Chromosome Behaviour with Special Reference to Sex Mechanism in *Herpestes auropunctatus* (Hodgson)

O. P. Mittal and B. Kaul

Department of Zoology, Panjab University, Chandigarh, India

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The initial report by Fredga (1964) on the chromosomes of the male mongoose, *Herpestes auropunctatus* (Hodgson) has led to the postulation of the existence of a novel type of the sex chromosome arrangement in the form of a Y/autosome translocation leading to odd number ($2n=35$) in the male with no discernible Y-chromosome. However, Talukdar and Manna (1966) have found a distinct Y-chromosome in the male of this species reporting $2n=36$ in both sexes. These authors and Fredga (1967) have further concluded that the discrepancy may be either due to the uncertainty as to the taxonomic identity of the specimens examined or there may be small variation in the chromosome number and morphology of the different local races or subspecies of the same species. Due to the above controversy, the present investigations have been undertaken on the chromosome behaviour with special reference to the sex mechanism in this primitive carnivore.

Material and technique

Small Indian mongoose, *Herpestes auropunctatus* (Hodgson) were obtained from the local animal collectors at Chandigarh and Delhi. The mitotic chromosomes were studied from the bone marrow and spleen, while meiotic from the testes. The animals were injected intraperitoneally with 0.01 ml of 0.04% aqueous colchicine solution/gm of body weight. After 3 hours the animals were sacrificed and various tissues removed from the body. The minced material was pretreated with sodium citrate (0.9%) for half an hour followed by fixation either in Carnoy without chloroform or in a mixture of ethanol, glacial acetic acid and distilled water (1:2:3 by volume) for 30 minutes. The fixed material was stained and squashed in Gomori's haematoxylin.

Observations

The chromosome number has been determined in 100 unequivocal cells from males and 44 cells from females. It is established that the male has the diploid number of 35 (Fig. 1), while the female 36 chromosomes (Fig. 2). In the karyotype (Fig. 3) the various elements can be grouped as follows:

A. 34 autosomes: They consist of a) medians—5 pairs; b) submedians—5 pairs; c) subterminals—5 pairs; and d) terminals—2 pairs.

B. Sex-chromosomes: The X-chromosome is the largest in the whole com-

plement and submedian in nature. There is no discernable Y-chromosome in the male complement.

Meiosis: The behaviour of chromosomes at meiosis has been studied only in males. From diplotene to metaphase I (Figs. 4 and 5), 16 bivalents and one trivalent are observed. At diakinesis/metaphase I, the X is somewhat despiralized and consequently reveals negative pycnosis. However, a few cells (Fig. 6)

Figs. 1-2. 1, gonial metaphase of male. 2, gonial metaphase of female.

Fig. 3. Karyotype prepared from male metaphase.

have also been found with 17 bivalents and an univalent. The latter is the X-chromosome which exhibits precocious disjunction from its autosomal bivalent partner. The morphology of the trivalent varies markedly depending on the position of the chiasmata (Fig. 7).

In metaphase II, two kinds of cells were observed: one with 17 autosomes plus an X-chromosome (Fig. 8), while the other with 17 autosomes only (Fig. 9).

Discussion

The male mongoose, *Herpestes auropunctatus* has been a controversial case. According to Fredga (1964) the diploid number in males is 35 while 36 in females.

Figs. 4-9. 4, diplotene (trivalent marked by arrow). 5, diakinesis/metaphase I with 16 bivalents and a trivalent (marked by arrow). 6, diakinesis with 17 bivalents and an univalent (marked by arrow). 7, various configurations of trivalents observed. 8, metaphase II with 17 autosomes and an X-chromosome. 9, metaphase II with 17 autosomes only.

Consequently his findings have been confirmed by the investigations of Fredga (1967), Ray-Chaudhuri *et al.* (1968) and Cohen and Chandra (1970). Todd and Pressman (1966) have described the same type of karyotype in the lesser Indian

mongoose, *Herpestes javanicus* Geoffroy, which is apparently identical to that of *H. auropunctatus* and recently has been considered to be the same by Wurster and Benirschke (1968). However, Talukdar and Manna (1966) and Fredga (1967) have attributed this discrepancy in the male of this species to the possibility of racial difference in the chromosome number as well as sex-determining mechanism.

In the present study based on the somatic and germinal tissues of the males from two different localities (Chandigarh and Delhi), the odd diploid number of 35 chromosomes was observed which is the same as that recorded by Ray-Chaudhuri *et al.* (1968) from the locality of Banaras. It may be that the species which Talukdar and Manna (1966) identified as *H. auropunctatus* is some other one or the balance collapsed and in that particular individual the sex mechanism of original type was restored. Thus, there is no such racial difference in the male sex mechanism. The findings of Ray-Chaudhuri *et al.* (1968) on *H. edwardsii* from South India further strengthen that this may be an established type of sex mechanism in the species of *Herpestes* found in India.

As reported by Fredga (1964), a part of original Y-chromosome has become translocated onto an autosome, and at meiosis that autosome pair forms an 'ordinary' bivalent but the X associates in an end-to-end position with the A⁷ giving rise to the trivalent. The various configurations of the trivalent (Fig. 7) makes the situation more complicated because four kinds of sperms will originate theoretically (Fredga 1964) and the zygotes produced will be non-viable. Our observations of meiosis I make it very clear that there is precocious separation of X from the particular autosomal bivalent. There is some kind of repulsion between X and Y which makes it possible to balance the sex mechanism in this animal.

It will be of interest to investigate the various species of mongoose i.e., *H. fuscus*, *H. smithi*, *H. vitticollis* and *H. urva* and to find the evolution of the chromosome number and sex mechanism in the family Herpestinae.

Summary

In the small Indian mongoose, *H. auropunctatus* (Hodgson) no racial difference has been found. The diploid number is confirmed to be 35 and 36 in the male and female, respectively. It is concluded that a part of original Y-chromosome is translocated onto an autosome. The X-chromosome forms a trivalent with that particular autosomal bivalent bearing Y. However, certain cells at diakinesis and metaphase I also reveal 17 bivalents and a univalent X, which is due to the precocious disjunction of X from that autosomal bivalent.

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