

The Karyotype of the Cyprinid Fish *Pseudaspius leptocephalus*

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The cyprinid subfamily Leuciscinae, highly speciose in Europe and North America, is not so diversified in East Asian freshwater fish fauna (Bănărescu, 1972). Various authors (e.g. Wu, 1964) listed many genera for this cyprinid group in this region. From a karyological point of view, however, only species of genera such as *Tribolodon*, *Moroco* and *Phoxinus* (Ojima et al., 1972; Itoh and Niiyama, 1972; Ueno and Ojima, 1984) show characteristics typical of European leuciscine cyprinids, i.e., diploid chromosome number $2n=50$ and some characteristic "marker" elements (reviewed e.g. by Vasiljev, 1985). Other East Asian leuciscine genera, such as *Ctenopharyngodon*, *Mylopharodon*, *Elopichthys* and *Luciobrama*, etc., differ from *Tribolodon*, *Moroco* and *Phoxinus* in both $2n$ values and karyotype morphology (reviewed e.g. by Arai, 1982; Yu et al., 1987). This situation may indicate that the Leuciscinae as a group does not reflect actual evolutionary relationships and that the understanding of karyotype differentiation within the Leuciscinae is incomplete.

Pseudaspius leptocephalus (Pallas), listed in the subfamily Leuciscinae, is endemic throughout the Amur R. basin (Berg, 1948) and, as far as I know, has not yet been karyotyped. The present report deals with the karyotype description of this species.

Material and methods

One female of *Pseudaspius leptocephalus*, 482 mm SL, was collected in the Barch R., tributary of the Onon R., Batshi-reed District, upper Amur R. basin in Northeastern Mongolia. The specimen (No. 7881) is deposited in the collections of the Institute of Systematic and Ecological Biology, Czechoslovak Academy of Sciences, Brno, Czechoslovakia. Chromosome preparations of this *P. leptocephalus* specimen were made in the field according to the procedure described by Ráb and Roth (1988). Classification of chromosomes followed that of Levan et al. (1964).

Results

The diploid chromosome number of the specimen examined was $2n=50$. The karyotype was composed of 7 pairs of metacentric (*m*), 13 pairs of submetacentric (*sm*) to nearly subtelocentric (*st*) and 5 pairs of *st*- to acrocentric (*a*) chromosomes. Therefore the chromosome arm number (NF value) equaled 90. The first *st* chromosome pair is the largest in the complement (Fig. 1).

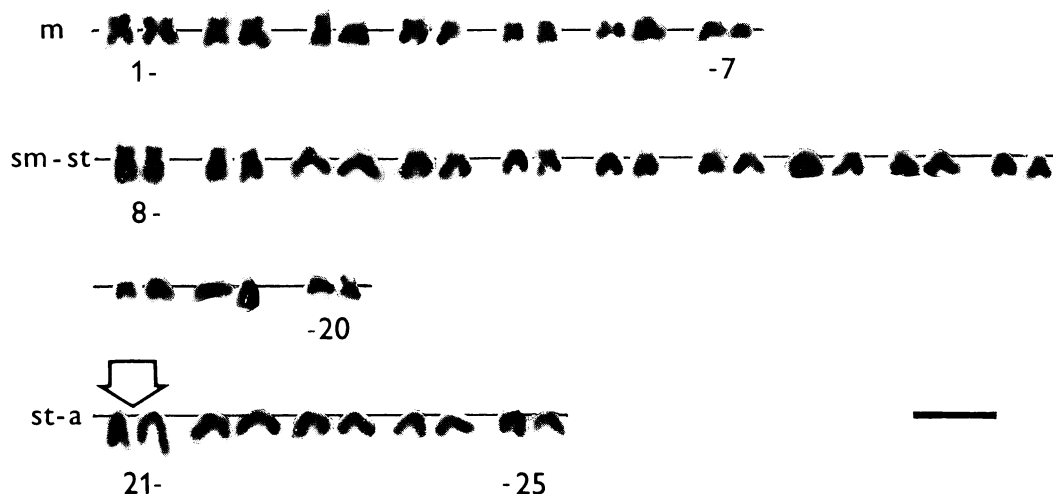


Fig. 1. Karyotype of female *Pseudaspius leptocephalus*. Large *st*-*a* marker pair is denoted by arrow. *m*, metacentric; *sm*, submetacentric; *st*, subtelocentric; *a*, acrocentric chromosomes. Bar indicates 5 μ m.

Table 1. Karyotype characteristics of some "aspinine" cyprinids, following Howes (1984).

