

Karyotypes of the Genus *Pseudopungtungia* (Pisces, Cyprinidae)

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Karyotypes of the two species, *Pseudopungtungia nigra* and *P. tenuicorpus*, which are known to be Korean endemic fish species, were analyzed to obtain a basic information on the systematic relationship of these fishes. Diploid chromosome number of *P. nigra* was 50, composed of 7 pairs metacentric, 18 pairs of submetacentric and/or subtelocentric chromosomes and in *P. tenuicorpus* the diploid number was also 50, comprising 10 pairs of metacentric, 15 pairs of submetacentric and/or subtelocentric ones.

KEY WORDS: Fish karyotype, Korean endemic, Cyprinidae, Genus *Pseudopungtungia*

Karyotype analysis can be a useful method in elucidating the phylogenetic relationship between the species and to look at the cytogenetic relationship between the species. So an accurate cytogenetic survey of the fish species becomes increasingly important in establishing the systematic relationships of the teleosts. Among approximately 20,000 species of fish, the chromosome number is known in about 1,000 and complete karyotyping has been made in about 800 species (Ojima, 1983). The development of cytogenetic techniques for fish chromosomes, particularly a current colchicine treatment to accumulate cells at metaphase and to facilitate the spread of chromosomes, has made possible the accurate delineation of the chromosomes in somatic cells.

The genus *Pseudopungtungia* is assumed to be closely related to the genus *Pungtungia*, but differs from it in having inferior and horseshoe shaped mouth, instead of terminal, and all fins except pectoral with distinct broad black cross bars. Because of these some distinct characters from the genus *Pungtungia*, Mori (1935) recorded it to a different genus and species *Pseudopungtungia nigra*. After that, Jeon and Choi (1980) reported a new cyprinid fish which was categorized in the same genus *Pseudopungtungia*. Presently, there are only two species in this genus, *Pseudopungtungia nigra* and *P. tenuicorpus* (Fig. 1) which are

known to be Korean endemic genus and species. *P. nigra* is not only a Korean endemic species but also appearing restricted at the Kum River, the Mankyung River and the Ungcheon River, exclusively (Choi, 1973). *P. tenuicorpus* also restricted only at the upper streams of the Han River. And this genus has become particular interest for the zoogeographic point of view and for the occurrence of intergeneric natural hybrid between the *Pungtungia herzi* and *Pseudopungtungia nigra* (Kim and Shim, 1988).

The present study was undertaken with a hope to obtain a basic information for understanding systematic relationship of the genus *Pseudopungtungia* in the Cyprinidae.

Materials and Methods

Karyotypes were made from 16 specimens. All captured fishes were brought in the laboratory and maintained in well aerated aquariums. They were obtained at the following localities: *P. nigra*: Ungcheon-myon, Boryung-gun, Chungnam-do (Ungcheon River), 2 males; Sangjeon-myon, Chinan-gun, Chonbuk-do (Kum River), 5 males, 4 females; Cheoncheon-myon, Changsu-gun, Chonbuk-do (Kum River), 2 males, 1 female. *P. tenuicorpus*: Kimhwa-myon, Cheolwon-gun,

