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A new centric fusion translocation in cattle, rob(16;18)

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A Barrosã bull (Portugal) has been found to carry a new Robertsonian translocation involving chromosomes 16 and 18 of standard cattle karyotype, as demonstrated by GBG- and RBG-banding techniques. C-banding patterns revealed the dicentric nature of this translocation. A comparison between normal cattle chromosome 16 and the q-arms of translocation chromosome and river buffalo chromosome 5 revealed the same G- and R-banding patterns, with only exception of a pericentromeric G-positive band which has been lost in river buffalo 5q and conserved in normal cattle chromosome 16 and rob(16;18) q-arms.

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Centric fusion translocations have been the most common chromosomal rearrangement to occur during the karyotype evolution of the Bovidae (WURSTER and BENIRSCHKE 1968), and are in cattle the most common chromosomal abnormalities (ELDRIDGE 1985; LONG 1985).

The translocation involving chromosomes 1 and 29 has been demonstrated to reduce fertility in carriers (GUSTAVSSON 1969; DYRENDAHL and GUSTAVSSON 1979). This chromosomal abnormality has been found in variable frequencies in about 60 different breeds (POPESCU and PECH 1991), while only a few cases of Robertsonian translocations involving other cattle chromosomes have been reported (reviewed by LONG 1985; BERLAND et al. 1988). The Barrosã cattle breed (Portugal) has shown the highest frequency of rob(1;29) carriers found so far (RANGEL-FIGUEIREDO and IANNUZZI 1991), and a new Robertsonian translocation involving chromosomes 15 and 25 of standard cattle karyotype has recently been found in this breed (IANNUZZI et al. 1992). In the present paper we report a new centric fusion translocation in a Barrosã bull and its comparison with the biarmed river buffalo chromosome 5.

Materials and methods

During a recent cytogenetic investigation on Barrosã cattle breed (North-Portugal), a phenotypically normal bull has been found to carry a centric fusion translocation different from rob(1;29). Unfortunately, we could not investigate its parents.

Pokeweed stimulated peripheral blood lymphocytes from the male carrier, two normal cattle and three river buffalo were cultured for about 72 h. Two sets of cell cultures were prepared. In *culture A*, cells were stored in McCoy's 5A modified medium (Gibco) at 38.5°C and treated for early incorporation of Bromodeoxyuridine (BrdU), as previously reported (IANNUZZI et al. 1989). In *culture B*, cells were cultured in RPMI 1640 medium (Gibco) at 38°C (CO_2 incubator) and 6 h before harvesting treated with BrdU (20 μg/ml) and Hoechst 33285 (40 μg/ml) to allow their late incorporation. Slides obtained from cultures A and B were treated for G- and R-banding techniques, respectively. The GBG- (IANNUZZI et al. 1989), RBG- (IANNUZZI 1990), and CBG- (SUMNER 1972) banding techniques were employed. G- and R-banded karyotypes were arranged according to the standard cattle karyotype (ISCNDA 1989).

Results and discussion

All the 110 scored metaphases of male carrier revealed a diploid number of 59 due to the presence of a biarmed chromosome, in addition to the submetacentric X and Y chromosomes (Fig. 1). The two clear blocks of constitutive heterochro-

