

## SHORT COMMUNICATION/NOTA PRÉVIA

### Chromosome analysis in cattle and horses

### Análise cromossômica em bovinos e eqüinos

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#### SUMMARY

We analyzed the chromosomes of 117 cows of different breeds for the identification of centric fusion and the chromosomes of 100 young Andaluz and Brasileiro de Hipismo mares for the identification of 63,X lines, using the technique of X chromosome identification based on interstitial heterochromatin on the long arm.

**UNITERMS:** Cattle; Horse; Chromosome.

Chimerism and chromosome translocations in cattle and X monosomy in horses are the chromosome diseases most commonly detected in these species. Among translocations, Robertsonian fusions are the major cause of rearrangements in the bovine karyotype<sup>6</sup>. Several studies have shown reduced fertility in males and females with balanced Robertsonian translocations, varying in intensity according to breed<sup>1,2,8</sup>. In horses, X monosomy is a well-known abnormality, usually causing sterility. There is no information over the occurrence of this aberration in the Brazilian herd, however, it is supposed that abnormality of sexual chromosomes is related with at least 50% of infertility cases in mares. The absence of outer anatomical defects in both cattle and horses carrying these aberrations has made karyotype analysis a procedure of fundamental importance for the detection of affected animals and for their exclusion from reproduction programs. The information thus obtained may be of benefit to a large number of cattle and horse breeders, motivating them to seek consulting services in animal genetics.

The objective of the present study was to analyze the karyotypes of cattle and horses for the detection of numerical and structural chromosome abnormalities, especially 1/29 translocation in cattle and X monosomy in horses, using the heterochromatin band on the long arm of the X chromosome as a marker.

The study was conducted on 117 cows: 55 Chianina

animals (54 females and one male), 20 Charolais (15 females and 5 males), 27 Marchigiana (15 females and 12 males), 5 Simmental males, 3 Brown Swiss males, 3 Pitangueiras males, 3 Limousin males, and one Piemontese male, and on 100 mares younger than one year, 50 Andaluz animals and 50 Brasileiro de Hipismo animals. Metaphases were obtained by lymphocyte culture and CBG banding<sup>3</sup>. CTG banding<sup>7</sup> was used to identify the X chromosome, which presents two visible bands, one centromeric and the other on the long arm (Fig. 1). All animals are from properties in the State of São Paulo, except for Charolais animals, which are from the State of Santa Catarina.

The 117 cows analyzed had normal karyotypes, with no apparent numerical or structural alterations. The analysis of animals with autosomal centric fusion is a relatively simple task since the fusion clearly changes the morphology of the chromosomes involved, which are transformed from acrocentrics to submetacentrics. The low frequency of Robertsonian translocations in Chianina cattle (1.97%) determined by Rocha<sup>5</sup> may be one of the factors responsible for the occasional absence of this translocation. Another factor may be the culling of animals identified as carriers, a measure adopted by the Association of Chianina breeders. More animals carrying translocations were expected to occur in the Marchigiana breed, considering that Pinheiro *et al.*<sup>4</sup> found a 42.2% frequency of translocated animals in this breed. The fact that our samples were obtained from



**Figure 1**

C-banding of a mare (64,XX). Note the typical C-banding of the X chromosome identified by the heterochromatin on the long arm.

only two properties may explain the uniformity of the herd. On the other hand, the work carried out by the cited authors at Artificial Insemination Centers may have helped to prevent the reduction of dissemination of this translocation among Marchigiana animals. The low frequency of 1/29 translocation in the remaining breeds (Charolais, Simmental, Swiss Brown, Limousin, Pitangueiras, and Piemontese), and the small number of animals analyzed here may explain the absence of the translocation in these breeds.

Chromosome anomalies with significant effects do not represent important economic losses for breeders since they are rapidly eliminated by selection. The balanced 1/29 translocation, which causes reduced fertility (for a review, see Rocha and Jorge<sup>6</sup>), represents a risk for the population because of its easy dissemination. However, other factors such as small farm size without control of inbreeding and artificial insemination and embryo transfer may contribute to an increase in its frequency. Several investigators have postulated that the reduction in fertility may vary among breeds. Thus, karyotype analysis is needed for Brazilian

herds in order to determine the frequency of this translocation among the various breeds, followed by the elimination of carriers from reproduction programs.

In mares with X monosomy, clinical signs such as short stature, undeveloped uterus and cervix, small gonads and absent or irregular estrous cycle will become fully visible only after the reproductive age. On this basis, analysis carried on young animals or immediately after birth anticipates the diagnosis of possible carriers of 63,X lines. The C-banding technique utilized here permitted us to recognize the X chromosome on the basis of the heterochromatin marker in the middle region of the long arm (Fig. 1). This permitted us to determine that the 100 females analyzed had a normal karyotype with two X chromosomes identified by standard staining and/or on the basis of the marker. Some autosomal chromosomes presented peculiar characteristics, such as absence of labeling in pair 11 and slight labeling in pair 7. G banding was important for the identification of each chromosome pair, presenting specific positive and negative labeling patterns along the entire chromosome.

## RESUMO

Foram analisados os cromossomos de 117 bovinos de diferentes raças para identificação de fusão cêntrica e os cromossomos de 100 éguas jovens da raça Brasileiro de Hipismo para identificação de linhagens 63,X, utilizando a técnica de identificação do X baseada na heterocromatina intersticial do braço longo.

**UNITERMOS:** Bovinos; Equinos; Cromossomo.

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