

Karyological Observation of Red Mullet (*Mullus barbatus* Linnaeus, 1758)

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Abstract: The number and structure of red mullet chromosomes (*Mullus barbatus* Linnaeus, 1758) were investigated and the species karyotype was analyzed. Specimens were obtained by trawl from the coast of Zonguldak, Turkey. A colchicine solution, 0.1 mg/g of body weight, was intramuscularly injected dorsally, and intraperitoneally injected ventrally. Slides were prepared from gill and fin epithelial tissues. Results of the conventional staining method showed that this species has $2n = 44$ diploid chromosomes.

Key Words: Red mullet, *Mullus barbatus*, Karyotype

Barbunya Balığının (*Mullus barbatus* Linnaeus, 1758) Karyolojik İncelemesi

Özet: Barbunya balığı (*Mullus barbatus* Linnaeus, 1758)'nin kromozom sayısı ve yapıları incelenerek, karyotip analizi yapılmıştır. Araştırmada kullanılan örnekler Zonguldak kıyı bölgesinden trol avcılığı ile elde edilmiştir. Balığın her bir gram vücut ağırlığına 0.1 mg olacak şekilde kolsişin solusyonu dorsalden kas arasına ve ventralden karın boşluğuna enjekte edilmiştir. Preparatlar solungaç ve yüzgeç epitel dokularından hazırlanmıştır. Sonuçta; Barbunya balığının $2n = 44$ diploid sayıda kromozoma sahip olduğu belirlenmiştir.

Anahtar Sözcükler: Barbunya balığı, *Mullus barbatus*, karyotip

Introduction

The genus *Mullus*, belonging to the family Mullidae, includes 15 genera of which only 2, *Mullus* and *Upeneus*, exist in the Mediterranean and Black seas (1). A third genus, *Pseudupeneus*, was also defined by Whitehead et al. (2).

Red mullet, *Mullus barbatus*, living in the Mediterranean and Black seas is a benthic species, like the other mullets. They prefer sandy and muddy bottoms of the continental shelf, at depths between 20 and 300 m. They show a distribution from the east Atlantic to the coast of Senegal (2,3).

Scientists that have studied the reproduction and growth of *M. barbatus* and striped red mullet (*M. surmuletus*) have begun to examine some of their biochemical characteristics (4). Subsequently, investigation gained momentum and Sofradzija was the first to report that *M. surmuletus* has a diploid chromosome number of $2n = 44$ (5).

To the best of our knowledge, no detailed reports exist of the karyotype of red mullets in Turkey. Therefore, the aim of this study was to investigate the karyotype of red mullet in Turkey in order to help future taxonomical and genetic studies.

Materials and Methods

Seven red mullets (3 females and 4 males) caught by trawl off the Black Sea coast of Zonguldak, Turkey, were used in this study. Their sex was determined by externally examining their gonads (6). Fish between 8 and 13 cm long were kept alive in an oxygenated fiber bucket. Colchicine was injected intramuscularly and intraperitoneally to each specimen as 0.1 mg/g of body weight, dorsally and ventrally, respectively (7-10).

The fish samples were maintained in an oxygenated pail for 6-7 h and then were sacrificed. Gill and fins were dissected and placed in a 0.4% KCl solution for 30-40 min (7,8). Afterwards, tissues were fixed in 3 successive

changes of fresh methanol-acetic acid solution (3:1), and were then placed in small bottles and maintained in a refrigerator at 4 °C. One day later, tissues were minced in 50% acetic acid and then the cell suspension was dropped on clean slides warmed on a hotplate to 40-50 °C (8,11,12).

Slides were stained with 4% Giemsa solution for 15-20 min (4,7). The stained slides were observed with a Nikon® trinocular lab research microscope at 100x. In preparation of each pattern, 30 or 50 chromosome sites were checked (13,14). Then, their karyotypes were made with the Karyotype Analysis® program.

Chromosomes were classified on the basis of the system published by Levan et al. (15). The fundamental number of chromosomes (NF) was also detected from biarmed chromosomes (metacentric (M) and submetacentric (SM) chromosomes) and one-armed

chromosomes (subtelocentric (ST) and acrocentric (A) chromosomes) (14-16).

Results

Metaphase chromosome spreads of 3 females and 4 males were determined from at least 30-50 chromosome sets. Comparison of the karyotypes from the males and females did not reveal the presence of any chromosomal differences. In all, 107 counts on 10 slides were made of the chromosome spreads.