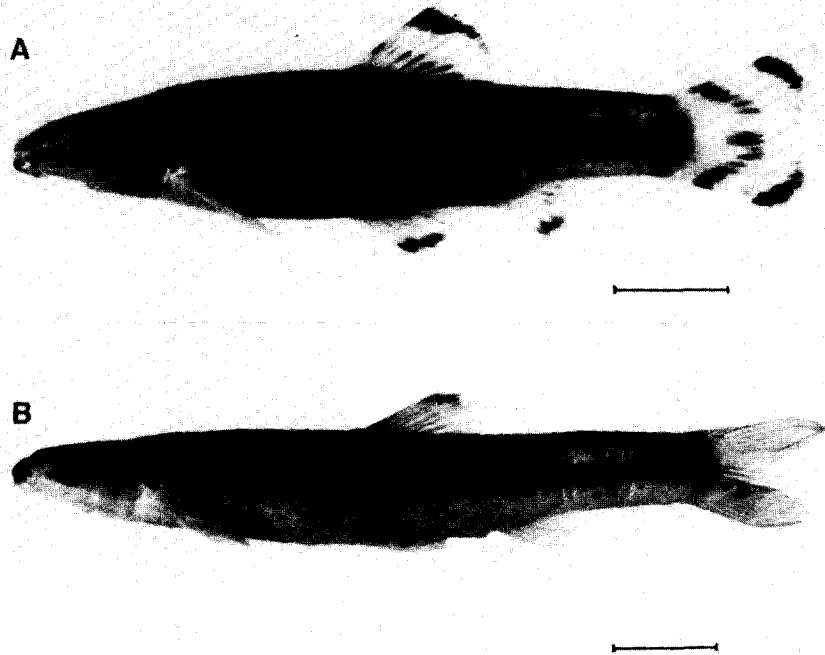


Fig. 1. Photographs of *Pseudopungtungia nigra* (A) and *P. tenuicorpus* (B). Bar, 10 mm.

Gangwon-do (Han River), 2 males.

The colchicized specimens were conducted to the flame drying technique described as follows. Two hours after colchicine injection into the intraperitoneal cavity of the fish, gill epithelium and kidney tissues were removed, minced with small scissors into fine fragments and then suspended in 0.075 M KCl. Following the hypotonic treatment, the cells were fixed in three changes of Carnoy solution. Slides were made by flame drying method with 5% Giemsa staining. Morphology of chromosomes have been described by Levan et al. (1964).

Results and Discussion

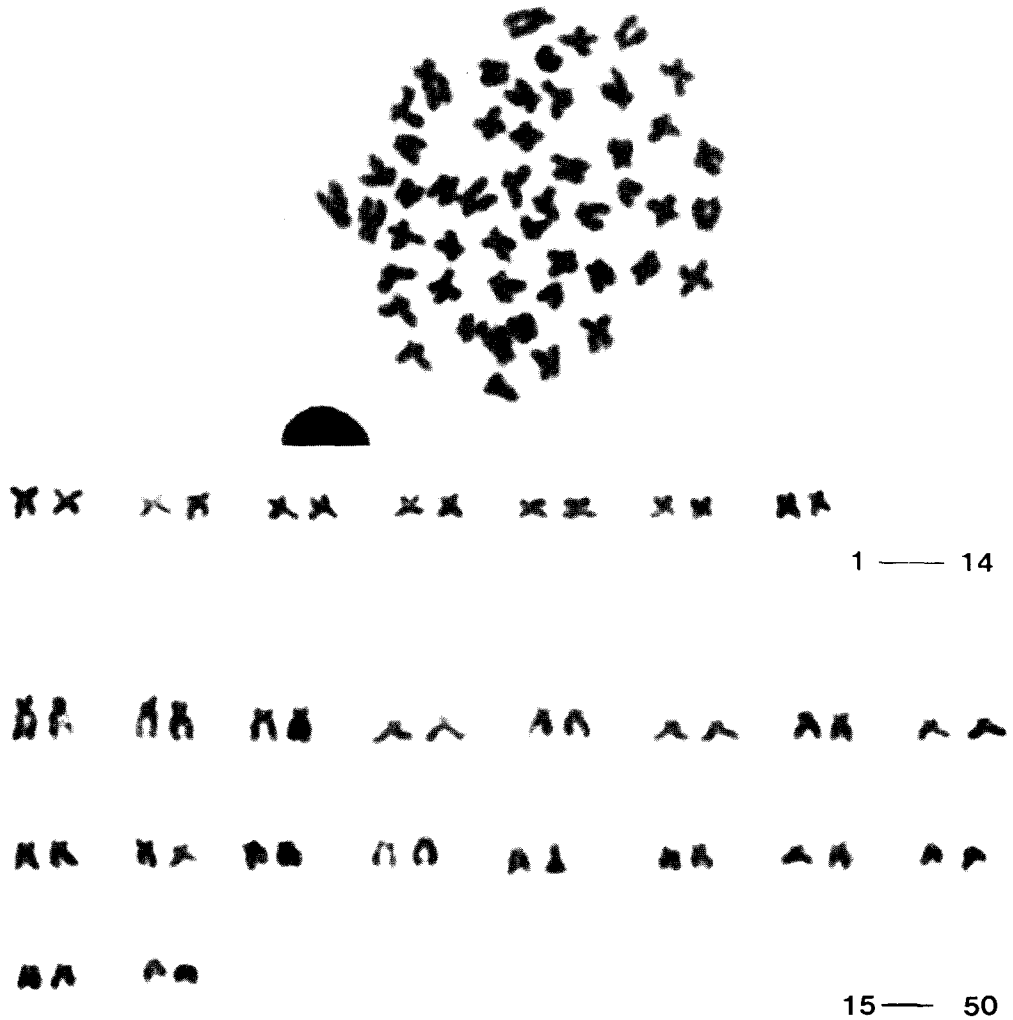
The modal diploid chromosome number of *Pseudopungtungia nigra* was 50 in the majority of cells examined (87%) although the numbers of chromosomes ranged from 44 to 51. And that of *P. tenuicorpus* was 50, too, and the number

