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KARYOTYPE OF THE CHINESE FOUR-LINED SKINK, *EUMECES QUADRILINEATUS* (REPTILIA: SCINCIDAE), FROM HONG KONG

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ABSTRACT. - A karyological survey was made on *Eumeces quadrilineatus*, for the first time, by the bone marrow-air dry method. This species has 2n=26 chromosomes, with six large and five small biarmed and two small uniarmed homologous pairs. Comparison of this karyotype with karyotypes of congeneric species strongly suggests that the *Pariocela* section of the genus *Eumeces* is karyologically considerably invariable.

KEYWORDS. - Karyotype, skink, *Eumeces*.

INTRODUCTION

Eumeces is considered to be the most archaic genus of the extant scincid genera, and is widely distributed in subtropical and temperate Eurasia, northern Africa and North America (Greer, 1970). This genus is divided into two sections, of which the *Eumeces* section is distributed in northern Africa, West Asia, and central America. The *Pariocela* section, on the other hand, occurs in East Asia and North America (Lieb, 1985). Recently, Hikida (1993) analysed the phylogenetic relationships among 13 East Asian and North American species

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of the latter on the basis of morphological data, and revised the classification prevailing to that date. In his classification, *E. quadrilineatus* from central and southern China, Vietnam, Cambodia, and Thailand (Taylor, 1935) was assigned to the distinct monotypic *E. quadrilineatus* species-group of the *E. brevirostris* subsection. The remainder were assigned to four species-groups, all belonging to the *E. fasciatus* subsection. This classification was largely supported by a subsequent biochemical study (Kato et al., 1994).

In the genus *Eumeces*, 16 species have hitherto been karyotyped. Of these, three species belonging to the *Eumeces* section are known to be chromosomally divergent from species of the *Pariocela* section (Table 1). Kupriyanova (1986) demonstrated that the karyotype of *E. taeniolatus*, being composed of 2n=28 chromosomes, sharply differs from that of *E. schneiderii* (2n=32). Caputo et al. (1993, 1994) pointed out that karyotypes of *E. algeriensis* and *E. schneiderii*, both consisting of 2n=32 chromosomes, differ from each other in centromeric positions in several elements. On the other hand, species of the *Pariocela* section, hitherto karyotyped, invariably have 2n=26 chromosomes including 12 biarmed macrochromosomes and 14 microchromosomes (Kupriyanova, 1986).

In this paper we describe the karyotype of *E. quadrilineatus*, a species taxonomically distant from other species within the *Pariocela* section (Lieb, 1985), for the first time and compare it with karyotypes of congeneric species described in published literature.

MATERIALS AND METHODS

Three males and three females from Cheung Chau Island of Hong Kong were used. Voucher specimens were deposited in the herpetological collection of the Department of Zoology, Kyoto University (KUZ 36508-36513). All specimens were brought alive to the laboratory,

