

Karyotypes of Cyprinid Fish *Capoeta trutta* and *Capoeta capoeta umbla* (Cyprinidae) From the Tigris River

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Abstract: Chromosome numbers and karyotypes of Cyprinid fish *Capoeta trutta* and *Capoeta capoeta umbla* (Cyprinidae) in the Tigris River were determined by the use of chromosome preparation techniques from uncultured kidney. The diploid chromosome number in *C. trutta* was found to be $2n = 150$, with 35 pairs of meta-submetacentric chromosomes, 40 pairs of subtelo-acrocentric chromosomes and the chromosome arms number (NF) was 220. Chromosomal studies on the *C. c. umbla* revealed the diploid chromosome number to be $2n = 150$, with 43 pairs of meta-submetacentric chromosomes, 32 pairs of subtelo-acrocentric chromosomes with $NF = 236$. Sex chromosomes were not determined in the studied species.

Key Words: *Capoeta trutta*, *Capoeta capoeta umbla*, Chromosome, Karyology, Tigris River.

Dicle Nehri'ndeki *Capoeta trutta* ve *Capoeta capoeta umbla* (Cyprinidae)'nın Karyotipi

Özet: Bu çalışmada Dicle nehri'nden elde edilen *Capoeta trutta* ve *Capoeta capoeta umbla* (Cyprinidae) türlerinin böbreklerinden elde edilen preparatlarda kromozom sayıları ve karyolojik özellikleri belirlenmiştir. *Capoeta trutta*'nın diploid kromozom sayısı, 35 çift meta-submetasentrik, 40 çift subtelo-akrosentrik olmak üzere $2n = 150$, $NF = 220$ olarak belirlenmiştir. *Capoeta c. umbla*'nın diploid kromozom sayısı, 43 çift meta-submetasentrik, 32 çift subtelo-akrosentrik kromozom olmak üzere $2n = 150$ ve $NF = 236$ olarak tespit edilmiştir. Çalışılan türlerde eşey kromozomları saptanamamıştır.

Anahtar Sözcükler: *Capoeta trutta*, *Capoeta capoeta umbla*, Kromozom, Karyoloji, Dicle Nehri.

Introduction

Cyprinidae are the richest and most important family of fish, and its members are distributed world-wide. A vast majority of boned fish belong to this family in Turkey, and they are distributed widely in fresh water sources. Although this family is represent by approximately 1,500 species in the world, there are about 30 genus and 70 species in Turkey (1-4). The cyprinid genus *Capoeta* is represented by nine species from West Asia including Anatolia (5). The aim of this study is to determine karyotypes of *Capoeta trutta* (Heckel, 1843) and *Capoeta capoeta umbla* (Heckel, 1843) which are only found in the Euphrates and Tigris River Basin (6).

The study of karyotypes in Pisces has stimulated the interest of many researchers in the last few years (7-19). However, the small size and large number of chromosomes in fish, and the lack of a standard technique

for fish chromosome preparation, makes their evaluation difficult (20,21). Chromosomal analysis is of interest in fish breeding from the viewpoint of genetic control, the rapid production of inbred lines, taxonomy and evolutionary studies. About 1,300 fresh water and saltwater fish species' karyotypes have been reviewed. (22).

The chromosomes of Turkish cyprinids have not been studied sufficiently (23-28). None of the *Capoeta* species of Turkish fauna has been examined karyologically. This study describes the chromosomes and karyotype of *C. trutta* and *C. c. umbla* from the Tigris River in Turkey.

Materials and Methods

Twelve *Capoeta trutta* (8 male, 4 female) and fourteen *Capoeta capoeta umbla* (9 female, 5 male) samples were captured using an electroshock apparatus

from the Tigris River (37° 55' N, 40° 12' E). The fish were transported live to the laboratory, and kept in a well-aerated aquarium at 20-25°C before analysis. The fish were injected with 0.1% phytohemagglutinin M (PHA) to activate cell division 48 hours before decapitation (25).

Mitotic chromosomes were prepared directly from their kidneys. For this purpose, the fish were injected intraperitoneally and intramuscularly with 0.06% colchicine solution (1 ml/100 g body weight) and sacrificed after 3.5-4 hours. Techniques for the preparation of cell suspensions, hypotonic treatment and the fixation of the cells have been described previously (29). The preparations were stained with 0.5% giemsa.

