

CYTOGENETIC STUDIES ON TWO SPECIES OF GENUS *LABEO* AND THEIR FERTILE HYBRID

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Summary

Chromosome data on two species of Indian Carps viz., *Labeo rohita*, *Labeo calbasu* and their fertile hybrid 'CALBAHU' (*Labeo calbasu* ♀ × *Labeo rohita* ♂) are presented. From the analysis of mitotic metaphase chromosome spreads from kidney tissues, the modal diploid chromosome number was found to be $2n = 50$ with an NF = 78 in *Labeo rohita*, NF = 82 in *Labeo calbasu* and NF = 80 in 'CALBAHU'. No definite indication of sex chromosomes was observed in the present study.

Introduction

Though information on cytogenetic studies on Indian Carps are available (Rishi, 1971; Naseem, 1972; Khuda-Buksh and Manna, 1973, 1974) such data on their hybrids are rather limited (Manna and Khuda-Buksh, 1974). With this in view karyotypic studies of *Labeo rohita*, *Labeo calbasu* together with their hybrid 'CALBAHU' (*Labeo calbasu* ♀ × *Labeo rohita* ♂) have been attempted.

Material and Methods

Mitotic metaphase chromosome spreads were obtained following essentially the same method described earlier (Vasudevan *et al.*, 1973). Eleven specimens of *L. rohita* (7 males and 4 females), 9 of *L. calbasu* (6 females and 3 males) and 4 of 'CALBAHU' (all females) were used in the present study. Hybrids used were those produced and maintained at the laboratories of the Central Institute of Fisheries Education, Bombay.

Measurements of chromosomes were made from enlarged photographic prints (Reitalu, 1968) and the arm ratio and centromeric index for each chromosome were determined from the same (Levan *et al.*, 1964). In the karyotypes, chromosomes are arranged in groups of metacentrics (M, m), submetacentrics and subtelocentrics together (sm, st) and telocentrics (T, t), all in order of decreasing length.

Results and Discussion

A clear and consistent mode of $2n = 50$ chromosomes was found in all the three groups. In *L. rohita*, 87.5% of the cells examined (197 in 225) showed $2n = 50$ chromosomes. Figs. 1 and 2 show the metaphase spread and karyotype respectively from a male *L. rohita*. The diploid metaphase complement from males and females consisted of 50 chromosomes with 6 pairs of metacentrics (No. 1-6), 4 of submetacentrics

(No. 8, 10, 11, 14), 4 of submetacentrics (No. 7, 9, 12, 13) and 11 of telocentrics (No. 15 to 25), with an $NF = 78$. The mean length of the longest and shortest chromosomes ranged between $2.04 \pm 0.26 \mu$ and $0.64 \pm 0.14 \mu$. Though the maximum difference between the two adjacent chromosomes was 0.47μ (between No. 7 and 8) in the rest it was never more than 0.20μ . As the chromosomes were gradually seriated size grouping was difficult. The total mean length of the haploid set of chromosomes was 27.43μ .

In *L. calbasu* the chromosome number ranged between 46 and 50 but 88.8% (206 in 232) showed $2n = 50$ chromosomes. Figs. 3 and 4 show the metaphase spread and its karyotype respectively from a male *L. calbasu*. Analysis of karyotypes revealed 6 pairs of metacentrics (No. 1-6), 6 of submetacentrics (No. 8, 10, 11, 12, 15, 16), 4 of submetacentrics (No. 7, 9, 13, 14) and 9 of telocentrics (No. 17 to 25) with an $NF = 82$. The mean length of the longest and shortest chromosomes ranged between $2.44 \pm 0.47 \mu$ and $1.01 \pm 0.25 \mu$. The maximum difference between two adjacent chromosomes was 0.56μ (No. 7 and 8) while in many cases hardly any difference was noticed at all (No. 13 and 14, 19 and 20). The total mean length of the haploid set of chromosomes was 35.06μ . The longest pair of submetacentrics invariably showed a structure suggestive of secondary constriction.

In 'CALBAHU' 81.9% (68 in 83) had $2n = 50$ chromosomes. Figs. 5 and 6 show the metaphase spread and the karyotype respectively from a female 'CALBAHU'. The mean length of the longest and shortest chromosomes ranged between 1.74μ and 0.76μ . The total mean length of the haploid set was 25.66μ . Although fairly good number of samples were investigated in this group, due to condensation of chromosomes and unsatisfactory spreads, proper measurements of arm-lengths were not possible.

