Studies on Meiotic Chromosome of *Pseudapocryptes elongatus*

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Abstract :

Chromosomal analysis of fishes can be useful for addressing a variety of evolutionary & genetic questions. Though karyotypic studies have been done for some of the marine fish families, not much information is available about the chromosomes of the fishes of family Gobiidae. Among this group chromosomal idiosyncrasies play crucial role in species discrimination and evolution. Therefore, the present study has been performed for studying the chromosomes of *Pseudapocryptes elongates.*

Keywords : Meiotic chromosome, Pseudapocryptes elongatus

Introduction : Cytogenetical studies on fishes have been useful for providing information concerning evolutionary & taxonomic studies as well as for the genetic improvement of the commercial fish stock (Gold, 1974). Perciformes are unique for chromosomal conservation (2N=48) as identified in some families. And among Perciformes, suborder Blennioidei (732 species) and Gobioidei (2,121 species) (Galvao et al., 2011) are represented throughout the tropical region with large number of species. But small specimens with low mobility and ability to with stand fluctuation of temperature and salinity are two remarkable feature of this groups (Nelson, 2006).

Species of Blennioidei & Gobioidei were investigated (Cataudella et al., 1975; Garcia et al., 1987; Eve, 2003) with enough chromosomal peculiarities for species discrimination & understanding of their evolutionary aspects. Diversity at chromosome level, was not yet sufficiently available. Among Gobidae chromosomal polymorphisms were characterized by robertsonian arrangements (Caputo et al, 1999; Eve,2003) tandem fusions and pericentric inversions (Giles et al., 1985a & b; Amores et al., 1990).

Out of 25,690 taxonomically known fish species, about 2,500species have so far been cytologically investigated (Ojima, 1985) including nearly 165 species belonging to 40 odd families studied in India (Dhar & Chatterjee, 1984). In the present study, *Pseudapocryptes elongatus* was utilized for chromosome study. Earlier studies confirmed presence of 38 chromosomes (Nayak & Khuda-Bukhsh, 1983) in Apocryptes lanceolatus. Recent naming system confirmed Apocryptes as Pseudapocryptes. Though earlier workers confirmed in their study only mitotic divisions & generated karyotypes. But studies on meiotic chromosomes were scanty. There are 11 genera of family Gobiidae in India which include 89 species (Das, 1934).

Materials and Methods :

Pseudapocryptes sp. has been reported from India, Burma, the Andaman Islands & Malay Archipelago. *P. elongatus* is a demersal and amphidroumas fish which is found in mudflats of estuaries and the freshwater tidal zone of rivers. *P.elongatus* is an amphibious air breather.

The fishes were transported live to the laboratory & are kept in a well aerated aquarium at 20^{o}C-25^{o}C before analysis. For karyological study, the modified method of Uwa (1986) was used. Colchicine solution was prepared with 0.005g in 20 ml. physiological serum. The fishes were injected intraperitonally with 0.02 ml. of colchicine per gram of body weight using an insulin syringe & then the fishes were replaced in an aquarium for 4-5 hours. The gill filaments & kidneys of these specimens were then removed & placed in a hypotonic 0.36% KCl solution for 45 minutes at room temperature (25^{o}C). Thereafter, the solution was centrifuged for 10 minutes at 1000 rpm, in which 2-3 drops of fresh & cold Carnoy fixative (1:3, Acetic Acid: Methanol) were added before centrifugation. After centrifugation, the supernatants were discarded & 5 ml. of fresh & cold fixative was added to sediments, mixed thoroughly & left for 1 hour. The fixation & centrifugation processes were repeated for 2 times. The suspensions now were dropped on to the cold slides. The slides were stained with 10% Giemsa stain & kept for 20 minutes. Chromosomes were observed, selected & photographed by Olympus microscope mounted with camera.