An Olympus binocular microscope with a built-in camera, on Ilford 50 ASA film, was used. The best 4-8 metaphase figures of each specimen were karyotyped following the method of Levan et al. (30).

Results

Relatively small- and high-number chromosomes were observed in *Capoeta trutta* and *C. c. umbla*. The sex chromosomes were not determined.

In 65 metaphases from the kidney cells of twelve *Capoeta trutta* specimens, the diploid number was found to be 2n = 150. Different chromosome numbers in a total of 8 metaphase cells were recorded ranging from 148 to 152 (Table 1). Cells not having normal values (148-152) were probably caused by losses during preparation or additions from nearby cells. The karyotype consists of 35 pairs of meta-submetacentric and 40 pairs

of subtelo-acrocentric chromosomes (Figure 1). The number of chromosome arms were therefore determined to be NF = 220.

In 87 metaphases from the kidneys of 14 *C. c. umbla* specimens, the diploid chromosome number was found to be 2n = 150. Different chromosome numbers in a total of 16 metaphase cells were recorded ranging from 148 to 152 (Table 2). Cells not having normal values (148-152) were probably caused by losses during preparation or additions from nearby cells. The karyotype consists of 43 pairs of meta-submetacentric and 32 pairs of subtelo-acrocentric chromosomes, NF = 236 (Figure 2).

Discussion

Chromosome numbers, along with conventional morphology criteria, data from palaeontology, behavioral patterns, ecology and genetic experiments, provide a further tool for deciphering the phylogeny of fishes (31). The majority of cyprinid species have 2n = 50 chromosomes (32), while *Cyprinus carpio* has 2n = 98-100 (8, 22) and the polyploid *Barbus* species from Southern Africa have 2n = 148 or 150 chromosomes (11). A number of 48 chromosomes were found in a few species, such as *Cyprinion macrostomus* (23) and *Ctenopharyngodon idella* (22).

The diploid chromosome numbers of both *Capoeta trutta* and *Capoeta capoeta umbla* were found to be 2n = 150. The number of chromosomes that deviated from the normal value (148-152) was probably due to losses or additions from the nearby cells (16). To the best of

Table 1. Chromosome complement of *C. trutta*

Number of fish	chrososome number:					total metaphases	karyotype (2n=150)		
	148	149	150	151	152		m-sm	st-a	NF
1	1		5			6	70	80	220
2			4		1	5			
3		1	5			6			
4	1		4			5			
5			4	1		5			
6			5			5			
7			4		1	5			
8			5			5			
9			5			5			
10	1		6			7			
11			5			5			
12			5	1		6			
Totals	3	1	57	2	2	65			

