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GENETIC DIVERGENCE IN DIPLOID VARIETIES OF SUGARBEET

Pooja Nath, H.M. Srivastava and Rajesh Kumar

Division of Crop Improvement,
Indian Institute of Sugarcane Research (ICAR),
Lucknow 226 002 (Uttar Pradesh)

Eighteen diploid varieties of sugarbeet (*Beta vulgaris*, L.) were evaluated under subtropical climate of Lucknow. Data on five important economic attributes was recorded to study genetic divergence among these genotypes. Clustering of genotypes was done on the basis of Mahalanobis D^2 analysis. This study indicated that genetic divergence and geographical diversity were not related. Contribution of individual character towards genetic divergence showed that root yield and survival of roots contributed more than 30% towards total divergence. Usefulness of the above information in sugarbeet breeding programme for subtropical India has been described and discussed in this paper.

Key words : Genetic divergence, Sugarbeet, Varieties, clusters

Sugarbeet (*Beta vulgaris*, L) is being cultivated in India since more than last two decades as a supplementary sugar crop for sugar production. Sugarbeet is generally sown in India in October-November and the root crop is harvested in April-May when the temperatures are high and range between 35-45°C (Srivastava 1995). Most of the varieties under commercial cultivation in India are exotic, therefore, in order to develop our own varieties and breeding material, D^2 analysis (Mahalanobis, 1928, 1949) was undertaken to study genetic divergence in a set of diploid varieties of sugarbeet to identify (i) diverse diploid sugarbeet genotypes, (ii) select suitable genotype for future programmes for subtropical Indian conditions.

MATERIALS AND METHODS

The experimental material comprised of 18 diploid genotypes of sugarbeet from different countries (Table 1). A trial was conducted in randomized block design with three replications at the experimental farm of Indian Institute of Sugarcane Research, Lucknow. Row to row distance was kept at 50 m and final plant to plant distance was kept at 20 cms. The crop was raised by adopting standard cultural practices and recommended fertilizer of 120 Kg, N, 80 kg P_2O_5 and 80 kg K_2O was given. Root crop was harvested in May

Table 1. Mean values for five economic attributes in different varieties of sugarbeet

S.No.	Varieties	Genetic Constitution	Origin	Root yield (t/ha)	Sucrose %	Recovery %	Recoverable sugar (t/ha)	Survival of roots %
1.	IISR Comp-1	Comp.	India	52.0*	15.6	14.5	12.5	81.5
2.	LKC-2	Comp.	"	52.7*	14.7	13.4	12.0	74.2
3.	IISR-2	Open Poll.	"	36.0	14.6	13.2	7.8	76.5
4.	LS-6	"	"	35.3	14.6	12.6	7.4	68.8
5.	LS-7	"	"	38.0	15.3	13.4	8.8	75.3
6.	AJ-3	"	Poland	36.0	16.3	15.4	9.1	78.7
7.	AJ-4	"	"	38.0	15.0	12.9	8.1	61.2
8.	Brasov	"	Romalia	35.3	15.0	13.6	8.0	83.0
9.	Stupinizm	Diploid hybrid	U.K	34.0	15.3	13.9	8.0	61.6
10.	2F XX 77	Open Poll.	"	43.3	13.3	12.2	8.8	73.8
11.	Sharpes Klein E	"	"	41.3	14.5	12.6	8.7	73.9
12.	OPH	"	Sweden	33.3	15.0	10.8	9.7	53.2
13.	Dobrogica-C	"	Chekoslovakia	35.3	15.6	14.1	8.3	73.41
14.	V-25	"	USSR	34.7	15.3	13.2	7.5	80.5
15.	US-75	"	USA	25.7	14.9	13.2	5.6	82.5
16.	RK(RH)	"	Indian sel	34.0	14.7	13.6	7.7	72.3
17.	RK(GH)	"	"	38.7	14.7	13.5	8.8	76.8
18.	Ramonskaya-06	"	USSR	47.3	15.3	12.7	10.0	84.7
	General Mean			38.3	15.0	13.3	8.7	74.0
	CD at 5%			11.2	1.6	3.4	2.9	28.7

