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Short Communication

GENETIC DIVERGENCE IN SOYBEAN (*GLYCINE MAX.* L) EVALUATED UNDER HIGH ALTITUDE CONDITIONS

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In view of the importance of soybean in the hilly areas, the germplasm lines have been collected from various parts of the world for breeding programme. Since no information is available in this crop for high altitude region, an attempt has been made to study the genetic diversity for yield and its contributing characters.

Twenty seven accessions were collected and grown at Defence Agricultural Research Laboratory, Field Station, Auli (Joshimath) during 1990-91. Auli is situated at an altitude of 2700 m above msl in central Himalayas. The germplasm included collections from Myanmar, China, England, Germany, Hungary, India, Italy, Korea, Nepal, Turkey, USA and erstwhile USSR. The field experiment was conducted in a randomized complete block design with 3 replications. Each plot consisted of two rows of 3 m length and spacing between rows was 45 cm. Plant to plant distance was maintained at 10 cm. Five competitive plants were selected from each genotype in each replication to record the observations on days to 50 per cent flowering, maturity days, plant height, number of primary branches, size of leaves, pod length, pods per plant, seeds per pod, 100 seed weight and seed yield per plant. Genetic divergence was assessed using Mahalanobis D^2 statistics (Mahalanobis, 1949) and the material was grouped into clusters according to Tocher's method (Rao, 1952).

Analysis of variance of means revealed significant variation amongst the genotypes for all the characters. The coefficient of variation for yield per plant and number of pods per plant revealed that two traits were highly variable.

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Based on D^2 values the germplasm was classified into 8 clusters, as follows :

Cluster I : Bragg (USA), Lee (USA), Pickely (USA), Monetta (USA), Hood (USA), PLSO-41 (Himachal Pradesh), PLSO-42 (Himachal Pradesh), IC 9445 (Sikkim), IC 7840 (Himachal Pradesh), UPSM-120 (Dehradun)

Cluster II : EC 25737 (USSR), EC 36896 (Taiwan), EC 36819 (Taiwan), EC 18126 (Nepal), EC 18596 (Nepal), EC 18533 (Nepal)

Cluster III : EC 34101 (Hungary), EC 34098 (Hungary), EC 32573 (England)

Cluster IV : EC 34344 (Germany), EC 34348 (Germany), EC 33776 (Italy)

Cluster V : PI-172-902 (Turkey)

Cluster VI : PI-123-440 (Myannar)

Cluster VII : PI-60273 (China), PI-90481 (China)

Cluster VIII : PI-60269 (Korea)

The average intercluster distance values ranged from 10.4 to 21.7 (Table 1). The maximum distance (D = 21.7) existed between Cluster V and VII. The second largest distance (D = 20.5) existed between Cluster V and VI. Intracluster distances were smaller than the intercluster distances as greater similarity existed within the clusters. D^2 values revealed that intracluster divergence was maximum for Cluster I (10.8) which included 10 genotypes and accounted for 37 per cent of total germplasm and 23 per cent of exotic lines.

Table 1 : Inter and intra cluster values in soybean

Clusters	I	II	III	IV	V	VI	VII	VIII
I	10.8	11.2	12.9	14.1	15.8	15.0	14.7	15.7
II		10.7	11.9	13.2	17.1	15.9	15.8	15.6
III			9.7	16.5	18.0	14.0	18.7	15.0
IV				9.5	15.3	10.4	19.3	16.4
V					0	20.5	21.7	16.6
VI						0	15.5	17.8
VII							1	17.7
VIII								0

Cluster means showed appreciable variation among the 8 clusters grouped according to D^2 analysis (Table 2). The differences among cluster means, though observed for all characters, were more pronounced for plant height, size of leaves, pods per plant, seed weight and seed yield. The Cluster VI showed the highest mean seed weight. The genotypes in Cluster IV had highest number of pods per plant but were in medium long maturity duration.

Table 2 : Cluster mean for different clusters in soybean

Characters	Clusters							
	I	II	III	IV	V	VI	VII	VIII
Days to 50% flowering	61.97	61.87	66.66	58.58	58.00	56.50	63.75	63.50
Maturity (days)	120.45	118.30	124.08	116.41	112.50	121.25	119.87	124.50
Plant height (cm)	75.50	58.68	61.42	55.56	46.50	85.09	110.47	72.05
No. of primary branches	6.62	7.22	8.33	6.96	7.95	8.00	5.97	6.84
Size of leaves (cm^2)	75.32	58.31	74.44	63.30	85.60	74.58	64.64	52.38
Pod length (cm)	4.41	4.49	4.37	4.25	4.50	4.79	4.63	4.40
Pods per plant	60.04	63.08	97.07	105.78	83.84	91.15	51.60	74.50
Seeds per pod	2.07	2.73	2.90	2.65	2.90	2.85	3.55	3.00
100 seed weight (g)	12.99	13.71	12.92	14.66	10.50	15.75	10.38	8.25
Yield per plant (g)	20.20	31.77	22.75	37.04	21.90	45.80	13.88	13.80

The utility of classifying germplasm for selection of diverse parents for hybridization has long been appreciated (Bhatt, 1970). The genotypes grouped in Cluster V and VII followed by IV and VII were widest apart and were of short duration, tall, having broader leaf size, bold seed and high yield. Obviously, the crosses between genotypes of these clusters might be useful for fixing transgressive segregants. However, selection of more than one genotype from large clusters may pose specific problem. Apart from high genetic divergence, the performance of genotypes for characters such as number of pods per plant and seed weight should be considered prior to their inclusion in breeding programme. The genotypes EC 34344, EC 33776, PI 172-902 and PI 60273 appeared to be desirable for further soybean improvement programme. Inclusion of these parents in crossing programme is expected to prove rewarding.

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