HERITABILITY ESTIMATES OF REPRODUCTIVE TRAITS AND PART PRODUCTION IN HOLSTEIN X GIR AND JERSEY X GIR CROSSES ALONG WITH DISCRIMINATE ANALYSIS[1]

SCHAETZUNGEN DER VERERBUNGSANGAGEN IM REPRODUKTIVE CHARAKTERZUEGE UND TELWEISE PROUKTION IN HOLSTEIN X GIR UND JERSEY X GIR KREUZUNGEN ZUSAMMEN MIT DISKRIMINATIVE ANALYSE[1]

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The genetic diversity existing between exotic and Indigenous breed are being explored to increase the productivity in dairy cattle. Efforts are being made to develop a breed of dairy cattle suitable to the particular environment and economical niches using different breeds or crossbreds. In evolving a new breed it is essential to identify the genetic diversity between different crosses produced so that decision on pooling different genetic group or on selecting a particular genetic group for the particular area suitable to economical niches can be taken. It is also essential to estimate the heritability for different economical traits used to identify for genetic diversity so that further selection can be practised.

Under All-India Coordinated Research Project on Cattle at Jabalpur, crossbreeding with Holstein Friesian (H) and Jersey (J) was done. The 1/2H1/2Gir and 1/2J1/2G crosses produced in first generation are being used to generate three-breed crosses which later will be used to develop an economical dairy breed. It was therefore, desirable to identify the genetic diversity between first generation halfbreds keeping in view the objective of the project. The economic traits related to growth, reproduction and production were taken to study genetic diversity.

The paper describes the heritability estimates of the reproductive and productive traits along with the results of discriminate function.

MATERIAL AND METHODS

The reproductive traits measured as age at first heat (AGF), age at conception (AG-Con) and age at calving (AGC) along with part production trait measured as first 100 days milk yield ($Prod_{100}$) on 1/2H1/2Gir and 1/2J1/2Gir crosses were analysed for genetic and non-genetic sources. The least-squares analysis included fixed effect of year and season of birth and breed

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1 Part of Ph.D. Thesis in Animal Breeding & Genetics (1978) submitted by senior author to J.N. Agricultural University, Jabalpur-482 004 (M.P.), India.

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group for AGF and AG-Con while for AGC included fixed effect of year and season of service, service-sire effect along with breed group. The first 100 days production model included fixed effect for year and season of calving, service-sire and breed group. The sire effect was taken as random in all the models. In case of AG-Con, the regression of number of services per conception were also included in the model.

The constants for fixed effects along with partial regression wherever applicable were used to adjust the data. The heritability estimates on adjusted data were made by paternal half-sib correlation method. The standard error for heritability were estimated by formula suggested by Swiger et al. (1964).

The genetic diversity between 1/2H1/2Gir and 1/2J1/2Gir crossbreds on the basis of growth i.e., weight at birth (BW_0) and body weight at 12 months (BW_{12}), reproduction measured as AGF and part production measured as $Prod_{100}$ was done by calculating the D^2 statistics of Mahalanobis (1930, 1936) by using the technique of fitting a linear discriminate function used by Fisher (1936, 1938). The value of D^2 was tested for its significance by the 'F' test as detailed below :-

$$F = \frac{(N_1 + N_2 - p - 1)\, N_1 N_2\, D^2_p}{p(N_1 + N_2)\,(N_1 + N_2 - 2)}$$

where; p and $(N_1 + N_2 - p - 1)$ being degree of freedom. N_1 and N_2 are number of observations in each breed group and p is number of traits considered for discriminant function. The relative values of four characters discriminating breed types were calculated as per the method suggested by Goulden (1952).

RESULTS AND DISCUSSION

The heritability estimates measured on adjusted data are presented in Table 1. The estimate for the AGF (0.42 ± 0.33) was in agreement with findings of Rathi et al. (1977) for crossbreds. A low estimate for AG-Con (0.11 ± 0.21) was recorded which was not significantly different from zero. A similar non-significant estimate for AGC (0.24 ± 0.20) was recorded. These estimates were higher than reported by Naidu and Desai (1965) for Holstein x Sahiwal and by Rajan et al. (1981) for Holstein x Tharparkar and Holstein x Gir crosses. However, it was very difficult to compare h^2 obtained from different studies as data may characerise to single herd over several periods represented by a small number of sires, while in others it may be with large population representing great number of sires. The h^2 estimate for first 100 days production was greater than one which is unrealistic. This may be due to small number of progeny with a higher positive environmental correlation.

