RESEARCH REVIEW JOURNALS
Volume-04
Issue-01
January -2019

ISSN: 2455-3085 (Online)
RESEARCH REVIEW International Journal of Multidisciplinary
www.rrjournals.com [UGC Listed Journal]

Karyotypic Analysis of Channa Gachua from Kapla Beel, Barpeta

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ARTICLE DETAILS

Article History
Published Online: 20 January 2019

Keywords
Channnidae, Channa gachua, metacentric, submetacentric, telocentric etc.

ABSTRACT

Genetic information on fish species is essential for propagation, conservation and their sustainable utilization of biodiversity. The freshwater dwarf snakehead fish, Channa gachua is a member of the family Channidae, are very important in fishery, aquaculture, food fish species, pharmaceutical products and traditional medicine. They are consumed in some regions as a traditional medicine for wound healing and reducing post-operative pain and discomfort. Lots of taxonomical works have been reported from North-East India on Channa species. But the cytological works on Channa gachua is very few in the North-East India specifically in Assam. Therefore the available cytological informations about Channidae are still inadequate and controversial. This study is aimed to investigate the cytological nature of Channa gachua from Kapla Beel, Barpeta, Assam. The diploid chromosome number of Channa gachua is found as 2n=78 comprising 19 pairs of metacentric, 1 pair of submetacentric, and 19 pairs of telocentric chromosomes. The fundamental number is found as 118. For the species no heteromorphic sex chromosomes are cytologically detected.

1. Introduction

The freshwater dwarf snakehead fish, *Channa gachua* is a member of the family *Channidae*, represented by 32 species, of which 29 are of Asian genus *Channa scopoli* and 3 of African genus *Para channa.* They are freshwater predatory fishes found throughout South, East and Southeast Asia and are very important in fishery, aquaculture, food fish species, pharmaceutical products and traditional medicine. The large and medium-sized *Channa* species are among the most common staple food fish in several Asian countries and they are extensively cultured. Apart from their importance as a food fish, snakeheads are consumed in some regions as a traditional medicine for wound healing and reducing post-operative pain and discomfort. Till date 12 species of *Channa* with minimum morphological differences are reported from the Northeast India (Vishwanath and Geetakumari 2009). Lots of taxonomical works have been reported from Manipur, Mizoram, Meghalaya, and Arunachal Pradesh on *Channa* species. But the cytological works on *Channa gachua* is very few in the North-East India specifically in Assam. Therefore the available cytological informations about *Channidae* are still inadequate and controversial.

With the advancement in molecular biology cytological studies on fishes are growing helping in perfect classification and identification of the species. North-East is the store house of diverse fishes. Explorations of all these species are very much important not only to know about the species but also to explore the evolutionary relationships among different species found in this region or in different regions of India. According to many researchers many species from Northeast are yet to be discovered. Northeast also contributes a great percentage of ornamental fishes found in India and *Channa gachua* belongs to them. *Channa gachua* is becoming very rare to be found i.e. its population is decreasing due to overexploitation and pollutions in the natural water bodies. As *Channa gachua* is highly demanded in market due to its medicinal value, therefore cytogenetic study of this species is supposed to be an imperative act for determining its natural genetic variation for future conservation programme.

2. Materials and methods

Channa gachua were collected from Kapla beel, Barpeta, Assam. Then they were identified up to species level following taxonomic keys (Jayaram 2002). Basic cytogenetic analysis methods are performed on 10 specimens for the species. Mitotic chromosome preparation is done using cells from gill epithelium and kidney and by following standard protocol (Kushwaha *et.al* 2018) with a little modification. Chromosome morphology is determined based on arm relationship (Levan *et.al* 1964). Fundamental number is calculated considering metacentric (m), sub metacentric (sm) and sub telocentric (st) chromosomes with two arms and telocentric (t) chromosomes with one arm. Giemsa stained mitotic chromosomes are photographed using Leica DFC295 microscope.