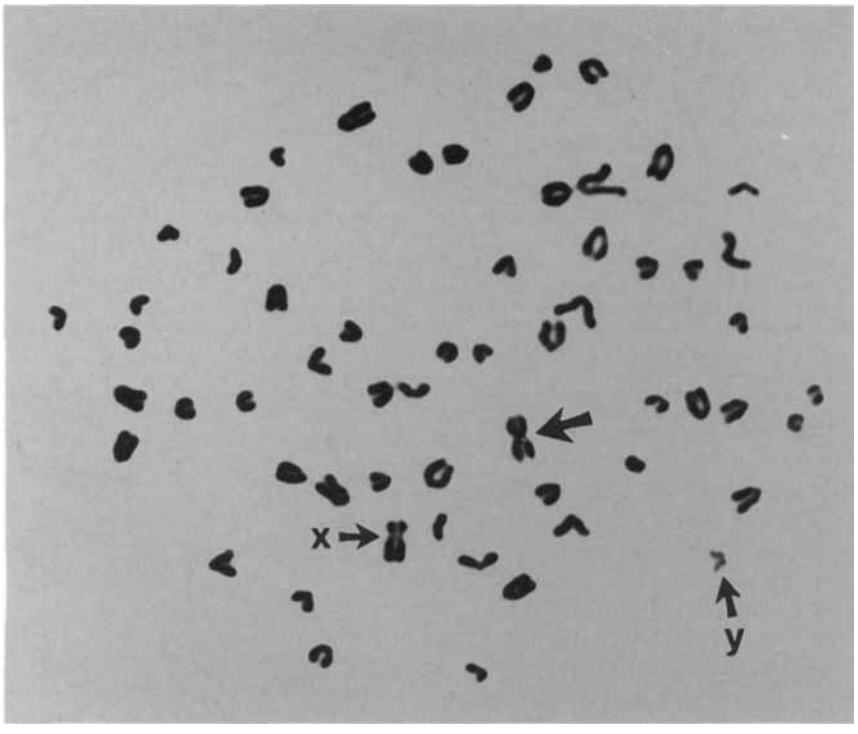

Fig. 1. Conventional stained metaphase plate of Barrosã bull heterozygous carrier of centric fusion translocation (large arrow). Sex chromosomes are also indicated.

matin seen in the biarmed chromosome (Fig. 2) revealed the dicentric nature of this centric fusion translocation, as found in other translocations previously studied (DI BERARDINO et al. 1979; CIUPERCESCU et al. 1984; POPESCU 1977; BERLAND et al. 1988; CRIBIU et al. 1989; IANNUZZI et al. 1992). All these authors agree on a recent origin for dicentric translocations in cattle, unlike the ancient origin for monocentric rob(1;29) (GUSTAVSSON 1974; POPESCU and BOSCHER 1974; IANNUZZI et al. 1987; RANGEL-FIGUEIREDO and IANNUZZI 1990, 1991).

After employing of R-banding technique (Fig. 3), we concluded that chromosomes 16 and 18 of standard cattle karyotype were involved in this new Robertsonian translocation.

Among the centric fusion translocations found so far in cattle, with the exception of rob(1;29), only a few cases have been studied using banding techniques (reviewed by BERLAND et al. 1988) and standard nomenclatures (DI BERARDINO et al. 1979; BERLAND et al. 1988; CRIBIU et al. 1989; IANNUZZI et al. 1992). Chromosome 18 has previously been involved in another centric fusion with chromosome 5 (PAPP and KOVACS 1980). Chromosome 16 is homologous to the river buffalo q-arm chomosome 5 which originated from a centric fusion translocation between homologous cattle chromosomes 16 and 29. This centric fusion resulted in losses of HC and pericentromeric q-arm G-positive band (IANNUZZI et al. 1987, 1990). Fig. 4 shows the GBG- and RBG-banding comparison between normal cattle chromosome 16 and the q-arms of rob(16;18) and river buffalo chromosome 5. The three chromosome arms conserved the same G- and R-banding patterns, with only exception of the pericentromeric G-positive band which has been lost in river buffalo 5q and conserved in normal cattle 16 and rob(16;18) q-arms.

All these marker chromosomes (centric fusions) are very important because they allow us (a) to characterize cattle banded karyotypes better, (b) to use them in gene mapping studies, and (c) to better understand the role of centric fusion translocations in the karyotype evolution of Bovidae.

