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Characterization of soybean (*Glycine max*) varieties as per DUS guidelines

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ABSTRACT

For the establishment of distinctiveness among Indian soybean [*Glycine max* (L.) Merrill] varieties, 20 characters were used and presented in a simple tabular form. The varieties were characterized for 20 characters, viz. flower colour, hypocotyl anthocyanin pigmentation, seed colour, absence or presence of pod pubescence, pod pubescence colour, plant growth type, pod colour, days to maturity, seed cotyledon colour, days to 50% flowering, seed size, seed shape, leaf colour, plant height (cm), seed hilum colour, seed lusture, plant growth habit, pod shattering, leaf shape and peroxidase activity. Of the 92 soybean varieties studied, 42 varieties were found to be distinctive on the basis of eleven essential characters. Remaining 50 varieties can be classified into 19 groups. However, 13 of these groups were distinct from each other on the basis of other remaining nine characters. But one group (4 varieties, viz. MAUS 1, PK 308, PUSA 20, and PUSA 37) belonging white flowered and five groups (10 varieties, viz. RKS 18 and RAUS 5, MAUS 47 and Monetta, ADT 1 and Co 1, MACS 57 and Pusa 16, Gujarat Soybean 1 and Punjab1) belonging purple flowered could not be differentiated being similar traits and therefore it is suggested to use of other biochemical markers/ DNA finger printing. This study will be useful for breeders/ researchers/ farmers to identify soybean varieties and to seek protection under Protection of Plant Varieties and Farmers Rights Act.

Key words: Soybean, DUS test, Characterization, Distinctiveness, Varieties, PPV & FR Act

Soybean [*Glycine max* (L.) Merrill] is an economically important legume (2n = 40) seeds contain an average of 40% protein and 20% oil, and its plants enrich the soil by fixing nitrogen in symbiosis. In the international world trade markets, soybean is ranked number one in world among the major oil crops (Chung and Singh 2008). In India, the consumption of oil has been increasing steadily as a result of rise in population and living standard of people.

In India, total 97 improved varieties have been notified/ released in India for the cultivation in different agro-ecological zones of the country so far. Being signatory to the General agreement on Trade and Tariffs, Government of India has enacted its *sui generis* system Protection of Plant Varieties and Farmers Right Act (PPV&FRA), 2001 for providing protection to plant varieties based on distinctiveness, uniformity and stability (DUS) test apart from novelty. Therefore, the characterization of a variety is prerequisite. Identification of plant varieties of common knowledge is essential for the protection of new plant varieties. Article15.3 (b) of the PPV&FR Act states that the new variety must be clearly distinguishable by one or more essential characters from any variety whose existence is a matter of common knowledge at the time of seeking protection. The uniqueness of a variety is to be established by the test called DUS. Therefore, candidate variety is to be compared with all the varieties, whose existence is matter of common knowledge and with the most similar variety. Variety identification with respect to its genetic purity is important in national and international seed and breeding programmes. Different varieties are commonly identified on the basis of taxonomic differences of seed, seedling and mature plants.

Characterization of variety is useful to identify and avoid duplication. Qualitative characters being more stable over generations (Raut 2003) hence are reliable for characterization of varieties. Therefore, the present study was planned to characterize the available soybean varieties for their traits.

MATERIALS AND METHODS

Eighty-six, 90 and 92 soybean varieties were grown in a randomized Block design with three replications during rainy (*kharif*) 2007 to 2009 at experimental farm of the Directorate of Soybean Research, Indore (Madhya Pradesh) which is situated at 22º 4'37''N latitude, 75º 52'7''E longitude and altitude of 540 m above the mean sea level. The varieties were sown in six rows in five meter length (spacing 45 cm

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× 10 cm). The experiments were carried out on deep black cotton soils with *p*H 7.6 to 8.1, low to medium in organic carbon and available phosphorus and high in potassium (Typical Chromusterts and Lithic Vertic Ustochrepts). Before sowing, recommended dose (20 N, 60 P, 20 K kg/ha) was applied in the form of commercial fertilizers. The varieties were characterized for 20 characters as per DUS test guidelines (Anonymous 2009). The method for seed coat peroxidase activity described by Buzzell and Buttery (1969) was used.

