

## A Karyotype of a Chinese Bitterling, *Paracheilognathus himantegus* (Cypriniformes, Cyprinidae)<sup>1)</sup>

By

**Ryoichi ARAI**

Department of Zoology, National Science Museum, Tokyo,

**Atsushi SUZUKI and Yutaka AKAI**

The Institute for Breeding Research, Tokyo University of  
Agriculture/Research Institute of Evolutionary Biology

**Abstract** Chromosomes of a Chinese bitterling, *Paracheilognathus himantegus*, were observed. The karyotype comprises 10 metacentric, 18 submetacentric, 6 subtelocentric, and 14 acrocentric chromosomes. From the viewpoint of comparative karyology, *P. himantegus* is closely related to *Acheilognathus lanceolatus*, *A. limbatus*, and *A. signifer*.

More than 20 species of bitterlings are distributed in China (WU *et al.*, 1964); of these, chromosomes of 9 species have been reported (HONG *et al.*, 1983; HONG & ZHOU, 1985; YU *et al.*, 1987). As regards relationships between the karyotype and the lateral line in Chinese bitterlings, the diploid chromosome number of species having the complete lateral line is reported to be 44 or 42, while that of bitterlings having the incomplete lateral line to be 48.

On the other hand, there are bitterlings in Japan and Korea, which have both the complete lateral line and 48 chromosomes, i.e., *Acheilognathus lanceolatus*, *A. limbatus*, and *A. signifer* (OJIMA *et al.*, 1973; LEE *et al.*, 1983). From these facts, it can be expected that, in China, there are also bitterlings which have the complete lateral line and 48 chromosomes.

Recently, we observed chromosomes of a Chinese bitterling, *Paracheilognathus himantegus* GÜNTHER, which has the complete lateral line. The result will be reported here.

### Materials and Methods

A male and a female of *Paracheilognathus himantegus* were obtained from an aquarium dealer, and used for chromosome observation. Some morphological characters of material fishes are shown in Table 1. They are deposited in the fish collection of the Department of Zoology, National Science Museum, Tokyo.

1) Contribution number 82, Research Institute of Evolutionary Biology.

Table 1. Characters of material fishes.

Cat No.	Sex	TL (mm)	SL (mm)	Dorsal fin	Anal fin	Number of vertebrae
A·47·1	male	54.3	42.5	iii, 8	iii, 10	31
A·47·2	female	56.4	43.7	iii, 8	iii, 10	33

Table 2. Frequency distributions of chromosome counts in a male and a female specimens of *Paracheilognathus himantegus*.

Sex & tissues	2n						Total
	44	45	46	47	48	49	
Male:							
Gill epithelial cells	2	1			7		10
Kidney cells	1				4		5
Female:							
Gill epithelial cells				3	10	1	14
Kidney cells					4		4

Method of chromosome preparation is followed to SUZUKI and TAKI (1981) except for mounting cells on the slide-glass and air drying procedure, which are followed to STOCK *et al.* (1972).

Classification of chromosomes is adopted from LEVAN *et al.* (1964). Metacentrics and submetacentrics are described as two-arm chromosomes, and subtelo-centrics and acrocentrics as one-arm chromosomes. The definition of the new arm number is referred to ARAI and NAGAIWA (1976).

### Result and Discussion

As shown in Table 2, the diploid chromosome number of *Paracheilognathus himantegus* was determined as 48. The diploid complement comprises 10 metacentric, 18 submetacentric, 6 subtelocentric, and 14 acrocentric chromosomes (Fig. 1). The first metacentric chromosome pair was large as compared with the other chromosomes, and might have been formed by centric fusion. No heteromorphic pair was detected in male and female karyotypes. The arm number is 76. The new arm number is 50.

This is the first record of the Chinese bitterling which has the complete lateral line and 48 chromosomes. The karyotype of this species agrees with those of *Acheilognathus lanceolatus*, *A. limbatus* and *A. signifer* in the diploid chromosome number.

On the other hand, morphological characters shared by these four species are 1) long barbels, 2) complete lateral line, 3) 8 or 9 branched dorsal fin rays, and 4) branched anal fin rays more numerous than branched dorsal fin rays. These mor-



Fig. 1. Photomicrographs of mitotic metaphase chromosomes and karyotypes from a kidney cell (male) and a gill epithelial cell (female) of a Chinese bitterling, *Paracheilognathus himantegus*. — A, Male (Cat. No. A·47·1),  $2n=48$ ,  $\times 3,450$ ; B, female (Cat. No. A·47·2),  $2n=48$ ,  $\times 3,850$ ; C, male, from Fig. A, NF=76,  $\times 3,130$ ; D, female, from Fig. B, NF=76,  $\times 2,940$ .

phological characters and the karyotype seem to suggest that *Paracheilognathus himantegus* is more closely related to *Acheilognathus lanceolatus*, *A. limbatus* and *A. signifer* than to a Chinese bitterling, *Paracheilognathus imberbis* ( $2n=44$ , no barbels, complete lateral line, 9 or 10 branched dorsal fin rays, and 9 or 10 branched anal fin rays).

### References

- ARAI, R., & K. NAGAIWA, 1976. Chromosomes of tetraodontiform fishes from Japan. *Bull. natn. Sci. Mus., Tokyo*, (A), **2**: 59–72, pls. 1–6.
- HONG, Y., & T. ZHOU, 1985. Studies on the karyotype and C-banding patterns in *Acheilognathus gracilis* with a discussion on the evolution of acheilognathid fishes. *Acta gen. sinica*, **12**: 143–148. (In Chinese with English abstract.)
- , M. ZHOU & T. ZHOU, 1983. Studies on the karyotypes of Chinese cyprinid fishes. III. Comparative analysis of the chromosomes of seven species of acheilognathid fishes. *J. Wuhan Univ.*, (Nat. Sci.), **1983** (2): 96–102, pl. 1. (In Chinese with English abstract.)
- LEE, H. Y., C. H. YU, S. K. JEON & H. S. LEE, 1983. The karyotype analysis on 29 species of fresh water fish in Korea. *Bull. Inst. basic Sci., Inha Univ.*, **4**: 79–86, pls. 1–7. (In Korean with English abstract.)
- LEVAN, A., K. FREDGA & A. A. SANDBERG, 1964. Nomenclature for centromeric position on chromosomes. *Hereditas*, **52**: 201–220.
- OJIMA, Y., K. UENO & M. HAYASHI, 1973. Karyotypes of the acheilognathine fishes (Cyprinidae) of Japan with a discussion of phylogenetic problems. *Zool. Mag., Tokyo*, **82**: 171–177. (In Japanese with English abstract.)
- STOCK, A. D., D. B. BURNHAM & T. C. HSU, 1972. Giemsa banding of meiotic chromosomes with description of a procedure for cytological preparations from solid tissues. *Cytogenetics*, **11**: 534–539.
- SUZUKI, A., & Y. TAKI, 1981. Karyotype of tetraploid origin in a tropical Asian cyprinid, *Acrossocheilus sumatranus*. *Jpn. J. Ichthyol.*, **28**: 173–176.
- WU, H.-W., & 5 others, 1964. *Cyprinid Fishes of China* 1. 228 pp., 78 pls. Shanghai. (In Chinese.)
- YU, X., T. ZHOU, K. LI, Y. LI & M. ZHOU, 1987. On the karyosystematics of cyprinid fishes and a summary of fish chromosome studies in China. *Genetica*, **72**: 225–235.