*Significant superior over General Mean.

to record observations on root yield, sucrose, and survival of roots. Ten roots per variety were taken randomly from each replication for sucrose determination by Sachs le docte method. Na, K and α amino nitrogen content in beet roots was determined by Curruthers and Oldfield (1961) method to find out purity and recovery percent. Recoverable sugar was calculated by multiplying root yield with recovery. Genetic divergence was determined using Mahalanobis D^2 statistics (Mahalanobis, 1928, 1949) and the genotypes were grouped into clusters according to Tochers method (Rao, 1952).

RESULTS AND DISCUSSION

Data for mean and range of variation for five economic characters are presented in Table 1. There were significant differences among varieties for all the five attributes.

Based on D^2 value the genotypes were grouped into 8 clusters (Table 2). Cluster I has maximum number of nine genotypes. Cluster II and III had 2 genotypes each and the rest of the clusters had one genotype each. The pattern of clustering demonstrated that the geographical origin of these genotypes is not related to genetic diversity as genotypes originating from same geographic area were distributed in different clusters and many genotypes of different geographical origin were grouped into same cluster (Table 2). Similar results have been reported by Srivastava (1996) in sugarbeet and by Suthmarthi and Stephan Dorairaj (1994) in Napier grass. The cluster mean for the five economic characters presented in table 3 revealed that cluster III represented by two composites IIST Comp 1 and LKC-2 developed at IISR, Lucknow, recorded maximum root yield and recoverable sugar t/ha followed by cluster VII (Ramonskaya-06). Cluster VI recorded highest sucrose and recovery (percent) in May harvested crop. Cluster VII represented by released variety Ramonskaya-06 recorded highest survival of roots. This is quite interesting observation because Ramonskaya-06 though originally of Russian origin is being cultivated in India since long and so has adopted itself to our conditions. Data for other economic attributes in this cluster were in general on higher side. Such clustering pattern could be utilized for cross combination likely to generate highest possible variability for various economic characters (Endang *et al.* 1977).

Table 2. Clustering of 18 sugarbeet genotypes on the basis of genetic divergence

Clusters	No. of Genotypes	Names of Genotypes
I	9	Brasov(Romania), V-25 (USSR), LS-7 (India), RK(GH) (Indian Sel.), IISR-2 (India), Doborovicka-C (Chezoslovakia), Sharpes Klein-E(U.K)., RK(RH) (Indian sel.), LS-6 (India)
II	2	AJ-4 (Poland), Stupinizm (U.K.)
III	2	IIR Comp-1 (India), LKC-2 (India0
IV	1	OPH (Sweden)
V	1	US-75 (USA)
VI	1	AJ-3 (Poland)
VII	1	Ramonskaya-06 (USSR)
VIII	1	2F XX 77 (U.K.)

Table 3. Cluster Means for five economic characters studied for genetic divergence

Cluster	Genotype	Root yield (t/ha)	Sucrose %	Recovery %	Recoverable sugar (t/ha)	Survival of roots %
I	3, 4, 5, 8, 11, 13, 14, 16, 17	36.51	14.92	13.33	8.10	75.68
II	7, 9	36.00	15.13	13.42	8.04	61.41
III	1, 2	52.33	15.20	13.94	12.27	77.85
IV	12	33.33	15.00	10.83	9.89	53.20
V	15	25.67	14.93	13.20	5.65	82.59
VI	6	36.00	16.33	15.36	9.18	78.67
VII	18	47.33	15.30	12.70	10.01	84.72
VIII	10	43.33	13.33	12.17	8.80	73.82

Table 4. Average intra and intercluster D^2 values

Cluster	I	II	III	IV	V	VI	VII	VIII
I	2.55	5.82	18.99	6.80	7.60	8.71	12.61	8.25
II		1.42	28.55	10.44	13.48	13.79	32.30	10.44
III			4.42	23.94	43.05	15.22	18.11	23.04
IV				0.00	11.74	13.66	6.75	12.83
V					0.00	17.08	13.91	18.92
VI						0.00	6.33	25.88
VII							0.00	10.74
VIII								0.00