RESULTS AND DISCUSSION

Qualitative characters are considered as marker characters in the identification of soybean species and varieties, which are less influenced by environmental fluctuations. The work on inheritance and linkage studies of qualitative characters was reviewed by Raut (2003). The published work (Satyavathi *et al.* 2004, Gupta *et al*. 2010) also substantiated that the flower colour, presence and absence of pod hair, colour of hair, seed colour were the most stable characters across the agro-climatic zones.

To establish distinctiveness among soybean varieties, 20 characters have been used (Table 1) as per the National test guidelines for the conduct of test for DUS on Soybean (Anonymous 2009). The characterization of all the varieties is shown in such a manner that essential characters are considered first so as to classify similar or dissimilar varieties on the basis of expression of the traits (Table 2). Study revealed the characters hypocotyl anthocyanin pigmentation and flower colour was found closely associated. All purple hypocotyl varieties exhibited purple colour flower, while green hypocotyl exhibited white colour flowers. Gupta *et al*. (2010) also observed the same association. Soybean varieties of India were grouped into two major groups on the basis of flower colour. The flower color is reported to be controlled by six genes (W1, W2, W3, W4, Wm and Wp) and pubescence color by two genes (T and Td) (Palmer *et al*. 2004, Takahashi *et al*. 2008). Out of 92, 37 soybean varieties exhibited white flowers, whereas 55 varieties exhibited purple flowers. It is clearly observed from the Table 2, that most of the varieties were distinguishable on the basis of characters published in the DUS guidelines. Variety Hara Soya was the only variety which had green seed coat and green cotyledons whereas JS 90-41 yellow-green seed coat and yellow cotyledons. Out of total 92 varieties available, four were black seeded. The colour of seed coats and hila is controlled by five loci (reviewed by Palmer and Kilen 1987). Two white flowered black seeded varieties (Birsa soya 1 and VL Soya 1) were distinctive on the pod colour, leaf colour, plant height and growth habit, whereas two purple flowered black seeded varieties (JS 76-205 and Kalitur) were distinctive on the pod colour, seed size, seed lusture, leaf shape, peroxidase activity and on the pod shattering nature.

On the basis of essential characters [star (*) in the

Table 1 Characters along with their descriptor

Character	Descriptor code and name				
Flower colour*	White	Purple			
Hypocotyl: anthocyanin pigmentation*	Present	Absent			
Seed Colour*	Yellow	Yellow-green	Green	Black	
Pod pubescence*	Absent	Present			
Pod pubescence colour*	Grey	Tawny			
Plant growth type*	Determinate	Semi-determinate	Indeterminate		
Pod colour*	Yellow	Brown	Black		
Days to maturity*	Early (< 95 days)	Medium (96–105 days)	Late (> 105 days)		
Seed cotyledon colour*	Yellow	Green			
Days to 50% flowering*	Early(< 35 days)	Medium (36–45 days)	Late(> 45 days)		
Seed size*	Small (=10.0g)	Medium (10.1-13.0g)	Large (>13.0g)		
Seed shape	Spherical	Elliptical			
Leaf colour	Green	Dark green			
Plant: Height (cm)	Short (< 40 cm)	Medium (41-60 cm)	Tall (>60 cm)		
Seed: hilum colour	Yellow	Grey	Brown	Black	Variegated
Seed lusture	Shiny	Dull			
Plant: Growth habit	Erect	Semi-erect			
	Pod shattering	Shattering	Non-shattering		
	Leaf shape	Lanceolate	Pointed ovate	Round ovate	
	Peroxidase activity	Absent	Present		

*Essential characters (star marked in the guidelines) that shall be observed during every growing period on all varieties and shall always be included in the description of the variety as per DUS guidelines

