GENETIC DIVERGENCE IN VARIOUS INDIGENOUS AND CROSSBRED DAIRY CATTLE

Divergence génétique dans des divers types bovins laitiers indigènes et croisés

Divergencia genética en varios tipos indígenas y cruzados de vacuno lechero

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Introduction

Crossbreeding with better developed breeds of European origin offers a much quicker method for increasing milk production in tropics. Indian Council of Agricultural Research has launched a large scale crossbreeding experiment using three exotic dairy breeds (Holstein Friesian, Brown-Swiss and Jersey) on six indigenous breeds are better than others with respect to dairy traits. It would therefore suggest that crosses produced from dams of such breeds would be better than others. In order to resolve this problem the data on three indigenous breeds viz.

Sahiwal, Hariana, Tharparkar and their crosses with Holstein have been studied, using discrinment function and multivariate approach considering simultaneously three important traits (age at first calving, first lactation yield and first calving interval) from dairy cattle breeding point of view.

Material and methods

Six genetic groups viz. three indigenous (Sahiwal, Hariana, Tharparkar) and 3 crossbred grades (1/2 Sahiwal × 1/2 Holstein, 1/2 Hariana × 1/2 Holstein and 1/2 Tharparkar × 1/2 Holstein) formed the material for this study.

To test the significance of differences in the mean values of three characters

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TABLE 1

AVERAGES WITH COEFFICIENT OF VARIABILITY FOR AGE AT FIRST CALVING, FIRST LACTATION YIELD AND FIRST CALVING INTERVAL FOR VARIOUS INDIGENOUS AND CROSSBRED GRADES

Grades	Age at first calving			First lactation yield			First calving interval		
	No. of obs.	Mean	C. V. (%)	No. of obs.	Mean	C. V. (%)	No. of obs.	Mean	C. V. (%)
1	267	1255	15.4	247	1597	30.7	219	460 *b*	26.6
2	114	1205	11.9	111	1098 *c*	38.0	83	393 *b*	15.4
3	25	1128 *a*	8.3	19	1287 *c*	38.8	18	436 *b*	27.2
4	45	1015 *b*	15.2	38	2213 *b*	24.7	35	425 *ab*	21.3
5	84	106 *ab*	12.5	77	2373 *ab*	20.7	75	452 *ab*	23.2
6	28	1006 *b*	9.8	17	2642 *a*	28.9	16	417	16.6

For grouping the means followed by the same latter in any one column do not differ significantly from each other ($p \leq 0.05$).
Grade 1 = Sahiwal.
Grade 2 = Hariana.
Grade 3 = Tharparkar.
Grade 4 = 1/2 Sahiwal × 1/2 Holstein.
Grade 5 = 1/2 Hariana × 1/2 Holstein.
Grade 6 = 1/2 Tharparkar × 1/2 Holstein.

Wilk's Λ criterion was used. The original mean values for three characters (X_1 to X_3) were transformed to uncorrelated variables (Y_1 to Y_3) by pivotal condensations method for 3×3 common dispersion matrix. Divergence was studied in these genetic groups by the method of multivariate analysis using Mahalnois in these genetic groups by the method of multivariate analysis using Mahalnobis D^2 and the relative contribution of each character to the divergence was estimated according to the procedure out lined by RAO (1952). D^2 values calculated from the uncorrelated variables were used to classify 6 genetic groups into clusters. Group constellations were derived using canonical analysis (RAO, 1952).

RESULTS AND DISCUSSION

Analysis of variance showed highly significant grade differences for the three characters under study. And idea about the average values and coefficient of variability can be had from the results presented in table 1. The coefficient of variability for age at first calving, first lactation yield and first calving interval across the 6 genetic groups ranged between 8 to 15, 21 to 39 and 15 to 27 percent, respectively. DUNCUN's multiple range test (DMRT) was applied to these averages to show the pattern of grouping of the 6 genetic groups. The results of DMRT revealed that the grouping pattern of the 6 genetic groups for the three traits was different.

The test of significance of differences in the mean values using Wilk's Λ criterion showed highly significant grade difference for the three characters taken together as one. This was quite expected as the grade effect for all the three characters was highly significant.

The range in uncorrelated mean values of characters between grades was very small. This was due to lesser variability in the characters used here for divergence study. These uncorrelated mean values were used for calculation of D^2 values.

The relative contribution of the three characters to divergence was estimated.

TABLE 2

MEAN VALUES OF THE TWO CANONICAL VARIATES

Grades	Z (1)	Z (2)
1	— 1.04	— 1.03
2	— 0.78	— 1.77
3	— 1.25	— 1.24
4	0.87	0.88
5	1.00	1.01
6	0.73	1.74

$\lambda_1 = 11.85$
$\lambda_2 = 0.73$
Sum of all canonical roots = 12.70
Contribution of canonical root (1) = 93.3 %
Contribution of canonical root (2) = 5.8 %

D^2 was ranked in decending order and the characters in the same order are: First calving interval 56 (44.44 %), age at first calving 44 (34.92 %) and first lactation yield 26 (20.63 %).

