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Jl S. Afr. vet. med. Ass. 40 (1): 99-100 1969

KARYOLOGICAL STUDIES ON SOUTHERN AFRICAN PERISSODACTYLA*

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A cytogenetic survey was undertaken on the southern African species and subspecies of the order Perissodactyla, taking advantage of the relatively recent improvements whereby chromosome number and karyotypes could be established with greater accuracy.

Material was obtained from male and female animals either chemically immobilized, caught or shot in various game parks or game farms in South Africa, South West Africa, Rhodesia and Mozambique. The bone marrow biopsy technique based on that of Sandberg, Crosswhite & Gordy [1] with some adaptations [2] was employed. Several, up to about 50, good chromosome spreads were counted and karyograms were constructed. Simultaneously blood smears were made and the nuclear appendages on 500 neutrophil polymorphonuclear leukocytes counted to determine the feasibility of polymorphic sexing.

The following results were obtained:

Species	2n Chromosomes	Metacentric (=meta-submetacentric) chromosome pairs	Acrocentric (=acro-subtelocentric) chromosome pairs	Number of animals
Ceratotherium simum	82	0	40	5
Diceros bicornis	84	4	37	1
Equus burchelli	44	18	3	15
Equus zebra	32	13	2	8

The chromosomes as they appear in the four species of the Perissodactyla are shown in figures 1 (1, 2 and 3) and 2 (1, 2, 3 and 4).

The subspecies of *Equus burchelli*, namely *E. b. burchelli*, *E. b. antiquorum* and *E. b. crawshaii (=selousi)* and intermediate types between the latter two all have the same chromosome number, namely 2n=44, and morphologically apparently identical karyograms. The same applies to the subspecies of *Equus zebra*, *E. z. zebra* and *E. z. hartmannae*, with a diploid chromosome number of 32.

The karyotypes of the different species of the Perissodactyla were compared with each other. There is a great variation in number and morphology of the karyotypes, so that no morphological relationship between the autosomes was found, although a similarity was recognized in the sex chromosomes throughout the order. The sex chromosomes of the rhinoceroses resemble those of the horse.

Karyotype evolution among the Perissodactyla was difficult to explain. Robertsonian fusion, whereby a decrease of chromosome number is accompanied by a decrease in number of acro-subtelocentric chromosomes could not be the only reason for the existence of such a wide range from 32 to 84 chromosomes in this order. Robertsonian fusion must have been accompanied by other phenomena, such as tandem fusion, translocations with subsequent loss of heterochromatic centromeres, translocations reverting to acrosubtelocentric chromosomes as a result of pericentric inversion or possibly the loss of very small chromosomes. Polyploidy could not be offered as an explanation here.

These cytogenetic studies could not assist in clarifying the taxonomic problems among the zebras at subspecies level. Nevertheless, it has confirmed the existing classification at species level ,with every species of this order having its specific diploid chromosome count.

It was concluded that an identical chromosome number and an identical karyotype may not be advanced uncritically for the identity of species, neither may differences in chromosome number be accepted as proof of difference in species, unless one excludes

*A summary of a thesis submitted in partial fulfilment of the requirements for the degree of Master of Science (Agric.) in the Department of Genetics, Faculty of Agriculture, University of Pretoria, Pretoria. December, 1968. To be published in Kudu No. 13, 1970 (Journal for Scientific Research in the National Parks of the Republic of South Africa).

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chromosome polymorphism.

Although no chromosomes of hybrids were studied, the findings of other authors on hybrids were discussed, showing that in nearly all known hybrids of the Equidae, the diploid number of the hybrid was equal to the sum of the haploid number of both parents and that all Equidae hybrids, excluding a few exceptional mules, were sterile.

Suggestive evidence was found for the existence of a mitotic cycle with peak activity during about 9 to 11 o'clock a.m. Although not specifically investigated, indications were found that activity of the animal (and thus external factors influencing that activity) may play a rôle, yet that physical stress, excitement, and delay in collection of bone marrow after immobilization may possibly depress the number of mitotic figures obtained, presumably due to circulatory changes in the bone marrow.