Table 2 Characterization of the varieties (total 92) as per DUS guidelines

Varieties	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Birsa Soya 1	W	A	Bl	P	T	D	Br	M	Y	M	M	Sp	Dg	M	Bl	Sn	Se	Ns	Po	A
VL Soya 1	W	A	Bl	P	T	D	Y	M	Y	M	M	Sp	G	S	Bl	Sn	Er	Ns	Po	A
Hara Soya	W	A	G	P	T	Sd	Bl	M	G	M	M	Sp	G	S	Br/Bl	Dl	Er	Ns	Po	A
PK 262	W	A	Y	P	Gy	D	Br	M	Y	M	M	Sp	G	S	Br	Sn	Se	Ns	Po	P
PS 1241	W	A	Y	P	Gy	D	Br	M	Y	M	M	Sp	G	M	Bl	Sn	Se	Ns	Po	A
PK 472	W	A	Y	P	Gy	D	Y	M	Y	M	M	El	G	M	Br	Sn	Er/Se	Ns	Po	P
VL Soya 47	W	A	Y	P	Gy	Sd	Br	M	Y	M	L	El	G	M	Bl	Dl	Se	Ns	Po	P
Hardee	W	A	Y	P	Gy	Sd	Y	L	Y	M/L	M	El	G	M	Br	Dl	Er	Ns	Po	P
MAUS 2	W	A	Y	P	Gy	Sd	Y	M	Y	M	M	El	G	M	Br	Sn	Se	Ns	Po	P
Shivalik	W	A	Y	P	Gy	Sd	Y	M	Y	M	M	Sp	G	M	Bl	Dl	Se	Ns	Po	A
TAMS 38	W	A	Y	P	Gy	Sd	Y	M	Y	L	Sm	El	G	M	Br	Sn	Se	Ns	Po	P
PS 1225	W	A	Y	P	Gy	Sd	Y	M	Y	M	M	Sp	Dg	M	Br	Dl	Se	Ns	Po	A
PS 1042	W	A	Y	P	T	D	Bl	M	Y	M	M	Sp	Dg	M	Br	Sn	Se	Ns	Po	P
LSb 1	W	A	Y	P	T	D	Br	E	Y	E	L	Sp	G	S	Br	Sn	Se	St	Po	A
PS 1024	W	A	Y	P	T	D	Br	M	Y	M	M	Sp	G	M	Br	Sn	Er	Ns	Ln	P
PS 1347	W	A	Y	P	T	D	Br	M	Y	L	M	El	Dg	S	Br	Sn	Se	Ns	Ln	P
VL Soya 21	W	A	Y	P	T	D	Br	M	Y	E	M	Sp	Dg	M	Bl	Sn	Se	Ns	Po	A
Ankur	W	A	Y	P	T	D	Br	M	Y	M	M	El	G	S	Br	Sn	Se	Ns	Po	A
SL 525	W	A	Y	P	T	D	Br	M	Y	M	M	El	G	M	Bl	Sn	Se	Ns	Po	A
Bragg	W	A	Y	P	T	D	Br	M	Y	M	M	Sp	Dg	S	Bl	Sn	Se	Ns	Po	A
PK 471	W	A	Y	P	T	D	Br	M	Y	M	M	Sp	G	M	Br	Sn	Er	Ns	Po	A
Alankar	W	A	Y	P	T	D	Br	M	Y	M	M	Sp	G	M	Br	Sn	Se	Ns	Po	P
PS 564	W	A	Y	P	T	D	Br	M	Y	M	M	Sp	G	M	Bl	Sn	Se	Ns	Po	A
PS 1029	W	A	Y	P	T	D	Br	M	Y	M	M	Sp	G	M	Bl	Sn	Se	Ns	Po	P