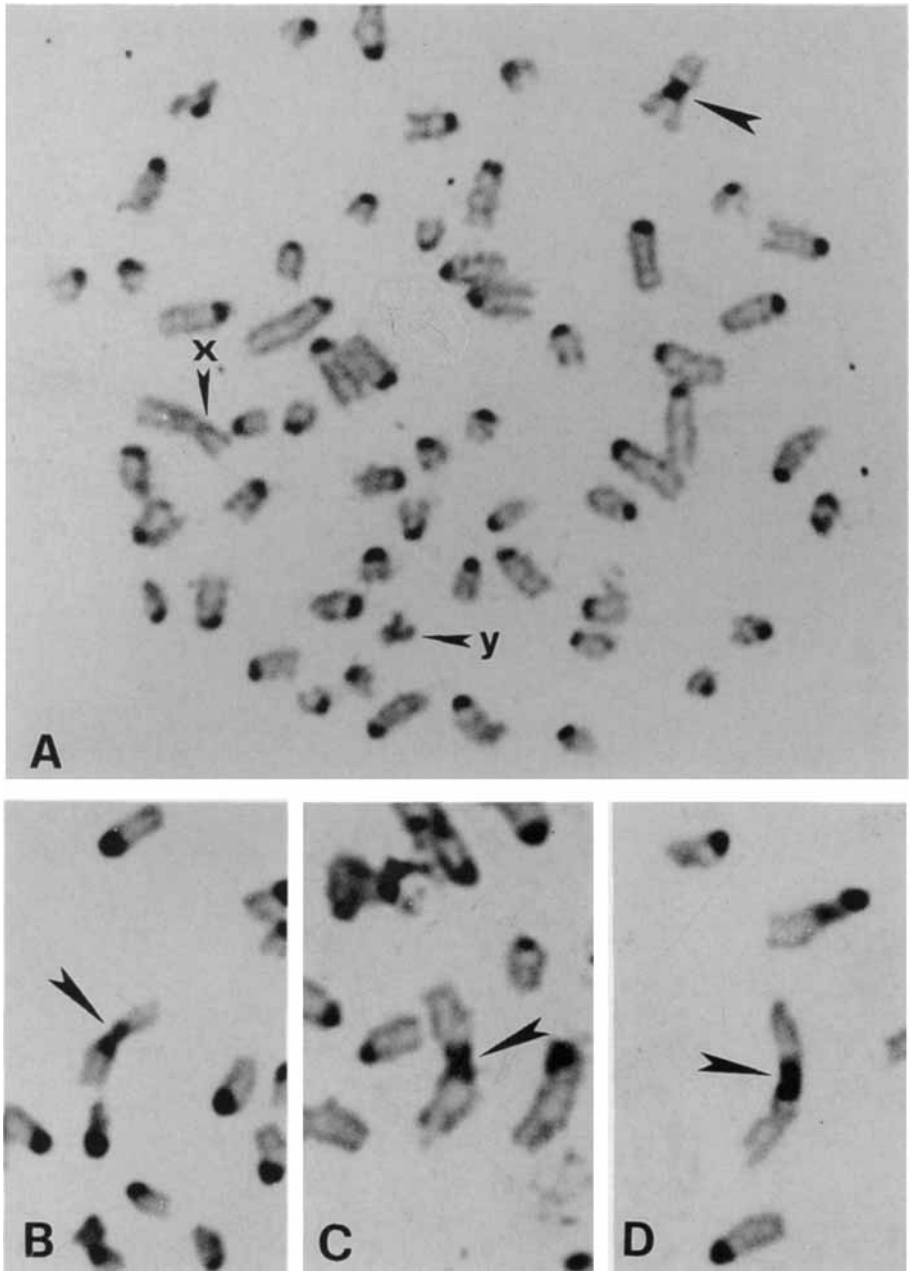

Fig. 2A–D. Fig. A. C-banded metaphase plate showing the dicentric nature of the centric fusion translocation (large arrows). **Fig. B–D.** Details of translocated chromosome (arrows) showing two blocks of constitutive heterochromatin.

