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Nor Characterization in Three Species of Genus *Channa* (Ophiocephalidae, Teleostei)

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Abstract: Nucleolus organizer regions (NORs) were studied in the mitotic chromosomes of three species of family Ophiocephalidae: *Channa marulius, C. micropeltes,* and *C. punctatus.* All the three species exhibited a single nucleolus organizer chromosome pair in their karyotype. The NOR-bearing homologues are of acrocentric in *C. Marulius* and *C. micropeltes* and location is terminal in both these forms. However, in case of *C. punctatus* NORs are present on the long arm of metacentric pair near the centromere. This unusual situation of NORs in *C. punctatus* is a derived one, which indicates the complex nature of the karyotype of *C. punctatus.*

Key words: NORs, *Channa,* karyotype.

Introduction: Silver stained NORs can be of good use in analyzing, differentiation and evolution of particular group of animals. Number of NORs and position of NORs on the chromosomes have shown marked diversity. These different aspect of NORs provide a good material for research of species differentiation as well as systemic classification. However, NORs are very important markers for intraspecific variation. These intraspecific variations (in size, number and location) of silver stained NORs are interesting in relation to the nature of NORs themselves (structure, function and evolution of ribosomal genes). In Indian fishes, some work on the distribution of NORs has been done earlier (Rishi and Girdhar, 1992; Rishi and Thind, 1992; 1994; Rishi and Gill, 1992; Rishi *et el.,* 1994; 1995; Barat *et el.,*1990). But there is a need to analyze more fish species for NORs. The present report encompasses data on the karyotypes of three species of the genus *Channa* analyzed with the help of silver-NOR staining.

Materials and Methods: All the three species of the genus *Channa,* which have been worked out during the present investigations, were collected from their natural habitat and brought to the laboratory in live condition. *Channa punctatus* was collected from Satluj-Yamuna link canal near Kurukshetra. *Channa marulius* was collected from Adhichandloor near Quilova river in Kerala state and *C. micropeltes* specimens were obtained from Pechipara reservoir in Tamilnadu. Chromosomal preparations were made by colchicine-hypotonic-acetic alcohol-air drying method (cf. Rishi, 1989). Best results were obtained from kidney tissue in both the sexes. Method of Howell and Black (1980) was used for silver staining of NORs.

Results: Presently worked out karyotypic details of all the three species have been given in table 1.

Name of the species	2n	Karyotype	Nature of NOR
Channa marulius (Fig.1)	42	2m+40t	4th pair telocentric Terminal NORs present
C. micropelets (Fig. 2)	44	2m+42t	3rd pair, telocentric Terminal NORs present
C. punctatus (Fig. 3)	32	20m+12sm	6th pair, metacentric Pericentric NORs present

Table: 1: Karyotypic details of three species of genus Channa.
m = metacentric, sm = submetacentric t = telocentric.

Ag-NOR- staining: This staining has revealed that NORs are located on a single pair of chromosomes in all the three species. The NOR-bearing homologues are of acrocentric nature in *C. marulius* and *C. micropelets* and the location is terminal in both of these forms (Fig. 1,2), these homologues are placed in the 4th position in the karyotype in the case of *C. marulius* (Fig. 1) and 3rd position in the case of *C. micropeltes* (Fig. 2). However, an unusual location of NORs has been observed in *C. punctatus.* In this fish NORs are present on the long arm of metacentric pair near the centromere (Fig. 3). This pair is 6th in the karyotype.