Species	2n	Haploid karyotype characteristics	Reference
<i>Elopichthys bambusa</i>	48	5m + 12sm + 6st + 1a	Li et al., 1985
<i>Luciobrama macrocephalus</i>	48	6m + 11sm + 6st + 1a	Li et al., 1985
<i>Aspius aspius</i>	50	7m + 14sm + 4st-a	Ráb et al., 1990
<i>Pseudaspius leptocephalus</i>	50	7m + 13sm + 5st-a	This report

Discussion

Eurasian leuciscine cyprinids of many genera such as *Alburnus*, *Alburnoides*, *Abramis*, *Aspius*, *Blicca*, *Leucaspius*, *Leuciscus*, *Phoxinus*, *Rutilus*, *Scardinius*, *Vimba*, etc., are characterized by both $2n=50$ and very similar karyotypes comprising 6–8 pairs of *m*, 12–16 pairs of *sm*, and 3–5 pairs of *st-a* elements with the largest pair characteristically included in the lattermost category (Vasiljev, 1985; Collares-Pereira, 1985; Arefjev and Karnauchov, 1989; Ráb and Roth, 1989; Suzuki, 1989; Ráb et al., 1990). It is well known that karyotypes of cyprinids are characterized by the presence of small elements with their centromere position ranging gradually from median to nearly terminal. This fact, as well as the effect of chromosome arm contraction during mitosis due to temporal and dose colchicine treatment make difficult the precise assignment of some chromosomes to particular categories. Even so, although chromosome slides prepared under difficult field conditions are of indifferent quality, the karyotype characteristics of *P. leptocephalus* were the same as found in most European leuciscine cyprinids.

Analyzing the skeletal morphology of "aspinine" cyprinids, Howes (1984) assumed that the sister group of the monotypic genus *Pseudaspius* was a group comprised of the genera *Luciobrama* and *Aspiolucius*, with the sister group of these three genera being *Aspius* and *Elopichthys*. Recently, Bănărescu (1990) expressed the same opinion, but Bogutskaya (1990) assumed that "aspinine" cyprinids could be divided into three tribes; the tribe Pseudaspinini in which *Pseudaspius* is most closely related to *Oreoleuciscus* and a little more distantly to *Tribolodon*, the Elopichthyini including *Elopichthys*, and the Aspinini comprising *Aspius* and *Aspiolucius*.

Karyotypes of *Aspiolucius* species are unknown at present. The karyotype characteristics of the Elopichthyini and the Aspinini of Bogutskaya (1990) are given in Table 1. This comparison shows that

karyotypes of *P. leptocephalus* and *A. aspius* on one hand and *L. macrocephalus* and *E. bambusa* on the other are undoubtedly closer to each other than could be assumed from the relationships hypothesized by both Howes (1984) and Bogutskaya (1990). On the other hand, Giemsa-stained karyotypes of four species displayed certain similarities (the similar ratios between numbers of chromosomes in particular categories and the presence of the large *st-a* chromosome pair), though actual interspecies chromosomal homologies could be identified only on the basis of chromosome banding techniques. Banding studies have not been done for these four species. With respect to the Pseudaspinini of Bogutskaya (1990), the karyotypes are known for *Tribolodon ezoe* and *T. hakonensis* ($2n=50$) (Ojima et al., 1972; Itoh and Niiyama, 1972), and *Oreoleuciscus pewzowi* and *O. potanini* ($2n=48$) (Vasiljev, 1980). These karyological differences in *Tribolodon* and *Oreoleuciscus* may be similar to the situation described above.

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Literature cited

- Arai, R. 1982. A chromosome study on two cyprinid fishes, *Acrossocheilus labiatus* and *Pseudorasbora pumila pumila*, with notes on Eurasian cyprinids and their karyotypes.

