

## Presumptive 1/29 Robertsonian translocation observed in the Argentinean Creole cattle breed

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**Abstract** — A cytogenetic investigation was carried out on 39 Argentinean Creole cattle (8 bulls and 31 cows) from the Experimental Station in Chamental (La Rioja, Argentine). Heparinised blood samples were cultured using a method of Moorhead et al. with some modifications. Karyotypes were established using a chromosomal digital analyser. A presumptive 1/29 Robertsonian translocation was found in one bull which had  $2n = 59$  chromosomes. The remaining animals appeared chromosomally normal. The 1/29 translocation has been diagnosed in other Creole breeds in America but never in Argentine. The Y chromosome of the sampled bulls had the typical sub-metacentric structure normally occurring in *Bos taurus*. It is suggested that programmes for genetic and reproductive improvement incorporate chromosomal analysis of bulls and cows with a high genetic value for natural and artificial breeding. Individuals with chromosomal abnormalities could then be eliminated, helping to assure the high fertility rates of this breed.

**Argentinean Creole cattle breed / genetic selection / 1/29 Robertsonian translocation / fertility**

**Résumé** — **Translocation Robertsonienne 1/29 observée chez un bovin Créole Argentin.** L'analyse cytogénétique a porté sur 39 bovins Créoles Argentins (8 taureaux et 31 vaches) de la station expérimentale de Chamental (La Rioja, Argentine). Les échantillons de sang hépariné ont été mis en culture selon une méthode dérivée de celle de Moorhead et al. Les caryotypes ont été établis à l'aide d'un analyseur chromosomique numérique. Une translocation Robertsonienne 1/29 a été mise en évidence chez un taureau ayant  $2n = 59$  chromosomes. Les autres animaux sont apparus chromosomiquement normaux. La translocation 1/29 a été diagnostiquée dans d'autres races Créoles en Amérique, mais jamais en Argentine. Qui plus est, le chromosome Y des taureaux testés avait une

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structure submétacentrique typique de l'espèce *Bos taurus*. Ceci suggère que les programmes d'amélioration génétique et de reproduction doivent inclure une analyse chromosomique des taureaux et des vaches ayant un fort potentiel génétique avec la mise à la reproduction naturelle ou artificielle. Les animaux présentant des anomalies chromosomiques pourraient alors être éliminés afin de préserver les taux de fertilité élevés de cette race.

## bovin Créole Argentin / sélection génétique / translocation Robertsonienne 1/29 / fertilité

### 1. INTRODUCTION

The Argentinean Creole cattle breed is a local cattle biotype that has been bred on the American continent for more than 500 years. Its predecessors were originally from Spain. The animals adapted to all the geographic regions in Argentine and by the end of the 19th century there were more than 48 million animals in the country. There are now only 1 million heads that live in poor, arid areas. The Argentinean Association of Creole Breeders (established in 1985) has carried out several studies on production, reproduction and behaviour and is promoting this breed for its rusticity, fertility, tameness, longevity and total absence of dystocia. It also adapts well to marginal areas, is resistant to disease and has a good carcass output of lean meat. With the global increase in ecological and sustainable processes and the general preference for animals bred with natural pasture and sun, Creole cattle production seems to have a promising future as a meat cross biotype in Argentine.

Creole cattle have  $2n = 60$  chromosomes with 58 autosomal acrocentric chromosomes and two sex chromosomes (Large submetacentric X and 1 small submetacentric Y), like other *Bos taurus* breeds. This cytogenetic characterisation is typical of *Bos taurus* but there are few cytogenetic studies on the Argentinean Creole. The first cytogenetic analysis in Argentine was carried out by Igartúa et al. [5] on 34 beef cattle females, Deluca et al. [1] on 36 bulls and Género et al. [3] performed a systematic chromosomal analysis of the biotype from Patagonia on 25 animals. All

reports conclude that these animals have a chromosomal number of  $2n = 60$ , with no 1/29 Robertsonian translocation. Muñoz et al. [8, 9] and Postiglioni et al. [11] analysed the Venezuelan and Uruguayan Creole breeds, respectively, and found the 1/29 Robertsonian translocation associated with a low rate of fertility.

