included in this experiment. All these genotypes are morphological characterized for different traits. These genotypes were grouped for several agro-morphological descriptions. Data were recorded on fourteen traits viz., stem anthocyanin coloration, foliage color, foliage waxy bloom, leaf lets, leaf axil color, stipule rabbit eared, flower opening (days), flower standard petal color, number of pods per axil, pod curvature, pod shape of distal part, seed shape, seed surface and seed cotyledon color.

Most of the genotypes belongs to the category of stem anthocyanin coloration is absent (33), some were in present (7) stem anthocyanin coloration is presented in Table-1. Genotypes were also classified on the basis of foliage color. Three types of foliage color viz., light green, dark green and green were observed in the varieties but most of them belongs to either green (21) or dark green (15) and some were in light green color also (4). While foliage waxy bloom observed in some genotypes (15). In most of the varieties were leaflets was present (32) and at the same time considerable variability was observed in plant height. Some varieties were show stipule rabbit eared type leaf lets (15). Leaf axil color classified as a 2 categories viz., purple and green. 6 genotypes show purple leaf axil color and 34 genotypes show green leaf axil color.

Field pea varieties were largely of medium (35) to early (3) flowering group and some were in extra early (1) and late (1) flowering category. Flower standard petal color classified as a 2 categories viz., purple and white. 7 genotypes show purple flower petal color and white flower petal color observed in 33 genotypes.

Number of pods per axil are classified as a 3 categories viz., single, double and multiple. Most of the varieties belongs to double (29) to single (10) type pod per axil and some were in multiple pods per axil category. Pod shape of distal part classified as a 2 categories viz., pointed and blunt. Pointed type of pod shape observed in 13 genotypes and blunt type pod shape observed in 27 genotypes. In some genotypes were observed normal pod curvature.

Seed shape classified as a 3 categories viz., cylindrical, dimple and spherical. Cylindrical type seed shape observed in 3 genotypes, dimple type seed shape observed in 6 genotypes and 31 genotypes were show spherical type seed shape. Seed surface was smooth in most of the varieties (31). However, some with wrinkled (9) seed surface. Seed cotyledon color classified as a 3 categories viz., green, yellow and creamy. Most of the varieties belongs to category of creamy cotyledon color (25), some were observed yellow (1) to green (1) type seed cotyledon color. Further, the unique features can be selected for developing varieties with unique identification may be particularly referred to as indicators to determine an unstable expression of the phenotype of variety. Similar to findings which were reported by (4,5,6).

Conclusions

Morphological characterization is the first step in the description and classification of the germplasm. An understanding of morphological characters facilities the identification, selection of desirable traits and designing of new populations. According to the DUS guidelines, a total of 14 morphological traits were considered for the identification of visible difference in the forty field pea germplasm included in this investigation. Overall result revealed that sufficient amount of morphological difference were present in the field pea germplasm and it showed that the genotypes utilized in this study are of diverse in origin.

Acknowledgements

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