After the calculation of uncorrelated mean values, first twe canonical variates were estimated. The mean values of the first two canonical variates are detailed in table 2. The contribution of λ_1 and λ_2 was 11.85 and 0.73, respectively. The canonical roots λ_1 and λ_2 contributed a total of 12.58 which accounted for 93.3 % and 5.8 % of total variability. Since 99.1 % of the variability is explained by the first two roots, a two dimensional representation of the relative positions of grades is considered to be adequate in this case. The sum of all the canonical roots was 12.70. The graphical representation of λ_1 and λ_2 for the 6 grades has been made in Fig. 1. Clusters were made on the basis of closeness of distance and the 6 genetic groups were grouped into two clusters. Cluster I consisted of all the three indigenous breeds and cluster II consisted of 3 crossbred grades.

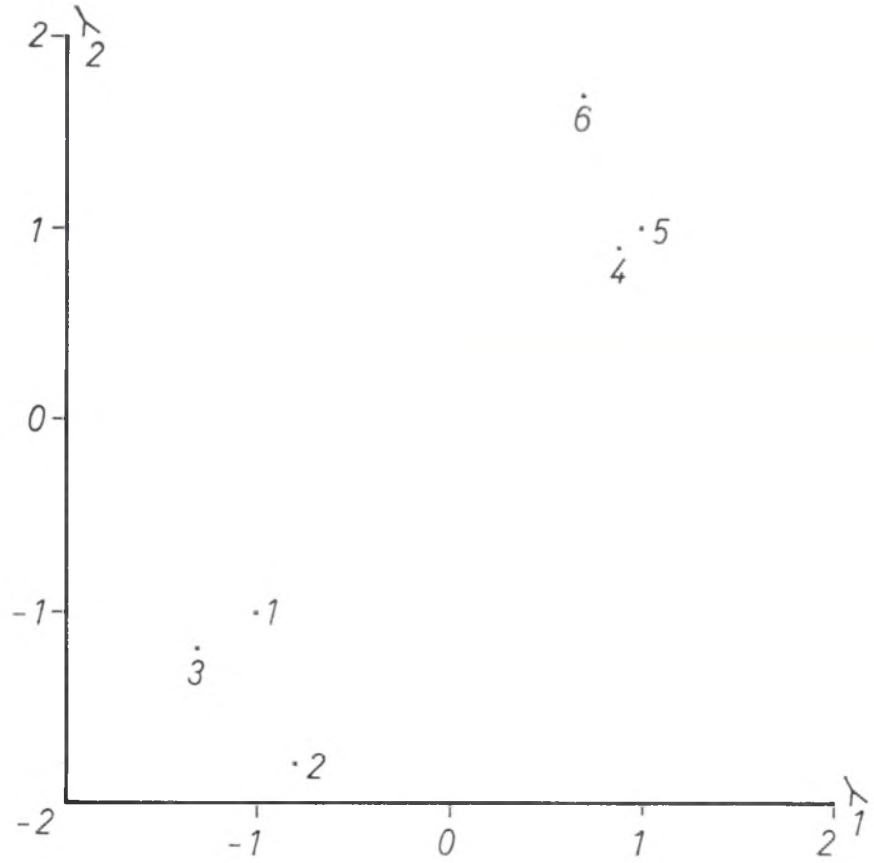

FIG. 1

The configuration of grades in the λ_1 λ_2 chart

The intracluster distance (D^2) in cluster I and II was 0.89 and 0.58 respectively, which was very small. The intercluster distance between the two was 7.11. The results in general, indicated that the distance between the indigenous and crossbreds was the maximum.

From the clustering pattern it can be concluded that the crossbreds irrespective of indigenous breed used were very close to each other.

SUMMARY

The degree of genetic divergence (D^2 statistic) between six grades (3 indigenous and 3 crossbreds) was examined in relation to 3 characters namely age at first calving, first lactation yield and first calving interval. 6 grades were grouped into two cluster. Cluster I consisted of three indigenous breeds while the cluster II had 3 crossbred grades.

RESUME

On révise le degré de divergence génétique (statistique D^2) entre six ordres (trois indigènes et trois races croisées) par rapport à trois caractères: âge du premier accouchement, première production de lait, et premier intervalle inter-accouchement. On groupa ces ordres en deux groupes, en étant formé le premier par les trois races indigènes, et la deuxièmes par les trois races croisées.

RESUMEN

Se examina el grado de divergencia genética (estadística D^2) entre seis órdenes (tres indígenas y tres razas cruzadas) con relación a tres caracteres, a saber: edad al primer parto, primera producción de leche y primer intervalo inter-parto. Se agrupó a estos órdenes en dos grupos, consistiendo el primero de ellos en tres razas indígenas y el segundo en tres razas cruzadas.

REFERENCE

1. Rao, C. R. (1952): *Advanced statistical methods in biometric research.* Ed. J. Johns Villey and Sons., New York.