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A CASE OF CENTRIC FUSION TRANSLOCATION IN A DEONI (*BOS INDICUS*) INDIAN CATTLE BULL CALF

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ABSTRACT

Introduction: *Translocations are very common in cattle This is the first report on the Robertsonian translocation in phenotypically normal Deoni cattle bull calf out of 458 cattle breeds of Indian origin Bos indicus screened so far to detect chromosomal aberrations during routine investigation.* ***Objective:*** *Detection of chromosomal aberrations in breeding bulls as the aberrations are associated to fertility problem in domestic animals.* ***Method:*** *Lymphocyte culture was set in a growth medium, RPMI-1640 supplemented with fetal calf serum, antibiotics, and mitogen. Culture was incubated at 37 degree C for 72 hrs and metaphase was arrested for chromosome study.* ***Results:*** *All metaphase chromosomes exhibited 59 chromosomes instead of 60. Cytogenetic investigation revealed the less chromosome numbers are because of centric fusion of two chromosomes; probably involving chromosome number 16 and 20. Conclusion: This is the first report of Deoni cattle (Bos indicus) as usually translocation or centric fusions are common chromosomal aberrations of Bos taurus cattle. Animals with centric fusion may not be used for artificial programme as the abnormality can cause repeat breeding problem in breedable female population.*

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KEY WORDS

Bos indicus; chromosome; translocation; centric fusion; autosomes

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[I] INTRODUCTION

Among various numerical and structural chromosomal aberrations reported so far, the translocations are very common in cattle breeds, which are known to cause varying degrees of subfertility (Long, 1985). In balanced form, it has no visible effect on body conformation because the genetic material present in the centric fusion chromosome is the same as in the two separate chromosomes. The centric fusion translocations are also known as Robertsonian translocation as it was first observed by W R B Robertson [1] while working with grasshoppers. The Robertsonian 1/29 translocation is the most frequent structural chromosomal abnormality in cattle [2] that was first observed in Swedish Red breed of cattle [3]. It has been documented in various frequencies in about 60 different breeds of both *Bos taurus* and *Bos indicus* [4]. Besides, many cases of centric fusion translocation involving other chromosomes have also been reported in various breeds of cattle worldwide [5, 6, 7, 8, 9, 10, 11, 12]. Such translocations have also been documented for other large animal species [13, 14].

India possesses 15% of the total cattle population and there are 30 distinct breeds of indigenous cattle (National Bureau Animal Genetic Resources, India). These cattle are distributed in three categories, mainly milch, drought and dual purpose breeds. In addition, a large number of non-descript cattle with poor productivity are also geographically distributed all over the country. However, most of Indian cattle breeds are well known for their draught resisting quality and to with stand diseases and parasites. Deoni is one of Indian cattle breeds (*Bos indicus*) known as dual purpose cattle.

This is the first time that a centric fusion translocation appeared in an Indian *Bos indicus* breed that was encountered during routine cytogenetic investigation prior to selection of bull for semen production.

[II] MATERIALS AND METHODS

Peripheral blood was collected from phenotypically normal 2 years old young bull calf of Deoni breed, in a heparinzed vacutainer blood collecting tube. Chromosomal preparations were performed by using standard whole blood culture in RPMI-1640 (Gibco) medium supplemented with antibiotics,15% fetal calf serum and 1% pokeweed mitogen [12]. The blood culture was incubated at 37°C for 72 hours. To increase the relative frequency of prometaphase chromosomes, Ethidium bromide (Sigma) @10 µg/ml was added and to arrest somatic cell division at metaphase stage, Colchicine (Sigma) @ 2 µg/ml was added to the culture for 2 and 1 h respectively, prior to the harvesting. The cells were separated by centrifugation at 150 g for 5 minutes followed by hypotonic treatment with 0.56% KCl for 20 minutes at 37°C and fixed in 3:1 ratio of methanol and acetic acid glacial. Finally, cell suspension was dropped on slides and air dried. Slides were conventionally stained in Giemsa stain for screening under the Nikon

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compound microscope attached with photographic system.

