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# STUDIES ON KARYOTYPES OF SOUTH AFRICAN ARGASIDAE. I. *ORNITHODOROS SAVIGNYI.* (AUDOUIN) (1827)

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Data on the chromosomal complexes of Argasid ticks are scarce in spite of the fairly extensive literature on the cytogenetics of insects. The first record of the karyotype of an Argasid dates back to Opperman, 1935, (cited by Goroshchenko, 1962) in his work on *Argas reflexus*. He found the chromosome number to be 2n = 26. During the next twenty years very little was contributed in this field of study until Geigy & Wagner (1957) published the karyotype of *Ornithodoros moubata* Murray, (1877). They found the chromosome number to be 2n = 20, but could not differentiate either the components to be 2n = 20, but could not differentiate either the components or the presence of sex-chromosomes. Goroshchenko (1962) investigated a number of species of Argasidae from Europe and the U.S.S.R.; he lists the ten known species, and of these he examined eight. He expresses the opinion that the sex-chromosomes are morphologically distinguishable, and suggests the possibility of a heteromorphic pair of sex-chromosomes in the male.

The primary object of this study is the identification of sex-chromosomes in Argasidae, and the description of the karyotype of *O. savignyi*, which has not been studied to date.

## Materials and Methods

The tampans used were trapped in the North Western Cape Province (Kalahari), where vast numbers abound in the sand in shaded areas around stock yards and under trees. Trapping by means of the $CO_2$ method (Nevill, 1964) is remarkably effective for obtaining all stages in a reactive state. Pre-adult stages, the third and fourth stage nymphae, were selected for investigation since the probability of finding a sufficient number of dividing cell forms in the developing organs is greater in them than in the adults. The method of Sandberg, Crosswhite & Gordy (1960) as adapted by Gerneke (1964) for the pig, was found to be the most suitable. Dissections were performed in an isotonic glucose-saline solution, the organs being transferred rapidly to hypotonic sodium citrate.

Staining in May-Grunwald-Giemsa, alkalinised with ammonia, gives satisfactory results in that it is easily controlled to give the desired intensity. Mitotic figures in metaphase and in early anaphase were selected for study. Due to differences in length of the chromosomes in different phases, they are represented by their relative, rather than absolute, sizes in the idiogram (Figure 1).

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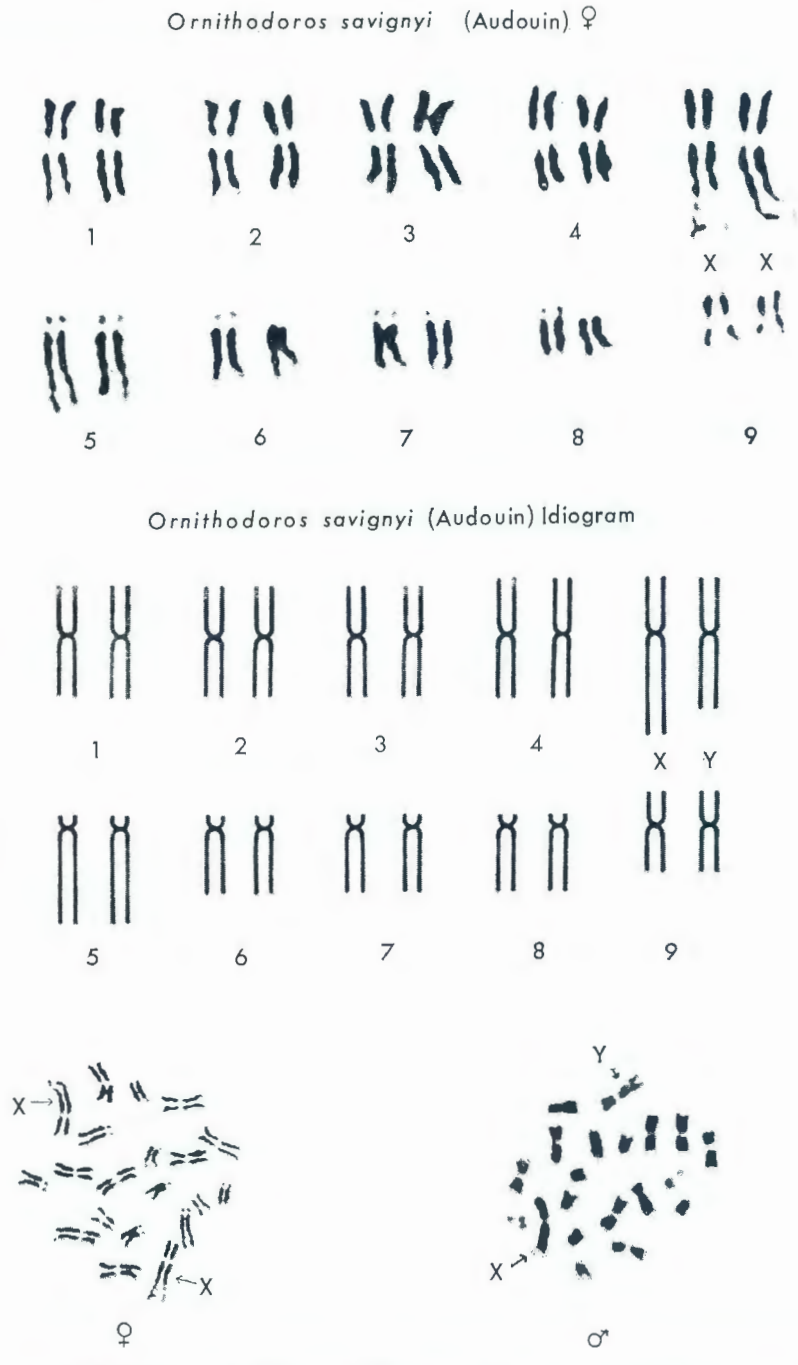


