

SOMATIC CHROMOSOMES OF TWO MARINE TELEOSTS

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ABSTRACT

Somatic chromosomes of two species of sciaenids *Otolithes cuvieri* (Trewavas) and *Nibea diacanthus* (Lacepede) are reported here. Chromosome preparations were made using colchicine-citrate-aceto-methanol-air-drying technique using tissue from kidney, stomach, gills and intestine. Both the species gave a diploid count of 48 acrocentric chromosomes.

INTRODUCTION

Studies on the chromosomes of plants and animals gives a better understanding of their evolutionary trend. Fishes are of particular interest to ichthyologists as well as cytogeneticists as they occupy a very important position for the systematic differentiation of vertebrates. Of late, study on the chromosomes is gaining more importance because of application of hybridization techniques can contribute to the improvement of culture stock. In spite of very early initiation of cytological work on fishes until 1960 studies on fish chromosomes were carried out generally from testes and rarely from post-fertilized cleaving eggs and tail tips of fishes (Denton, 1973; Ojima, 1980). But because of technical limitations they were less dependable. Greatly influenced by the startling improvements in handling mammalian chromosomes by colchicine-citrate technique, various tissues of fishes like kidney, (Manna and Prasad 1968) spleen, liver, cornea and embryo for somatic chromosomes and testes for germinal chromosomes *in vivo* were used. Since marine fishes are more in numbers and exhibit greater diversity than fresh water forms their study can make a very useful contribution towards assembling further cytological information on fishes. Cytological study on the Indian marine fishes is very meagre except preliminary work done by Rishi (1973), Manna and Prasad (1974), Khudabaksh and Manna (1978), Patro and Prasad (1979), Das *et al* (1980), Das (1983) and Chakraborty and Kagwade (1986). Observations made on the chromosome study on two species of marine fishes belonging to the family Sciaenidae-*Otolithes cuvieri* (Trewavas) and *Nibea diacanthus* (Lacepede) are reported here.

MATERIAL AND METHODS

Live specimens were maintained in well aerated aquaria at room temperature for some time in order to acclimatize them. An intraperitoneal injection of 0.2 ml. of phytohaemagglutinin (PHA: DIFCO) per 50g. of body weight was given and the fishes were allowed to swim for 24 hours. Thereafter 0.1% colchicine (Loba) was injected intraperitoneally at the rate of 0.5 ml. per 50 g. of

body weight. After four hours the fishes were sacrificed and the kidney, gills, intestine and stomach were taken out. For the preparation of chromosomes the method of Rishi (1976) was followed with minor alterations viz. 0.5% of tri-sodium-citrate was used for hypotonic treatment and methanol was used in combination with glacial acetic acid instead of absolute alcohol. Preparations were stained in carbol-fuchsin (Carr and Walker, 1961) and mounted in D.P.X. Microphotographs were taken in Oil-immersion using green sub state filter and high contrast slow speed film (DK-5-ORWO) and printed on contrast paper. For the determination of mitotic activity of different tissues the method of Kligerman *et al* (1975) was followed.

RESULTS AND DISCUSSION

Kidney and intestine gave greater number of usable metaphases. A total of 198 and 138 metaphase counts were made for *O. cuvieri* and *N. diacanthus* respectively. Only well spread metaphase were counted. The number of chromosomes ranged from 41 to 51 and 42 to 50 for *O. cuvieri* and *N. diacanthus* respectively (Fig.1). A diploid count of 48 chromosomes were obtained in 71.28% and 67.23% of the metaphases of *O. cuvieri* and *N. diacanthus* respectively. This indicates the diploid number of chromosomes for both the species to be 48. In both the species all the chromosomes were found to be acrocentric. The metaphase plates and the karyotypes of these two fishes are given in fig. 2-5.