Fig.1: Ag –stained karyotype of male *Channa marulius.*

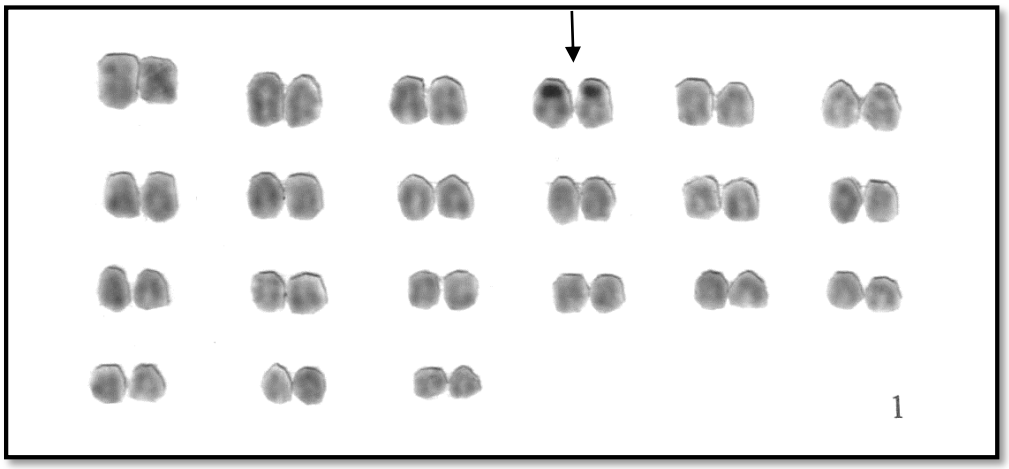

Fig.2: Ag- stained karyotype of male *Channa micropeltes*

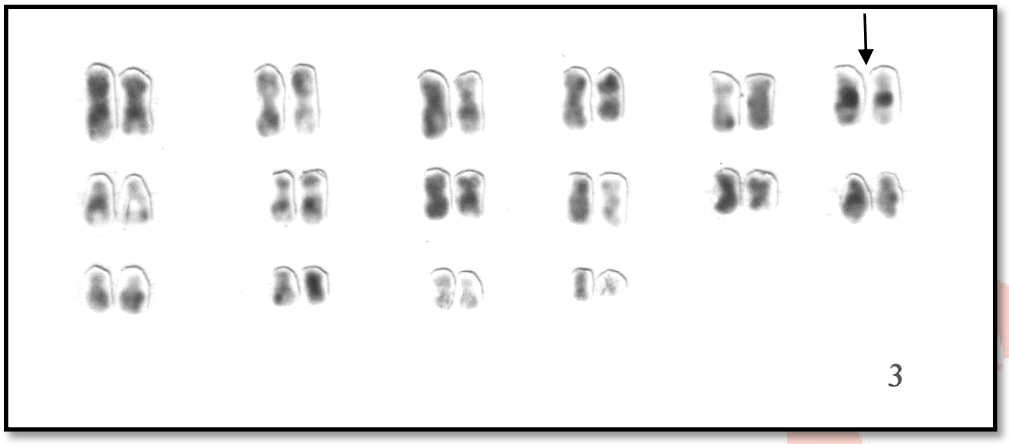

Fig.3: Ag - Stained karyotype of male *Channa punctatus*

Discussion: Family Ophiocephalidae comprises a small group of fresh water fishes and include a single genus *Channa*, represented by 16 of taxonomically known species worked by different workers (Musikasinthorn, 2000; Singh *et. al*., 2013, Ravindra Kumar *et. al*., 2019). Popularly these fishes are known as murrels or snake-heads.

Presently, three species of genus *Channa* have been worked out to locate the silver stained NORs in their karyotypes. *C. marulius* has revealed 2n=42 (FN 44). This species was worked out earlier by Nayyar (1966) but the present results differ from that of Nayyar probably because of the use of better methodology. *C. micropeltes* has shown 2n=44 (FN 46). This fish has been worked out for the first time. For *C. punctatus* a 2n=32 karyotype was reported by earlier workers (Manna and Prasad, 1973; Rishi, 1973; Rishi and Rishi, 1981; Rao and Rao, 1973; Rishi and Haobam, 1990 and Rishi *et al.*, 1993) earlier Nayyar (1966) reported a diploid set of 34 chromosomes in this fish. the present results show a 2n=32 (20m + 12sm) karyotype. These results are in agreement with that of Rishi and Haobam (1990). It may be pointed out that excepting the findings of Nayyar (1966), which were based on old technique, there is a considerable agreement in the results of all the other workers who have described the same karyotype for *C. punctatus*. Whatever small variation in FN values is there, it is probably because of technical reasons.

Nucleolus organizer regions are the secondary constrictions (Scs) on metaphase chromosomes, which are difficult to detect with the conventional staining. The silver staining of NORs has applied to overcome this difficulty and has provided valuable and interesting information during previous years (Foresti et al., 1981; Gold, 1984; Takai and Ojima, 1982).

Generally, the size of secondary constrictions, the size of Ag-NORs and the r-DNA content are closely related. Therefore, the difference of Ag-NOR size probably reflects the differences of r-DNA contents. Takai and Ojima (1986) said that in fishes most species have small NORs present in a single chromosome pair, which seems to be the fundamental and original NOR distribution pattern and large NORs as well as the distribution at multiple sites are the derived type.

Presently, Ag-NOR staining revealed that all the three species have only a single pair of chromosomes bearing NORs. The location is terminal in case of *C. marulius* and *C. micropeltes* which is the usual condition among fishes. However, *C. punctatus* has unusual inter-calary location of NORs near the centromere. This shows that this condition might have been produced through pericentric inversions or through tendom fusion of two acrocentric chromosomes, one of which had a telomeric NOR. Even a low 2n number (32) and the presence of all bi-armed chromosome suggest that centric fusion has played a prominent role in the phylogenetic evolution of the fish.

The unusual situation of NORs in *C. punctatus* is of course a derived one, which indicates the complex nature of the karyotype of *C. punctatus*. The data from these three species point out that NORs can serve as useful criteria for species identification in fishes.

Conclusion: Study of fish Chromosome is significant as it provides basic data for chromosomal manipulation and hybridization techniques, which are commonly used to get the hybrid vigor to increase fish production. The number of NORs, is an important tool as these cytotaxonomic markers could be used in illustrating the karyotypic evolution and phylogenetic relationships in this group.

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