KARYOTYPE ANALYSIS OF TWO SPECIES OF ORIBATIDA (ACARI)

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ACARI ORIBATIDA
KARYOTYPE
B-CHROMOSOME

SUMMARY : The karyotypes of two species of Oribatida, *Brasilobates spinosus* Fujita (1989) and *Galumna longoporosa* Choi, (1986), were studied in oocyte. The result showed that *B. spinosus* has 16 chromosomes on mitosis metaphase plate (male: 2n=16), and that its karyotype was 2n_=16 (2m + 12st + 1t + X), N. F =18. A B-chromosome was found on mitosis metaphase; *G. longoporosa* has 19 chromosomes on mitosis plate (2n_=19), and its karyotype is 2n_=19 (2sm + 16st + X), N. F =21. The two species of Oribatida have the same sex-determining mechanism (XX : XO).

INTRODUCTION

The number of known species of Acari is about 40,000 in the world. In 1960's, the study of chromosome of mites is inchoate. Studies on chromosomes have been reported from about 440 species of Acari but the studies of Oribatida's chromosomes are few. The karyotype of Acari were explored by CHEN, MUNDERLOH & KURTTI (1994); GUNN & HILBURN (1990, 1995); JONG, LOBBES & BOLLAND (1981); KING (1980); ZHOU HONGFU & MENG YANGCHUN (1982); CHEN CHUNSHENG & MENG YANGCHUN (1986, 1987, 1990); QIN ZHIHUI, ZHOU HONGFU & MENG YANGCHUN (1997). Although karyological investigations have been carried out constantly in this family, the chromosomes are known in less than 5% of the total described species. Some questions have not been confirmed, such as the genesis of B-chromosome, the sex-determining mechanisms, and so on. In the present report, chromosomes of *B. spinosus* and *G. longoporosa* were analyzed.

MATERIALS AND METHODS

Specimens of *B. spinosus* and *G. longoporosa* were collected from Qianfu Mountain in Shandong Province of China in April of 2003. These specimens were bred and the eggs collected. The eggs were dipped 30 minutes in 0. 01% colchicines, then crushed with glass-stick. Oocytes were collected by centrifugation (10 minutes). After hypotonic treatment for 15 minutes, the solution was fixed in fresh methanol-acetic acid (3: 1) for 1-2 hours. A drop of solution was placed on frozen and cleaned slide, blown the liquid to spread the cell. Preparation was dried on the flame and stained with Giemsa (pH 7. 0 — 7. 5) for 30-60 minutes.

RESULTS

Chromosome numbers: The number of male diploid chromosomes in *B. spinosus* is 16 (FIG. 1)

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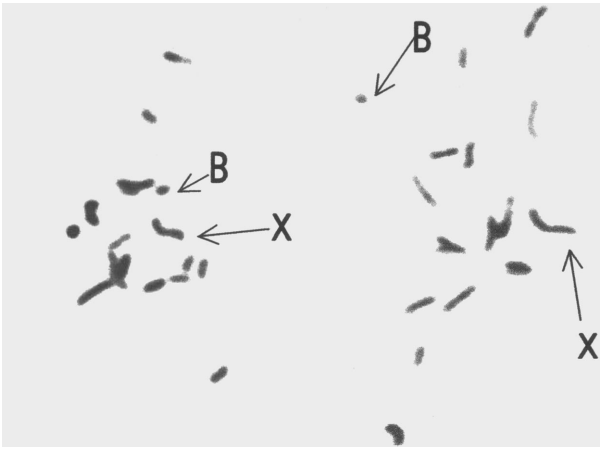

FIG. 1: Chromosomes of *B. spinosus*

FIG. 2: Chromosomes of *G. longoporosa*

including seven pairs of autosomes, a single B-chromosome and one X chromosome, 2n♂=16 (14A + 1B + X). The three pairs of autosomes are long chromosomes, and four pairs of autosomes are medium chromosomes. The X chromosomes is the largest element, with a relative length (%) 17.636. The single B-chromosome is a micro-chromosome, and its relative length (%) is 3.668. B-chromosome is easily recognizable from others by its smaller size and by negative heteropycnosis. The karyotype of *B. spinosus* is 2n♂=16 (2m + 12st + 1t + X). The chromosomes of number 1 are metacentric; the other autosomes and X chromosome are acrocentric; and the B-chromosome is telocentric (TABLE 1).

