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Note

A case of subfertile cow with structural abnormalities of the X-chromosome

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Summary

Cytogenetic examination was performed on a three years old *Japanese Black*, cow, which had been slaughtered due to subfertility. Structural chromosome abnormalities were found in 41 (20 p. 100) out of 200 mitotic cells analysed.

The aberrations including deletions affected more specifically the X-chromosome. The frequency was significantly higher than that observed normally in cultures from a cow population of the same breed.

Cytogenetic studies of cattle with either sub- or infertility have recently appeared in the literature. In general, these animals showed a significantly high incidence of structural abnormalities of the autosome and /or the X-chromosome (HALNAN, 1972; EL-NAHASS *et al.*, 1974; BONGSO and BASRUR, 1976). And, EL-NAHASS *et al.* (1976) found that the frequency of chromosome abnormalities was lower for A.I. bulls and breeding cows than for slaughter Cattle. Similar results were obtained in Swine population (MICHELMANN *et al.*, 1977). In the course of a chromosome survey of the *Japanese Black* Cattle, a case of low fertile cow with an unusually high frequency of structural abnormalities of the X-chromosome was detected.

The animal for which the chromosome examination was performed was a three years old *Japanese Black* cow, which had been culled owing to repeated abortions. Blood sample was taken from the femoral vein before slaughter, and cultured *in vitro* for 48 hrs according to the procedure described previously

(HANADA and MURAMATSU, 1980). Two hundred well-spread metaphases were selected under the microscope and studied on microphotographs.

No phenotypic abnormalities were detected in the animal. The results of cytogenetic analysis are given in Table 1. Most cells (79.5 p. 100) showed normal chromosome constitution without any structural abnormality. The rest (41 cells; 20.5 p. 100) were abnormal cells with one or two structural abnormalities of the

TABLE I

Chromosome analysis in a subfertile cow
Analyse chromosomique chez une vache subfertile

No. of cells analysed	200
Normal cells	159 (79.5 p. 100)
Cells with structural abnormalities	41 (20.5 p. 100)

Chromosomes involved	No. of abnormalities per cell		
	1	2	Total
Autosomes	13	6	19
X-chromosomes	16	5	21
Autosome and X-chromosome	0	1	1
Total	29	12	41

autosome and/or the X-chromosome, but with a normal female complement, $2n = 60,XX$.

The details of abnormalities are shown in Table 2. The autosomal abnormalities were found in 20 cells (10.0 p. 100) involving 26 chromosomes, whereas those on the X-chromosomes were observed in 22 cells (11. p. 100) involving 27 X-chromosomes. The frequency and the nature of autosomal abnormalities were similar to those occurring spontaneously in cultures from a cow population of the same breed. On the other hand, the incidence of abnormalities of the X-chromosomes was about 6 times higher than that observed spontaneously. Furthermore, chromosome deletions, which were extremely rare in normal cattle, were observed with a high incidence ($\chi^2_1 = 47.9$, $P < 0.001$). In 5 cells, as shown in figure 1, aberrations were recognized on both X-chromosomes. In the present case subfertility in a cow was associated with a significant number of abnormalities of the X-chromosomes.

Similar results have been reported in a two years old infertile *Black and White* heifer (EL-NAHASS *et al.*, 1974) and a three months old *Holstein* calf affected with chronic tympanism of the rumen (GENEST and GURY, 1978).

On the other hand, autosomal abnormalities have also been detected in a high percentage of mitotic cells in cultures from sub- or infertile cattle (HALNAN, 1972;

TABLE 2

Comparison between the frequency of abnormalities in the present case and in a cow population of the Japanese Black *breed*
Comparaison de la fréquence des anomalies chromosomiques dans le cas présent et dans une population de vaches appartenant à la race Noire Japonaise

