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Chromosomes of the Japanese gagrellid, *Paraumbogrella huzitai* Suzuki (Gagrellidae, Opiliones, Arachnida)

Nobuo Tsurusaki
Zoological Institute,
Faculty of Science,
Hokkaido University,
Sapporo 060, Japan

Summary

The chromosomes of the Japanese opilionid, *Paraumbogrella huzitai* Suzuki, were successfully analysed by the air-drying technique. The diploid chromosome number of 10 with an XX-XY (male heterogametic) sex-determining mechanism was established.

Introduction

A number of papers have been published concerning chromosomes in harvestmen (Sokolow, 1929, 1930; Tomohiro, 1940; Suzuki, 1941, 1976; Juberthie, 1956; Parthasarathy & Goodnight, 1958; Sharma & Dutta, 1959). However, these authors employed paraffin section and/or squash methods and mostly failed to make a precise karyological analysis or to distinguish sex chromosomes. Exceptions are an American cosmetid, *Vonones ornata* (Wood), and an Indian gagrellid, *Melanopa unicolor* Roewer, in which the existence of XO- and XY-type sex-determining mechanisms were implied respectively (Parthasarathy & Goodnight, 1958; Sharma & Dutta, 1959).

In this study, a current air-drying technique was applied to obtain good photographs of chromosomes. In consequence, the karyotype of the Japanese gagrellid, *Paraumbogrella huzitai,* was successfully analysed in both sexes and an XX-XY sex-determining mechanism was clearly demonstrated.

Materials and Methods

Animals were collected on the campus of Hokkaido University, Sapporo, northern Japan, on 18 September 1981. Testes or ovarian tissues were dissected out in Ringer solution for *Drosophila* from living animals (2 fresh adult ♂♂ and 2 subadult ♀♀). Air-dried slides were prepared according to the method of Takagi & Oshimura (1973) which involves lactic acid treatment to dissociate individual cells immediately before slide preparation, followed by Giemsa staining.

Metaphase chromosomes were serially arranged according to descending order of length and position of the centromeres (Fig. 1 a-c).

Results and Discussion

On the basis of chromosome counts in numerous metaphase plates from spermatogonia (Fig. 1d) and ovarian follicle cells, and in first spermatocytes (Fig. 1e), the diploid and haploid chromosome numbers were determined as 10 and 5, respectively. The autosomes were composed of 4 pairs of similar-sized metacentrics (Fig. 1a-c) and the sex chromosomes were determined as XY for the male and XX for the female. The X chromosome was submeta- or subtelocentric in structure and similar in size to chromosomes 3 and 4, while the Y was the smallest metacentric. This chromosome number (2n=10) is the lowest found in Opiliones, previously observed only in *Systenocentrus japonicus* by Suzuki (1966).

Very little is known concerning the sex-determining mechanism in Opiliones. Parthasarathy & Goodnight (1958) indicated the existence of an XX-XO sex-determining mechanism in the American species, *Vonones ornata* (Cosmetidae), in which the male possessed an odd diploid set comprising 25 elements. The XX-XY type has not clearly been demonstrated before in any opilionid species studied, although it was suggested by Sharma & Dutta (1959). Like other previous workers, Sharma & Dutta (1959) studied only the male reproductive cells and detected the occurrence of a pair of chromosomes showing heteropycnosis during both mitosis and meiosis and differential behaviour during meiotic divisions in *Melanopa unicolor* (Gagrellidae), thereby indicating the probable existence of this type of sex determination. Since the male diploid chromosome numbers have been even in more than 30 species so far investigated, with the unique exception of *Vonones ornata,* the XX-XY type is probably the prevailing mode of sex-determination in the Opiliones.

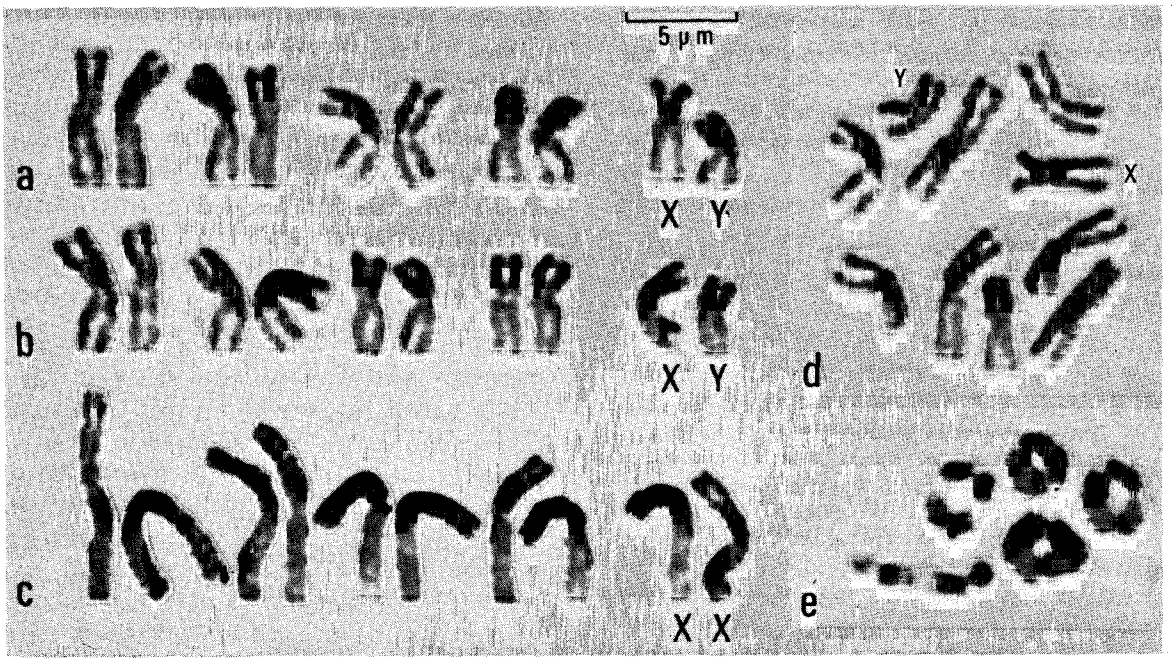

Fig. 1: Chromosomes of *Paraumbogrella huzitai* Suzuki. **a-b** Two representative karyotypes with 10 chromosomes, XY, from spermatogonial metaphases; **c** The karyotype with 10, XX, from a mitotic metaphase in ovarian follicle cells; **d** Spermatogonial metaphase spread; **e** A first spermatocyte with 5 bivalents.

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