CHROMOSOME STUDIES IN A MALE NYALA (TRAGELAPHUS ANGASI)

C. WALLACE

University of the Witwatersrand, Anatomy Department, Medical School,
Hospital Street, Johannesburg 2001, South Africa

Received January 24, 1980/Accepted April 1, 1980

Mitotic and meiotic chromosome studies in a male nyala (*Tragelaphus angasi*) are described. The study confirms the diploid number of 55 in male nyala. G-banding and meiotic atudies confirm the presence of a Y-to-autosome fusion. The difference in morphology between the Y-autosome fusion chromosome in the nyala (subtelocentric) and that of other members of the tribe (where it is metacentric) is explained as being the result of pericentric inversion.

Introduction

The nyala is a member of the African antelope tribe Tragelaphini. It is a large ungulate which primarily inhabits dense bush or forest. The male shows a long fringe on the throat and back (Fig. 1). Females are smaller and lighter than the darker coloured males.

The tribe Tragelaphini is unique in that all males of the hitherto studied species show the presence of a Y-to-autosome fusion (Jorge et al., 1976). This report presents the results of meiotic and G-band mitotic studies in a free-roaming male nyala.

Material and methods

A male and female nyala were shot at Umfolozi Game Reserve in Zululand, South Africa; the male in the northern section near Umfolozi River, the female in the Sontuli Circle. Heparinized blood (30 ml) was drawn by direct cardiac puncture after opening the chest. In addition, testicular material was removed from the male and immediately exposed to hypotonic potassium chloride (0.075 M) and subsequently to fixative at the side of the animal according to the method of Wallace & Fairall (1968). The blood and fixed testicular material were then removed to the laboratory at Johannesburg 650 km away for further processing. Blood cultures were set up using the technique of Wallace (1979), after which they were exposed to colchicine, hypotonic potassium chloride and fixative. The suspension of cells was dropped onto slides and the fixative was ignited to ensure spreading of metaphases. Some of the slides obtained from blood cultures as well as from testicular material

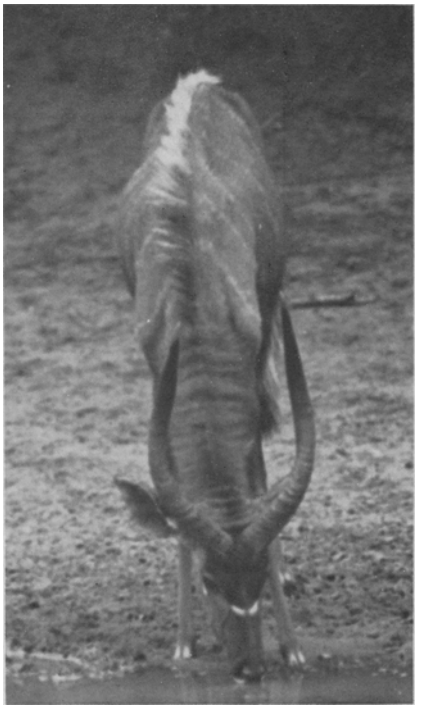

Fig. 1. Male nyala, *Tragelaphus angasi.*

Genetica 54, 101-103 (1980). 0016-6707/80/0541-0101 $ 0.60.

were stained conventionally with Giemsa, the remaining slides were pretreated with trypsin (Seabright, 1971) before staining with Giemsa.

Results

Dividing cells were noted in preparations from the male only. In general, few metaphases were observed. The diploid number is 55, and the chromosomes are mainly acrocentrics of large to small size. A pair of large submetacentric chromosomes is present in each metaphase as well as a large subtelocentric chromosome. This is in agreement with conventional studies reported earlier (Wurster & Benirschke, 1968; Wallace, 1976) which have portrayed the possible X as a large acrocentric and the large subtelocentric as a Y-to-autosome fusion chromosome.

Several of the metaphases examined showed satisfactory G-banding (Fig. 2). Most chromosomes are identifiable on the basis of size and banding pattern. The sex chromosomes consist of a large acrocentric X and the fusion Y. The latter consists of an autosome making up the lower portion (the unpaired homologue was easily identified), and the Y making up the upper part which includes the almost terminal centromere. Figure 3 shows the fusion chromosome from six metaphases, one of which is stained by conventional methods and the others by G-band techniques.

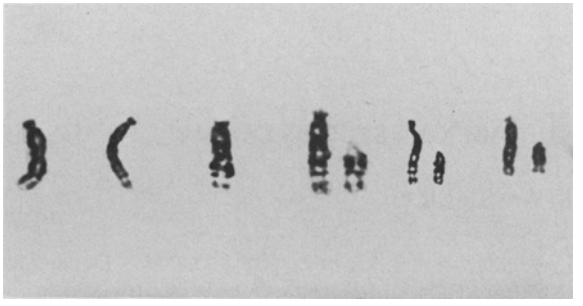

Fig. 3. Y-fusion chromosomes from six metaphases. Chromosome on left conventionally stained, others G-banded. To right, three fusion chromosomes paired with autosomal homologues.

Pachytene spermatocytes showed a large, dense sex vesicle (representing the condensed X and Y chromosomes). Apparently attached to the sex vesicle in several well-spread pachytenes, and protruding from it was a short chromatid arm (Fig. 4). Many well-spread figures at diakinesis and first meiotic metaphase were observed. These had a modal number of 27. All figures showed the presence of a large structure interpreted to be a quadrivalent, consisting of chromosomes in end-to-end configuration (the X and the Y) attached at one end to an autosomal bivalent (Fig. 5). The X portion of the end-to-end part is about twice the lenght of the Y portion. The Y portion is attached to the autosomal bivalent.