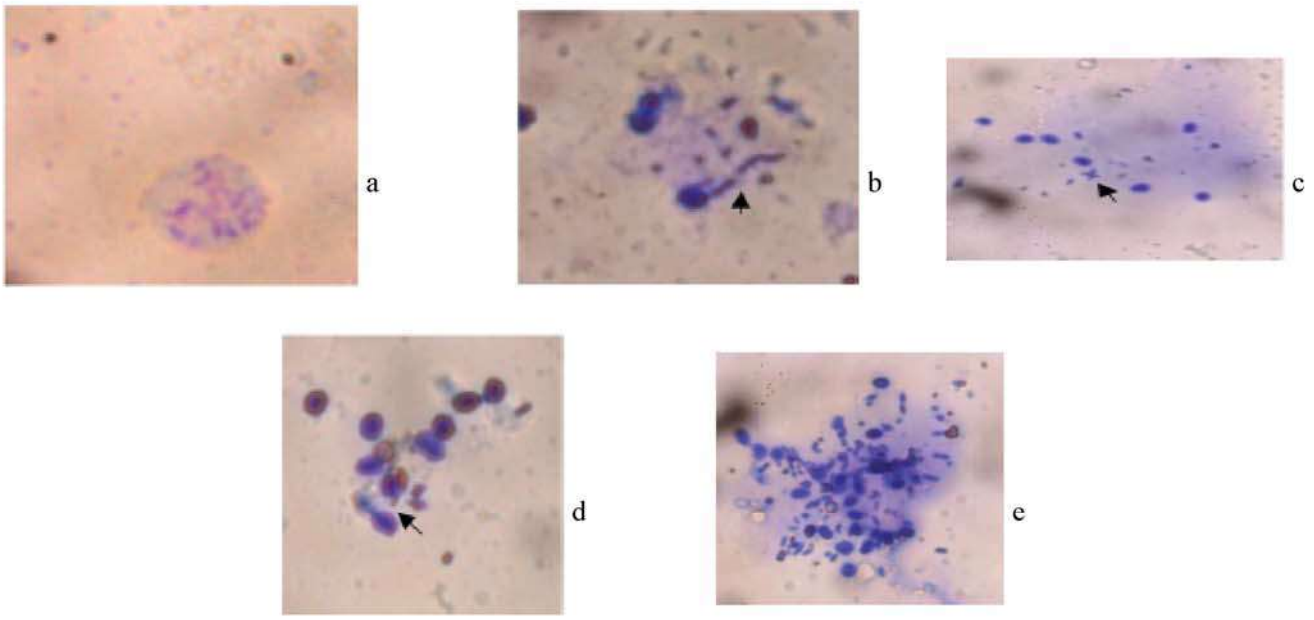

Plate 1: Plates showing meiotic chromosome plates of *Pseudapocryptes elongatus* during (a) Zygotene stage, (b) Late Pachytene early Diplotene stag e, (c) Late Diplotene early Diakinesis stage, (d) Diakinesis stage and (e) Metaphase I (in 40x10X).

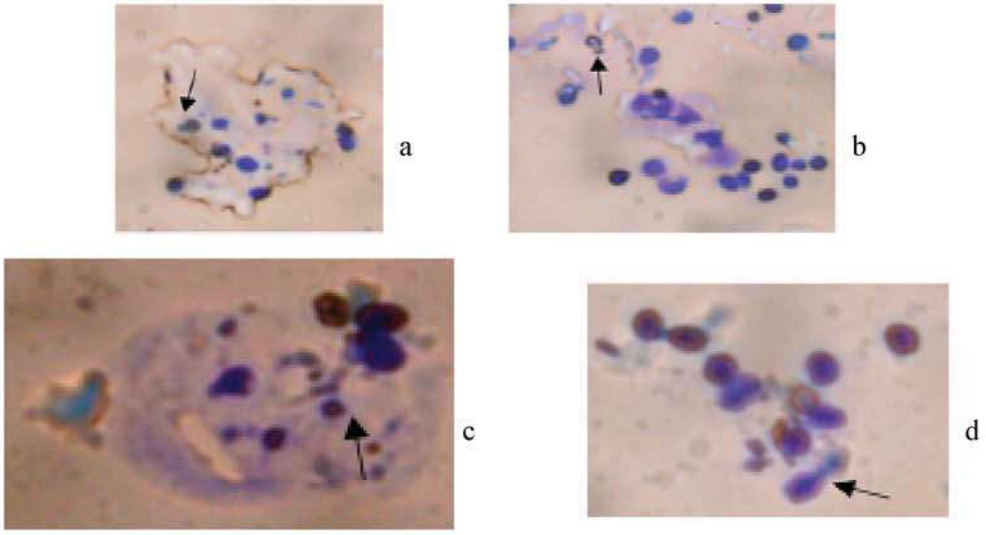

Plate 2: Plates showing fission-fusion cycle of chromosome during diakinesis of meiotic division of *Pseudapocryptes elongates* (in 40x10X).