varied from 46 to 51 (Table. 1). The karyotypes of the two species consisted of 25 pairs of homomorphic chromosomes which were tentatively categorized into two groups. *P. nigra* was composed of 7 pairs of metacentric and 18 pairs of submeta and/or subtelocentric chromosomes, and 10 pairs of metacentric and 15 pairs of submeta and/or subtelocentric ones in *P. tenuicorpus*, respectively (Fig. 2 and 3). We could not find the chromosomal variances and polymorphism among individuals within the species.

Among the cyprinid species the chromosome numbers were 44, 48 and 50 in almost all species so far reported (Ojima, 1983). The Korean endemic cyprinid species *P. nigra* and *P. tenuicorpus* were included in these categories. Karyomorphology of *P. nigra* had been reported previously (Lee et al., 1983), and the chromosome number was same as our results. And so far as the present authors are aware, the karyomorphology of *P. tenuicorpus* had not been studied. So it considered to be the first report in this study.

Table 1. Frequency distribution of diploid chromosome numbers in the genus *Pseudopungtungia*.

Species and localities	Diploid numbers								No. cells
	44	45	46	47	48	49	50	51	
<i>P. nigra</i>									
Ungcheon River	1	0	1	0	1	2	20	0	25
Kum River	4	2	0	3	6	13	207	2	235
<i>P. tenuicorpus</i>									
Han River	0	0	1	0	1	2	21	1	26

