

Acheilognathus melanogaster, a Senior Synonym of *A. moriokae*,
with a Revision of the Genera of the Subfamily
Acheilognathinae (Cypriniformes, Cyprinidae)

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Abstract The fishes of the subfamily Acheilognathinae are classified into the three genera, *Tanakia*, *Acheilognathus*, and *Rhodeus*. *Acheilognathus melanogaster* BLEEKER, 1860, the type-species of *Acheilognathus*, is revived, and *A. moriokae* JORDAN et THOMPSON, 1914, is synonymized with it. *Rhodeus oryzae* JORDAN et SEALE, 1906, the type-species of *Tanakia*, is a name given to juveniles of *Tanakia limbata* (TEMMINCK et SCHLEGEL, 1846) (= *Acheilognathus limbatus*).

The type-species of *Acheilognathus* BLEEKER (1860a, p. 228) is *A. melanogaster* BLEEKER, 1860, which was erected with two specimens from Jedo (=Tokyo), Japan (BLEEKER, 1860b; JORDAN, 1919), and *A. melanogaster* has been for a long time synonymized with *A. lanceolatus* (TEMMINCK et SCHLEGEL, 1846) (see JORDAN & FOWLER, 1903; BOESEMANN, 1947; OKADA, 1960; NAKAMURA, 1969).

In the study on a revision of the genera of Japanese bitterlings, it was found that *Acheilognathus melanogaster* is not a junior synonym of *A. lanceolatus*, but a senior synonym of *A. moriokae* JORDAN et THOMPSON, 1914. Additionally, the paratypes of *Rhodeus oryzae* JORDAN et SEALE, 1906, the type-species of *Tanakia* JORDAN et THOMPSON, 1914, were recognized as the juveniles of *Acheilognathus limbatus* (TEMMINCK et SCHLEGEL, 1846).

The present paper deals with details of these findings and grouping nominal species of the world into the three genera, *Tanakia*, *Acheilognathus*, and *Rhodeus*.

Counts and measurements follow HUBBS and LAGLER (1947). Vertebrae were counted from radiographs and standard length was also measured from radiographs.

Acheilognathus melanogaster, a Senior Synonym of *A. moriokae*

Generally, bitterlings are identified into specific level by male nuptial coloration, and it is difficult to identify species of specimens which are preserved in alcohol and

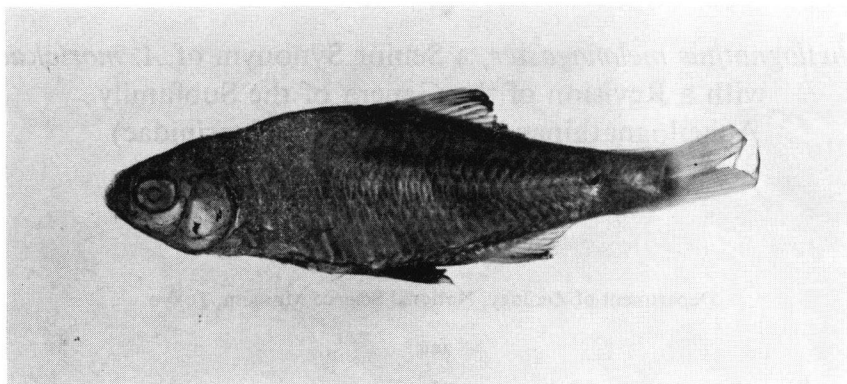


Fig. 1. The lectotype of *Acheilognathus melanogaster* (Cat. No. BMNH 1866.5.2:81), male, 52.5 mm in standard length, from Tokyo.

decolorized. Fortunately, BLEEKER's original description (BLEEKER, 1860b, p. 92) was based on two specimens (66 mm and 72 mm in total length) with developed nuptial color. Table 1 shows comparison of characteristics of the type specimen¹⁾ of *A. melanogaster* (Cat. No. BMNH 1866.5.2:81) (Fig. 1), which is deposited at the Department of Zoology, British Museum (Nat. Hist.), with those of five species including subspecies of Japanese bitterlings probably conspecific with *A. melanogaster*: *A. moriokae* (Japanese name: Tanago), *A. lanceolatus* (Japanese name: Yaritanago), *A. tabira tabira* JORDAN et THOMPSON, 1914 (Japanese name: Shirohire-tabira), *A. tabira* subsp. (a) sensu NAKAMURA (1969) (Japanese name: Akahire-tabira), and *A. tabira* subsp. (b) sensu NAKAMURA (1969) (Japanese name: Seboshi-tabira). Among these species and subspecies, BLEEKER had already separated *A. lanceolatus* from *A. melanogaster* (BLEEKER, 1860b, p. 57).

With respect to 11 characters shown in Table 1, *Acheilognathus melanogaster* shares all features with *A. moriokae*, while five with *A. lanceolatus*, six with *A. tabira tabira*, eight with *A. tabira* subsp. (a), and seven with *A. tabira* subsp. (b). From these data, it is concluded that *Acheilognathus melanogaster* is the same species with *A. moriokae*.

Additionally, it was found that GÜNTHER's description on the type specimen of *A. melanogaster* is not very accurate (GÜNTHER, 1868, p. 278). Therefore, morphological characters of the type specimen are redescribed. Dorsal fin rays, iii, 9; anal fin rays, iii, 8; lateral line scales, 37; scales above lateral line, 6; scales below lateral line, 4; vertebrae, 36. Total length, 63.5 mm; standard length, 52.5 mm; orbit diameter, 3.8 mm (left) and 3.8 mm (right). Barbels much shorter than eye diameter,

1) Dr. M. J. P. VAN OIJEN kindly sought the type specimen of *A. melanogaster* which must have been deposited in Rijksmuseum van Natuurlijke Historie, Leiden, but he was not able to locate it in "A Collection" (Dr. BLEEKER's Collection). We were informed from Dr. VAN OIJEN that the other type specimen is mentioned in GÜNTHER's catalogue (1868: 278). Mr. Alwyne WHEELER of British Museum (Nat. Hist.) loaned us the type specimen.