Intra and inter-cluster D^2 values are presented in Table 5. Intra cluster values ranged from 4.42 to 0.00. The highest intracluster value was recorded in cluster III (4.42) followed by cluster I (2.55) and cluster II (1.42). Inter cluster D^2 values range from 43.05 to 5.52. Highest inter-cluster D^2 values was observed between cluster III and V (43.05) which indicates that these clusters are highly divergent. The next higher D^2 value was observed between cluster II and VII (32.30). Minimum Inter cluster D^2 value was recorded between cluster I and II (1.42) which indicates close relationship between these two clusters.

Table 5. Contribution of each character to genetic divergence

Character	Root yield	Sucrose %	Recovery %	Recoverable sugar	Survival of roots	Total
No. of times appearing first in ranking	54	30	7	13	49	153
% contribution	35.29	19.60	4.50	8.40	32.00	99.79

The intercluster distance was higher than the intra-cluster distances in all the cases indicating more divergence of genotypes between the clusters. Gondane and Lal (1993) observed similar relationship in Okra. The highest intercluster distance was observed between cluster III and cluster V (6.56). Intercluster distances and their mutual relationship has been depicted in Fig. 1.

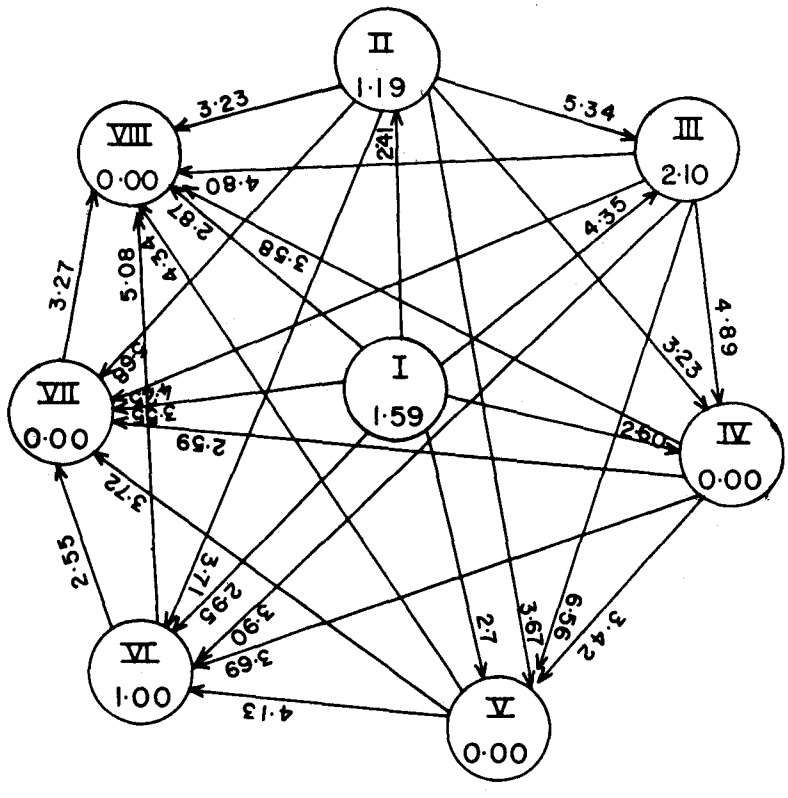

Fig. 1. Cluster diagram showing mutual relationship between different clusters of sugarbeet

Contribution of individual character towards divergence (Table 6) revealed that maximum contribution to total genetic divergence is recorded by root yield (35.29%) and survival of roots (32.0%) followed by sucrose, recoverable sugar and recovery in descending order.

These results also indicate that if we take one representative genotype from each cluster and make a diallel, then in the progeny we can get better heterotic effects and more variability in F_2 population which will be helpful in breeding programme for sub-tropical India.

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