The discriminant coefficients obtained are presented in Table 2, along with its relative contributed values taking first 100 days milk production as a unit as the coefficient for this trait was minimum. This was done as per Goulden (1952). The discriminant function obtained in the present study for crossbreds was -

$$Y = 47\ BW_0 + 8.0\ BW_{12} + 3.6\ AGF + 1.0\ Prod_{100}$$

TABLE 1

Estimation of heritability (h^2) and its standard error (SE) for the reproductive traits (age at first heat, age at first conception, age at first calving) and 100 days production of Holstein x Gir and Jersey x Gir crossbreds

	Age at first heat AGF			Age at first concep. AG-Con			Age at first cal. AGC			First 100 days milk production $Prod_{100}$		
	df	MS	EMS	df	MS	EMS	df	MS	EMS	df	MS	EMS
Between sires	26	9496.23	569.06	25	17038.16	413.96	19	23531.32	1141.72	19	268119.64	30641.27
Error	197	4807.18		150	14293.60		136	15916.52		117	63742.36	
K		8.24			6.63			6.67			6.67	
h^2		0.4232			0.1126			0.2400			1.28	
$SE(h^2)$		0.2262			0.2100			0.2000			0.4020	

EMS - Component of variance
K - Average number of progeny per sire

TABLE 2

Estimated coefficient of discriminant function and the relative contribution of the characters used in construction of discriminant function for comparison of Holstein x Gir and Jersey x Gir crossbreds

Character	Coefficient (b_1)	Contribution value
Birth weight (X_1)	0.00235	47.00
Body weight at 12 months of age (X_2)	0.00040	8.00
Age at first heat (X_3)	0.00018	3.60
First 100 days production (X_4)	0.00005	1.00

Mahalonobis D^2 = 3.9269**

F value (4,117) = 24.29

The D^2 was found to be highly significant indicating that the two halfbreds i.e., 1/2H1/2G and 1/2J1/2G were genetically divergent, when above four economical traits were taken into account. This test also discriminated that Jersey halfbreds were inferior to Holstein halfbreds when overall evaluation on growth, reproduction and production was made, although Jersey halfbreds were economically superior in respect of AGF.

SUMMARY

The reproductive parameters like age at first heat (AFH), age at first conception (AF-Con) and age at first calving (AFC) along with part production as 100 days milk ($Prod_{100}$) of Holstein x Gir (1/2H1/2G) and Jersey x Gir (1/2J1/2G) generated under All-India Coordinated Research Project on Cattle, totalling to 234 halfbred females were analysed. The heritability on adjusted data estimated were 0.42 ± 0.226, 0.11 ± 0.21, 0.24 ± 0.20, and 1.28 ± 0.40, respectively.

The discriminate function combining growth, reproduction and production parameters which included body weight at birth (BW_0), at 12 months (BW_{12}), AFH, and $Prod_{100}$ obtained was; $Y = 47\ BW_0 + 8.0\ BW_{12} + 3.6\ AFH + 1.0\ Prod_{100}$. A significant Mahalanobis D^2 indicated that 1/2H1/2G was superior and genetically divergent with 1/2J1/2G.

ZUSAMMENFASSUNG

Die reproduktive Parameter sowie sum Beispiel des Alter um die erste Ditzeperiode (AFH), Alter um die erste Konseption (AF-Con) and das Alter um des erste Kalben (AFC) zusammen mit Teilproduktion von ersten 100 Tagen ($Prod_{100}$) in der Kreuzungen des Holstein Gir (1/2H1/2G) und Jersey x Gir (1/2J1/2G) erzeugt unter dem "All-India Coordinated Research Projekt on Cattle" Projekt. Unter diesem Projekt wurden insgesamt 234 Mischlingstiere des weibliches. Geschlechtes analysiert. Die Vererbungsanlagen in adjustiertes Werte wurden kalkuliert 0.42 ± 0.226, 0.11 ± 0.21, 0.24 ± 0.20 und 1.28 ± 0.40 der Reihen nach.

Die unterschiedliche Funktionen, zusammenfassend Wachstum, Wiedererzeugung und Produktion parameter, welches enthaelt Koerpergewicht um die Genburt (BW_0), im Alter um den 12 Monat (BW_{12}), Alter um die erste Hilzeperiode (AFH), und $Prod_{100}$ erzielt war; $Y = 47\ BW_0 + 8.0\ BW_{12} + 3.6\ AFH + 1.0\ Prod_{100}$. Signifikantes Mahalanobis D^2 wies darauf hin das 1/2H1/2G war Genetisch divergierent und besser als 1/2J1/2G.

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