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Karyotype analysis of an endemic sucker catfish, *Glyptothorax silviae* Coad, 1981 (Actinopterygii: Sisoridae), from Iran

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Abstract: The karyotypic and cytogenetic characteristics of southern catfish, *Glyptothorax silviae* Coad, 1981, was investigated for the first time by examining metaphase chromosome spreads obtained from gill epithelial and kidney cells. The diploid chromosome number of this species was 2n = 52. The karyotype consisted of 9 pairs of metacentric, 14 pairs of submetacentric, and 3 pairs of subtelocentric chromosomes. The arm number was 98. No heteromorphic sex chromosomes were cytologically detected in this catfish. Comparison of the chromosome number of this fish with that of the other members of subfamily Glyptosterninae shows that 2n = 52 may be regarded as characteristic of the primitive karyotype in this subfamily.

Key words: *Glyptothorax*, karyotype, chromosome, idiogram, Iran, Middle East

Introduction

Siluriformes, or catfish, are a group of freshwater or marine fish with 35 families, about 446 genera, and about 2867 species (Nelson, 2006). The sisorid, or sucker catfishes, are found in Asia as far east as Borneo. There are about 17 genera with about 112 species in 2 subfamilies—Sisorinae and Glyptosterninae (Nelson, 2006). They are mostly small (as small as 2 cm), although some are very large (2 m). Five nominal species are reported from the Tigris-Euphrates basin in southwest Asia, but only 1 genus—the sisorid catfish *Glyptothorax* Blyth, 1860—with 2 endemic species, including Kordestan catfish *G. kurdistanicus* (Berg, 1931) and southern catfish *G. silviae* Coad, 1981 (Figure 1) are found in Iran (Coad, 2008). *G. silviae* is known from rivers draining into the Persian Gulf in southwestern Iran. Although *G. silviae* has been described and compared morphologically, its karyotype has not as yet been investigated. The aim of the present study was to provide some karyological features of this endemic catfish from Iran for the first time.

Materials and methods

Five *Glyptothorax silviae* specimens were collected from Kohmareh Sorkhi Stream (31°55.307′ N, 50°56.325′ E, alt. 2278 m), Gulf Basin, Fars province,

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southwest Iran using an electrofishing device and dip net. The catfish were transported alive to the laboratory and kept in a well-aerated aquarium at 20-25 °C until analysis. For karyological studies the modified method of Uwa (1986) was used. Colchicine solution was prepared with 0.005 g in 20 mL of physiological serum. The fish were injected intraperitoneally with colchicine at a dose of 0.02 mL g^{-1} of body weight using an insulin syringe, and then were placed in the aquarium for 4-5 h. The gill filaments and kidneys of those specimens were then removed and placed in hypotonic 0.36% KCl solution for 45 min at room temperature (25 °C). Thereafter, the solutions were centrifuged for 10 min at 1000 rpm, adding 2-3 drops of fresh cold Carnoy's fixative (1:3, acetic acid:methanol) before centrifugation. The supernatants were then discarded and 5 mL of fresh cold fixative was added to the sediments, mixed thoroughly, and then left for 1 h. The fixation and centrifugation stages were repeated 2 times. The suspensions were then trickled onto cold slides. These slides were stained with 10% Giemsa for 20 min. Chromosomes were observed, selected, and photographed with an Olympus light microscope-mounted camera.

Karyotypes were prepared by arranging chromosomes in pairs by size. Mean length of the short and long arms, and arm ratio (the ratio of the long arm length to the short arm length) of each chromosome were calculated, and then the chromosomes were classified according to the criteria of Levan et al. (1964). The fundamental number (NF) is expressed as double the number of atelocentric plus the number of telocentric chromosomes. An idiogram was prepared with Harvard Graphics v.2.0 software.

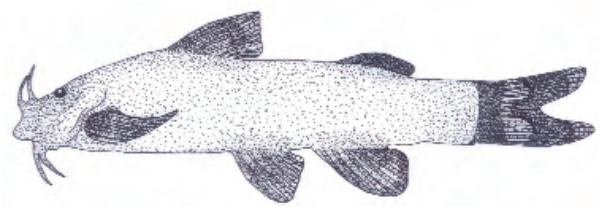

Figure 1. *G. silviae* from Iran.