NRC 2	W	A	Y	P	T	D	Br	M	Y	M	M	Sp	G	M	Gy	Sn	Er	Ns	Po	P
PK 416	W	A	Y	P	T	D	Br	M	Y	M	M	El	G	M	Br	Dl	Er	Ns	Po	P
SL 295	W	A	Y	P	T	D	Br	M	Y	M	L	Sp	G	S	Bl	Dl	Er	Ns	Po	P
Durga	W	A	Y	P	T	Sd	Bl	M	Y	M	Sm	El	G	Tl	Bl	Dl	Se	Ns	Po	P
NRC 37	W	A	Y	P	T	Sd	Bl	M	Y	M	M	Sp	G	Tl	Br	Sn	Se	Ns	Po	A
DS 98-14	W	A	Y	P	T	Sd	Br	M	Y	M	M	Sp	Dg	M	Br	Dl	Er	Ns	Ro	A
MAUS 1	W	A	Y	P	T	Sd	Br	M	Y	M	M	Sp	G	M	Br	Sn	Se	Ns	Po	A
PK 308	W	A	Y	P	T	Sd	Br	M	Y	M	M	Sp	G	M	Br	Sn	Se	Ns	Po	A
PUSA 20	W	A	Y	P	T	Sd	Br	M	Y	M	M	Sp	G	M	Br	Sn	Se	Ns	Po	A
PUSA 37	W	A	Y	P	T	Sd	Br	M	Y	M	M	Sp	G	M	Br	Sn	Se	Ns	Po	A
PUSA 24	W	A	Y	P	T	Sd	Br	M	Y	M	L	Sp	G	M	Bl	Sn	Se	Ns	Po	A
DS 97-12	W	A	Y	P	T	Sd	Br	M	Y	M	Sm	Sp	G	S/M	Bl	Sn	Se	Ns	Po	P
JS97 52	W	A	Y	P	T	Sd	Br	M	Y	L	M	Sp	G	M	Bl	Dl	Se	Ns	Po	P
JS 76-205	Pu	P	Bl	P	T	Sd	Br	M	Y	M	M	Sp	G	M	Bl	Dl	Se	Ns	Po	A
Kalitur	Pu	P	Bl	P	T	Sd	Bl	M	Y	M	Sm	Sp	G	M/Tl	Bl	Sn	Se	St	Ln	P
JS 90-41	Pu	P	Yg	P	T	Sd	Bl	E	Y	M	M	Sp	G	M	Bl	S n	Se	Ns	Ln	P
JS 95-60	Pu	P	Y	A	-	D	Bl	E	Y	E	M	Sp	Dg	S	Br	Sn	Er	Ns	Ln	A
Co Soya 2	Pu	P	Y	A	-	D	Br	M	Y	M	M	Sp	Dg	M	Br	Dl	Se	Ns	Po	A
RKS 18	Pu	P	Y	A	-	D	Br	M	Y	M	M	Sp	Dg	M	Bl	Dl	Se	Ns	Po	A
RAUS 5	Pu	P	Y	A	-	D	Br	M	Y	M	M	Sp	Dg	M	Bl	Dl	Se	Ns	Po	A
JS 71-05	Pu	P	Y	A	-	D	Y /Br	E	Y	E	L	Sp	Dg	M	Bl	Sn	Er	Ns	Ro	A
JS 93-05	Pu	P	Y	A	-	Sd	Bl	E	Y	M/E	M	Sp	Dg	S	Bl	Sn	Se/Er	Ns	Ln	A
JS 335	Pu	P	Y	A	-	Sd	Br	M	Y	M	M	Sp	Dg	M	Bl	Sn	Se	Ns	Po	A
MAUS 71	Pu	P	Y	A	-	Sd	Br	M	Y	M	M	Sp	Dg	M	Bl	Sn	Se	Ns	Po	P
MAUS 81	Pu	P	Y	A	-	Sd	Br	M	Y	M	M	Sp	Dg	M	Bl	Dl	Se	Ns	Po	P
DS 228	Pu	P	Y	A	-	Sd	Br	M	Y	M	M	Sp	Dg	M	Br	Dl	Se	Ns	Po	A

