SHORT COMMUNICATION

Performance and Genetic Diversity Pattern in the Landraces of *Allium cepa* L.

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Performance and diversity pattern are very much important to applied crop breeding, because diversity may reduce vulnerability to pests and at the same time accelerate breeding progress for agronomic trait such as yield. The continuing use of diverse landraces and exotic modern cultivars as parental stock in recent decades has been associated with improved yield and pest resistance in many vegetable crops. A study was undertaken to understand the potentiality of the landraces in terms of yield and the diversity pattern existing in the population. The results of this experiment are presented here.

A total of 114 germplasm accessions collected from various parts of country along with check variety B-780 have been evaluated for their performance and their diversity pattern at Rajgurunagar farm in *kharif* season of the year 2004. All the genotypes were grown in randomized block design with 3 replications in $1m^2$ plots. The data was generated from five competitive plants for various characters *viz.* plant height (PH), no. of leaves (NL), collar thickness (CT), 5 bulb weight (5BW), neck thickness (NT), polar diameter (PD), Equatorial diameter (ED), weight of 'A' grade bulbs (Wt. 'A') weight of 'B'grade bulbs (Wt. 'B') weight of 'C' grade bulbs (Wt. 'C'), total soluble solids (TSS), total yield (TY), marketable yield (MY). Analysis of variance (Table 1) was calculated and non-hierarchical Euclidian Cluster Analysis was performed on the original data of thirteen characters to assess the distinctness of the gene pool through multivariate analysis. The components were utilized for grouping of the genotypes as described by Beale (1969) and elaborated by Spark (1973).

The results indicated that all the characters showed significant differences among the genotypes tested. Variation displayed by thirteen characters in terms of range, mean, SEm, CV and number of superior genotypes in each attribute were presented in Table 2.

The results indicated that the range was maximum in total yield (0.79-4.49 kg), marketable yield (0.75-4.40 kg), TSS (9.33-13.96%) and plant height (31.67-60.82 cm). Further, the variation displayed in 5 bulb weight (0.17-0.36 kg), weight of 'C' grade bulbs (0.14-0.83 kg) is minimal. On perusal of results presented in the table, the study helped to identify 47 genotypes for total yield, 50 for marketable yield, 53 for TSS, 43 for 'A' grade bulbs, 56 for neck thickness, 60 for 5 bulb weight, 56 for number of leaves and 54 for plant height as superior genotypes among 114 lines tested in kharif season.

On perusal of mean data, the top 15 germplasm lines (in descending order) performing superior in marketable yield, total yield, 5 bulb weight, TSS, equatorial diameter, polar diameter, neck thickness and earliness are presented in Table 3. The results indicated that the germplasm lines NRCOG-1012, B-780, NRCOG-85, 975, 1000, 938, 893, 1009, N-53, 985, K-519-R and K-923 were promising both in the marketable and total yield. The accession NRCOG-925, 1033, 985, 998, and 1032 were found superior for 5-bulb weight, whereas NRCOG-966, 879, 924, 923, 953 recorded minimum

Table 1. Analysis of variance for 13 attributes in 115 landraces of onion

Source	df	Mean sum of squares												
		PH	NL	CT	5 BW	NT	PD	ED	Wt. 'A'	Wt. 'B'	Wt. 'C'	TSS	TY	My
Replication	2	1421.09	7.84	0.29	0.004	0.003	1.38	0.08	1.39	0.48	0.11	0.88	4.13	3.04
Treatment	113	91.94**	2.99**	0.04**	0.004**	0.02**	0.28**	0.32**	0.50**	0.30**	0.05**	2.26**	1.43**	1.42**
Error	226	42.79	1.53	0.02	0.002	0.01	0.15	0.13	0.20	0.09	0.03	0.91	0.40	0.41

*and ** indicates significant at 5% and 1% level of probability

Table 2. Phenotypic variations in 13 characters

Characters	Range	Mean	SE (±)	CV (%)	No. of superior genotypes
Plant height (cm)	31.67–60.82	45.15	0.44	14.48	54
No.of leaves	5.60–10.40	8.10	0.07	15.29	56
Collar thickness (cm)	0.62–1.28	0.91	0.009	16.55	–
5 bulb weight (kg)	0.17–0.36	0.27	0.003	16.48	60
Neck thickness (cm)	0.26–0.70	0.42	0.007	25.71	56
Polar diameter (cm)	2.38–4.55	3.73	0.02	10.51	–
Equatorial diameter (cm)	2.32–5.40	4.70	0.02	7.77	–
Weight of 'A' grade bulbs (kg)	0.15–2.20	0.75	0.03	60.29	43
Weight of 'B' grade bulbs (kg)	0.29–2.20	0.92	0.02	32.48	–
Weight of 'C' grade bulbs (kg)	0.14–0.83	0.38	0.01	50.38	–
TSS (%)	9.33–13.96	11.24	0.06	8.51	53
Marketable yield (kg)	0.75–4.40	2.83	0.04	22.47	50
Total yield (kg)	**0.79–4.49**	**2.93**	**0.04**	**21.99**	**47**

thickness. The variety B-780 continued to prove superior in terms of yield and growth attributes. However, NRCOG-1012 (44.9 t/ha) showed supremacy in yield with moderate resistant reaction against thrips followed by B-780, NRCOG-85, NRCOG-1009 and NRCOG-975.