Clear-cut sex differences exist in all the species and subspecies examined; the female sex can be determined by counting typical "drumsticks" only.

REFERENCES

1. Sandberg, A. A., Crosswhite, L. H. & Gordy, E., 1960 *J. Am. med. Ass.* 174 : 221
2. Gerneke, W. H. 1967 *Jl S. Afr. vet. med. Ass.* 34 : 219

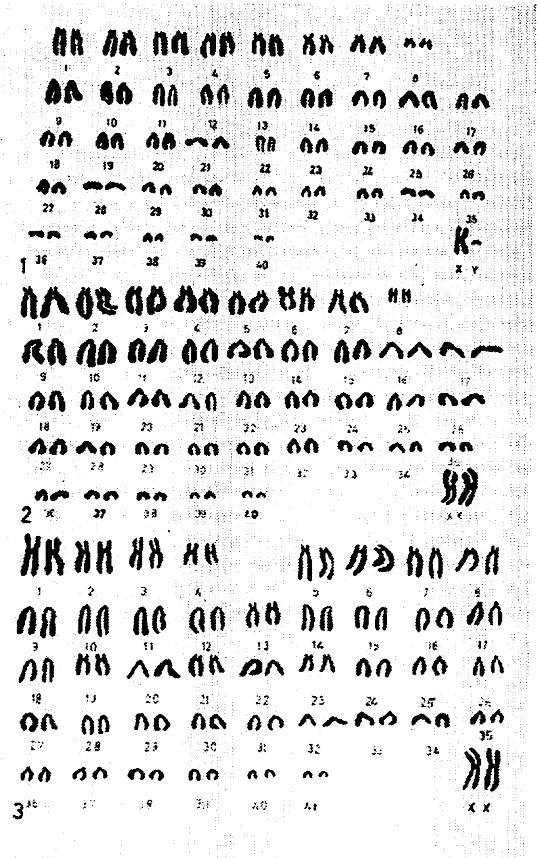

FIG. 1. (1) Male and (2) female karyogram from mitotic chromosomes of **Ceratotherium simum.** (3) Female karyogram from mitotic chromosomes of **Diceros bicornis.**

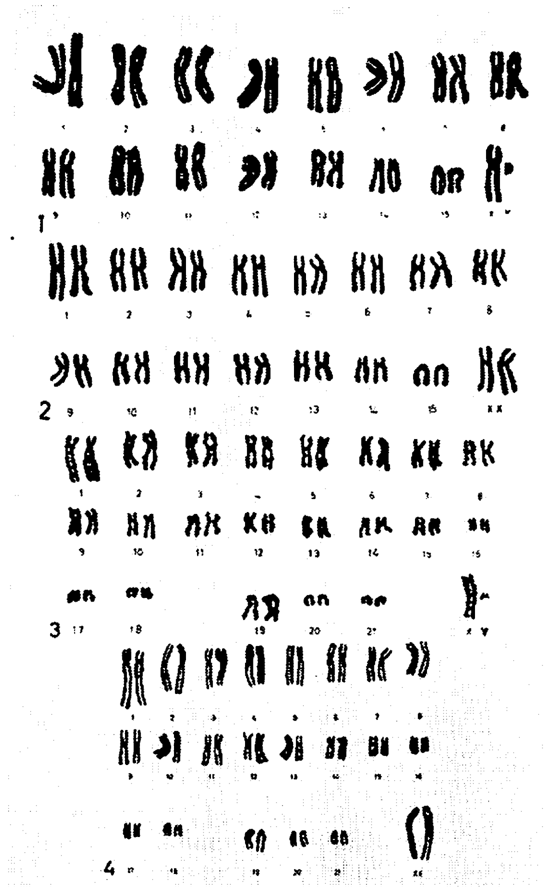

FIG. 2. (1) Male and (2) female karyogram from mitotic chromosomes of **Equus zebra.** (3) male and (4) female karyogram from mitotic chromosomes of **Equus burchelli.**

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