Number	Relative length(%) (*S* + *L*=*T*)			Centromere Index(%)	Arm Ratio (Long/ Short)	Type
1	6.789	8.974	15.763	43.069	1.322	m
2	3.199	9.754	12.953	24.698	3.049	st
3	2.746	9.428	12.174	22.556	3.433	st
4	2.575	9.091	11.666	22.074	3.530	st
5	2.107	7.296	9.403	22.407	3.463	st
6	2.090	6.767	8.857	23.597	3.238	st
7	1.483	6.399	7.882	23.762	4.316	st
X	3.799	13.837	17.636	21.541	3.640	st
B	0	3.668	3.668	0	_ _	t

TABLE 1. Relative length, arm ratio and type of the chromosomes in *B. spinosus*

The number of male diploid chromosomes in *G. longoporosa* is 19 (FIG. 2), including nine autosomes and one X chromosome, 2n♂=19 (18A + X). Nine pairs of autosomes are medium chromosomes. The X chromosome is the largest element, with a relative length (%) of 22. 169. The karyotype of *G. longoporosa* is 2n♂=19 (2sm + 16st + X). The chromopsomes of number 1 is submetacentric, the others (autosomes and X) are acrocentric chromosomes (TABLE 2).

B. spinosus and *G. longoporosa* have the same XX: XO sex-determining mechanism.

Number	Relative length(%) (*S* + *L*=*T*)			Centromere Index(%)	Arm Ratio (Long/ Short)	Type
1	2.840	7.736	10.576	26.853	2.724	sm
2	2.150	8.277	10.427	20.627	3.848	st
3	2.109	8.169	10.278	20.520	3.873	st
4	2.112	7.927	10.039	21.038	3.753	st
5	2.055	7.968	9.023	22.775	3.877	st
6	1.880	5.858	7.738	24.296	3.116	st
7	1.771	5.609	7.380	23.997	3.167	st
8	1.512	4.852	6.364	23.759	3.209	st
9	1.454	4.552	6.006	24.209	3.131	st
X	5.528	16.641	22.169	24.936	3.010	st

TABLE 2. Relative length, arm ratio and type of the chromosomes in *G. longoporosa*

Model chart

In order to analyse the karyotype and to make model chart we used the karyotypical analysis software (FIG. 3 and FIG. 4).