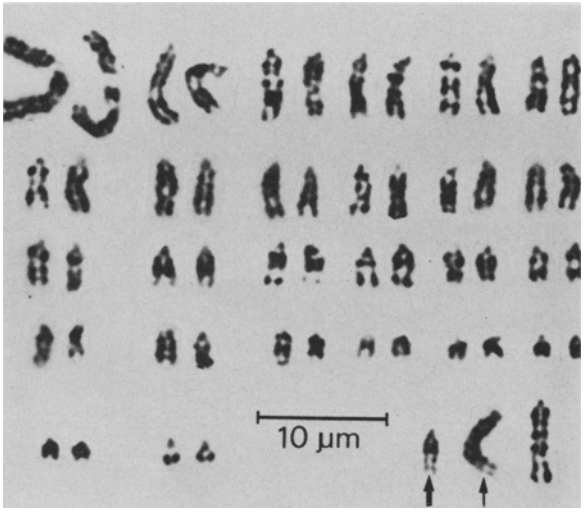

Fig. 2. G-banded karyotype from male nyala. Thin arrow indicates Y-to-autosome fusion, thick arrow indicates autosomal homologue.

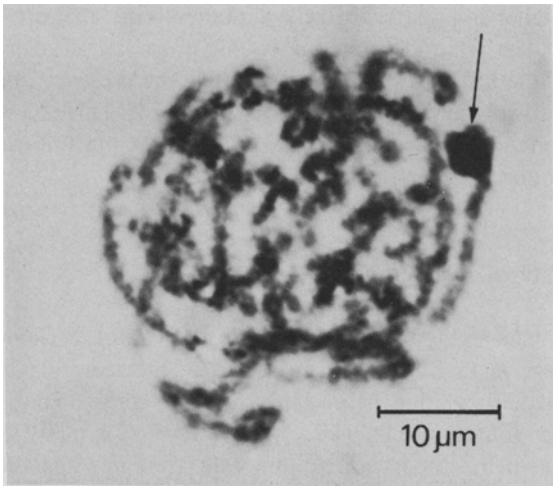

Fig. 4. Pachytene stage of meiosis of male nyala. The arrow indicates the sex vesicle with protruding paired chromatid arm.

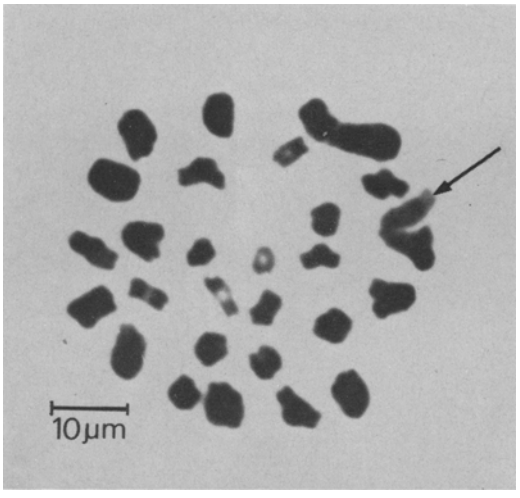

Fig. 5. First meiotic metaphase of male nyala. The quadrivalent is arrowed.

Discussion

The only other chromosome studies reported in nyala have been on conventional mitotic preparations (Wurster & Benirschke, 1968; Wallace, 1976). The present study confirms the diploid number of the male as 55 and confirms also, that the unpaired large subtelocentric chromosome in the male is, indeed, the fusion Y, so characteristic of males of the tribe. The homologue to the autosomal segment of the fusion chromosome shows a very similar banding pattern to that of the bushbuck (Wallace, unpublished data) and the kudu (Jorge et al., 1976).

A comparison of the banding pattern of the subtelocentric fusion in the nyala with that of the metacentric fusion in the bushbuck (Wallace, unpublished data) and the metacentric fusion chromosome in the kudu and eland (Jorge et al., 1976) shows that the difference in centromere position is in keeping with a change brought about by pericentric inversion of the Y portion.

The meiotic studies allow for a comparison of the sex quadrivalent of the nyala, the kudu (Wallace & Fairall, 1968) and the bushbuck (Wallace, 1977). Despite the difference in centromere position of the fusion chromosome of the nyala, the quadrivalent as well as the sex vesicle is very similar in morphology in the three species.

The present report strengthens the contention (Wallace, 1977) that the occurrence of the Y-to-autosome fusion in tragelaphine antelopes so far studied can be explained on the basis of a single fusion in a common ancestor of present-day species. As speciation took place leading to present-day forms, each species retained the fusion in one form or the other. The fusion event could have taken place in the distant past, perhaps even more than three million years ago (Wallace, 1976).

Dr. G.L. Smuts and Dr. J.L. Anderson of the Natal Parks Board are thanked for their kind co-operation in providing animals for study. The study was supported in part by a grant from the Anatomy Department Donations Fund.

References

Jorge, W., S. Butler & K. Benirschke (1976). Studies on a male eland x kudu hybrid. *J. Reprod. Fert.* 46: 13-16.

Seabright, M. (1971). A rapid banding technique for human chromosomes. *Lancet* 2 : 971-972.

Wallace, C. (1976). *Cytogenetic investigations of certain free-roaming wild mammals in the Kruger National Park*. Ph.D. Thesis. University of the Witwatersrand, Johannesburg.

Wallace, C. (1977). Chromosome analysis in the Kruger National Park; the chromosomes of the bushbuck (Tragelaphus scriptus). *Cytogenet. Cell Genet.* 18: 50-56.

Wallace, C. & N. Fairall (1968). Chromosome analysis in the Kruger National Park; a rare translocation chromosome in the kudu. *S. Afr. J. med. Sci.* 33: 113-118.

Wurster, D. & K. Benirschke (1968). Chromosome studies in the superfamily Bovoidea. *Chromosoma* 25: 152-171.