Table 1. Comparison of features of *Acheilognathus melanogaster* BLEEKER, 1860, with those of five species including subspecies of Japanese bitterlings probably conspecific with *A. melanogaster*.

<i>melanogaster</i> * Lectotype BMNH 1866.5.2:81	<i>moriokae</i>	<i>lanceolatus</i>	<i>tabira</i> <i>tabira</i>	<i>tabira</i> subsp. (a)	<i>tabira</i> subsp. (b)
1. Combination of numbers of branched fin-rays of dorsal and anal fins (D./A.), 9/8 or 10/9 (9/8 in lectotype)	yes (9/8) (in mode)	no (usually) (8/9, 9/10)	yes (10/9) (in mode)	may be (9/9) (in mode)	may be (9/9) (in mode)
2. Number of lateral line scales, 38	yes	yes	yes	yes	yes
3. Barbels much shorter than eye diameter	yes	no	yes	yes	yes
4. Ventral part in front of ventral fin is flat	yes	no	no	no	no
5. Body depth low (SL/BD, 3.3 in lectotype)	yes	no	no	no	may be
6. Body greenish	yes	yes	yes	yes	yes
7. Edge of anal fin is white	yes	no	yes	may be**	yes
8. Both ventral and caudal fins margined with black	yes	may be	no	no	no
9. A spot just behind upper posterior margin of opercle	yes	may be***	yes	yes	yes
10. Distribution in Jedo (=Tokyo)	yes	yes	no	yes	no
11. White band of anal fin is narrow	yes	no	no	may be**	no

* Features 1–11 from the original description (BLEEKER, 1860b).

** Usually red but white for a very short time, i.e., during spawning behavior.

*** Vaguely present.

i.e., ratio of barbel length to orbit diameter is 0.24 (left) and 0.29 (right). The standard length is 3.28 of the body depth, and 4.17 of the head length.

Rhodeus oryzae, a Junior Synonym of *Tanakia limbata*

Rhodeus oryzae was erected with 7 specimens collected at Kawatana, Nagasaki Prefecture, Japan (JORDAN & SEALE, 1906) and designated as the type-species of *Tanakia* (JORDAN & THOMPSON, 1914).

Tanakia is the only one generic name that should be adopted for the first genus in the revision of the genera of the subfamily Acheilognathinae from Japan (ARAI, 1988). However, specimens of *Rhodeus oryzae* have not been collected in Japan since the first record. Therefore, this species was considered to be problematical and the type specimens to be abnormal or mutants (NAKAMURA, 1969, p. 453). Then it became important to examine whether this species is valid or invalid, and the four paratypes of *R. oryzae* (Cat. No. SU 9258) were loaned from California Academy of Sciences.

Rhodeus oryzae is very similar to *Acheilognathus limbatus* in the morphological characters except the lateral line. The incomplete lateral line is an important character peculiar to *R. oryzae*, and this character has been expected to be found in

Table 2. Meristic counts and morphometric measurements of *Tanakia limbata*.

Specimens	Total length (mm)	Stand- ard length (mm)	Head length (mm)	Body depth (mm)	Orbit length (mm)	Barbel length (mm)	No. of pored scales	No. of branched fin-rays D./A.	No. of vertebrae
SU 9258	*	17.3	4.2	5.6	1.6	**	5	8/10	34
	*	17.9	4.2	5.8	1.8	**	*	8/11	35
Paratypes of <i>R. oryzae</i>	*	20.0	5.0	7.1	1.6	0.2	10	8/11	34
	*	22.0	5.1	7.7	1.8	0.3	11	8/11	34
NSMT-P 29821	17.5	13.9	3.9	4.4	1.8	**	1	8/11	35
	18.7	14.5	4.2	4.3	1.9	**	0	8/10	34
	20.9	15.8	4.6	4.9	2.1	**	3	8/10	34
	24.9	19.6	5.4	6.4	2.2	**	6	8/9	34
SK 4717	22.6	17.6	4.8	5.7	1.9	0.2	5	8/10	34
	26.0	20.0	5.2	6.7	2.3	0.3	5	8/10	35
	28.1	21.5	5.7	7.5	2.5	0.4	10	8/11	33
NSMT-P 21695	*	19.6	5.2	6.8	2.3	0.3	3	8/11	34
	25.2	21.3	5.5	7.4	2.4	0.4	4	8/11	33
	29.9	23.7	6.7	8.1	2.5	0.7	9	8/11	33
	30.1	24.6	6.8	7.9	2.6	0.6	11	8/10	34
	30.2	24.2	6.5	8.0	2.5	1.0	9	9/11	34
	30.3	23.9	6.2	8.6	2.7	1.0	14	8/11	35
	30.3	25.2	6.6	8.0	2.6	0.6	10	8/11	36
	31.6	25.6	6.8	8.9	2.6	0.9	11	8/11	34
	31.6	26.2	6.8	8.5	2.7	0.7	18	8/11	35
	32.3	26.6	7.0	9.6	2.7	1.1	16	8/11	34
	33.1	27.0	7.2	9.5	2.5	1.1	16	8/11	34
	33.4	26.1	6.9	9.5	2.7	0.9	19	8/11	35
	34.1	26.8	7.4	9.3	2.6	0.8	14	8/10	35
	34.2	26.5	7.1	9.8	2.8	1.1	10	8/10	34
	36.8	29.6	7.8	10.4	3.1	1.3	17	8/11	34
	*	32.1	8.6	12.0	3.2	1.5	32	9/11	35
	41.3	34.1	9.1	12.8	3.2	1.6	15	8/11	35
	42.0	32.7	8.9	12.9	3.2	1.5	28	8/11	34
	45.2	35.3	9.5	13.6	3.6	1.9	30	8/10	34
	45.5	37.2	9.5	13.6	3.3	1.8	32	8/10	35
	55.9	39.8	11.0	17.1	4.0	2.3	32	8/10	34
	56.4	43.4	11.5	17.9	4.0	2.8	32	8/12	35
	57.1	45.9	11.0	17.5	4.1	2.4	32	8/11	34

* The caudal fin is incomplete or the pored scales are lost.