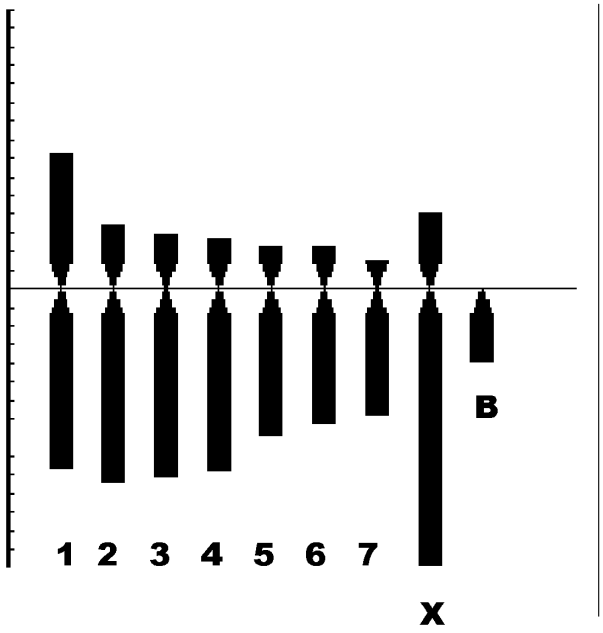

FIG. 3. *B. spinosus:* model chart of chromosome

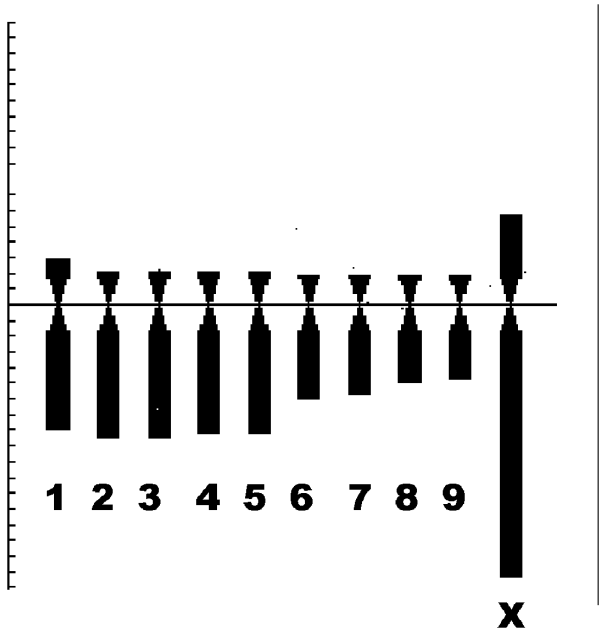

FIG. 4. *G. longoporosa:* model chart of chromosome.

In *B. spinosus*, n=9 (7A + 1B + X), and the chromosomes are divided into five groups according to their relative lengths: group I — between 12 to18 (No. 1— 3, 8); group II— between 10 to 12 (No. 4); group III— between 8 to 10 (No. 5, 6); group IV— between 6 to 8 (No. 7); group V — between 0 to 2 (No. 9). Constitution of relative length is $4L + 1M_3 + 2M_2 + 1M_1 + 1S$. Karyotype type is 1B. Centromere Index (N. F) = 18. Ratio of chromosome length (L/S) =2.2. Asymmetry index of karyotype =70.

The chromosomes of *G. longoporosa* : n=10 (9A + X). Four groups according to the relative lengths: group I— between 12 to23 (No. 10); group II— between 10 to 12 (No. 1-4); group III— between 8 to 10 (No. 5); group IV— between 6 to 8 (No. 6-9). Constitution of relative length is $1L + 4M_3 + 1M_2 + 4M_1$. Karyotype type is 1B. Centromere Index (N. F) =21. Ratio of chromosome length (L/S) =3.7. Asymmetry index of karyotype =61. 2.

DISCUSSION

CHEN CHUNSHENG & MENG YANGCHUN (1990) summed up the results of karyotypes studied in Acari. They found that the number of chromosomes of Oribatida was from 16 to 36, and that most species of Oribatida presented the XX: XO sex-determining mechanism, and that few species have the X-Y sex-determining mechanism. Hitherto, they summed up the studies on B-chromosome and found that B-chromosome presented adaptability in some species, such as *Dermacentor nuttalli* and *Dermacentor silvarum*.

Different authors agreed to the fact that B-chromosome consists of constitutive heterochromatin, and they thought the B-chromosome may not play an important role on the heredity. But the genesis of B-chromosome has not been found out. That a single B-chromosome was found in *B. spinosus* may provide a useful clue for the study of Oribatid chromosomal evolution.

GUNN & HILBURN (1990, 1995) studied the karyotype of ten species of ticks (*Amblyomma* and *Derma-*

centor) found in North America. The number of chromosomes was 20 and the autosomes of all species were acrocentric chromosomes; all species were XX: XO sex-determined and X chromosome was the largest element. CHEN, MUNDERLOH & KURTTI (1994) studied the karyotype of specimens of *Ixodes scapularis* (Acari: Ixodidae). Three species were found with 28 chromosomes (female: 26 autosomes and XX; male: 26 + XY), sex chromosomes with X the largest.

On the two oribatids studied, autosomes are mostly acrocentric and X chromosome is the largest which accord with the researches of GUNN & HIBURN ; they have the same XX: XO sex-determining mechanism. We find a B-chromosome on mitosis metaphase plate of *B. spinosus*. We hope our studies will supply some useful data for the genetics and taxonomy of Acari.

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