Contd.

Table 2 *concluded*

Varieties	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
KB 79	Pu	P	Y	P	Gy	D	Br	M	Y	M	M	El	G	M	Br	Sn	Er	Ns	Po	P
NRC 7	Pu	P	Y	P	Gy	D	Y	E	Y	E	L	Sp	Dg	S	Bl	Sn	Er	Ns	Po	A
VL Soya2	Pu	P	Y	P	Gy	D	Y	M	Y	M	L	Sp	Dg	S	Br	Sn	Se	Ns	Ro	A
Indira Soya 9	Pu	P	Y	P	Gy	Sd	Br	M	Y	Lt	M	Sp/El	G	M	Br	Sn	Se	Ns	Po	A
MAUS 32	Pu	P	Y	P	Gy	Sd	Br	M	Y	Lt	Sm	El	G	Tl	Br	Sn	Se	Ns	Po	P
PK 327	Pu	P	Y	P	Gy	Sd	Br	E	Y	M	M	Sp	G	M	Br	Sn	Se	Ns	Po	A
MAUS 61	Pu	P	Y	P	Gy	Sd	Y	M	Y	Lt	M	Sp	G	Tl	Br	Dl	Se	Ns	Po	A
TYPE 49	Pu	P	Y	P	Gy	Sd	Y	Lt	Y	Lt	M	El	G	Tl	Br	Sn	Se	Ns	Po	P
MAUS 47	Pu	P	Y	P	T	D	Bl	E	Y	M	M	Sp	G	M	Br	Sn	Se	St	Po	P
Monetta	Pu	P	Y	P	T	D	Bl	E	Y	M	M	Sp	G	M	Br	Sn	Se	St	Po	P
JS 2	Pu	P	Y	P	T	D	Br	E	Y	M	L	El	Dg	S	Br	Sn	Er	St	Po	A
Palam Soya	Pu	P	Y	P	T	D	Br	E	Y	M	L	Sp	G	S	Br	Sn	Se	St	Po	A
PRS 1	Pu	P	Y	P	T	D	Br	E	Y	E	L	El	G	S	Y	Dl	Er	St	Ro	P
NRC 12	Pu	P	Y	P	T	D	Br	M	Y	E	L	Sp	G	M	Bl	Sn	Er	Ns	Po	A
PS 1092	Pu	P	Y	P	T	D	Br	M	Y	E	M	Sp	Dg	S	Bl	Sn	Er	Ns	Po	P
PUSA 40	Pu	P	Y	P	T	D	Br	M	Y	M	Sm	Sp	G	M	Br	Sn	Se	Ns	Po	P
ADT 1	Pu	P	Y	P	T	Sd	Bl	Lt	Y	Lt	Sm	Sp	G	Tl	Br	Sn	Se	St	Po	P
Co 1	Pu	P	Y	P	T	Sd	Bl	Lt	Y	Lt	Sm	Sp	G	Tl	Br	Sn	Se	St	Po	P
Co Soya 3	Pu	P	Y	P	T	Sd	Bl	M	Y	Lt	Sm	Sp	G	Tl	Br	Dl	Se	St	Po	P
Gaurav	Pu	P	Y	P	T	Sd	Bl	M	Y	M	Sm	Sp	G	M	Br	Sn	Se	St	Po	A
Gujarat Soybean 2	Pu	P	Y	P	T	Sd	Bl	M	Y	M	Sm	El	G	Tl	Br	Dl	Se	Ns	Po	A
Shilajeet	Pu	P	Y	P	T	Sd	Br	E	Y	M	L	El	Dg	M	Br	Sn	Se	Ns	Po	A
VL Soya 59	Pu	P	Y	P	T	Sd	Br	E	Y	M	L	El	Dg	S	Br	Sn	Se	Ns	Po	A
VL Soya 63	Pu	P	Y	P	T	Sd	Br	E	Y	M	L	Sp	Dg	S	Br	Sn	Se	Ns	Po	A
MACS 13	Pu	P	Y	P	T	Sd	Br	M	Y	Lt	M	El	G	M	Bl	Sn	Se	Ns	Po	A
MAUS 61-2	Pu	P	Y	P	T	Sd	Br	M	Y	Lt	M	El	Dg	Tl	Br	Dl	Se	Ns	Po	A
MACS 57	Pu	P	Y	P	T	Sd	Br	M	Y	M	M	El	G	M	Br	Sn	Se	Ns	Po	A
PUSA 16	Pu	P	Y	P	T	Sd	Br	M	Y	M	M	El	G	M	Br	Sn	Se	Ns	Po	A
Gujarat Soybean 1	Pu	P	Y	P	T	Sd	Br	M	Y	M	Sm	Sp	G	M	Br	Sn	Se	St	Po	A
Punjab 1	Pu	P	Y	P	T	Sd	Br	M	Y	M	Sm	Sp	G	M	Br	Sn	Se/Er	St	Po	A
PUSA 22	Pu	P	Y	P	T	Sd	Br	M	Y	M	M	Sp	G	M	Br	Sn	Se	Ns	Po	A
TAMS 98-21	Pu	P	Y	P	T	Sd	Br	M	Y	M	M	Sp	G	M	Br	Dl	Se	Ns	Po	A
Improved Pelican	Pu	P	Y	P	T	Sd	Br	M	Y	M	Sm	Sp	G	Tl	Br	Dl	Er	Ns	Po	A
KHSB 2	Pu	P	Y	P	T	Sd	Br	M	Y	Lt	M	El	G	M	Bl	Sn	Se	Ns	Po	P
MACS 124	Pu	P	Y	P	T	Sd	Br	M	Y	Lt	M	El	G	Tl	Br	Sn	Se	Ns	Po	P
LEE	Pu	P	Y	P	T	Sd	Br	M	Y	Lt	Sm	El	G	Tl	Bl	Dl	Se	Ns	Po	P
JS 80-21	Pu	P	Y	P	T	Sd	Br	M	Y	M	M	El	G	Tl	Br	Dl	Se	St	Po	P
MACS 58	Pu	P	Y	P	T	Sd	Br	M	Y	M	M	El	G	Tl	Br	Sn	Se	Ns	Po	P
JS 79-81	Pu	P	Y	P	T	Sd	Br	M	Y	M	M	Sp	G	M	Br	Sn	Se	Ns	Po	P
MACS 450	Pu	P	Y	P	T	Sd	Br	M	Y	M	M	Sp	G	M	Bl	Sn	Se	Ns	Po	P
SL 688	Pu	P	Y	P	T	Sd	Br	M	Y	M	Sm	Sp	G	M	Br	Dl	Se	Ns	Ro	A
JS 75-46	Pu	P	Y	P	T	Sd	Y	M	Y	M	M	Sp	G	M	Br	Sn	Se/Er	Ns	Po	P