** Shorter than 0.1 mm.

adults of this species, although all type specimens are small in size (the largest an inch long) (JORDAN & SEALE, 1906).

In this study, it was found that *R. oryzae* is not an independent species by the following facts: (1) all paratypes of *R. oryzae*, that were examined, are considered to be juveniles in size, (2) adult specimens of *R. oryzae* have not been reported in spite

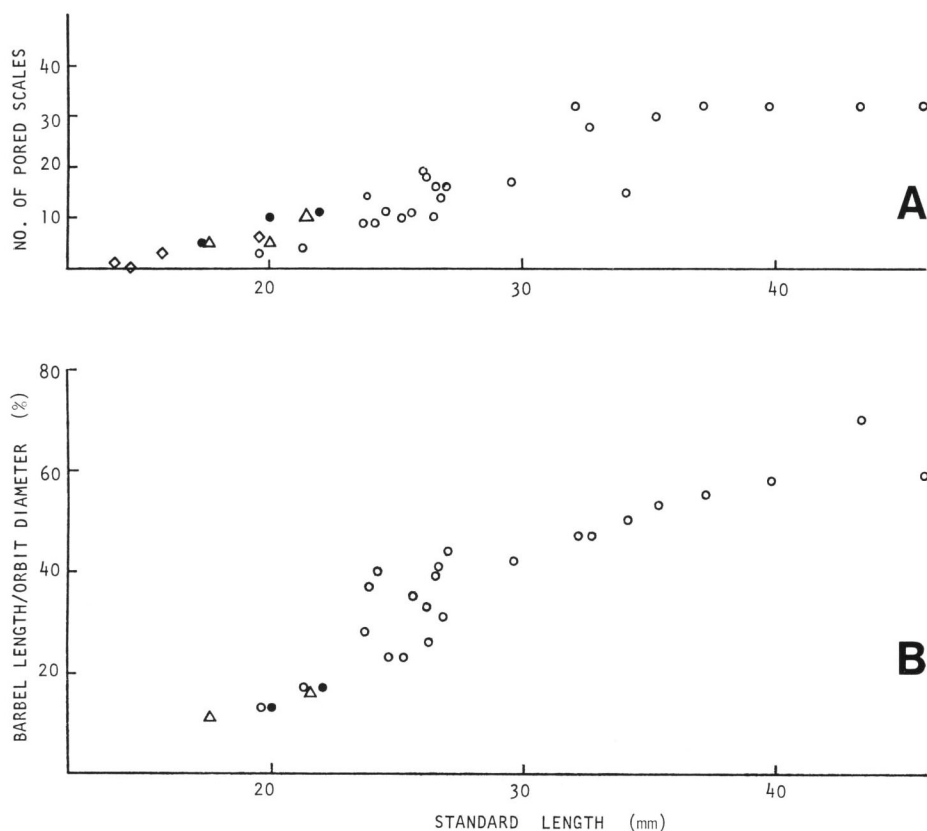


Fig. 2. Ontogenetic change of the lateral line (A) and barbel growth (B) in *Tanakia limbata*. ●, SU 9258, paratypes of *Rhodeus oryzae*, from Kawatana, Nagasaki Pref.; ◇, NSMT-P 29821, fish used for development experiment, 65 days after hatching; △, SK 4717, from Kumamoto Pref.; ○, NSMT-P 21695, from Fukuoka Pref. As for details, see Table 2.

of efforts to collect them, (3) *A. limbatus* is distributed at the type locality of *R. oryzae*, (4) the lateral line of juveniles of *A. limbatus* is incomplete, and (5) *R. oryzae* cannot be distinguished from juveniles of *A. limbatus* (Table 2 and Fig. 2). As the results, *Rhodeus oryzae* JORDAN et SEALE, 1906, is a name given to juveniles of *Tanakia limbata* (TEMMINCK et SCHLEGEL, 1846) (= *Acheilognathus limbatus*).

Revision of the Genera of Acheilognathinae

ARAI (1988) studied phylogenetic systematics of 15 species including subspecies of the subfamily Acheilognathinae from Japan, and classified them into 3 genera. But he did not give the three genera scientific names.

The first genus (Japanese name: Yaritanago-zoku), which is the most primitive

genus in the Acheilognathinae, consists of 3 species: *Acheilognathus lanceolatus* (TEMMINCK et SCHLEGEL, 1846), *A. limbatus* (TEMMINCK et SCHLEGEL, 1846), and *Tanakia tanago* (TANAKA, 1909). With respect to the generic name of the first genus, *Tanakia* should be adopted by following reasons: (1) *Acheilognathus* should be nominally adopted for the second genus which includes *A. melanogaster*, the type-species of *Acheilognathus*, and (2) the 4 paratypes of *Rhodeus oryzae*, which is the type-species of *Tanakia*, are identical with the juveniles of *Acheilognathus limbatus*.

The second genus (Japanese name: Tanago-zoku) is *Acheilognathus*, which is composed of 8 species including subspecies: *A. melanogaster* BLEEKER, 1860 (= *A. moriokae* JORDAN et THOMPSON, 1903), *A. cyanostigma* JORDAN et FOWLER, 1903, *A. tabira tabira* JORDAN et THOMPSON, 1914, *A. tabira* subsp. (a) sensu NAKAMURA (1969), *A. tabira* subsp. (b) sensu NAKAMURA (1969), *A. rhombeus* (TEMMINCK et SCHLEGEL, 1846), *A. longipinnis* REGAN, 1905, and *A. typus* (BLEEKER, 1863).

The third genus (Japanese name: Baratanago-zoku) is *Rhodeus* AGASSIZ, 1835, which consists of 4 species including subspecies: *Rhodeus ocellatus ocellatus* (KNER, 1867), *R. o. smithii* sensu NAKAMURA (1969), *R. atremius atremius* (JORDAN et THOMPSON, 1914), and *R. a. suigensis* (MORI, 1935).