Out of 20,000 odd species of fishes described by taxonomists we have cytological information on about 1,300 species of inland and marine fishes (Denton, 1973, Ojima 1980, Manna and Khudabaksh, 1976). Manna (1983) is of the opinion that in near future knowledge of fish cytogenetics would be on par with Mammalian cytogenetics and the fish material is no longer avoided for reasons of difficulties in handling. Several research workers hold the view that 48 rod-like (acrocentric) chromosomes constitute the primitive karyotype of fishes. It appears the view was biased because most of the early workers had studied marine fishes which commonly had such types of chromosomes. Das (1983) found that chromosome numbers and morphology of marine fishes unlike fresh water forms were less variable. Thus out of 88 species belonging to 44 families and 11 orders, 60% had a diploid count of 48 chromosomes. It was also generalized that karyotype of species belonging to Cyprinidae Synodontidae, Bagridae and Gobidae were more variable as compared to those species under the order Mugiliformes, Perciformes, Anguiliformes and Tetradontiformes. This generalization is however, made from the limited data available so far and therefore might show variation when adequate data from all the families would be worked out.

Ojima *et al* (1976) in their review paper on chromosome numbers in fishes have not mentioned the family Sciaenidae. Patro and Prasad (1979) reported 48 acrocentric chromosomes for two members of the family sciaenidae viz. *J. carutta* and *J. vogleri*. The members of the family sciaenidae belong to the group Perciformes and lends support to the view of Das (1983) that the karyotypic variation is less in this group. Family sciaenidae has a large number of species and difficulties are encountered in classifying them on morphological and anatomical characters. Cytological data would in all probability supplement identification of some of the problematic species. Reports on the chromosomes are available for four species of sciaenids namely *J. vogleri* and *J. carutta* (Patro and Prasad, 1979) and *J. belangerii* and *N. semiluctuosa* (Chakraborty and Kagwade 1986). All of them have 48 acrocentric chromosomes. Based on the present study it is rather difficult to establish a clue to their taxonomic and evolutionary relationship but it nonetheless confirms the plasticity of the number of chromosomes in marine fishes in general and the group Perciformes in particular.

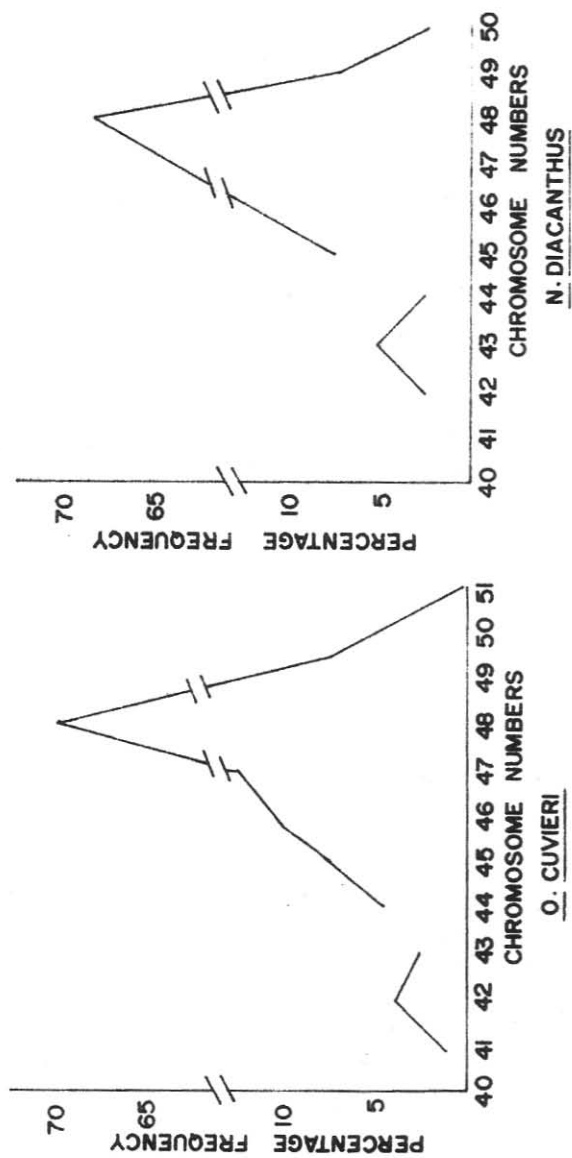


Fig. 1. Chromosome counts, range of numbers and percentage of constancy for *Otolithes cuvieri* and *Nibea diacanthus*.