1. Flower colour; 2. anthocyanin; 3. seed colour; 4. pod pubescence; 5. pod pubescence colour; 6. plant growth type; 7. pod colour; 8. days to maturity; 9. cotyledon colour; 10. days to 50% flowering; 11. seed size; 12. seed shape; 13. leaf colour; 14. plant: height (cm); 15. seed: hilum colour; 16. seed lusture; 17. plant: growth habit; 18. pod shattering; 19. leaf shape; 20. peroxidase activity.

A = Absent, Bl = black, Br = brown, D = determinate, Dg = dark-green, Dl = dull, E = early, El = elliptical, Er = erect, G = green, Gy = grey, L = large, Lt = late, Ln = lanceolate, M = medium, Ns = non-shattering, P = present, Po = pointed ovate, Pu = purple, Ro = rounded ovate, S = short, Sd = semi-determinate, Se = semi-erect, Sm = small, Sn = shiny, Sp = spherical, St = shattering, T = tawny, Tl = tall, W = white, Y = yellow, Yg = yellow-green

guidelines], among the white flowered group, varieties PK 262 and PS 1241 were indistinctive but it distinguished on the plant height and hilum colour and peroxidase activity. Varieties MAUS 2 and Shivalik were distinguished on the seed shape, hilum colour and lusture. The nine varieties, viz. Ankur, SL 525, Bragg, PK 471, Alankar, PS 564, PS 1029, NRC 2 and PK 416 forms a single major group but they are also distinguished on the other nine characters. Ankur is distinctive being short height and brown hilum from SL 525 which is medium height and black hilum. Bragg is being dark-green leaf and short height. PK 471 and Alankar is distinguished on the growth habit and peroxidase activity. PS 564 and PS 1029 were distinguished on the peroxidase activity. NRC 2 was spherical seed shape, grey hilum and shiny lusture while PK 416 elliptical seed shape, brown hilum and dull lusture. All the white flowered varieties had presence of pod pubescence and were distinctive from each other except the four varieties, viz. MAUS 1, PK 308, PUSA 20, and PUSA 37 which could not be distinguished on any of the twenty characters studied (Table 2).