[III] RESULTS AND DISCUSSION

The cattle normally possess 60 (2n) chromosomes. The karyotype composed of 29 pairs of autosomes and one pair of sex chromosomes. All the autosomes are acrocentric and sex chromosomes (XY) are submetacentric in Bos taurus, whereas Y chromosome in *Bos indicus* is acrocentric. In the present case, all the scored 50 metaphase plates of the bull exhibited a diploid number of 59 due to presence of a biarmed chromosome, in addition to the submetacentic X and acrocentric Y chromosomes [Figure–1]. This is the first time that a centric fusion translocation appeared in Deoni breed out of 458 different breeds of *Bos indicus* screened during routine investigation (karyotyping). This finding is similar to many cases reported earlier [15, 16, 17] wherein they reported 16/20 translocation. As compared to exotic cattle, no case of translocation is reported in *Bos indicus* in India. However, a few cases of translocations were reported in Indian Jersey and Holstein crossbred cattle, and buffalo population. Thiagrajan et al. [18] identified 1/29 translocation in an Indian Jersey crossbred heifer with the history of anoestrus. Similarly, Chauhan et al [19] have also observed 1/29 translocation in a Jersey crossbred bull calf. Patel [12] reported a new centric fusion translocation [7, 16] in an Indian Holstein crossbred bull. Two cases of unusual translocation were also reported in Murrah buffaloes [20, 21] in India. Except unusual cases [19], the fertility of male is not grossly affected because of centric fusion.

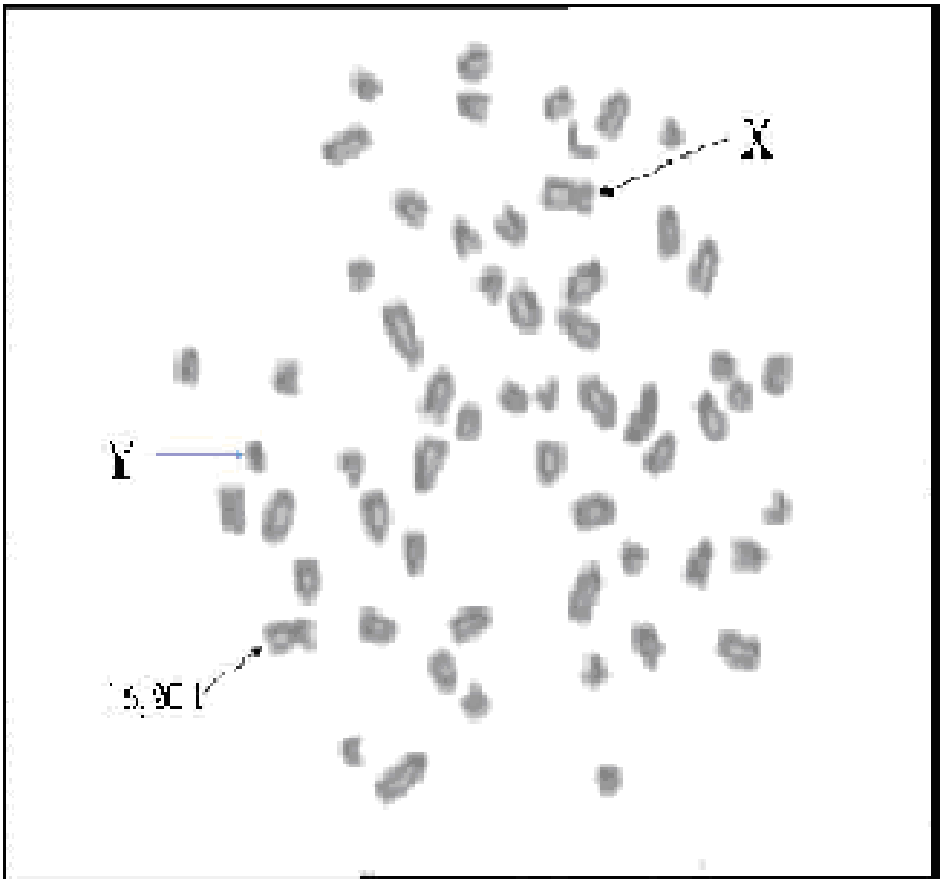

Fig. 1: Metaphase plate of *Bos indicus*

The reproductive potential of Deoni bull calf with 16/20 translocation in present study is not available since it is not in semen production and it was immediately culled from the semen station because of chromosomal aberration. It is always advisable to cull and avoid using such bulls for semen production as the Robertsonian translocation can have an adverse effect on fertility, apparently due to the production of chromosomally unbalanced gametes [22, 5]. Chromosome analysis of embryos indicated the occurrence of trisomic embryos resulting from the fertilization of normal ova by hyperhaploid spermatozoa [23]. Such unbalanced zygotes which tend to die at an early stage of development in females thus giving repeat breeding problems in normal females [24, 25].

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REFERENCES

[1] Robertson WRB. (1916) Chromosome studies I. Taxonomic relationship shown in the chromosomes of Tattigidae and Acrididae. Louustidae and Gryllidae: Chromosomes and Variation. *J Morph* 27:179–331.

[2] Popescu CP. (1978) A study of meiotic chromosomes in bulls carrying the 1/29 translocation. *Ann. Biol. Anim Bioch Biophys* 18: 383–389.