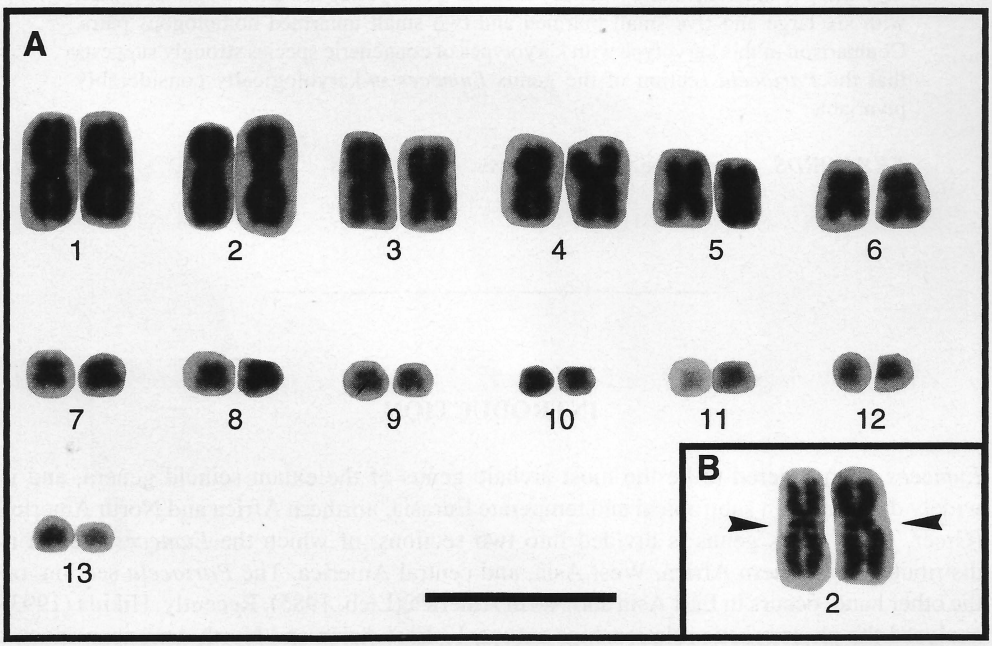

Fig. 1. Karyotype of female *Eumeces quadrilineatus* (KUZ 36512) from Hong Kong. (A), chromosomes from metaphase cell arranged in order of size. (B), second pair from another cell with more distinct achromatic gaps that represent secondary constrictions (indicated by arrows). Scale represents 10 μm.

where they were injected intraperitoneally with 0.1 ml of colchicine solution (2 mg/ml) per gram of body weight, 10 to 15 hours before being anesthetized with nembutal injection. Metaphase mitotic cells taken from femur bone marrow were treated with 0.06 mol/l KCl solution for 60 minutes, fixed in Carnoy's solution (1:3, glacial acetic acid:absolute methyl alcohol) for 60-70 minutes, and spread on glass slides to be air-dried. All chromosome preparations were photographed for detailed observation after being stained in 2% Giemsa solution for 40 minutes. The karyotype was determined for each individual on the basis of at least five well-spread cells. Terminology for chromosomal description follows Green & Sessions (1991).

RESULTS

The karyotype of *Eumeces quadrilineatus* consists of 2n=26 chromosomes forming two rather distinct size groups (Fig. 1). Of these, the larger size-group comprise five pairs of metacentric chromosomes (pairs 1,3,4,5 and 6) and one pair of submetacentric chromosomes (pair 2). Secondary constrictions are recognizable on longer arms near the centromere in pair 2. Of the chromosome pairs composing the smaller size-group, pairs 9 and 10 are metacentric, pairs 7, 8 and 11 are submetacentric, and the remainder are telocentric. The fundamental number (NF) is therefore calculated as 48. No sex chromosome heteromorphisms were evident.

DISCUSSION

Based on diploid number and size distribution of chromosomes, species of the genus *Eumeces* hitherto karyotyped could be classified into three groups. One of these, corresponding to the *E. schneiderii* species group in the *Eumeces* section, has 2n=32 chromosomes forming two distinct size-groups. *Eumeces taeniolatus* of the *E. taeniolatus* species group in the *Eumeces* section, having 2n=28 chromosomes gradually changing in size from large to small chromosomes, constitutes the second group by itself. The third group is composed of species in the *Pariocela* section, characterized by 2n=26 chromosomes forming two distinct size-groups (Table 1). *Eumeces quadrilineatus* shares the diploid number (26) and size distribution of chromosomes with other species in the *Pariocela* section. Present results, thus, strongly suggest that species divergence in the *Pariocela* section has not been accompanied by distinct chromosomal divergence involving changes in the diploid number and size arrangement, unlike that in the *Eumeces* section.

In the *Pariocela* section, karyotypes have hitherto been described for 13 species by a number of authors (Table 1). It is, however, obvious that these descriptions suffer inconsistency in terminology (e.g., some authors used the term "acrocentric", but others used "telocentric" and "subtelocentric" instead) and levels of accuracy [e.g., some authors reported the presence of secondary constrictions (expressed as achromatic gaps in chromosomes), but other authors did not. Such differences may be attributable to an artifact, deriving from the employment of inaccurate methods like testis sectioning (Gorman, 1973) or simply from insufficient numbers of metaphase cells observed (see Fig. 1)]. Furthermore, photographs of karyotypes were provided only for six out of those 13 species. We thus postpone more detailed comparisons of the karyotype of *E. quadrilineatus* with those of other members of the *Pariocela* section. Further comprehensive surveys, by standard methods, are much desired to illustrate detailed chromosomal variation within the *Pariocela* section.