In the following section, diagnoses of the three genera of the subfamily Acheilognathinae will be described. As bitterlings of the world can be grouped into these three genera, it is tried to classify almost all nominal species of the world into three genera, *Tanakia*, *Acheilognathus*, and *Rhodeus*. In grouping them, following literatures were examined; (1) classification and morphology of adults: UCHIDA (1939), NICHOLS (1943), BERG (1964), WU *et al.* (1964), NAKAMURA (1969), and KIM (1982), (2) morphology of larvae and juveniles: OLT (1893), UCHIDA (1939), NAKAMURA (1969), SUZUKI and HIBIYA (1984, 1985a, 1985b), SUZUKI *et al.* (1985, 1986), and SUZUKI and JEON (1987), (3) karyotypes: OJIMA *et al.* (1973), G. Y. LEE *et al.* (1982), G. Y. LEE (1983), H. Y. LEE *et al.* (1983), YU *et al.* (1987), and ARAI *et al.* (1988).

Subfamily Acheilognathinae

With respect to the scientific name of the subfamily, the Acheilognathini (BLEEKER, 1863, p. 213) were erected prior to the Rhodeina (GÜNTHER, 1868, p. 276). Therefore, Acheilognathinae was adopted for the subfamily name.

Genus *Tanakia* JORDAN et THOMPSON, 1914

(New Japanese name: Aburabote-zoku)

Tanakia JORDAN et THOMPSON, 1914: 230 [type-species: *Rhodeus oryzae* JORDAN et SEALE, 1906 (= *Capoeta limbata* TEMMINCK et SCHLEGEL, 1846), by original designation].

Diagnosis. Diagnosis of the genus *Tanakia* is shown in Table 3 and Fig. 3.

Nominal species of *Tanakia*. Nominal species are arranged in alphabetic order of specific names.

- Acheilognathus chii* MIAO, 1934, Contrib. biol. Lab. Sci. Soc. China, (Zool.), **10**(3): 182, fig. 33. Chinkiang, China.
- Achilognathus himantegus* GÜNTHER, 1868, Cat. Fish. Brit. Mus., **7**: 277. Formosa.
- Capoeta intermedia* TEMMINCK et SCHLEGEL, 1846, Fn. japon. Pisces, p. 203. pl. 100, fig. 4. Near Nagasaki, Japan.
- Capoeta lanceolata* TEMMINCK et SCHLEGEL, 1846, Ibid., p. 202, pl. 100, fig. 3. Near Nagasaki, Japan.
- Capoeta limbata* TEMMINCK et SCHLEGEL, 1846, Ibid., p. 203, pl. 100, fig. 5. Near Nagasaki, Japan.
- Rhodeus miobuta* TANAKA, 1909, J. Coll. Sci. imp. Univ. Tokyo, **27**(8): 12. Obama, Chiba Pref., Japan.
- Rhodeus oryzae* JORDAN et SEALE, 1906, Proc. U. S. natn. Mus., **30**: 144, fig. 2. Kawatana, Nagasaki Pref., Japan.
- Acheilognathus shimazui* TANAKA, 1908, Zool. Mag., Tokyo, **20**: 234, 1 fig. Lake Biwa, Japan.
- Acheilognathus signifer* BERG, 1907, Ann. Mag. nat. Hist., (7), **19**: 159. Pungtung, Korea.
- Rhodeus tanago* TANAKA, 1909, J. Coll. Sci. imp. Univ. Tokyo, **27**(8): 10. Tokyo.

Remarks. The Japanese name of *Tanakia* is changed from “Yaritanago-zoku” (ARAI, 1988) to “Aburabote-zoku”. “Aburabote” means the Japanese name of *Tanakia limbata*, and “Yaritanago” the Japanese name of *T. lanceolata*. When ARAI (1988) adopted “Yaritanago-zoku” for the first genus, synonymy of the type-species of the genus had not been clarified.

Genus *Acheilognathus* BLEEKER, 1860

(Japanese name: Tanago-zoku)

- Acheilognathus* BLEEKER, 1860a: 228 [type-species: *Acheilognathus melanogaster* BLEEKER, 1860b, by original designation].
- Paracheilognathus* BLEEKER, 1863: 213 [type-species: *Capoeta rhombea* TEMMINCK et SCHLEGEL, 1846, by original designation].
- Pseudoperilampus* BLEEKER, 1863: 214 [type-species: *Pseudoperilampus typus* BLEEKER, 1863, by original designation].
- Acanthorhodeus* BLEEKER, 1870: 253 [nom. nud.]; 1871: 39,40 [type-species: *Acanthorhodeus macropterus* BLEEKER, 1871, by original designation].
- Rhodeops* FOWLER, 1910: 479 [type-species: *Acheilognathus brevianalis* FOWLER, 1910 (= *Acheilognathus cyanostigma* JORDAN et FOWLER, 1903), by original designation].

Type-species: *Acheilognathus melanogaster* BLEEKER, 1860b, p. 92, pl. 2, fig. 1 (Type locality, Jedo=Tokyo).

Lectotype of *Acheilognathus melanogaster*. BMNH 1866.5.2:81, male, 52.5 mm in standard length, Tokyo. The lectotype is designated by the following reasons: (1) this specimen is one of the two syntypes of *A. melanogaster*, (2) according to BLEEKER's original description, fin-ray counts of the larger syntype is D. iii, 10 and A. iii, 9. Such combination of numbers of branched fin-rays of the dorsal and anal fins suggests the possibility that the larger syntype is different species from the smaller syntype, and (3) the larger syntype which must be deposited at Rijksmuseum van Natuurlike Historie has not been able to be found (VAN OIJEN, pers. comm.).

Diagnosis. Characteristics of the genus *Acheilognathus* are shown in Table 3 and Fig. 3.

Table 3. Diagnoses of the three genera of the subfamily Acheilognathinae.