FIG. 1—Karyotypes and Idiogram of *O. savignyi* chromosomes in early anaphase

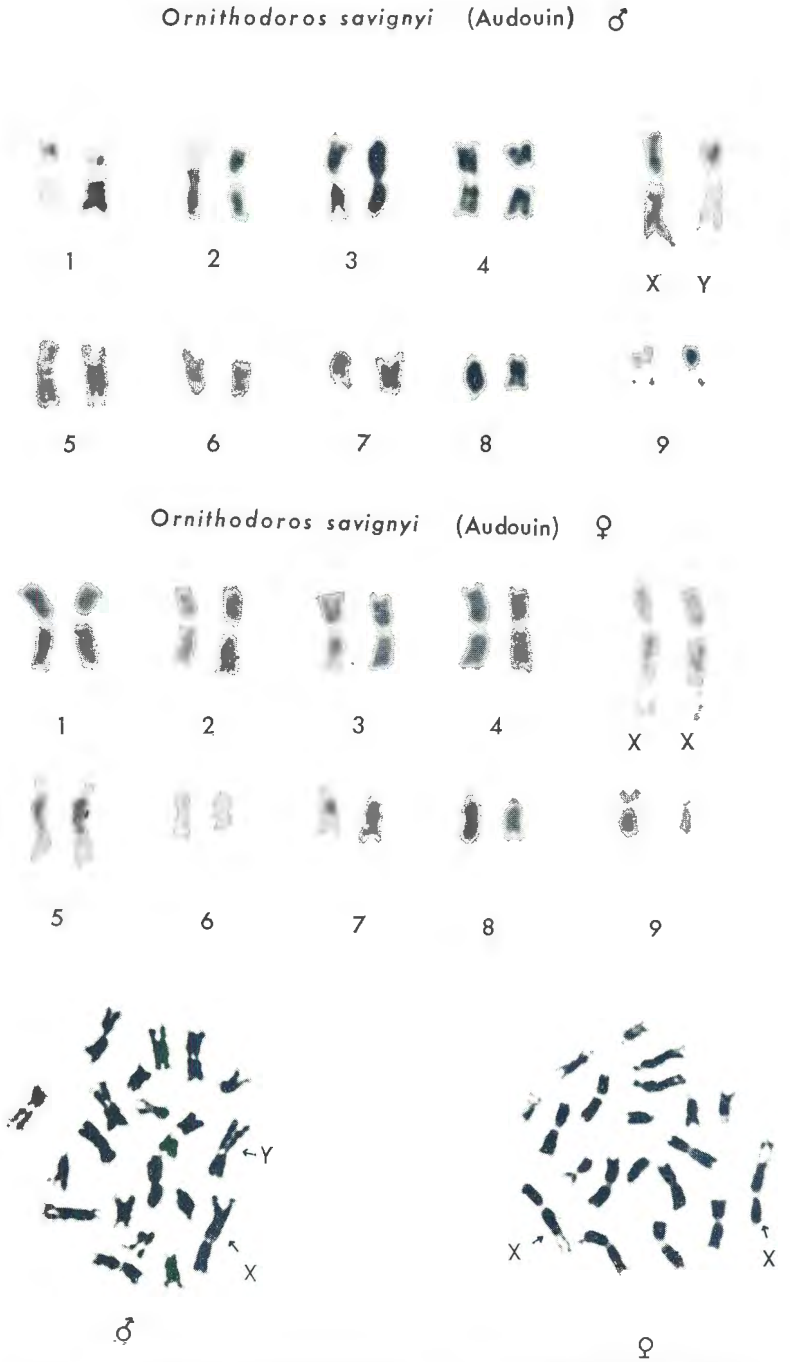


FIG. 2—Karyotype and metaphase figures of male and female *O. savignyi*

## Observations

In *O. savignyi* the chromosome number for both the male and female is consistently found to be 2n = 20. The presence of sex-chromosomes in both the male and female is evident in that in both sexes they are easily distinguished by their extremely large size. The karyotype of *O. savignyi* is arranged according to the Denver system; the chromosome pairs according to the position of the centromere, and in descending order of length.

The autosomes seen in Fig. 1 and 2 are as follows:

*Groups* 1–3: Medium sized chromosomes with submedian centromeres. The three pairs are morphologically alike in size and shape.

*Group* 4: Medium sized metacentric chromosomes of the same order of length as in the first group.

*Group* 5: The largest chromosomes in the acrocentric series of approximately the same length as the first two groups.

*Groups* 6–8: Short chromosomes with acrocentric centromeres. The three pairs are alike in size and shape.

*Group* 9: Short chromosomes of same length as previous group, but the centromeres are metacentric, each chromatid appears to possess a satellite. These satellites are not always clearly visible, but seen in a high percentage of cells. Also the centromere position is very clear in one member of the pair, but frequently less so in the other.

The sex-chromosomes as seen in Fig. 1 and 2 are large submedian chromosomes more than twice the length of the short group. The Y chromosome differs only in length from the X, both the upper and lower arms being slightly shorter; but it is still much larger than any of the autosomes.

## Discussion

Mitotic figures were extremely rare in preparations from unfed specimens of *O. savignyi*, whether immature or adult, probably due to the low metabolic rate of unfed tampans. However, good results were obtained when fed specimens were used. They were numerous in preparations of tampans dissected 5 to 8 days after a blood meal, but were rare prior to this period as well as thereafter. Though the number of chromosomal spreads may vary from one to twenty or more per slide, satisfactory clearly defined metaphase or early anaphase spreads are by no means abundant.