	Present case		Spontaneous incidence for the *Japanese Black* cattle (*)	
	Autosomes	X-chromosomes	Autosomes	X-chromosomes
No. of cells analysed	200		1 600	
No. of cells with structural abnormalities	41 (20.5 %)		266 (16.6 %)	
	20 (10.0 %)	22 (11.0 %)	243 (15.2 %)	31 (1.9 %)
No. of abnormal chromosomes	26	27	275	33
Gaps	54.0 (%)	44.4 (%)	51.6 (%)	66.7 (%)
Breaks	26.9	22.2	32.7	27.3
Exchanges	0.0	0.0	2.9	6.0
Dicentrics	0.0	0.0	2.2	0.0
Translocations	0.0	0.0	0.7	0.0
Deletions	0.0	33.3	0.0	0.0
Fragments	19.2	0.0	9.8	0.0
Frequency per chromosome ($\times 10^{-2}$)	0.22	6.76	0.31	1.10

(*) Cited from HANADA and MURAMATSU (1980).

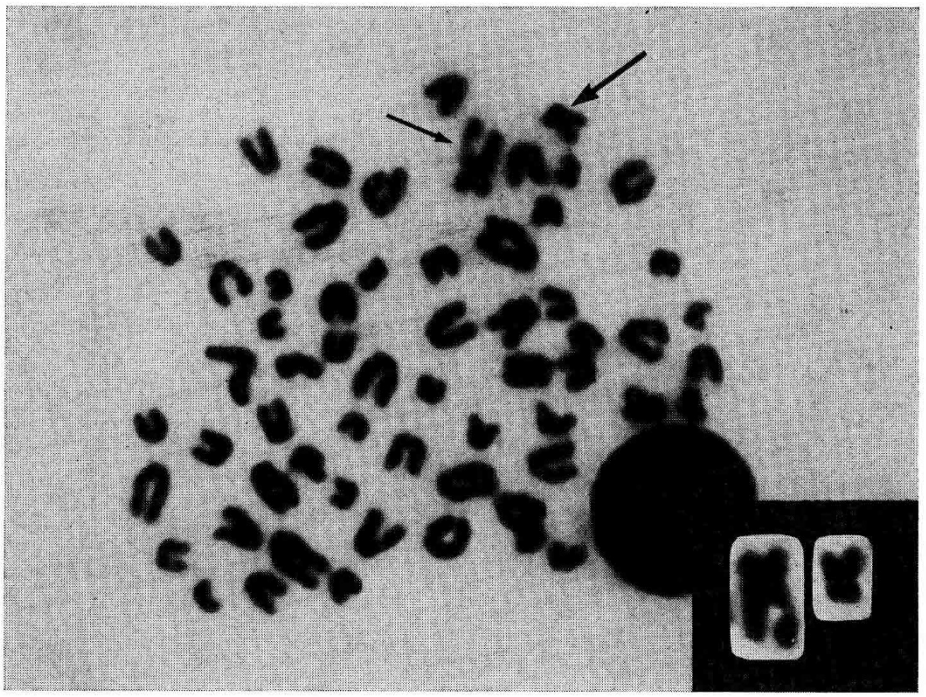

FIG. 1. — *Metaphase of a cell with a deletion* (bold arrow) *and a chromatid gap* (light arrow) *on both X-chromosomes.*

Métaphase d'une cellule montrant une délétion chromosomique (flèche épaisse) *et une interruption de la chromatide* (flèche fine) *affectant les deux chromosomes X.*

BONGSO and BASRUR, 1976). These results suggest that there is a definite association between low fertility and a high incidence of structural abnormalities of the X-chromosome and /or the autosome.

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Résumé

Subfertilité chez la vache accompagnée d'anomalies structurales du chromosome X

Une étude cytogénétique a été réalisée chez une vache subfertile appartenant à la race *Noire Japonaise* qui avait été abattue à l'âge de trois ans. Des anomalies chromosomiques structuraux ont été révélées dans 41 parmi les 200 cellules mitotiques comptées (20,5 p. 100).

Les anomalies, y compris des délétions, affectaient plus particulièrement le chromosome X. La fréquence des anomalies était statistiquement plus élevée que celle normalement observée chez les vaches de cette race.

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