Characters	<i>Tanakia</i>	<i>Acheilognathus</i>	<i>Rhodeus</i>
Morphology of adults			
1. No. of branched fin-rays of dorsal fin (br. D.)	8 to 9	8 to 18	8 to 12
2. No. of branched fin-rays of anal fin (br. A.)	8 to 13	7 to 14	8 to 12 except <i>R. spinalis</i>
3. br. D. minus br. A.	—4 to 0	—1 to 5	—1 to 1 except <i>R. spinalis</i>
4. Serration of pharyngeal teeth	vestigial	developed	less developed
5. Lateral line	complete or incomplete	complete or incomplete	incomplete
6. Barbels	present	present or absent	absent
7. A transverse row of black spots on fin-membrane of dorsal fin (Fig. 3 A)	one row	absent	absent*
8. White spots on fin-rays of dorsal fin form transverse bands (Fig. 3 B & C)	no	yes, two bands in both males and females	yes, two bands in males, absent or vaguely present in females
9. Nuptial color of anal fin of males	edge with black and inner part with red	edge or inside of edge with white	edge with black and inner part with red
10. Color pattern similar to male nuptial color appears on dorsal and anal fins of females	yes	no	no or little
Morphology of juveniles			
11. A black spot on dorsal fin	absent	less developed or developed on more posterior part than that in <i>Rhodeus</i>	developed on anteriormost part of dorsal fin
Morphology of larvae			
12. Wing-like yolk sac projection	less developed	not developed	well developed
13. Minute tubercles on skin surface	developed (circular cone-like shaped)	well developed (ellipsoid in diagonal cross section)	less developed (hemispheric shaped)
Karyotypes			
14. Diploid chromosome number	48	44 or 42 (42 in <i>A. gracilis</i>)	48 or 46
15. Large metacentric chromosomes	1 pair	3 or 4 pairs (4 pairs in <i>A. gracilis</i>)	1 pair in 2n=48 absent in 2n=46

* The fin-membrane of the dorsal fin in *R. sericeus* is black, but the color pattern in *R. sericeus* is different from that in the species of *Tanakia*.

Nominal species of *Acheilognathus*. Nominal species are arranged in alphabetic order of specific names.

Acheilognathus argenteus WU, 1939, Sinensia, Nanking, 10: 118. Yangso, Kwangsi, China.

Devario asmuksi DYBOWSKI, 1872, Verh. zool.-bot. Ges. Wien, 22: 212. Lake Khanka.

Acanthorhodeus asmuksi amurensis HOLČÍK, 1962, Jpn. J. Ichthyol., 9: 160, fig. 3. Lake Kabar, Amur River.

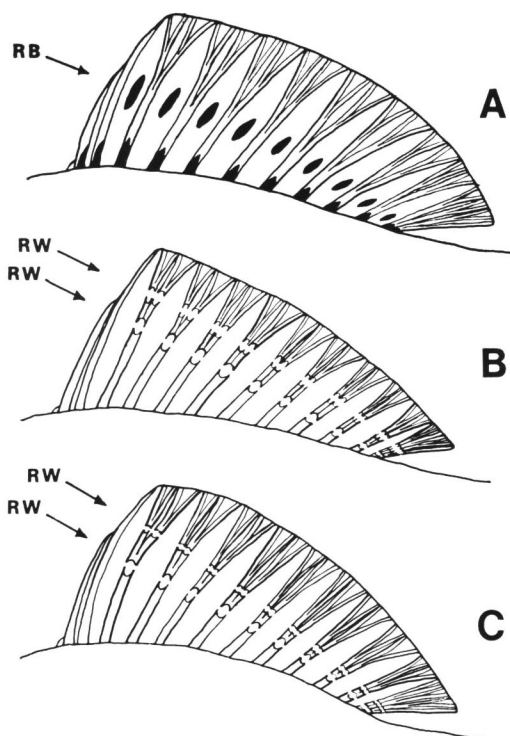


Fig. 3. Color patterns of the dorsal fin in *Tanakia*, *Acheilognathus*, and *Rhodeus*. A: A transverse row of black spots on the fin-membrane in *Tanakia*. B: Two transverse rows of white spots on fin-rays in *Acheilognathus*. The upper row is similar wide to the lower. C: Two transverse rows of white spots on fin-rays in *Rhodeus*. The upper row is narrower than the lower. RB, A transverse row of black spots; RW, a transverse row of white spots.

Acanthorhodeus asmussi sungariensis BERG, 1931, Ann. Mus. Zool. Acad. Leningrad, **32**: 218, fig. 6. Sungari, Harbin, China.

Acanthorhodeus atranalis GÜNTHER, 1873, Ann. Mag. nat. Hist., (4), **12**: 248. Shanghai, China.

Achilognathus barbatulus GÜNTHER, 1873, Ibid., (4), **12**: 248. Shanghai, China.

Acheilognathus barbatus NICHOLS, 1926, Amer. Mus. Novit., **214**: 6, fig. 6. Anhwei, China.

Acanthorhodeus bergi MORI, 1928, J. Chosen nat. Hist. Soc., Korea, **6**: 63. Manpochin, Korea.

Paracheilognathus bleekeri BERG, 1907, Ann. Mag. nat. Hist., (7), **19**: 162. Yangtze, Tientsin, China.

Acheilognathus brevianalis FOWLER, 1910, Proc. Acad. nat. Sci. Phila., **62**: 479, fig. 2. Lake Biwa, Japan.

Devario chankaensis DYBOWSKY, 1872, Verh. zool.-bot. Ges. Wien, **22**: 212. Lake Khanka.

Achilognathus coreanus STEINDACHNER, 1892, Anz. Akad. Wiss. Wien, **1892**: 133. Seoul, Korea.

Acheilognathus cyanostigma JORDAN et FOWLER, 1903, Proc. U. S. natn. Mus., **26**: 820, fig. 2. Lake Biwa and Lake Yogo, Japan.

Acanthorhodeus deignani SMITH, 1945, Bull. U. S. natn. Mus., **188**: 219, fig. 39. Huey Nam Puat, Mekon, Laos.

Acanthorhodeus dicaeus RUTTER, 1897, Proc. Acad. nat. Sci. Phila., **1897**: 58. Swatow, China.

Acanthorhodeus elongatus REGAN, 1908, Ann. Mag. nat. Hist., (8), **2**: 356. Yunnan, China.

