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A STUDY OF MEIOSIS IN RAMS CARRYING
MULTIPLE ROBERTSONIAN TRANSLOCATIONS

A THESIS PRESENTED IN PARTIAL FULFILMENT OF THE
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ABSTRACT

A study was made of meiotic chromosomes in air-dried preparations from 30 genitally sound rams (*Ovis aries*). Three of the rams had a normal mitotic karyotype ($2n = 54$) and the remainder were carriers of the t_1 , t_2 and t_3 Robertsonian translocations in various heterozygous and homozygous combinations.

The studies on the primary spermatocytes showed that the normal rams had a modal number of 27 chromosomal elements and the translocation-carrying rams were recorded with a modal number of either 24 or 25. The translocation in the heterozygous state was characterized by the presence of a trivalent in cells at the diplotene, diakinesis and metaphase I stages, while in the homozygous state it was characterized by the presence of a bivalent. The modal number of chromosomal elements was recorded in 90.5 to 97.3 percent of the cells at diakinesis and metaphase I in the translocation-carrying rams. The modal number of chromosomal elements was recorded in 88.3 percent of the cells in the normal rams. An association between the sex bivalent and a small autosomal bivalent was recorded in 3.5 to 5.3 percent of the cells at diakinesis and metaphase I in the translocation-carrying rams. Eight percent of the cells in the normal rams were seen with a sex bivalent association. The sex chromosomes were separated in 0.0 to 1.1 percent of the cells at diakinesis and metaphase I in the translocation-carrying rams, while 0.7 percent of the cells in the normal rams had separated sex chromosomes. However, aneuploidy involving the sex chromosomes was not observed in the secondary spermatocytes from the normal and translocation-carrying rams.

A total of 1,757 secondary spermatocytes were counted from 27 translocation-carrying rams and 103 secondary spermatocytes from 3 normal rams. The studies on the secondary spermatocytes showed that the modal number of 30 chromosome arms was recorded in 87.3 to 96.0 percent of the non-polyploid

cells in the translocation-carrying rams and 95.2 percent of the cells in the normal rams. No hypermodal cells were found in the normal rams. Hypermodal cells were recorded in 0.0 to 3.6 per cent of the non-polyploid cells in the translocation-carrying rams. There were individual variations in the percentage of hypermodal cells recorded in rams with identical karyotypes. There were also significantly greater numbers of cells with 29 chromosome arms than with 31 chromosome arms in the translocation-carrying rams. This suggested that chromosome loss due to lagging at anaphase I or technical manipulation, must have occurred in addition to non-disjunction. A significant surplus of secondary spermatocytes of normal karyotype and a deficit of $25, t_1 t_3$ were found in the metaphase II figures from the triple heterozygous rams. Significantly uneven distributions of segregation products were also found in the multiple translocation-carrying rams with karyotypes of $50, xy, t_1 t_2 t_2 t_3$ and $49, xy, t_1 t_2 t_2 t_3 t_x$.

The translocation-carrying sheep have been shown to have good conception rates and an average breeding performance. This would suggest that only balanced (euploid) spermatozoa are involved in fertilization and the unbalanced (aneuploid) spermatocytes fail to mature into spermatozoa and are selected against or degenerate during spermatogenesis.

The evidence indicates that the fertility of the ram is unaffected by the presence of the translocation chromosomes and consequently these sheep should not be eliminated arbitrarily from our animal populations.

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