Table 1. The diploid (2n) and fundamental numbers (NF) in the known karyotypes of *Eumeces* species. V, metacentric; sV, subcentric; I, telocentric; sI, subtelocentric; m, microchromosomes of undetermined arm ratios.

Species	2n	NF	Description	Sources
Eumeces Section*				
E. schneiderii Species Series				
E. schneiderii Species Group				
E. schneiderii sensu lato**				
	32	?	most elements biarmed	Gorman (1973)
	32	44	12V+18I+2m	DeSmet (1981)
	32	38	6V+26I	Kupriyanova (1973)
	32	46	8V+12sV+4I+8m	Hassan (1996)
E. schneiderii sensu stricto				
	32	60	16V+12sV+4I	Caputo et al. (1994)
E. s. schneiderii				
	32	64	16V+12sV+4sI	Caputo et al. (1993)
E. s. princeps				
	32	54	4V+18sV/sI+10m	Kupriyanova (1986)
	32	62	10V+10sV+10sI+2I	Eremtschenko et al. (1992)
E. algeriensis				
	32	44	14V+16I	Caputo et al. (1994)
E. taeniolatus Species Series				
E. taeniolatus Species Group				
E. taeniolatus				
	28	56	4V+24V/sV/sI	Kupriyanova (1986)
	28	56	24V+4sV	Ivanov & Bogdanov (1975)
	28	56	18V+8sV+2sI	Eremtschenko et al. (1992)
Pariocela Section***				
E. fasciatus Subsection				
E. obsoletus Species-series				
E. obsoletus Species-group				
E. obsoletus				
	26	52	26V/sV	Deweese & Wright (1970)
	26	52	26V	Caputo et al. (1994)
E. chinensis Species-series				
E. chinensis Species-group				
E. chinensis				
	26	48	18V+4sI+4I	Guo & Dong (1988)
	26	48	22V+4I	Zhang et al. (1995)
	26	?	12V+14m	Wu (1983)
E. fasciatus Species-series				
E. anthracinus Species-group				
E. tetragrammus brevilineatus				
	26	52	26V/sV	Deweese & Wright (1970)
E. fasciatus Species-group				
E. fasciatus				
	26	50	20V+2sV+2sT+2m	Eremtschenko et al. (1992)
E. inexpectatus				
	26	38	12V+14I	Capriglione (1987)
	26	52	26V	Caputo et al. (1994)
E. latiscutatus Species-group				
E. latiscutatus				
	26	?	12V/sV+14m	Nakamura (1931)
	26	?	6V+6sV+10V/sV+4I/sI	Itoh et al. (1968)
	26	48	12V+10V/sV+4m	Kupriyanova (1986)

Species	2n	NF	Description	Sources
E. marginatus marginatus				
	26	?	12V/sV+14m	Momma (1948)
	26	?	12V/sV+14m	Makino & Momma (1949)
E. elegans				
	26	?	12V/sV+14m	Makino & Momma (1949)
?E. barbouri				
	26	?	12V/sV+14m	Makino & Momma (1949)****
	26	?	12V/sV+14m	Momma (1948)****
E. brevirostris Subsection				
E. brevirostris Species-group				
E. copei				
	26	52	26V/sV	Deweese & Wright (1970)
E. dugesii				
	26	52	26V/sV	Deweese & Wright (1970)
E. skiltonianus Species-group				
E. gilberti				
	26	52	26V/sV	Deweese & Wright (1970)
E. skiltonianus				
	26	52	26V/sV	Deweese & Wright (1970)
E. quadrilineatus Species-group				
E. quadrilineatus				
	26	48	14V+8sV+4t	This study

* Following Lieb (1985)

** Possibly referring to *E. schneiderii* sensu stricto, *E. algeriensis* or both. See Caputo et al. (1993) for the confusion of taxonomic treatment of these nominal taxa.

*** Following Hikida (1993)

**** These authors erroneously referred their material from the northern part of Okinawa Island as *Eumeces elegans*, a species that closely resembles *E. barbouri* and does not occur there in reality (Toyama, 1985).

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