- Acheilognathus elongatus breviaudatus* CHEN et LI, 1987, Zool. Res., Kunming, **8**: 62, fig. 2B. Yangzonghai Lake, Yunnan, China.
- Acanthorhodeus fowleri* HOLČÍK et NALBANT, 1964, Annot. zool. bot., Bratislava, **1964**(2): 3, fig. 1. Yangtze River, Wuhan, China.
- Acanthorhodeus gracilis* REGAN, 1908, Proc. zool. Soc. London, **1908**: 60, pl. 2, fig. 1. Chongju, Korea.
- Acheilognathus gracilis* NICHOLS, 1926, Amer. Mus. Novit., **214**: 5, fig. 5. Tungting Lake, China.
- Acheilognathus gracilis luchowensis* WU, 1930, Sinensia, Nanking, **1**: 79, fig. 6. Luchow, China.
- Acanthorhodeus grahami* NICHOLS, 1918, Proc. biol. Soc. Wash., **31**: 18. Yunnan, China.
- Acanthorhodeus guichenoti* BLEEKER, 1871, Verh. Akad. Wet., Ams., Afd. Natuurk., **12**: 41, pl. 13, fig. 2. Yangtze, China.
- Acanthorhodeus hypselonotus* BLEEKER, 1871, Ibid., **12**: 43, pl. 11, fig. 2. Yangtze, China.
- Achilognathus imberbis* GÜNTHER, 1868, Cat. Fish. Brit. Mus., **7**: 278. China.
- Acanthorhodeus jeholicus* MORI, 1934, Rept. First sci. Exped. Manchoukuo, sec. 5, pt. 1: 33, pl. 1. Jehol, China.
- Acanthorhodeus kristinae* HOLČÍK, 1971, Věst. čsl. Spol. zool., **35**(4): 270, fig. 1. Szechuan Province, China.
- Acanthorhodeus lanchiensis* HERRE et LIN, 1936, Bull. Chekiang Prov. Fish. Exp. Sta., Tinghai, **2**(7): 17, fig. 5. Lanchie, China.
- Achilognathus longipinnis* REGAN, 1905, Ann. Mag. nat. Hist., (7), **16**: 364. Lake Biwa, Japan.
- Acanthorhodeus longispinnis* OSHIMA, 1926, Annot. zool. japon., **11**: 14. Kachek River, Hainan, China.
- Acheilognathus macrodorsalis* HSIA, 1949, Contrib. Inst. Zool. natn. Acad. Peiping, **5**(5): 200, 1 fig. Paiyang Tien, Hopeh, China.
- Acanthorhodeus macropterus* BLEEKER, 1871, Verh. Akad. Wet., Ams., Afd. Natuurk., **12**: 39, 40, pl. 2, fig. 2. Yangtze? China.
- Acheilognathus melanogaster* BLEEKER, 1860, Act. Soc. sci. Indo-Neerl., **8**: 92, pl. 2, fig. 1. Tokyo, Japan.
- Paracheilognathus meridianus* WU, 1939, Sinensia, Nanking, **10**: 117. Yangso, Kwangsi, China.
- Acheilognathus moriokae* JORDAN et THOMPSON, 1914, Mem. Carnegie Mus., **6**(4): 225, pl. 25, fig. 2. Morioka, Kitakami River, Japan.
- Acanthorhodeus ngowyangi* TCHANG, 1930, Cyprin. Bassin Yangtze, p. 115. Yangtze, China.
- Acanthorhodeus omeiensis* SHIH et TCHANG, 1934, Contrib. Biol. Dept. Sci. Inst. West China, Chungking, Szechwan, **2**: 8, fig. 1. Omei, Szechwan, China.
- Paracheilognathus peihoensis* FOWLER, 1910, Proc. Acad. nat. Sci. Phila., **62**: 481, fig. 3. Tientsin, China.
- Acanthorhodeus polylepis* WOO, 1964, Cyprinid Fishes of China, p. 257, fig. 5-22. Hunan and Chekiang, China.
- Acanthorhodeus polyspinus* HOLČÍK, 1972, Věst. čsl. Spol., zool., **36**(3): 183, fig. 5. Red River, Hanoi.
- Paracheilognathus pseudorhombeus* MORI, 1935, Zool. Mag., Tokyo, **47**: 565, fig. 3. River Rakuto, Korea.
- Capoeta rhombea* TEMMINCK et SCHLEGEL, 1846, Fn. japon., Pisces, p. 204, pl. 100, fig. 6. Near Nagasaki, Japan.
- Acanthorhodeus robustus* HOLČÍK, 1972, Věst. čsl. Spol. zool., **36**(3): 181, fig. 1. Yi-Hing, Yangtze River, China.
- Acheilognathus shibatae* MORI, 1928, Jpn. J. Zool., **2**: 67. Tsi-nan, China.
- Achilognathus steenackeri* SAUVAGE, 1883, Bull. Soc. Philom. Paris, (7), **7**: 146. Lake Biwa, Japan.
- Acheilognathus tabira* JORDAN et THOMPSON, 1914, Mem. Carnegie Mus., **6**(4): 220, pl. 25, fig. 1. Lake Biwa, Japan.
- Acanthorhodeus taenianalis* GÜNTHER, 1873, Ann. Mag. nat. Hist., (4), **12**: 247. Shanghai, China.
- Acanthorhodeus tokunagai* MORI, 1934, Rept. First sci. Exped. Manchoukuo, sec. 5, pt. 1: 35, pl. 13,

fig. 2. Jehol, China.

Acanthorhodeus tonkinensis VAILLANT, 1892, Bull. Soc. Philom. Paris, (8), 4: 127. Upper Tongking.
Pseudoperilampus typus BLEEKER, 1863, Ned. Tijdschr. Dierk., 1: 214. Tokyo, Japan.
Acanthorhodeus wangi TCHANG, 1930, Cyprin. Bassin Yangtze, p. 115, pl. 3, fig. 2. Yangtze, China.
Acheilognathus yamatsutae MORI, 1928, J. Chosen nat. Hist. Soc., Korea, 6: 62. Fen-huang-cheng, southern Manchuria.