Diversity Pattern

A wide genetic base with acceptable level of productivity and high general combining ability to yield superior segregants are essential in the parental selection. Selection of parents in onion has been on the basis of per se performance. The majority of the breeders have restricted their selection to known material and made intensive effort for local adaptation, as a result of which certain gene blocks were rapidly fixed along with correlated response, which in many cases has been in the adverse direction. Keeping in view, the data collected from the experiment of entire 115 landraces of onion were subjected to multivariate analysis. The classificatory procedures for earmarking distant genotypes have been emphasized by several workers (Griffing and Lindstorm, 1954; Moll *et al.*, 1962; Arunachalam, 1981).

Table 3. Performance of top 15 genotypes in terms of yield and its related characters

Acc no.	MY (t/ha)	Acc No.	TY (t/ha)	Acc. No.	5BW (g)	Acc. No.	TSS (%)	Acc. No.	ED (cm)	Acc. No.	PD (cm)	Acc. No.	NT (cm)	Acc. No.	Earliness
1012	44.00	1012	44.90	925	0.36	AK	14	914	5.40	1004	4.55	966	0.24	933	96
B-780 (c)	43.40	B-780 (c)	44.20	1033	0.36	MH-20 LR	13.1	991	5.24	914	4.28	879	0.26	930	96
85	42.50	85	42.50	998	0.35	905	12.93	72-1-R	5.22	925	4.27	924	0.28	923	98
975	39.80	1009	41.00	1032	0.34	991	12.86	1033	5.21	1009	4.26	923	0.29	948	98
1000	39.10	975	39.90	985	0.34	915	12.82	915	5.20	954	4.26	958	0.30	927	98
938	38.90	1000	39.50	ADR (c)	0.34	1003	12.73	85	5.20	1001	4.22	1036	0.30	914	98
893	38.90	72-1-R	39.20	918	0.33	998	12.66	1009	5.19	991	4.21	904	0.30	910	98
1009	38.50	893	38.90	973	0.33	914	12.47	ADR (c)	5.16	1033	4.17	696	0.31	971	98
N-53 (c)	38.20	938	38.90	AK	0.32	B-780 (c)	12.46	K-513-5C	5.12	986	4.16	N-53 (c)	0.31	917	99.33
939	37.30	K-519-R	39.60	940	0.32	999	12.46	AK	5.05	988	4.14	888	0.32	955	99.33
1001	36.80	N-53 (c)	38.50	B-780 (c)	0.32	918	12.34	918	5.03	976	4.13	976	0.33	952	99.33
985	36.40	985	38.20	K-513-5C	0.31	995	12.33	B-780 (c)	5.02	1000	4.12	1000	0.33	954	99.33
980	36.40	950	37.80	975	0.31	121 DR	12.33	940	5.00	999	4.12	964	0.33	998	99.33
AK	36.30	1001	37.40	1015	0.31	888	12.29	925	4.98	1006	4.08	925	0.34	919	99.33
K-519-R	36.10	939	37.20	952	0.31	889	12.28	917	4.97	K-519-R	4.06	927	0.34	944	99.33
911	35.60	973	37.10	N-53 (c)	0.31	1012	12.26	973	4.96	N-53 (c)	3.82	52	0.34	N-53 (c)	102
923	35.20	923	36.70	991	0.31	N-53 (c)	10.26	N-53 (c)	4.93	B-780 (c)	3.98	B-780 (c)	0.66	B-780 (c)	106
ADR (c)	35.10	ADR (c)	35.10	–	0.20	ADR (c)	10.13	–	5.10	ADR (c)	4.00	ADR (c)	0.36	ADR (c)	100.66
GM		28.23		29.38		0.27		11.24		4.70		3.73		0.42	99.10

Table 4. Distribution of 115 landraces of onion in different clusters

Cluster Number	No. of landraces in each cluster	Landraces in each cluster
I	22	NRCOG-048, 993, K-513-5C, 910, 889, 905, 940, 1016, 953, 1033, 918, 995, 915, 988, 999, 991, 998, 1003, Arka Kalyan, 121-DR, MH-20-LR, 981
II	2	NRCOG-696, 879
III	18	NRCOG-064, 966, 946, 956, 954, 924, 1020, 958, 972, 949, 934, 1008, 960, 941, 970, 919, 996, 1021.
IV	15	NRCOG-922, 974, 930, 971, 943, 931, 942, 964, 932, 944, 1010, 1022, 961, 975, 1036
V	1	NRCOG-1037
VI	12	NRCOG-891, 907, 1035, 955, 1019, 906, 950, 893, 945, 938, 939, 1025
VII	8	NRCOG-904, 948, 888, 911, 917,903, 914, 72-1-R
VIII	8	NRCOG-987, 990, 986, Behary Red, 1009, 1012, 085, B-780
IX	28	NRCOG-901, 976, 983, 992, 1015, 1032, 925, 1001, 1004, 1006, 994, 1005, 72-1-DR, 26-OP-DR, 900, K-519-R, 909, 937, 933, 921, 952, 973, 985, 923, N-53, 927, 1000, 980
X	1	Agri Found Dark Red

A total of 6555 D^2 values corresponding to all the 115 possible pairs of entries were computed as per the method suggested by Rao (1952). A total of 10 clusters were formed with number of landraces in each cluster from 1(cluster X) to 22 (cluster I). The distribution of 115 landraces of onion in different clusters was presented in Table 4.