Among purple flowered group, 10 varieties (viz. JS 95-60 Co Soya 2 RKS 18 RAUS 5 JS 71-05 JS 93-05 JS 335 MAUS 71 MAUS 81 and DS 228) were without pod pubescence, dark green leaf colour and absence of peroxidase activity in seed coat except MAUS 81. Five groups of two varieties, viz. RKS 18 and RAUS 5, JS 335 and MAUS 71, MAUS 47 and Monetta, ADT 1 and Co 1, MACS 57 and Pusa 16, Gujarat Soybean 1 and Punjab 1 could not be distinguished from each other and were alike on the basis of 20 characters. Other varieties such as MAUS 81 and DS 228 both were dull seed lusture but distinguished on the hilum colour and peroxidase activity. Shilajeet and VL Soya 59 were distinguished only on the plant height. JS 75 46 was distinctive being yellow pod colour and tawny pubescence. JS 95–60 had black pod colour and early maturity.

On the basis of leaf shape, two white flowered varieties (viz. PS 1024 and PS 1347) and four purple flowered varieties (viz. Kalitur, JS 90-41, JS 95-60 and JS 93-05) were observed with lanceolate leaf shape. The variation in hilum colour was observed by the earlier workers in certain varieties. Yadav and Sharma (2001) also reported variation in hilum colour in JS 80-21 (50.6%), PK 327 (11.8%) and Pusa 40 (9.5%). However hilum colour was stable for varieties with staunch black (JS 72-44, JS 72-280, MACS 13, PK 1029, PUSA 20 and PUSA 24) and brown (JS 75-46, PK 262, PK 308 and MACS 124). These variations probably associated with light intensity, temperature, drought, disease injury, and other environmental factors (Yadav and Sharma 2001). Such types of variations are obvious since this crop is photosensitive.

All white flowered varieties were resistant to pod shattering except LSb 1; however among purple flowered varieties, total 13 varieties (viz. Kalitur, MAUS 47, Monetta, JS 2, Palam Soya, PRS 1, ADT 1, Co 1, Co Soya 3, Gaurav, Gujarat Soybean 1, Punjab 1 and JS 80-21) were of pod shattering habit.

Studies on quantitative characters have earlier been made by Karnwal and Singh (2009) and Ramteke *et al*. (2010). Maximum plant height (93.67 cm) was observed in variety Lee, while minimum (19.00 cm) in variety LSb 1. Karnwal and Singh (2009) recorded the span of 66.25–110.75 cm for soybean genotypes. Data on 100-seed weight among varieties varied from 8.00 g to 15.33 g. VLS 47 recorded the most delayed flowering (57.33 days) while it was recorded to be shortest with Palam soya (30.67 days). In contrast to days to flowering, the variety LSb 1 recorded earliest maturity (82.66) and Co 1 matured at the last (107.0 days). In soybean eight loci with two alleles at each locus have been reported to control time to flowering and maturity through their response to photoperiod and should more accurately be referred to as photoperiod-sensitive loci (Cober and Morrison 2010).

It is concluded that out of 92 soybean varieties, 42 varieties were found to be distinctive on the basis of 11 essential characters. Remaining 50 varieties can be classified into 19 groups. However, 13 of these groups were distinct from each other on the basis of other remaining nine characters. But one group (four varieties, viz. MAUS 1, PK 308, PUSA 20, and PUSA 37) belonging white flowered and five groups (10 varieties, viz. RKS 18 and RAUS 5, MAUS 47 and Monetta, ADT 1 and Co 1, MACS 57 and PUSA 16, Gujarat Soybean 1 and Punjab 1) belonging purple flowered could not be differentiated being similar characters. It is suggested while identifying the variety, all traits *in toto* should be taken in to consideration. Furthermore, use of other biochemical markers/ DNA finger printing to be used. The study will be useful for breeders/researchers/ farmers to identify soybean varieties and to seek protection under Protection of Plant Varieties and Farmers Rights Act.

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