[3] Gustavsson I, Rockborn G. (1964) Chromosome abnormality in three cases of lymphocytic leukaemia in cattle. *Nature* 203:990.

[4] Popescu CP, Pech A. (1991) Une bibliographie Sur la translocation 1/29 de bovins dans le monde (1964- 1990). *Ann Zootech* 40:271–305.

[5] Teteno H, Miyaka YI, Mori H, Kamiguchi Y, Mikamo K. (1994) Sperm chromosome study of two bulls heterozygous for different Robertsonian translocations. *Hereditas* 120:7–11.

[6] Berland HM, Sharma A, Cribiu EP, Darre R, Boscher J, Popescu CP. (1988) A new case of Robertsonian ttranslocation in cattle. *J Heredity* 79:33–35.

[7] Pinheiro LEL, Carvalho TB, Oliveira DAA, Popescu CP, Basrur PK. (1995) A 4/21 tandom fusion in cattle. *Hereditas* 122: 99-102.

[8] Molteni L, Giovanni-Macchi A, De Succi G, Cremonesi F, Stacchezzini S, Di Meo GP, Iannuzzi L. (1998) A new centric fusion translocation in cattle: rob(13;19). *Hereditas* 129: 177–180

[9] Iannuzzi L, Range-Figueiredo T, Di Meo GP, Ferrara L. (1993) A new centric fusion translocation in cattle, rob (16;18). *Hereditas* 119: 239-243.

[10] Iannuzzi L, Rangel-Figueiredo T, Di Meo GP, Ferrara L. (1992) New Robertsonian translocation in cattle, rob (15;25). *Cytogenet Cell Genet* 59:280–283.

[11] Vallenzasca C, Martignoni M, Galli A. (1990) Finding of a bull with Y;17 traslocation. *Hereditas* 113:63–67.

[12] Patel RK. (1999) A new case of Robertsonian translocation rob (7;16) in HF crossbred bull. *Ind J Dairy Sci* 52:324-329.

[13] Pearce PD, Ansari HA, Maher DW, Malcolm AA, Stewart-Scott IA, Board TE. (1994) New Robertsonian translocation chromosomes in domestic sheep (Ovis aries). Cytogenet. *Cell Genet* 67: 137–140.

[14] Singh B, Fisher KRS, Yadav BR, Basrur PK. (1994) Characterization of a translocation and its impact on fertility in the pig. *Cand J Genome* 37:280–288.

[15] Buoen LC, Zang TQ, Weber AF, Anderson MR, Ruth GR. (1992) The requirement of fibroblasts to confirm the identy of cytogenetic centric fusion (CF) carrier in same-sex twin cattle. *J Vet Diagn Invest* 4: 212–214.

[16] Zhang TQ, Buoen LC, Weber AF, Ruth CR, Anderson ME. (1992) Two different centric fusion chromosomal defects in a Simbrah bull: A case report. *Theriogenology* 37: 553–558.

[17] Rubes J, Musilova P, Borkovec L, Borkovcova Z, Svecava D, Urbanova J. (1996) A new Robertsonian traslocation in cattle, rob (16;20). *Hereditas* 124: 275–279.

[18] Thiagarajan V, Rajasekaran J, Natarajan N. (1990) Robertsonian translocation in cattle, rob (16;20). *Hereditas* 124: 275–279.

[19] Chauhan JB, Patel RK, Singh KM, Soni KJ. (2009) A dicentric Robertsonian translocation, rob (1;29) in Indian Jersey crossbred (Bos taurus x *Bos indicus*) bull. *Nucleus* 52:119–123.

[20] Patel RK, Singh KM, Soni KJ, Chauhan JB. (2006) Novel Cytogenetic finding: an unusual X;X-translocation in Mehsana buffalo (Bubalus bubalis). Cytogent Genom Res 115:186-188.

[21] Vijh RK, Tantia MS, Sahai R. (1994) Translocation in Murrah buffalo. *Ind J Anim Sci* 64:534–538.

[22] Hanada H, Geshi M, Suzuki O. (1995) Additional evidence of formation of unbalanced embryos in cattle with 7/21 Robertsonian translocation. *Theriogenology* 44:499–505.

[23] Hanada H, Geshi M, Sakaguchi M, Yonai M. (1993) Chromosome analyses of embryos sired by bulls heterozygous for the 7/21 robertsonian translocation. *Anim Sci Technol (Jpn)* 64:1178–1183.

[24] Gustavsson I. (1979) Distribution and effect of the 1/29 Robertonian translocation in cattle. *J Dairy Sci* 62:825–855.

[25] Wilson TD. (1991) Monosomy and Trisomy in bovine embryos sired by bulls heterozygous for the 1;29 translocation chromosome. *Theriogenology* 36:789–793.