Among the chromosomal anomalies in cattle, the 1/29 Robertsonian translocation is the most frequent, with the largest distribution between breeds and the greatest economic consequences. It was first identified by Gustavsson and Rockborn [4] in three animals of the Swedish Red and White breed. The translocation is a centric fusion of two acrocentric chromosomes. Heterozygous and homozygous animals have 59 and 58 chromosomes, respectively. The daughters of carrier heterozygous bulls have a reduced fertility and the elimination rate is greater than for daughters of normal bulls. Dyrendahl and Gustavsson [2] reported a highly significant reduction in fertility in heterozygous Swedish Red and White bulls carrying the 1/29 Robertsonian translocation, on the basis of the non-return rates of 28 and 56 days.

A full review about the 1/29 Robertsonian translocation in different breeds in the world was made by Popescu and Pech [10].

Our objective was to specify the structural and numerical karyotype of the Argentinean Creole cattle breed kept at the National Institute for Farming Technology, Experimental Farming Station at Chamental in La Rioja, Argentine (EEA-INTA-Chamental).

## 2. MATERIALS AND METHODS

We karyotyped 39 sexually mature Argentinean Creole cattle (8 bulls and 31 females) belonging to the EEA-INTA-Chamical in the province of La Rioja, Argentina. The heparinised blood of the donor animals was cultured using a technique described by Moorhead et al. [7] with several modifications (culture medium RPMI – 1640 with HEPES) to which we added 0.3 mL of phytohaemagglutinine and incubated at 38.5 °C for 72 h. The cells were accumulated in the mitotic metaphase, adding colchicine to a final volume of 0.1 mg·mL<sup>-1</sup> in each culture, four hours before harvest. The hypotonic shock was performed with 0.075 M KCl at 37 °C for 10 min. The procedures for fixation, drying, storage and staining are described in Schifferli [13]. To analyse each slide we used a Zeiss Axioskop microscope 2 with 10 X, 40 X and 100 X lenses via a video camera connected to an image analyser (Ikaros, Metasystem). Karyotypes were made for each animal with its corresponding ideogram.

## 3. RESULTS AND DISCUSSION

We investigated the cytogenetics of the population of bulls and cows of the Argentinean Creole cattle breed at EEA-INTA-Chamical. For the first time, a 1/29 Robertsonian translocation was found in this breed (Fig. 1). The carrier bull had a karyotype  $2n = 59 XY, t(1/29)$ . These results coincide with those of Madriz and Muñoz [6], Muñoz et al. [8, 9] for the Venezuelan Creole, Postiglioni et al. [11] for the Uruguayan Creole and Igartúa et al. [5] for the Argentine Aberdeen Angus × Creole who all found the 1/29 Robertsonian translocation. Our results did not coincide with those of Deluca et al. [1] and Género et al. [3] who did not find structural or numerical anomalies in their cytogenetic stud-

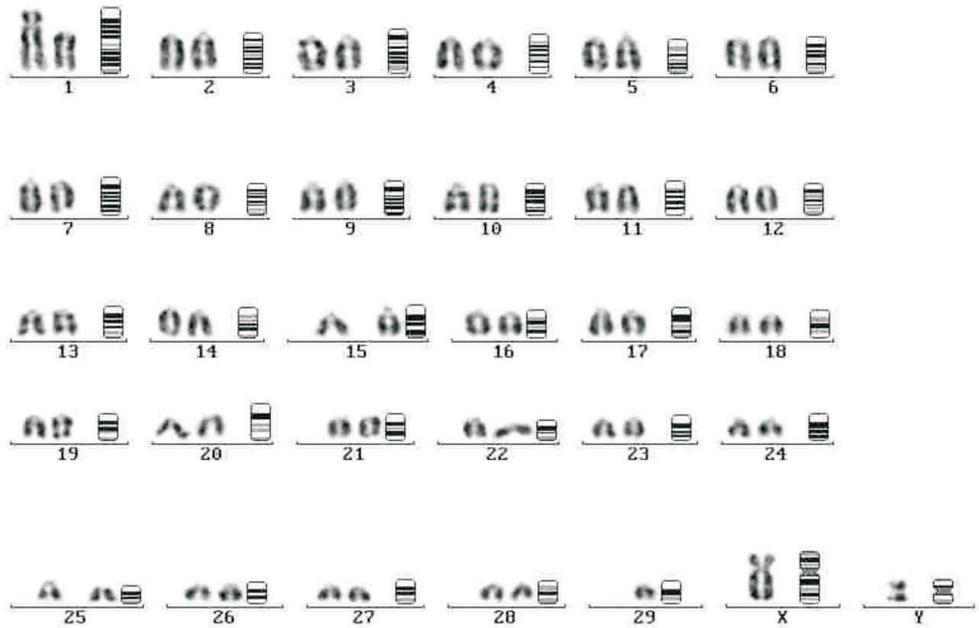
ies of the Patagonian biotype of the Argentinean Creole. They sustain that the high rate of fertility makes this breed free of this chromosomal anomaly. Nonetheless, we found a 1/29 Robertsonian translocation in one bull of this breed in EEA-INTA-Chamical. It would be very interesting to analyse the fertility of the carrier bull and the distribution of the chromosome anomaly to his offspring.