- Bull. Natn. Sci. Mus. Tokyo, Ser. A, 8(3): 131-152.
- Arefjev, V. A. and G. I. Karnauchov. 1989. Species-specificity of electrophoretic patterns of haemoglobins and uniformity of karyotypes in fishes, genus *Abramis* (Pisces: Cyprinidae). *Biochem. Syst. Ecol.*, 17(6): 479-488.
- Bănărescu, P. 1972. The zoogeographical position of the East Asian fresh-water fish fauna. *Rev. Roum. Biol., ser. Zool.*, 17(5): 315-323.
- Bănărescu, P. 1990. Zoogeography of fresh waters. Vol. 1. Aula-Verlag, Wiesbaden, 540 pp.
- Bogutskaya, N. G. 1990. Morphological bases of the system of the subfamily Leuciscinae (Cyprinidae). 2nd report. *Voprosy Ikhtiologii*, 30(6): 920-933. (In Russian.)
- Berg, L. S. 1949. Freshwater fishes of the USSR and adjacent countries. Part 2. *Acad. Sci. USSR, Moscow, Leningrad*, 926 pp. (In Russian.)
- Collares-Pereira, M. J. 1985. Cytotaxonomic studies in Iberian cyprinids II. Karyology of *Anaocypris hispanica* (Steindachner, 1866), *Chondrostoma lemmingi* (Steindachner, 1866), *Rutilus arcasi* (Steindachner, 1866) and *R. macrolepidotus* (Steindachner, 1866). *Cytologia*, 50: 879-890.
- Howes, G. 1984. Phyletics and biogeography of the aspinine cyprinid fishes. *Bull. Brit. Mus. nat. Hist. (Zool.)*, 47(5): 283-303.
- Itoh, Y. and H. Niiyama. 1972. Comparative chromosome study of two cyprinid fishes, ugui *Tribolodon hakonensis* (Günther) and ezo-ugui, *T. ezoe* Okada et Ikeda. *Bull. Fac. Fish. Hokkaido Univ.*, 23: 73-76.
- Li, Y., K. Li, Y. Hong, J. Gui and D. Zhou. 1985. Studies on the karyotypes of Chinese cyprinid fishes. VII. Karyotypic analyses of seven species in the subfamily *Leuciscinae* with consideration for the phylogenetic relationships of some cyprinid fishes concerned. *Acta Genet. Sinica* (Beijing), 12(5): 367-372. (In Chinese with English abstract.)
- Ojima, Y., M. Hayashi and K. Ueno. 1972. Cytogenetic studies in lower vertebrates. X. Karyotypes and DNA studies in 15 species of Japanese Cyprinidae. *Japan. J. Genet.*, 47(3): 431-440.
- Ráb, P. and P. Roth. 1988. Cold-blooded vertebrates. Pages 115-124 in P. Balicek, J. Forejt and J. Rubes, eds. *Methods of chromosome analysis. Czechoslovak Biol. Soc. Publishers, Brno.*
- Ráb, P. and P. Roth. 1989. Chromosome studies in European leuciscine fishes (Pisces, Cyprinidae). Karyotypes of *Rutilus pigus virgo* and *R. rutilus*. *Folia Zoologica*, 38(3): 239-245.
- Ráb, P., P. Roth and V. A. Arefjev. 1990. Chromosome studies of European leuciscine fishes (Pisces, Cyprinidae). Karyotype of *Aspius aspius*. *Caryologia*, 43(3-4): 249-256.
- Suzuki, A. 1989. Chromosomes of European rudd, *Scardinius erythrophthalmus* (Cypriniformes, Pisces). *Chromosome Information Service*, (46): 21-23.
- Ueno, K. and Y. Ojima. 1984. A chromosome study of 9 species of Korean cyprinid fish. *Japan. J. Ichthyol.*, 31(3): 338-344.
- Vasiljev, V. P. 1980. Chromosome numbers in fish-like vertebrates and fishes. *Voprosy Ikhtiologii*, 20(3): 387-422.
- Vasiljev, V. P. 1985. Evolutionary karyology of fishes. Nauka Publishers, Moscow, 300 pp. (In Russian.)
- Wu, H. W. 1964. Cyprinid fishes of China. Part 1. Shanghai Sci. Tech. Press, Shanghai, 598 pp. (In Chinese.)
- Yu, X., T. Zhou, K. Li, Y. Li and M. Zhou. 1987. On the karyosystematics of cyprinid fishes and a summary of fish chromosome studies in China. *Genetica*, 72: 225-236.

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コイ科魚類 *Pseudaspius leptcephalus* の核型

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モンゴル人民共和国北東部のアムール川水系上流域から採集された *Pseudaspius leptcephalus* 1尾 (♀) の染色体が観察された。

本種の核型は $2n=50$, 中部着糸染色体 7対, 次中部着糸染色体 13対, 次端部・端着糸染色体 5対であり, ヨーロッパ産ロイシスカス類の核型と同じ特徴を示した。

ロイシスカス類の分類は複雑で, 研究者により, その定義が異なるが, 比較核型学の立場から, 本種の核型は, 形態学的に近縁と考えられている *Elopichthys bambusa*, *Luciobrama macrocephalus*, *Aspius aspius* の核型と比較検討された。