This lack of clarity is even more pronounced in the photographs in the publications of previous workers. In these photographs, taken of preparations made according to the older methods such as aceto-orcein squashes, it is mostly impossible to fix the position of the centromeres and thus to recognise the homologous autosomes or the sex-chromosomes.

In contrast to the condition generally found in mammals, the centromeres in these Argasid chromosomes are refractory to staining. In the pig chromosomes 9 and 13 (Gerneke, 1964) also have refractory centromeres, thus forming the exception in mammals.

Refractory centromeres, therefore, make it almost impossible to establish with certainty the existence of satellites on chromosomes 8 and 9 of *O. savignyi*, although they are frequently present. The constant diploid number of 20 chromosomes for both the male and the female sandtampan lends support to the postulations of the presence of an XX and XY mechanism of sex-determination in the Argasidae, as was suggested by Goroshchenko (1962).

As the number and morphology of chromosomes of an organism are one of its most stable features, it is evident that a different karyotype, varying either in number or morphology or both, exists for each species. The specific karyotype is morphologically identical for all individuals of a species. Cytogenetic studies could, therefore, confirm or refute taxonomic relationships, especially between closely related species, and it could also aid in determining inter-specific hybridization.

## Summary

(1) The karyotype of *O. savigny* is described for the first time.

(2) The chromosome number of both male and female is 2n = 20.

(3) The presence of sex-chromosomes in the genus *Ornithodoros* is confirmed.

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