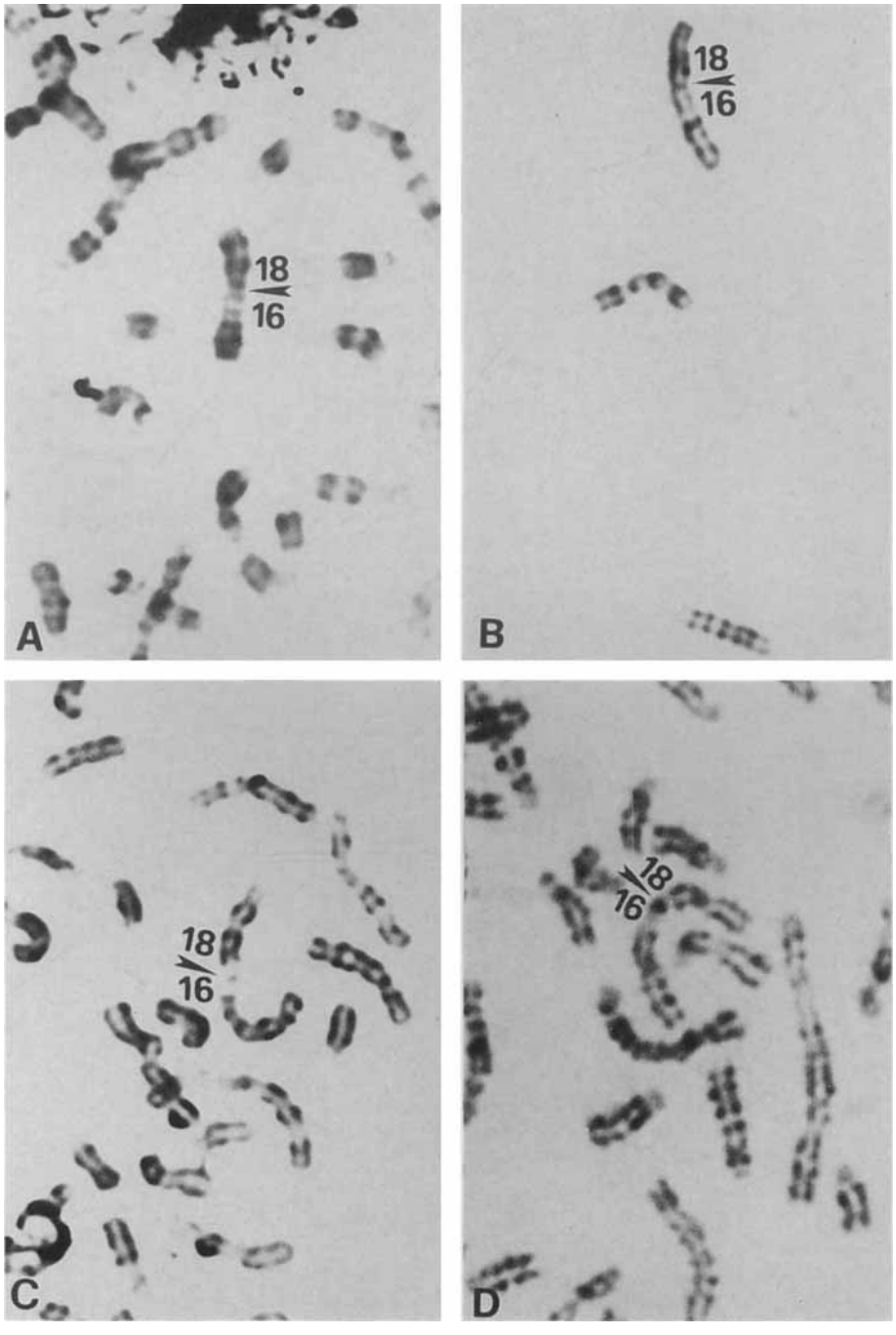

Fig. 3A–D. Details of rob(16;18) (arrows) taken from preparations with a different degree of chromosome contraction and treated for RBG-banding technique.

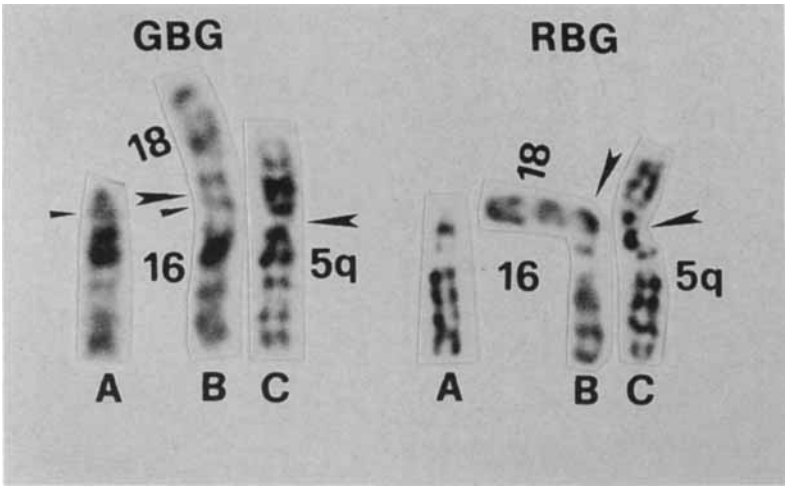

Fig. 4. Comparison between normal cattle chromosome 16 (A) and the q-arms of rob(16;18) (B) and river buffalo chromosome 5 (C) using GBG- (left) and RBG- (right) banding techniques. Notice the high degree of banding homologies between cattle 16 (normal and fused) and river buffalo 5q. Large arrows indicate the centromeres of fused chromosomes and little arrows (left) show the pericentromeric G-positive band which is present in both normal and fused cattle chromosome 16 and absent in river buffalo 5q.

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