We did not find any other structural or numerical chromosome anomalies in the rest of the animal population at EEA.

According to the Argentinean Association of Creole Breeders (1986), this breed has a high rate of fertility, easy calvings and lack of dystocia. We do not question this, but we think that we have to continue to study the population in order to prevent situations such as the elimination of animals with chromosomal anomalies that would decrease the fertility of the herd.

The Y chromosome of the seven bulls in the study had the typical submetacentric morphology, typical of *Bos taurus*. The presence of an acrocentric Y chromosome would demonstrate the introgression of the Zebu cattle (*Bos indicus*), as found by Primo [12] in the Brazilian Creole population.

The 1/29 Robertsonian translocation decreases the fertility of this species. Its detection and eradication will help to maintain the high levels of fertility which is characteristic of the Argentinean Creole. The programmes for genetic improvement of bovines should include chromosomal analysis in their selection programme in order to eradicate structural and numerical chromosomal anomalies. In addition, karyotyping can help to control the invasion of genes from *Bos indicus*. This is of vital importance for the Argentinean cattle industry in order to maintain the pure germplasm of the Creole breed at EEA-INTA-Chamical and assure a greater source of biodiversity.



**Figure 1.** The 1/29 Robertsonian translocation is showed on the karyotype of a bull belonging to the Creole cattle breed.

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## REFERENCES

- [1] Deluca J.C., Golijow C.D., Giovambatista G., Diessler M., Dulout F.N., Y-chromosome morphology and incidence of the 1/29 translocation in Argentine Creole bulls, *Theriogenology* 47 (1997) 761–764.
- [2] Dyrendahl I., Gustavsson I., Sexual functions, semen characteristics and fertility of bulls carrying the 1/29 translocation, *Hereditas* 90 (1979) 281–289.
- [3] Genero E.R., Rumiano F.J.L., Moreno-Millán M., Estudio citogenético del ganado bovino Criollo Argentino Patagónico, *Arch. Zootec.* 48 (1999) 425–427.
- [4] Gustavsson I., Rockborn G., Chromosome abnormality in three cases of lymphatic leukaemia in cattle, *Nature* 203 (1964) 990.
- [5] Igartúa D.V., Roldán E.R.S., Vitullo A.D., Estudios citogenéticos en hembras bovinas con transtornos reproductivos, *Rev. Arg. Prod. Anim.* 5 (1985) 175–181.
- [6] Madriz M.L., Muñoz G., Análisis cromosómico del ganado Criollo Venezolano, *Acta Cient. Venezolana* 42 (1991) 266–269.
- [7] Moorhead P.J., Newell P.C., Mellman W.J., Battips D.A., Hungerford D.A., Chromosome preparation of leukocytes cultured from human peripheral blood, *Exp. Cell. Res.* 20 (1960) 613–616.
- [8] Muñoz M.G., Ocanto D., Madriz M.L., Medina R., Vera O., Incidence of 1/29 translocation in Venezuelan Creole bulls, *Theriogenology* 41 (1994) 379–382.
- [9] Muñoz M.G., Ocanto D., Medina R., Duraes M.I., Incidence of 1/29 translocation in Venezuelan Creole pure and crossbreed cows used in reproductive programs, *Theriogenology* 43 (1995) 1055–1060.
- [10] Popescu C.P., Pech A., Une bibliographie sur la translocation 1/29 de bovins dans le monde (1964-1990), *Ann. Zootech.* 40 (1991) 271–305.
- [11] Postiglioni A., Lambi S., Gagliardi G., Bethencourt M., Caracterización genética de los bovinos Criollos del Uruguay, *Arch. Zootec.* 45 (1996) 209–213.
- [12] Primo A.T., Conservación de recursos genéticos en el Brasil, in: *Asociación Argentina de ganado Criollo y Orientación Gráfica*, Tomo 1, 1986, pp. 60–68.
- [13] Schifferli C., Estudio del cariotipo de toros provenientes de un centro de inseminación artificial, *Arch. Med. Vet.* 13 (1981) 29–37.

