

A new Robertsonian translocation in *Blonde d'Aquitaine* cattle, rob(4;10)

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Summary – The cytogenetic study of a population of *Blonde d'Aquitaine* cattle revealed the presence of a Robertsonian translocation. The chromosomes involved in this abnormality were determined using G (GTG), R (RBG) and C (CBG) banding techniques. The chromosomes in question were identified as chromosomes 4 and 10. The existence of 2 paternal half-sisters carrying the abnormality suggests that it originates from the sire.

cattle / chromosome / Robertsonian translocation

Résumé – Une nouvelle translocation chez les bovins *Blonde d'Aquitaine*, rob(4;10). L'étude cytogénétique d'une population de bovins *Blonde d'Aquitaine* a permis de trouver une nouvelle translocation robertsonienne. Les chromosomes impliqués dans cette anomalie ont été déterminés à l'aide des techniques de marquage G (GTG), R (RBG) et C (CBG). Les chromosomes concernés sont le 4 et le 10. L'existence de deux vaches porteuses demi-sœurs de père indique une origine vraisemblablement paternelle de l'anomalie.

bovin / chromosome / translocation robertsonienne

INTRODUCTION

Robertsonian translocations are the most commonly reported chromosome anomalies in cattle; the most widespread is the 1;29 translocation detected for the first time by Gustavsson and Rockborn (1964), and reported later with high frequency in numerous breeds worldwide (Popescu, 1977; Popescu and Pech, 1991). The 1;29 translocation is widespread in the *Blonde d'Aquitaine* breed since the frequency of the heterozygous and homozygous carriers ranges from 14 to 24% (Queinnec et

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in a CO₂ incubator as monolayer cultures in Falcon dishes (75 cm²) containing a medium similar to that previously described for lymphocyte cultures.

G-banding was achieved using a modification of the technique of Seabright (1971). The C-bands were obtained by the barium hydroxide/saline/Giemsa (BSG) technique (Summer, 1972). To induce R-banding, 5-bromo-2-deoxyuridine was added to the medium at a final concentration of 10 or 20 µg/ml. The cultures were incubated at 37°C until the number of mitotic round cells reached a maximum, about 8 to 9 h after BrdU addition (Hayes *et al*, 1991). In order to obtain RBG-bands, the cells were treated according to the procedure described by Hayes *et al* (1991) and fluorochrome-photolysis-Giemsa (FPG) staining was performed as described by Viegas-Péquignot *et al* (1989).

The chromosomes were identified, paired and arranged according to the recommendations of the Reading Conference (1976) and the ISCNDA (1989).

RESULTS

In classically stained metaphases, the karyotypes of the cow and 1 paternal half-sister included 59 chromosomes: the 2 X chromosomes, 56 acrocentric and one large submetacentric chromosome. The G- and R-bands showed that chromosome pairs 4 and 10 are involved in the translocation (figs 2, 3). The C-banding

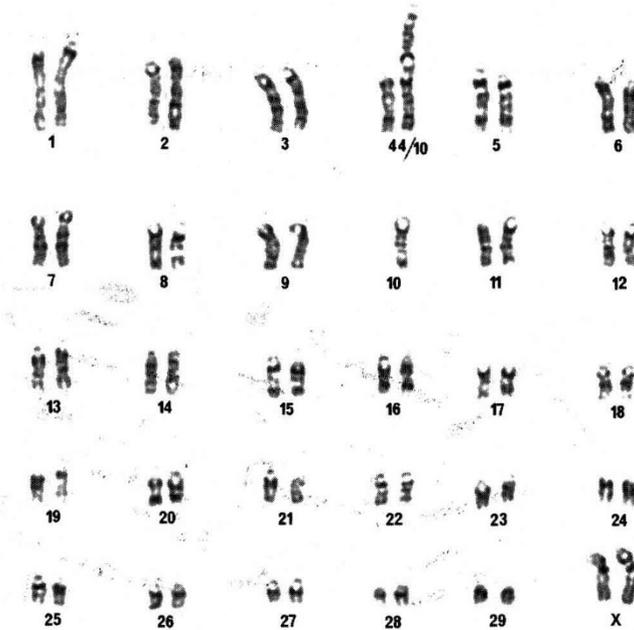


Fig 2. GTG-banded karyotype with the 4;10 translocation.



Fig 3. RBG-banded karyotype with the 4;10 Robertsonian translocation.



Fig 4. CBG-banded metaphase showing constitutive heterochromatin as 2 blocks in the 4;10 translocation (arrow).

technique revealed the presence of 2 constitutive heterochromatin blocks in the pericentromeric region of the 4;10 translocated chromosome (fig 4).

Among the other 3 animals examined, the mother, 1 paternal half-sister and 1 maternal half-sister were normal with a diploid chromosome number ($2n$) of 60.

DISCUSSION AND CONCLUSION

This chromosome abnormality is the fourth Robertsonian translocation reported in the Blonde d'Aquitaine breed. The first translocation was the 1;29 translocation which is known to have a wide distribution among AI bulls (Queinnec *et al*, 1974) and heifers (Frebling *et al*, 1987). Chromosomes implicated in the second and third translocations were identified as the 21 and 27, and the 9 and 23, respectively (Berland *et al*, 1988, Cribeu *et al*, 1989). These 2 rob(21;27) and rob(9;23) have been observed only in one Blonde d'Aquitaine bull and its progeny respectively.

Robertsonian translocations are the result of the fusion of 2 acrocentric chromosomes. Two types of Robertsonian translocations have been described in the Blond d'Aquitaine breed, depending on the presence of one block (1;29 translocation) and 2 blocks (21;27 and 9;23 translocation) of juxtacentromeric constitutive heterochromatin revealed by the CBG-banding technique (Berland *et al*, 1988; Cribeu *et al*, 1989). The presence of these 2 blocks would suggest the mechanism by which this translocation arose. The breakpoints involved the short arms, which are extremely limited in size, of both chromosomes 4 and 10 in the centromeric region; the fusion gave rise to a submetacentric chromosome and 2 minute fragments (short arms) which were lost during the subsequent cell divisions (Eldridge, 1974).

The origin of the translocation is uncertain, since the karyotype of the sire is unknown. It is probable that the 4;10 translocation originated from the sire since it was found in 1 paternal half-sister and not in the mother and the maternal half-sister.

As with a majority of Robertsonian translocations found in animal populations, the 4;10 translocation does not seem to be associated with phenotypic characteristics. In the absence of fertility records, a reduced fecundity in heterozygotes resulting from anaphase I nondisjunction and/or changes in the pattern of recombination in such individuals, cannot be excluded. For example, the 1;29 translocation produces in certain breeds a reduced fertility in the daughters of carrier bulls (Gustavsson 1969; Refsdal 1976).

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