The results indicated that cluster IX (28) had maximum number of genotypes followed by cluster I (22), cluster III (18) and cluster IV (15). The variety Agri Found Dark Red and NRCOG-1037 fell in separate clusters. A combination of 8 entries of high yielding lines along with B-780 and Behary red fell in cluster VIII. Further, these results revealed that, there was no specific relationship between the clustering pattern of the genotypes and their geographic sources. The tendency of the cultivars occurring in clusters was cutting across geographic diversity revealed that the pattern or distribution of genotypes from different geographical locations into different clusters was at random, demonstrating the geographical isolation may not be the only factor for causing genetic diversity. These results are in conformity with the findings of Krishna Prasad (1995) in bush bean and Krishna Prasad *et al.* (1993) in cucumber. Further, the results suggested that geographic isolation is not the only factor causing genetic diversity and this point should be considered while selecting parents for hybridization programme.

Table 5. Contribution of characters towards genetic divergence of the onion germplasm analyzed in the study

Character	Times ranked 1st	Contribution (%)
Plant height	553	8.44
No. of leaves	360	5.49
Collar thickness	540	8.24
5 bulb weight	422	6.44
Neck thickness	542	8.27
Polar diameter	427	6.51
Equatorial diameter	343	5.23
Weight of 'A' grade bulbs	447	6.82
Weight of 'B' grade bulbs	853	13.01
Weight of 'C' grade bulbs	372	5.68
TSS	860	13.12
Marketable yield	637	9.72
Total yield	199	3.04

The selection of parents on large phenotypic differences may be useful but there are several instances where a single gene can provide large-scale differences in plant height, maturity and disease resistance. Therefore measures of quantifying diversity have become important in classifying the material commonly used by the breeders.

On perusal of results (Table 5) weight of 'B' grade bulbs and TSS appeared to contribute maximum towards divergence followed by marketable yield, plant height, and neck thickness.

The cluster mean per plot yield was maximum in cluster IX, followed by cluster VIII, VII and VI. Minimum yield was observed in cluster II. Only five clusters recorded above mean values both in marketable yield and total yield (Table 6). The divergent lines with high yield potential and some degree of resistance to disease will be identified for formulating the breeding programme.

Hundred and fourteen accessions of onion were

Table 6. Cluster means for 13 attributes of 115 landraces of short day onion

Clusters	PH (cm)	NL (cm)	CT	5 B Wt (kg)	NT (cm)	PD (cm)	ED (cm)	Wt 'A' (kg)	Wt 'B' (kg)	Wt 'C' (kg)	TSS %	MY (kg)	TY
I	45.27	8.11	0.89	0.29	0.48	3.69	4.83	0.73	0.89	0.40	12.25	2.67	2.79
II	38.83	6.46	0.71	0.27	0.28	3.57	4.27	0.86	0.22	0.18	11.93	0.78	0.83
III	41.54	7.92	0.85	0.25	0.39	3.55	4.57	0.43	0.56	0.30	10.74	2.11	2.27
IV	41.08	7.28	0.84	0.24	0.37	3.66	4.59	0.54	0.86	0.53	10.53	2.61	2.72
V	49.80	8.60	1.00	0.17	0.35	3.60	2.32	0.17	0.47	0.54	9.73	2.53	2.73
VI	48.34	8.93	1.00	0.27	0.41	3.54	4.67	0.59	0.91	0.28	11.15	3.16	3.25
VII	50.58	8.55	0.89	0.25	0.40	3.80	4.93	0.85	0.93	0.31	11.83	3.19	3.32
VIII	52.21	9.20	1.10	0.27	0.65	3.97	4.85	1.08	1.14	0.35	11.43	3.28	3.37
IX	44.83	7.93	0.93	0.29	0.40	3.92	4.76	1.05	1.22	0.39	11.00	3.29	3.40
X	47.50	8.06	0.82	0.34	0.36	4.00	5.16	0.90	1.07	0.41	10.13	3.51	2.51
Mean	45.99	8.10	0.90	0.26	0.40	3.73	4.49	0.72	0.82	0.36	11.07	2.71	2.71

evaluated for genetic diversity. The accessions were grouped in ten clusters. Cluster IX had maximum of 28 accessions followed by cluster I (22) and cluster II (18). The tendency of the cultivars occurring in clusters was cutting across geographic diversity revealed that geographic isolation may not be the only factor for causing genetic diversity. Therefore selection of parents possessing large phenotypic variability and from divergent clusters will be useful in onion improvement.

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