3. Results

The diploid chromosome number of *Channa gachua* is found as 2n=78 for 80% of counted metaphase plate. Karyotype comprises 19 pairs of metacentric, 1 pair of submetacentric, and 19 pairs of telocentric chromosomes. The numerical data presented (Table.1) high lightened the total chromosome length (ranging from 2.37µ to .73µ), arm ratio (ranging from ∞ to 2.58), relative length (ranging from 4.61% to 1.33%) and centromeric index (ranging from 49.74 to 0) Fundamental number (FN) is found as 118. The largest chromosome pair is metacentric (chromosome pair 1). For the species no heteromorphic sex chromosomes are cytologically detected.

4. Discussion

As per the karyotypic data available on the species *C. gachua* of different geographical locations of India (Kalyani and Jammu) shows diploid count of 2n=78 which is not diverse from the present finding of 2n=78. The same diploid count (2n=78) of *C. gachua*, irrespective of three different geographical locations Assam, Kalyani and Jammu regions, India; shows divergence in NF. This variation can be used in the search of evolutionary relationship between inter- and intra-populations. This divergence may be attributed to differences in the karyotype macrostructure, reflecting a real geographical variation common to widespread species. The differences in the NF within the same species of different geographical locations, inspite of conserved diploid number (2n=78) suggested the structural rearrangement in chromosome, as a consequence changes in chromosome morphology without change in chromosome number. (Khuda Bukhsh 1984).

Chromosome number and morphology can change among fish species which is useful in establishing the evolutionary relationship between inter and intra populations (Thorgard 1990). But due to their small size and usually abundant and more contracted structures studying and measuring fish chromosome is somewhat difficult as compared to mammals. Another problem with fish karyotype is the destitution of a standard karyotype as fish karyotypes are not identical to that of other animal species. Again polymorphism exists not only among various fish species but also within species (Al-Sabti 1991) that make fish karyotype a bit stiff. Though it has limitations to draw absolute conclusions about phylogenetic relationships by comparing karyotype of different species but it plays a major role to understand the evolutionary pathway within distinct groups. Considering the importance of cytological study on the fishes of North- East India present work is aimed to offer new informations about karyotypic relations of *Channa gachua* by comparing the present data with the data available for genus. Hopefully this study comprising the cytogenetic pattern of *Channa gachua* will contribute to better cytogenetic research of fish.

Acknowledgements

The authors are grateful to Department of Zoology, Gauhati University for making this study possible by allowing working there. The authors are also thankful to Dr Banasri Mech, Assistant professor (Dept. of Zoology), Gauhati University for her kind suggestion and guidance.

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Table.1. Morphometry of the karyotype of *C. gachua* showing the mean values of measurements from 10 best mitotic metaphases.

Chromosome No.	Length of p (μ),	Length q (μ)	Total length of the chromosome (μ)	r	Chromosome type	CI (%)	R_L (%)
1	0.96	1.41	2.37	1.46	Metacentric	40.50	4.61
2	1.01	1.02	2.03	1.00	Metacentric	49.75	
3	0.95	0.96	1.91	1.01	Metacentric	49.74	3.98
4	0.79	1.10	1.89	1.39	Metacentric	41.80	
5	0.77	1.06	1.83	1.38	Metacentric	42.08	3.77
6	0.85	0.92	1.77	1.08	Metacentric	48.02	
7	0.83	0.84	1.67	1.01	Metacentric	49.70	3.50
8	0.74	0.92	1.66	1.24	Metacentric	44.58	
9	0.74	0.89	1.63	1.20	Metacentric	45.40	3.40
10	0.77	0.83	1.60	1.08	Metacentric	48.13	
11	0.74	0.85	1.59	1.15	Metacentric	46.54	3.33
12	0.63	0.96	1.59	1.52	Metacentric	39.62	
13	0.77	0.78	1.55	1.01	Metacentric	49.68	3.25
14	0.69	0.85	1.54	1.23	Metacentric	44.81	
15	0.70	0.83	1.53	1.19	Metacentric	45.75	3.15