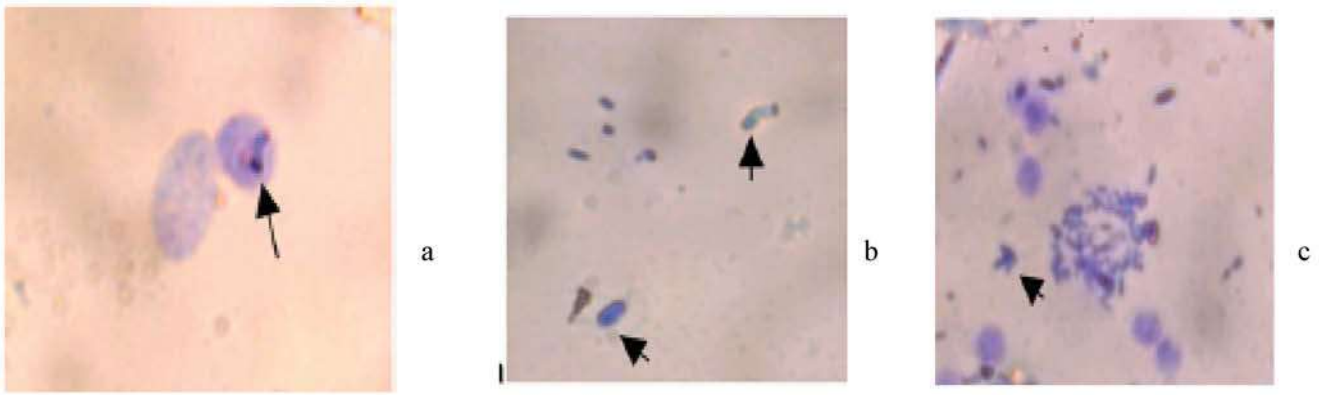

Plate 3: Plates (a & b) showing NOR and c) triploidy in mitotic chromosome of *Pseudapocryptes elongates* (in 40x10X)

Result & Discussion:

Meiotic divisions have been shown in plate 1 during (a) Zygotene stage, (b) Late Pachytene early Diplotene stage, (c) Late Diplotene early Diakinesis stage, (d) Diakinesis & (e) Metaphase I. During Diakinesis stage, circular chromosomes became distinct as shown in plate 2. Breakdown of chromosomes from circular chromosomes became distinct. In plate 3 (a) & (b) Nucleolus Organizer Region (NOR) became distinct.

Earlier studies also confirmed cytogeneric species *Apocryptes serperaster* having 44 chromosomes & *A. bato* with 46 chromosomes. Morphology of the congeneric species also differed (Nayak & Khuda-Bukhsh, 1983). Meiotic chromosome study also confirms that in circular diakinesis stage chromosome breaks into mini chromosomes (Plate 2). Fusion-fission cycle during mitosis as well as meiosis reported in Mulberry Plant (Xuan et al., 2017).

Karyotype evolution of eukaryotes are the result of polyploidy, dysploidy and aneuploidy. Dysploidy may increase or decrease basic chromosome number through fission or fussion. In field bin (*Vicia faba*, 2N=14), it was first reported where one pair of metacentric chromosome were broken into two pairs of telocentric chromosome (Schubert et al, 1995). Though breakdown of diakinetic chromosomes into small chromosomes in fish or in any animal is not yet reported. Detail study on molecular mechanism behind fusion-fission cycle between mitotic & meiotic chromosomes may reveal a unique mechanism playing pivotal role on karyotype evolution.

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