Karyotyping defined 3 pairs of M/SM, 8 pairs of ST, and 11 pairs of A chromosome complements (2n = 44). NF was 50. An example of the metaphase spreads and the karyogram are shown in Figure 1 (a) and (b), respectively.

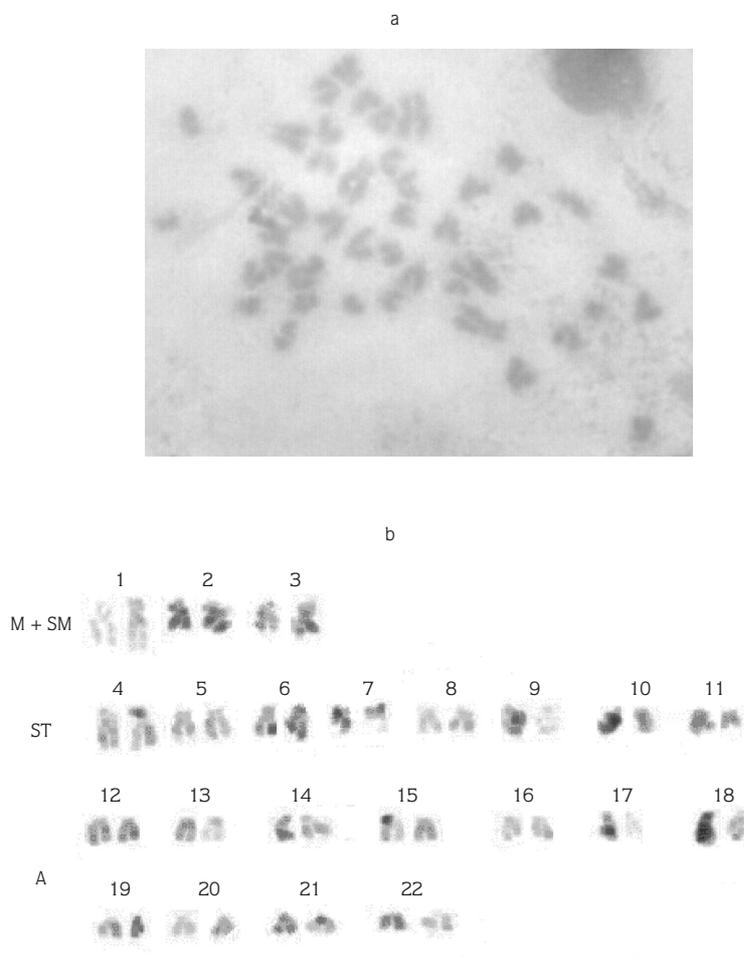


Figure 1. Photograph of metaphase spreads; (a) Metaphase plate, (b) Karyogram Bar = 10 µm.

Discussion and Conclusion

The chromosome number of $2n = 44$ ($3m-sm+8st+11a$) of the red mullet found in this study is in agreement with Vitturi et al. (4); however, Vasiliev reported a karyotype of *M. barbatus ponticus* E., 1927 of $2n = 50$, with 6 M/SM chromosomes as biarmed, and 8 ST, and 11 A chromosomes as one-armed (17).

Similar karyotypes have been reported for other member of the family Mullidae. Vitturi et al. reported a karyotype of $2n = 44$ for *Mullus surmuletus* L., 1758 (4). Sofradzija recorded a similar result for a mullet species, *M. surmulets*. The karyotype of this species was $2n = 44$ ($18msm+26sta$) and $NF = 62$ (5). The karyotype of *M. surmuletus* was also reported as $2n = 48$ and $NF = 50$ by Cano et al. (18).

Arai and Koike described the karyotype of the goatfish (*Parupeneus spilurus*) to be $2n = 44$ ($8m+8sm+28sta$) with $NF = 60$ (19). Rishi studied the gold band goatfish (*Upeneus tragula*) and reported the diploid number of chromosomes as 50 ($NF = 50$, all having A chromosomes) (20).

These findings show that these species are obviously closely related to each other. Although the types of the chromosomes are very different, all diploid numbers are

identical. This may be due to different karyotyping techniques employed or different geographical specimens having different karyotypes (4).

Teleostean fishes with a diploid number of 48 chromosomes are regarded as primitive fishes by some authors (4). This can also be valid for the *Mullus* species with which we have conducted karyotype analyses.

A few scientists have studied karyotyping of a small number of freshwater fishes in Turkey. To the best of our knowledge, the present study is the first to report on the karyotyping of red mullet in Turkey. We trust that this study will prove to be helpful to future genetic studies, especially those that seek to determine the genetic diversity of fishes in Turkey.

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