Results

The metaphase spread of this species is shown in Figure 2a. The diploid chromosome number was 2n = 52 (Figure 2b). The quantitative data used to classify the chromosomes and idiogram are given in Table 1 and Figure 3. The karyotype consisted of 9 metacentric, 14 submetacentric, and 3 subtelocentric chromosomes (9m, 14sm, 3st), and the arm number was 98. No heteromorphic elements indicating sex chromosomes were observed in this endemic catfish.

Discussion

The diploid chromosome number in fish varies from 2n = 22-26 in some species of Notothenіidae

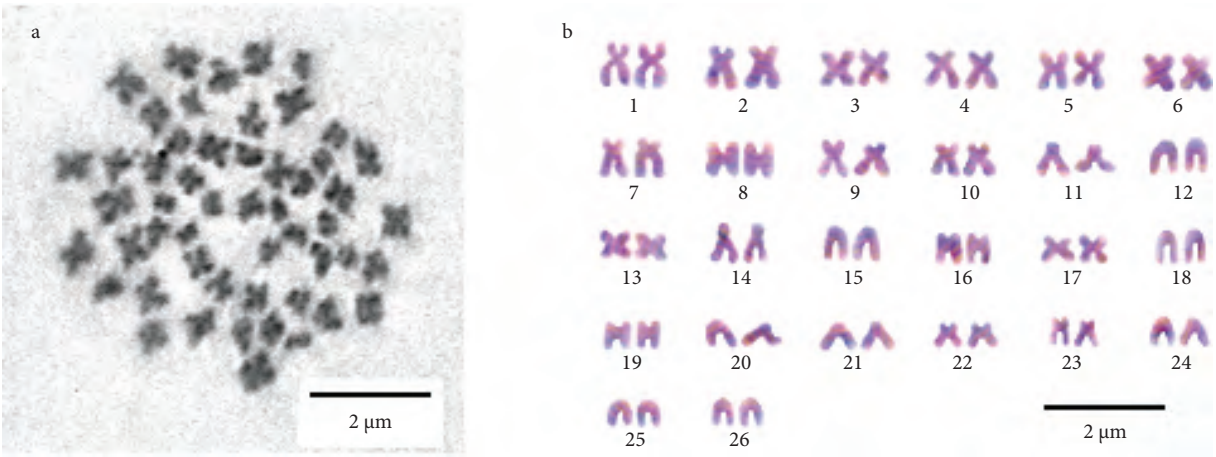

Figure 2. Giemsa-stained chromosome spread (a) and karyotype (b) of *G. silviae* from Iran.

Table 1. Chromosome measurements (μm) and classification of *G. silviae* chromosomes (M: metacentric; Sm: submetacentric; St: subtelocentric).

Chromosome type	arm value	Short arm length (μm)	Long arm length (μm)	Chromosome numbe	Chromosome type	arm value	Short arm length (μm)	Long arm length (μm)	Chromosome number
Sm	2.80	0.15 ± 0.06	0.42 ± 0.09	14	m	1.53	0.34 ± 0.08	0.51 ± 0.09	1
Sm	2.24	0.17 ± 0.08	0.38 ± 0.07	15	m	1.53	0.31 ± 0.06	0.47 ± 0.10	2
Sm	1.93	0.19 ± 0.05	0.36 ± 0.10	16	m	1.63	0.28 ± 0.04	0.47 ± 0.05	3
Sm	2.95	0.13 ± 0.05	0.40 ± 0.08	17	Sm	2.27	0.23 ± 0.07	0.51 ± 0.06	4
Sm	2.11	0.17 ± 0.06	0.36 ± 0.04	18	m	1.43	0.30 ± 0.06	0.42 ± 0.05	5
Sm	2.64	0.14 ± 0.08	0.37 ± 0.06	19	m	1.20	0.32 ± 0.04	0.38 ± 0.02	6
Sm	2.46	0.15 ± 0.06	0.36 ± 0.07	20	m	1.68	0.25 ± 0.08	0.42 ± 0.08	7
St	3.39	0.11 ± 0.06	0.38 ± 0.04	21	m	1.51	0.26 ± 0.04	0.39 ± 0.05	8
Sm	2.32	0.14 ± 0.08	0.34 ± 0.08	22	Sm	1.82	0.23 ± 0.07	0.41 ± 0.07	9
St	4.86	0.08 ± 0.02	0.39 ± 0.05	23	m	1.69	0.23 ± 0.10	0.39 ± 0.08	10
Sm	2.53	0.13 ± 0.06	0.33 ± 0.05	24	Sm	1.85	0.21 ± 0.08	0.39 ± 0.10	11
Sm	2.30	0.13 ± 0.06	0.31 ± 0.07	25	m	1.81	0.21 ± 0.08	0.38 ± 0.07	12
St	3.20	0.10 ± 0.02	0.32 ± 0.04	26	Sm	2.62	0.16 ± 0.06	0.42 ± 0.08	13