Remarks. The generic names, *Acheilognathus* (BLEEKER, 1860) and *Achilognathus* (GÜNTHER, 1868) are homonyms.

Genus *Rhodeus* AGASSIZ, 1835

(Japanese name: Baratanago-zoku)

Rhodeus AGASSIZ, 1835: 37 [type-species: *Cyprinus amarus* BLOCH, 1782, by original designation].

Diagnosis. Diagnosis of the genus *Rhodeus* is shown in Table 3 and Fig. 3.

Nominal species of *Rhodeus*. Nominal species are arranged in alphabetic order of specific names.

- Cyprinus amarus* BLOCH, 1782, Oekon. Naturg. Fisch. Dtschls., 1, p. 52, pl. 8, fig. 3. Elbe basin.
Acanthorhodeus atremius JORDAN et THOMPSON, 1914, Mem. Carnegie Mus., 6(4): 227, pl. 25, fig. 3. Chikugo River, Kurume, Japan.
Pararhodeus fangi MIAO, 1934, Contrib. biol. Lab. Sci. Soc. China, (Zool.), 10(3): 180, fig. 31. Chinkiang, China.
Pseudoperilampus hainanensis NICHOLS et POPE, 1927, Bull. Amer. Mus. nat. Hist., 54: 379, fig. 42. Hainan, China.
Rhodeus hwanghoensis MORI, 1928, Jpn. J. Zool., 2: 68. Tsinan, China.
Rhodeus kurumeus JORDAN et THOMPSON, 1914, Mem. Carnegie Mus., 6(4): 229, pl. 26, fig. 2. Chikugo River, Kurume, Japan.
Pseudoperilampus lighti WU, 1931, Contrib. biol. Lab. Sci. Soc. China, (Zool.), 7: 25, fig. 4. Foochow, China.
Rhodeus maculatus FOWLER, 1910, Proc. Acad. nat. Sci. Phila., 62: 476, fig. 1. Tientsin, China.
Rhodeus mantschuricus MORI, 1934, J. Chosen nat. Hist. Soc., Korea, 17: 57, 1 fig. Koga, Manchuria, China.
Rhodeus notatus NICHOLS, 1929, Amer. Mus. Novit., 377: 6, fig. 4. Tsinan, Shantung, China.
Pseudoperilampus? ocellatus KNER, 1867, Reise "Novara", Zool., 1, Fische, p. 365, pl. 15, fig. 6. Shanghai, China.
Rhodeus pingi MIAO, 1934, Contrib. biol. Lab. Sci. Soc. China, (Zool.), 10(3): 176, fig. 30. Chinkiang, China.
Acanthorhodeus sciosemus JORDAN et THOMPSON, 1914, Mem. Carnegie Mus., 6(4): 228, pl. 26, fig. 1. Chikugo, Japan.
Cyprinus sericeus PALLAS, 1776, Reise, III, p. 704. Onon, USSR.
Rhodeus sinensis GÜNTHER, 1868, Cat. Fish. Brit. Mus., 7: 280. China.
Achilognathus smithii REGAN, 1908, Ann. Mag. nat. Hist., (8), 1: 150. Nodogawa River, Kyoto, Japan.
Rhodeus spinalis OSHIMA, 1926, Annot. zool. japon., 11: 16. Kachek River, Hainan, China.
Pseudoperilampus suigensis MORI, 1935, Zool. Mag., Tokyo, 47: 563, fig. 2. Suigen, central Korea.
Pseudoperilampus uyekii MORI, 1935, Ibid., 47: 562, fig. 1. River Kan, Keijo, Korea.
Rhodeus wangkinfui WU, 1930, Sinensia, Nanking, 1: 77, fig. 5. Luchow, China.

Remarks. The genus *Pararhodeus* was erected by BERG (1907) as one of genera of the Rhodeinae. However, *Rhodeus syriacus* LORTET, 1883, the type-species of *Pararhodeus*, is not a bitterling, but is classified to *Pseudophoxinus* (see PELLEGRIN, 1911, 1933; GOREN, 1972).

List of Materials Examined

Abbreviations of institutes are as follows: BMNH, British Museum (Nat. Hist.); FAKU, Department of Fisheries, Faculty of Agriculture, Kyoto University; NSMT, National Science Museum, Tokyo; SK, Shigenken Collection, National Science Museum, Tokyo; SU, Natural History Museum, Stanford University; YCM, Yokosuka City Museum; ZUMT, Department of Zoology, University Museum, University of Tokyo.

Tanakia himantegus: ZUMT 39432–39440, 9 individuals, Taiwan; ZUMT 56265, 7, Taiwan.

Tanakia lanceolata: NSMT-P 14108, 8, Kasumiga-ura, Ibaraki Pref., Japan; YCM-P 12705 and 12701, 2, Korea.

Tanakia limbata: SU 9258 (paratypes of *Rhodeus oryzae*), 4, Kawatana, Nagasaki Pref.; NSMT-P 29829, 1, Kawatana, Nagasaki Pref.; NSMT-P 11008 and 11001, 40, Iki Island, Nagasaki Pref.; NSMT-P 14595, 2, Yoshii River, Okayama Pref.; NSMT-P 27712, 1, Yanagawa, Fukuoka Pref.; SK 2875, 1, Lake Biwa; SK 4717, 3, Arisa, Kumamoto Pref.; SK 488, 33, Hikone City, Lake Biwa; SK 4833, 10, Muromigawa River, Fukuoka Pref.; NSMT-P 21695, 40, Fukuoka Pref.; NSMT-P 29821, 4, specimens used for development experiment, Okayama Pref., Japan; NSMT-P 20935, 1, Korea.

Tanakia signifer: YCM-P 12593, 2, Korea.

Tanakia tanago: NSMT-P 27392, 10, Yokohama City; NSMT-P 21205, 2, Ôtawara City, Tochigi Pref., Japan.

Acheilognathus argenteus: FAKU 56795–56797, 3, south China.

Acheilognathus asmussi: YCM-P 12590, 1, Korea; ZUMT 56287, 9, Taedong River, Korea.