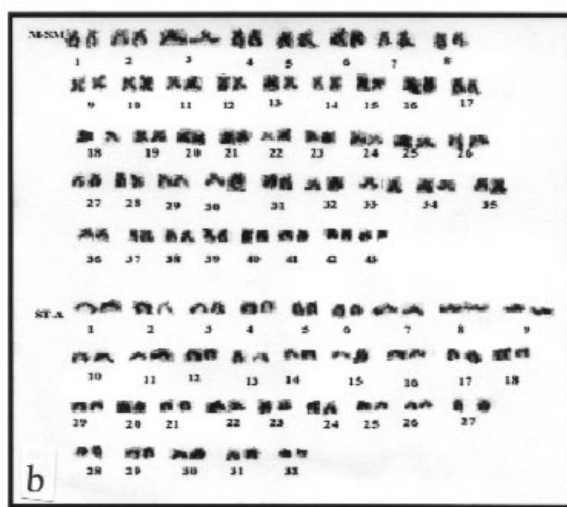
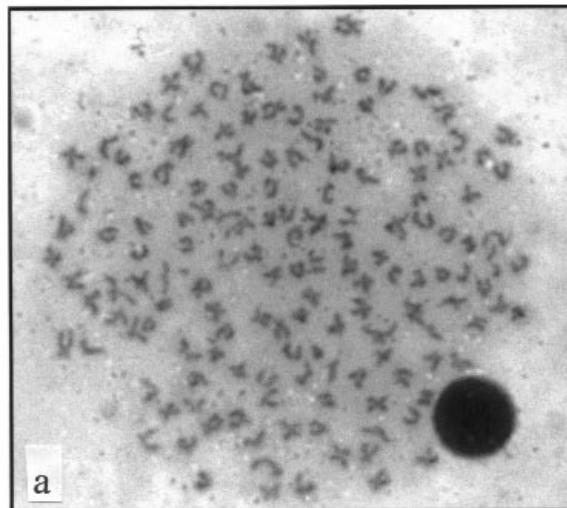
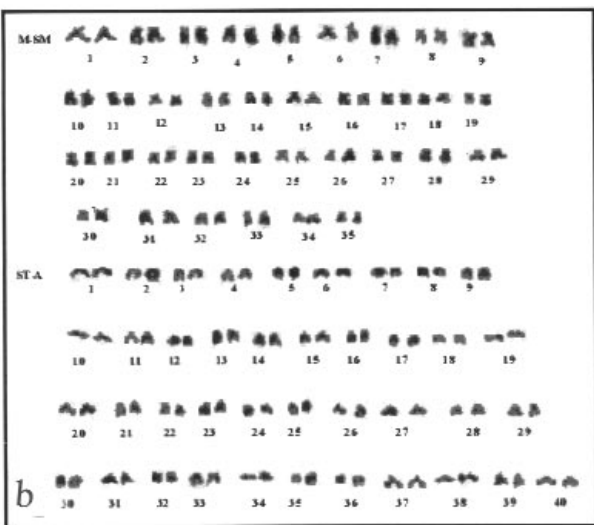
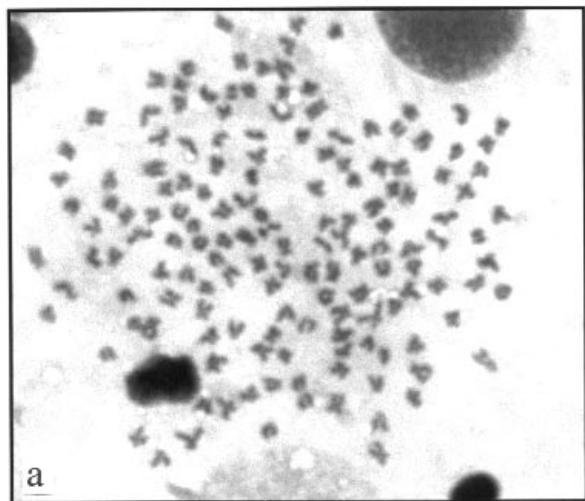


Figure 1. Chromosomes of *Capoeta trutta* from the Tigris River (Turkey). (a) Mitotic metaphase. (b) Karyotype. X 1,600.

Figure 2. Chromosomes of *Capoeta capoeta umbla* from the Tigris River (Turkey). (a) Mitotic metaphase. (b) Karyotype. X 1,600.

Table 2. Chromosome complement of *C. c. umbla*

Number of fish	chromosome number:					total metaphases	karyotype (2n=150)		
	148	149	150	151	152		m-sm	st-a	NF
1		1	5			6	86	64	236
2		1	4		1	6			
3		1	5			6			
4	1		6			7			
5		1	4	1		6			
6			5			5			
7			6			7			1
8			5			5			
9		2	5			7			
10	1		6			7			
11			5			5			
12		1	4			6			1
13	2		5			7			
14			6	1		7			
Totals	5	6	71	2	3	87			

our knowledge, no other species of genus *Capoeta* has yet been karyotyped. Thus, it is difficult to determine chromosomal differentiation or the existence of poliploidy in other species of this genus. However, some *Barbus* species with 150 chromosomes have been recorded as hexaploid from southern Africa (33) and from Ethiopia (11). These species belong to the African 'large *Barbus*'. Berrebi (34) reported that the genus *Barbus* includes diploid (chromosome number 50), tetraploid (chromosome number 100) and hexaploid (chromosome number 150) species. In our study, since we obtained

high chromosome numbers, the species of *Capoeta* are thought to be hexaploid, as in some species of *Barbus*.

The karyotypes of the two species were found to be different. *C. c. umbra* had high-number meta-submetacentric chromosomes but low subtelo-acrocentric chromosomes when compared to *C. trutta*. Chromosome arm numbers (NF) of *C. c. umbra* were also higher than those given for *C. trutta*.

There was no evidence of sexual dimorphism of the chromosomes in either *C. trutta* or *C. c. umbra*. Similar results were also observed in most fish species (7-12).

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