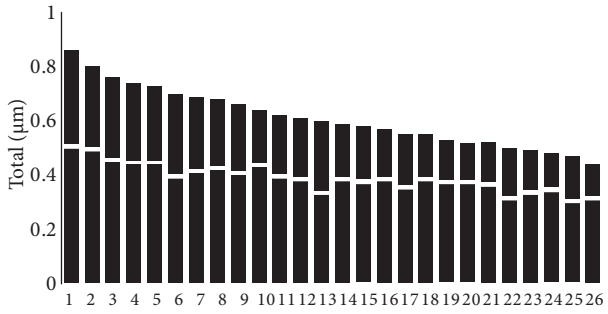

Figure 3. Haploid idiogram of *G. silviae* from Iran.

(Fontanat et al., 1997), an Antarctic fish group, to 2n = 240-260 in some anadromous Acipenseridae that have several microchromosomes (Fontanat et al., 1997).

Based on our observations, the diploid chromosome number of the southern catfish species was 2n = 52, which conforms to the chromosome number of some other species of this genus. Yu et al. (1987) reported that the chromosome number of *G. sinensis* and *G. fokiensis* was 2n = 52 versus 2n = 56 in *G. telchitta* (Khuda-Bukhsh et al., 1986). The chromosome numbers reported in other genera of this family, such as *Coreglanis kishinouyei* and *Euchiloglanis davidi,* were 2n = 50 and 2n = 36, respectively (Yu et al., 1987). As such, chromosome number in Glyptosterninae ranges from 2n = 36 to 2n = 56; however, about 50% of Glyptosterninae species have 2n = 52 and, therefore, 2n = 52 may be regarded as the modal number in this subfamily. Robertsonian translocation may have played an important role in the karyotype evolution of this subfamily. The number of chromosomes in this catfish is also similar to that of some other species of Siluriformes, such as *Leiocassis crassilarbis*, *L. longirostris*, *Pelteobagrus fulvidraco*, *Pseudobagarus nitidus*, *P. vachelli*, *P. emarginatus*, *P. pratti*, *P.* tenuis, *P. truncatus*, and *P. ussuriensis* from the family Bagridae (Yu et al., 1987). It may show the close relationship between sisorid and bagrid catfishes.

Cytogenetic studies of the order Siluriformes from 16 families and 70 genera conducted by different researchers, as summarized by Khuda-Bukhsh et al. (1986), Yu et al. (1987), and Alves et al. (2006), show that among 219 records of different analyzed species the diploid number ranges from 2n = 24 in *Leiobagrus marginatus* (Amblycipitidae) to 2n = 80 in *Hypostomus* sp. (Loricariidae), indicating high diploid number variation. It seems that the chromosome number is not conservative in catfishes and that some major chromosome rearrangements, such as Robertsonian translocation, polyploidy, and inversion, might have played a significant role during the speciation and evolution of catfishes.

The karyotype formula of this catfish was 9m, 14sm, and 3st, and the NF was 98. This NF is in the range of NF recorded for other catfishes. The species

of Siluriformes display wide variation in NF, with values ranging from 45 to 116 (Khuda-Bukhsh et al., 1986; Yu et al., 1987; Alves et al., 2006).

In the present study no cytological evidence was observed for sex chromosome dimorphism in *G. silviae*, which is in agreement with reports on many fish species (Esmaeili and Piravar, 2006; Esmaeili et al., 2006, 2007). Moreover, despite the large number of living marine fish species, the occurrence of cytologically differentiated sex chromosomes appears to be rare (Galetti et al., 2000), although it has been described in platyfish (Devlin and Nagahama, 2002) and in some catfish (Alves et al., 2006).

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