Acheilognathus chankaensis: NSMT-P 3304, 11, Shanghai, China; ZUMT 42450–42453, 42516 and 42517, 6, Manchuria; ZUMT 44991, 44993 and 44994, 3, Korea; ZUMT 45156 and 45157, 2, Suigen, Korea; FAKU 56798–56801, 4, Sinyang, Honan, China.

Acheilognathus cyanostigma: NSMT-P 1951, 1, Zeze, Lake Biwa; NSMT-P 21255, 1, Echigawa River, Shiga Pref.; NSMT-P 27992, 28, Lake Biwa, Japan.

Acheilognathus jeholicus: NSMT-P 3329, syntypes, 13, Chengteh, Hopeh, China.

Acheilognathus longipinnis: NSMT-P 1357, 1, Nagaragawa River, Gifu Pref.; NSMT-P 2593, 1, Hikone, Lake Biwa; NSMT-P 12499, 6, Ibigawa River, Gifu Pref.; NSMT-P 27897, 48, Yodogawa River, Osaka, Japan.

Acheilognathus macropterus: NSMT-P 12511, 1, Shanghai, China; ZUMT 19096, 33318 and 38422, 3, China.

Acheilognathus melanogaster: BMNH 1866.5.2: 81, lectotype, Tokyo; NSMT-P 188, 3, Tokyo; NSMT-P 11651, 19, Iwaizumi, Iwate Pref.; NSMT-P 14822, 1, Hirosegawa River, Miyagi Pref.; SK 4047, 5, Yoda-ura, Ibaraki Pref., Japan.

Acheilognathus peihoensis: ZUMT 38441, 1, China.

Acheilognathus rhombeus: NSMT-P 1766, 3, Kyoto; NSMT-P 1593, 8, Takahata, Saga Pref.; NSMT-P 2583, 1, Lake Biwa, Japan; ZUMT 2841 and 22701, 2, Han River, Korea; ZUMT 45033, 1, Korea.

Acheilognathus tabira tabira: NSMT-P 192, 4, Lake Biwa; NSMT-P 1994, 3, Lake Biwa; NSMT-P 2580, 1, Lake Biwa, Japan.

- Acheilognathus tabira* subsp. (a): NSMT-P 27043, 3, Natori City, Miyagi Pref.; NSMT-P 27553, 2, Yasuda-machi, Niigata Pref., Japan.
- Acheilognathus tabira* subsp. (b): NSMT-P 21702, 12, Chikugogawa River, Japan.
- Acheilognathus tokunagai*: NSMT-P 3193, syntypes, 2, Chengteh, Hopeh, China.
- Acheilognathus typus*: NSMT-P 175, 3, Tokyo; NSMT-P 3250, 1, Lake Suwa; NSMT-P 27390, 1, Natorigawa River, Miyagi Pref., Japan.
- Acheilognathus yamatsutae*: NSMT-P 20941, 7, Korea.
- Rhodeus atremius atremius*: NSMT-P 11003, 11, Iki Island, Nagasaki Pref.; SK 1452, 2, Fukuoka Pref., Japan.
- Rhodeus atremius suigensis*: NSMT-P 27927, 4, Yoshiigawa River, Okayama Pref., Japan; NSMT-P 20934, 13, Korea.
- Rhodeus lighti*: ZUMT 38434, 3, China.
- Rhodeus ocellatus ocellatus*: NSMT-P 19425, 54, Masudagawa River, Miyagi Pref.; NSMT-P 16506, 2, Natorigawa River, Miyagi Pref.; NSMT-P 27571, 3, Hinogawa River, Fukui Pref.; NSMT-P 22395, 3, Kanbegawa River, Shimane Pref.; SK 4898, 7, Tonegawa River, Japan; NSMT-P 27714, 1, Taiwan; ZUMT 13564, 2, Taiwan.
- Rhodeus ocellatus smithii* sensu NAKAMURA (1969): NSMT-P 1600, 2, Saga Pref.; NSMT-P 2104, 40, Okayama Pref.; NSMT-P 27991, 5, Nara Pref., Japan.
- Rhodeus sericeus amarus*: NSMT-P 13754, 59, Timis River, Albina-Uliuc, Rumania; ZUMT 24188, 1, Neckar, south Germany.
- Rhodeus sericeus sericeus*: NSMT-P 27414, 2, Amur River, USSR; ZUMT 42533, 1, Manchuria, China; ZUMT 42576, 1, Manchuria, China; ZUMT 44969, 6, northern Korea.
- Rhodeus sinensis*: ZUMT 38442–38446, 5, China; ZUMT 45371 and 45372, 2, Paoting, China.
- Rhodeus uyeikii*: NSMT-P 20933, 5, Korea.

Acknowledgments

We would like to greatly appreciate Mr. Alwyne WHEELER, British Museum (Natural History), for loan of the type of *Acheilognathus melanogaster*, Dr. M. Eric ANDERSON, California Academy of Sciences, for loan of the paratypes of *Rhodeus oryzae*, and Dr. Yoshiaki TOMINAGA, University of Tokyo, Dr. Kazumi HOSOYA, Kyoto University, and Mr. Masayoshi HAYASHI, Yokosuka City Museum, for loan of many specimens from Korea and China. Dr. Nobuhiro SUZUKI, Hayama Fisheries Research Laboratory, Kajima Corp., kindly gave us many juvenile specimens which were used for development experiments, and Mr. Seiro KIMURA, Kyushu University, donated us a specimen of *Tanakia limbata* from the type locality of *Rhodeus oryzae*. Our thanks are due to Prof. CHU Xin-Luo, Kunming Institute of Zoology, and Prof. LI Si-Zhong, Institute of Zoology, Beijing, for the valuable literatures which are difficult to see in Japan. We are also grateful to Dr. M. J. P. VAN OIJEN, Dr. Morizumi NAKAMURA, Dr. Kazumi HOSOYA, Dr. Nobuhiro SUZUKI, Mr. Masahiro AIZAWA, and Mr. Toshihiro ISHINABE for valuable advice to this study.

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