16	0.68	0.78	1.46	1.14	Metacentric	46.58	
17	0.63	0.79	1.42	1.25	Metacentric	44.37	2.98
18	0.58	0.83	1.41	1.43	Metacentric	41.13	
19	0.65	0.75	1.40	1.53	Metacentric	46.43	2.94
20	0.61	0.78	1.39	1.28	Metacentric	43.88	
21	0.66	0.71	1.37	1.08	Metacentric	48.18	2.87
22	0.64	0.73	1.37	1.14	Metacentric	46.72	
23	0.62	0.74	1.36	1.19	Metacentric	45.59	2.87
24	0.53	0.83	1.36	1.57	Metacentric	38.97	
25	0.63	0.72	1.35	1.14	Metacentric	46.67	2.81
26	0.62	0.71	1.33	1.15	Metacentric	46.62	
27	0.49	0.81	1.30	1.65	Metacentric	37.69	2.70
28	0.56	0.71	1.27	1.27	Metacentric	44.09	
29	0.62	0.63	1.25	1.01	Metacentric	49.60	2.62
30	0.60	0.64	1.24	1.07	Metacentric	48.39	
31	0.55	0.69	1.24	1.25	Metacentric	44.35	2.60
32	0.54	0.70	1.24	1.30	Metacentric	43.55	
33	0.59	0.63	1.22	1.07	Metacentric	48.36	2.54
34	0.49	0.70	1.19	1.43	Metacentric	41.18	
35	0.47	0.68	1.15	1.45	Metacentric	40.87	2.35
36	0.46	0.63	1.09	1.37	Metacentric	42.20	
37	0.41	0.68	1.09	1.66	Metacentric	37.61	2.18
38	0.39	0.60	0.99	1.54	Metacentric	39.39	
39	0.46	1.19	1.65	2.58	Submetacentric	27.88	2.87
40	0.35	0.74	1.09	2.11	Submetacentric	32.11	
41	0	1.50	1.50		Telocentric	0	2.99
42	0	1.36	1.36		Telocentric	0	
43	0	1.25	1.25		Telocentric	0	2.60
44	0	1.23	1.23		Telocentric	0	
45	0	1.22	1.22		Telocentric	0	2.50
46	0	1.17	1.17		Telocentric	0	
47	0	1.16	1.16		Telocentric	0	2.43
48	0	1.15	1.15		Telocentric	0	
49	0	1.10	1.10		Telocentric	0	2.29
50	0	1.08	1.08		Telocentric	0	
51	0	1.06	1.06		Telocentric	0	2.20
52	0	1.03	1.03		Telocentric	0	
53	0	1.02	1.02		Telocentric	0	2.12
54	0	0.99	0.99		Telocentric	0	
55	0	0.98	0.98		Telocentric	0	2.05
56	0	0.98	0.98		Telocentric	0	
57	0	0.96	0.96		Telocentric	0	2.01
58	0	0.95	0.95		Telocentric	0	
59	0	0.93	0.93		Telocentric	0	1.95
60	0	0.93	0.93		Telocentric	0	
61	0	0.93	0.93		Telocentric	0	1.91
62	0	0.89	0.89		Telocentric	0	
63	0	0.88	0.88		Telocentric	0	1.85
64	0	0.88	0.88		Telocentric	0	
65	0	0.87	0.87		Telocentric	0	1.82
66	0	0.86	0.86		Telocentric	0	

67	0	0.85	0.85		Telocentric	0	1.78
68	0	0.85	0.85		Telocentric	0	
69	0	0.85	0.85		Telocentric	0	1.78
70	0	0.84	0.84		Telocentric	0	
71	0	0.83	0.83		Telocentric	0	1.72
72	0	0.81	0.81		Telocentric	0	
73	0	0.80	0.80		Telocentric	0	1.66
74	0	0.78	0.78		Telocentric	0	
75	0	0.77	0.77		Telocentric	0	1.57
76	0	0.73	0.73		Telocentric	0	
77	0	0.68	0.68		Telocentric	0	1.43
78	0	0.66	0.66		Telocentric	0	