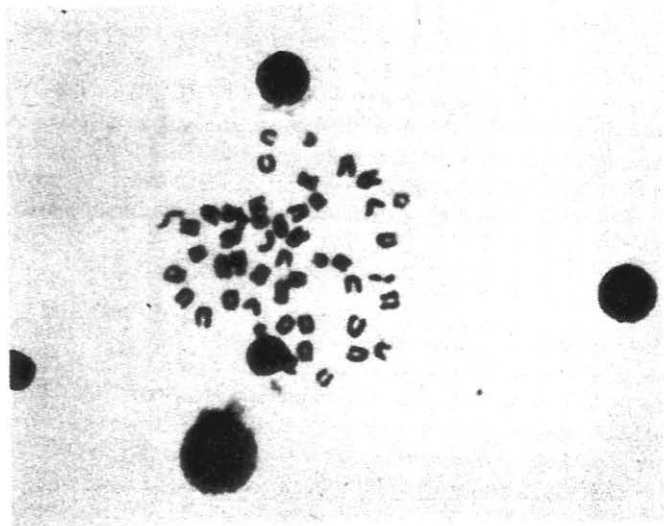


Fig. 2. Photomicrograph of somatic metaphase spread of *Otolithes cuvieri*.

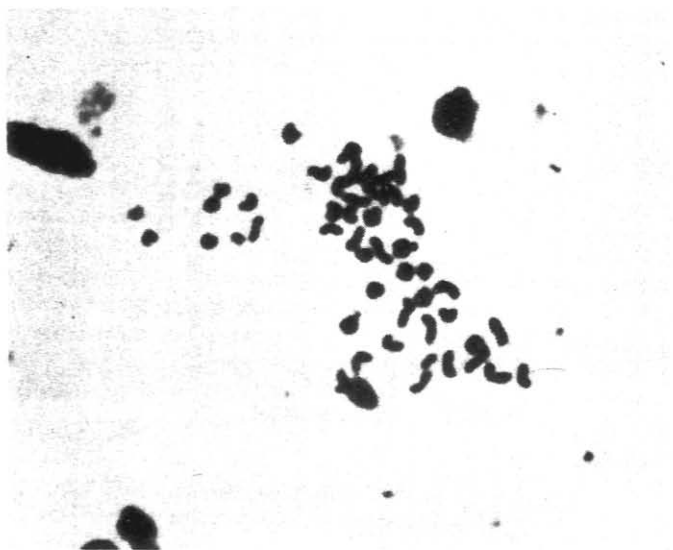


Fig. 3. Photomicrograph of somatic metaphase of *Nibea diacanthus*.

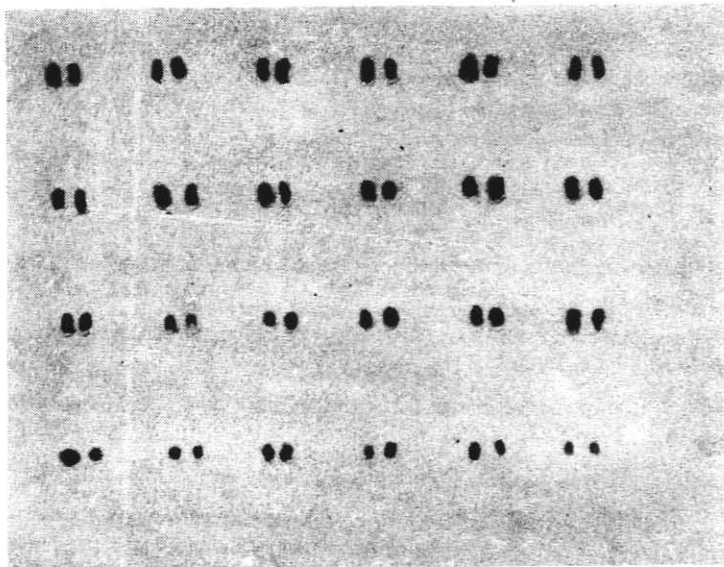


Fig. 4. Tentative karyotype of *O. cuvieri*.