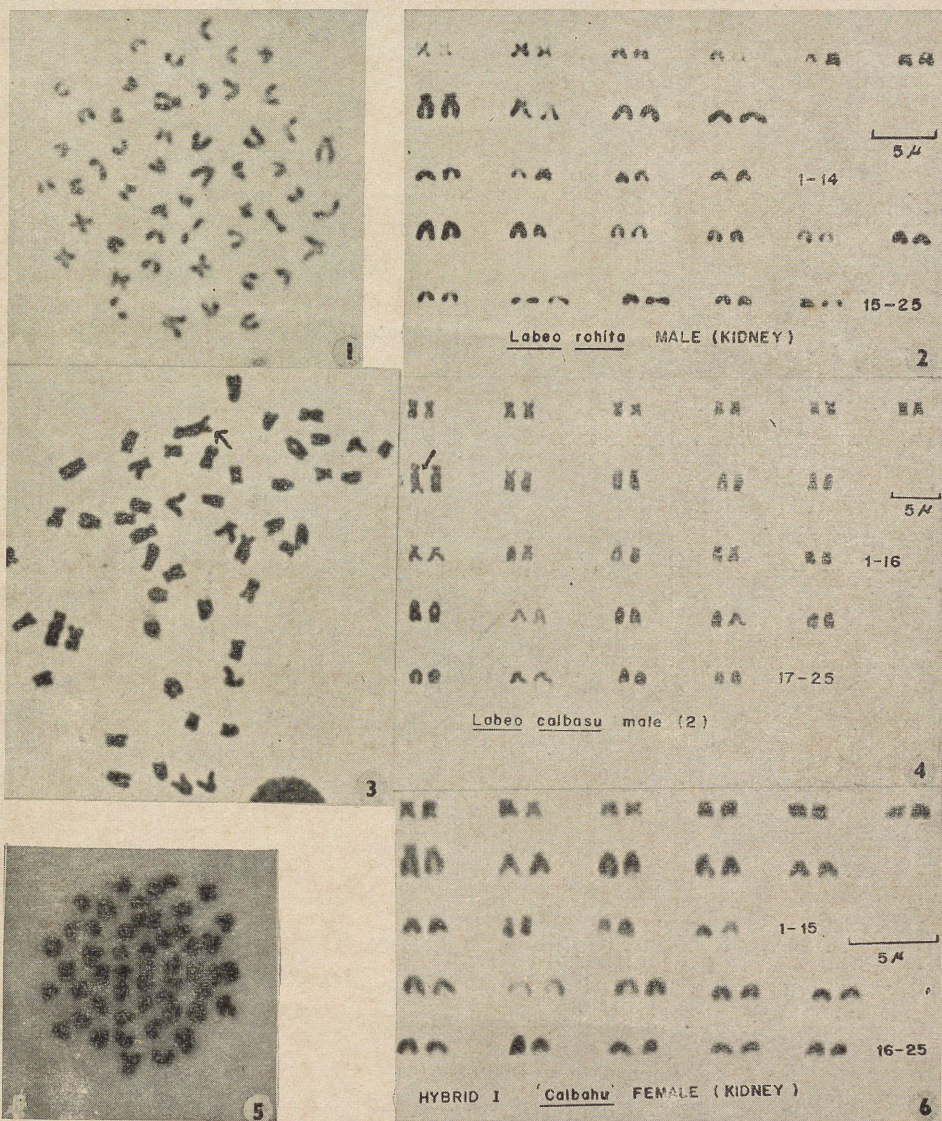
Manna and Khuda-Bukhsh (1974) reported $2n = 50$ chromosomes in *L. rohita* and *L. calbasu*, though Naseem (1972) had reported $2n = 48$ in *L. rohita*. Most of the Cyprinids studied have a diploid chromosome number made of 50 chromosomes, about 20 of which are acrocentrics while the rest are metacentrics (Ohno, 1970). *L. rohita* and *L. calbasu* represent two closely related species of the genus *Labeo* belonging to the family *Cyprinidae*. They show several pairs of shared chromosomes especially the long submetacentrics. Manna and Prasad (1971) while discussing the evolution of chromosome in fishes have put forth a view that pericentric inversions played a major role in the evolution of karyotypes of many fishes, though certain less significant structural rearrangements are also possible.

The hybrids examined show no difference in the modal number, besides the arm number $NF = 80$ was consistent with parents of $NF = 78$ and $NF = 82$. Such composite hybrid compliments composed of approximately haploid set of chromosomes from each parent species were reported in certain Minnow hybrids and *Fundulus* hybrids (Greenfield *et al.*, 1973; Chen and Ebeling, 1975).

In the present study no definite indication of sex chromosomes was observed. Though scattered reports of chromosomal sexual dimorphism in fishes are available (Ebeling and Chen, 1970), in majority of the species studied no definite sex chromosomes have been reported.

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Figs. 1 and 2. Mitotic metaphase spread and its karyotype from a male *L. rohita*. Figs. 3 and 4. Mitotic metaphase spread and its karyotype from a male *L. calbasu*, suggestive of secondary constriction. Figs. 5 and 6. Mitotic metaphase spread and its karyotype from a female 'CALBAHU'.

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References

- Chen, T R, and Ebeling, A W, *Copeia* (1975) 176.
Ebeling, A W and Chen, T R, *Trans Amer Fish Soc* 99 (1970) 131.
Greenfield, D W, Hameed, F A, Deckert, G D and Flinn, R R, *Copeia* (1973) 54.
Khuda-Bukhsh, A R, and Manna, G K, *Proc Ind Sci Congr* 3 (1973) 422.
Khuda-Bukhsh, A R, and Manna, G K, *Proc Ind Sci Congr* 3 (1974).
Levan, A, Fredga, K and Sandberg, A A, *Hereditas* 52 (1964) 201.
Manna, G K, and Khuda-Bukhsh, A R, *Chrom Infor Ser* 16 (1974) 26.
Manna, G K, and Prasad, R, *Proc 1st All India Congr Cytol Genet* (1971) 237.
Naseem, Hamsa, Ph. D. Thesis University of Bombay (Unpublished) (1972).
Ohno, S, *Trans Amer Fish Soc* 99 (1970) 120.
Reitalu, J, *Hereditas* 59 (1968) 1.
Rishi, K K, *Proc 1st All India Congr Cytol Genet* (1971) 213.
Vasudevan, P, Rao, S R V and Rao, S G A, *Curr Sci* 42 (1973) 427.