**Fig. 2.** Metaphase plate and karyotype of *Pseudopungtungia nigra*.

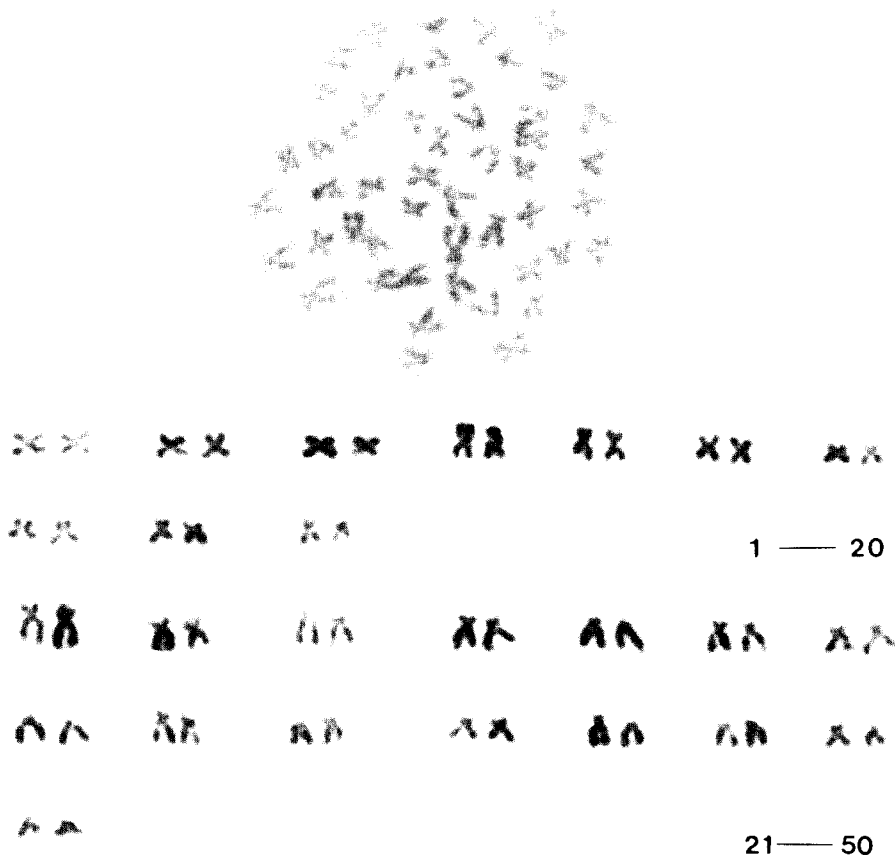


Fig. 3. Metaphase plate and karyotype of *Pseudopungtungia tenuicorpus*.

In spite of high morphological similarity between the genera *Pungtungia* and *Pseudopungtungia*, it had separated to the alternative genus for some distinct characters, i. e. position and shape of mouth parts and color patterns on the body side and all fins except pectoral. And it seems to be closely related genera among the Gobioninae. Above all a marked similarity of chromosome complement was found between *P. tenuicorpus* in this study and *Pungtungia herzi* reported by previous workers (Ojima et al., 1972; Kasama et al., 1984), that is, the chromosome complement of two species are 10 metacentric and 15 submetacentric and/or subtelocentric chromosomes. So special systematic regrads at the level of the genus, whether lumping or splitting as it is, would be paid to the taxonomic problem.

References

- Choi, K. C., 1973. On the geographical distribution of freshwater fishes south of DMZ in Korea. *Korean J. Limnol.* **6**: 29-36.
- Jeon, S. R. and K. C. Choi, 1980. A new cyprinid fish, *Pseudopungtungia tenuicorpus* from Korea. *Korean J. Zool.* **23**: 41-48.
- Kasama, M., H. Kobayashi, and S. R. Jeon, 1984. Chromosomes of *Coreoleuciscus splendidus* compared with those of *Pungtungia herzi*. *Jap. Women's Univ. J.* **31**: 109-111.
- Kim, I. S. and J. H. Shim, 1988. Occurrence of natural hybrid, *Pungtungia herzi* x *Pseudopungtungia nigra*. *The 43th proceedings of Zool. Soc. Korea, abst., z. 14*.
- Levan, A., K. Fredga, and A. Sandberg, 1964. Nomenclature for centromeric position on chromosomes. *Hereditas* **52**: 201-220.

- Lee, H. Y., C. H. Yu, S. K. Jeon, and H. S. Lee. 1983. The karyotype analysis on 29 species of freshwater fish in Korea. *Bull. Inst. Basic Sci. Inha Univ.* **4**: 79-93.
- Mori, T., 1935. Descriptions of two new genera and seven new species of cyprinidae from Chosen. *Annot. Zool. Japon.* **15**: 164-166.
- Ojima, Y., 1983. Fish cytogenetics. In: Chromosomes in evolution of eukaryotic groups, (Sharma, A.K. and A. Sharma, eds.). CRC press Inc., Boca Raton, Florida, Vol. 1, pp. 111-145.
- Ojima, Y., M. Hayashi, and K. Ueno, 1972. Cytogenetic studies in lower vertebrates. X. Karyotype and DNA studies in 15 species of Japanese Cyprinidae. *Jap. J. Genet.* **47**: 431-440.
- (Accepted August 29, 1990)

감돌고기屬 Genus *Pseudopungtungia* (魚綱; 잉어科) 魚類의 核型

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감돌고기屬 魚類에는 2種이 알려져 있으며 이들은 모두 韓國固有魚種이다. 감돌고기 *Pseudopungtungia nigra*의 核型分析 結果 diploid chromosome number는 50이었으며, 7雙의 metacentric, 18雙의 submeta/subtelocentric chromosome으로 구성되어져 있었다. 가는돌고기 *P. tenuicorpus*의 2N은 50이었으며 10雙의 metacentric, 15雙의 submeta/subtelocentric chromosome으로 구성되어져 있었다.