p- short arm q- long arm µ- macron CI- Centromeric Index RL- Relative Length

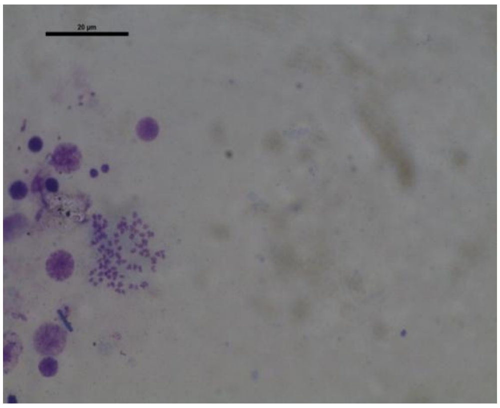

Fig. 1

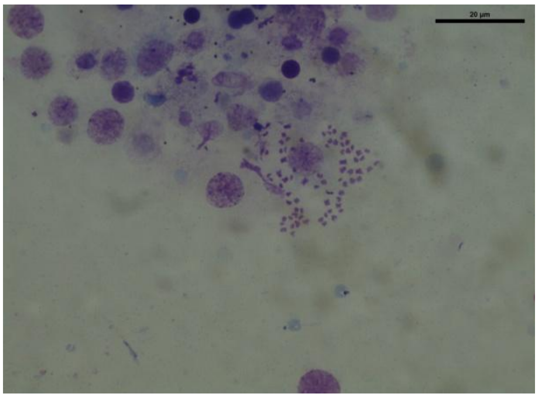

Fig. 2

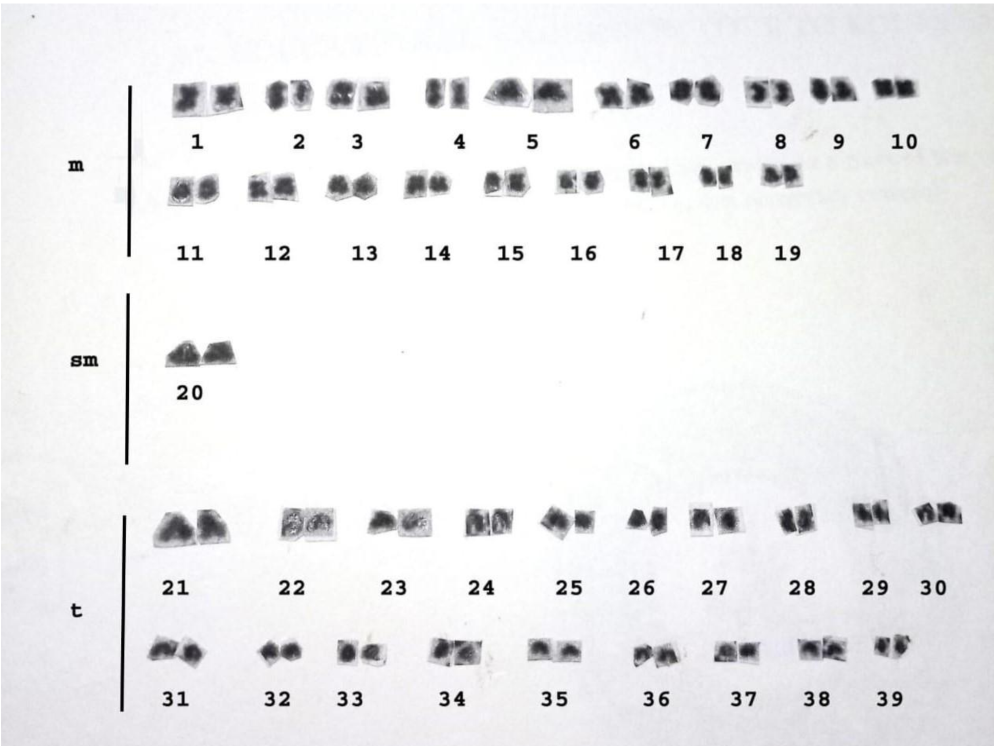

Fig. 3

FIGURE CAPTIONS

Fig.1: Metaphase spread from *Channa gachua,* 2n=78.
Fig.2: Metaphase spread from *Channa gachua,* 2n=78.
Fig.2: Somatic karyotype of *Channa gachua.*