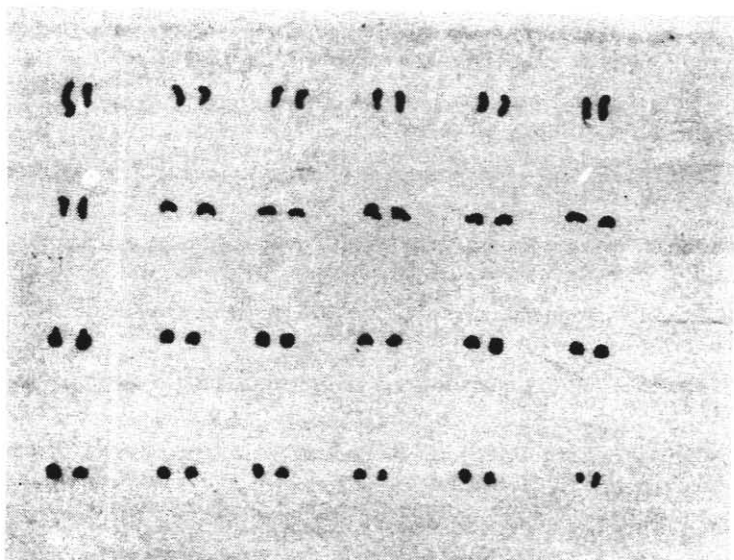


Fig. 5. Tentative karyotype of *N. diacanthus*.

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REFERENCES

- Carr, D.H. and Walker, J.E. (1961). Carbol-fuchsin as a stain for human chromosomes. *Stain Tech.*, **36**: 233-236.
- Chakraborty, S.K. and Kagwade, P.V. (1986). On the chromosome counts of *Nibea semiluctuosa* and *Johnius belangerii*. *India J. Fish.*, **33**(1): 115-118.
- Das, C.C. (1983). Chromosomes of marine fishes. *Proc. Fourth Indian Sci. Congr. Part 2* (Presidential address): 1-18
- Das, N.K. Prasad, R. and Das, C.C. (1980). Chromosomes of four species of marine fishes (Fam. Carangidae). *Indian Biol.*, **12** (1-2): 21-25
- Denton, T.E. (1973). *Fish chromosome methodology*, Charles C. Thomas Publ., Springfield (Illinois) U.S.A. : 1-166.
- Khudabaksh, A.R. and Manna, G.K. (1978). Chromosome analysis of two species of Indian Mulletts (Pisces). *Indian Biol.*, **8**: 23-26.
- Kligerman, A.D., Bloom, S.E. and Howell, W.M. (1975). *Umbra limi* : A model for study of chromosome aberration in fishes. *Mutat. Res.*, **31**: 225-233.
- Manna, G.K. and Khudabaksh, A.R. (1977). A checklist of the chromosomes in Cyprinoid fishes. *J. Zool. Res.*, **1**: 34-43
- Manna, G.K. and Prasad, R. (1968). A study of the somatic chromosomes of common Indian live fish *Channa punctatus* by a kidney technique. *Proc. 55th Indian Sci. Congr., Part 3*: 468.
- Manna, G.K. and Prasad, R. (1974). Chromosomes of three species belonging to the family Gobiidae. *Cytologia*, **39**: 609 - 718
- Manna, G.K. (1983). Cytogenetic studies on fishes and Amphibia. *Genetical Research in India, ICAR Publ.*: 244-273.
- Ojima Yoshio, Koichi, Weno and Makato, Hyashi. (1976). A review of the chromosome numbers in fishes. *La kromosomo*, II-I: 19-47.
- Ojima, Y., (1980). Chromosome data retrieval system (CDR) List: *Reports of Biological Laboratory, Kwansai Gakuin University No.2*: 1-126
- Patro, R., and Prasad, R. (1979). Chromosomes of six marine percoids from the Indian Sea. *Indian Biol.*, **XI** (1-2): 9-12
- Rishi, K.K. (1973). A preliminary report on the karyotype of eighteen marine fishes. *Research Bull. (N.S.) of Punjab University*, Part III-IV: 161-162.
- Rishi, K.K. (1986). Karyotype study on four species of fishes. *Nucleus*, **19**: 101-107.