

# A New Distributional Record of an Acheilognathine fish, *Rhodeus sericeus* (Pallas) (Cyprinidae, Pisces) in South Korea

Byung-Soo Chae and Hong-Jun Yang

Department of Biology, Teacher's College, Kyungpook National University, Taegu 702-701, Korea

Eighty one specimens of *Rhodeus sericeus* (Pallas, 1776) were collected at the upper stream of the Som River (37° 32' 38" N, 127° 58' 57" E; Maegok-ri, Konggun-myon, Hoengsong-gun, Kangwon-do, Korea) which is a tributary of the Namhan River. This is the first report of the species in the southern part of the Korean Peninsula. This species is well discriminated from the other species in the genus *Rhodeus* by the following respects. The number of scales of transverse series is more than 34 (range 34-37, mean  $35.7 \pm 0.7$ ). Head is shorter and snout is longer than those of the other species. The upper part of the eye is always black and the lateral body surfaces are reddish purple. It had been known that the southern limit of the distribution of *Rhodeus sericeus* was the Yonghung River in Hamgyongnam-do, north-eastern part of the Korean Peninsula. But their distributional range is extended more southerly to the Han River system which runs westward through the central part of the Korean Peninsula.

**KEY WORDS:** *Rhodeus sericeus*, Distribution, Som River, South Korea

*Rhodeus sericeus* (Pallas) is a small cyprinid fish and distributes most northerly and widely among the acheilognathine fishes. Its distribution ranges from Far-East Asia to Europe (Berg, 1949). It was known that southern limit of the distribution of this species is the Yonghung River in Hamgyongnam-do, north-eastern part of the Korean Peninsula (Uchida, 1939; Nagata, 1976; Chyung, 1977). In the course of a survey on the Korean cyprinid fishes, we collected some specimens of *Rhodeus sericeus* at the Kumgye Stream, an upper stream of the Som River which is a first tributary of the Namhan River. We describe in this report the morphological characteristics of present specimens and compare with previous descriptions and the other species of the genus *Rhodeus*.

Followings are three species used for the morphological comparison. *Rhodeus ocellatus*

(Kner, 1867): 23 specimens, 37.8-50.1 mm SL, Wichon River, Ssanggye-ri, Pian-myon, Uisong-gun, Kyongsangbuk-do, June 16, 1991; 21 specimens, 37.6-50.3 mm SL, Hyongsan River, Kuktang-ri, Kangdong-myon, Kyongju-gun, Kyongsangbuk-do, July 26, 1991. *Rhodeus uyekii* (Mori, 1935): 15 specimens, 34.6-53.5 mm SL, Mangyong River, Upnae-ri, Kosan-myon, Wanju-gun, Chollabuk-do, October 13, 1990; 12 specimens, 39.0-44.7 mm SL, Kum River, Aho-ri, Nonsan-up, Nonsan-gun, Chungchongnam-do, October 12, 1990. *Rhodeus notatus* (Nichols, 1929): 15 specimens, 33.3-39.6 mm SL, Mangyong River, Upnae-ri, Kosan-myon, Wanju-gun, Chollabuk-do, October 13, 1990; 14 specimens, 32.5-39.3 mm SL, Kum River, Aho-ri, Nonsan-up, Nonsan-gun, Chungchongnam-do, October 12, 1990.

The specimens of *Rhodeus sericeus* and the

above three species were deposited at the Department of Biology Education, Teacher's College, Kyungpook National University.

***Rhodeus sericeus* (Pallas, 1776)**

**(Fig. 1)**

*Cyprinus sericeus* Pallas, 1776 (p.708) [cited from Berg, 1949 (p.816)].

*Rhodeus amarus* var. *sericeus* Dybowski, 1877 (p.12) [cited from Berg, 1949 (p.816)].

*Rhodeus sericeus* Berg, 1907 (p.160) [cited from Kim, 1982 (p.4)]; Mori, 1935 (p.559); Uchida, 1939 (p.90); Chyung, 1977 (p.200).

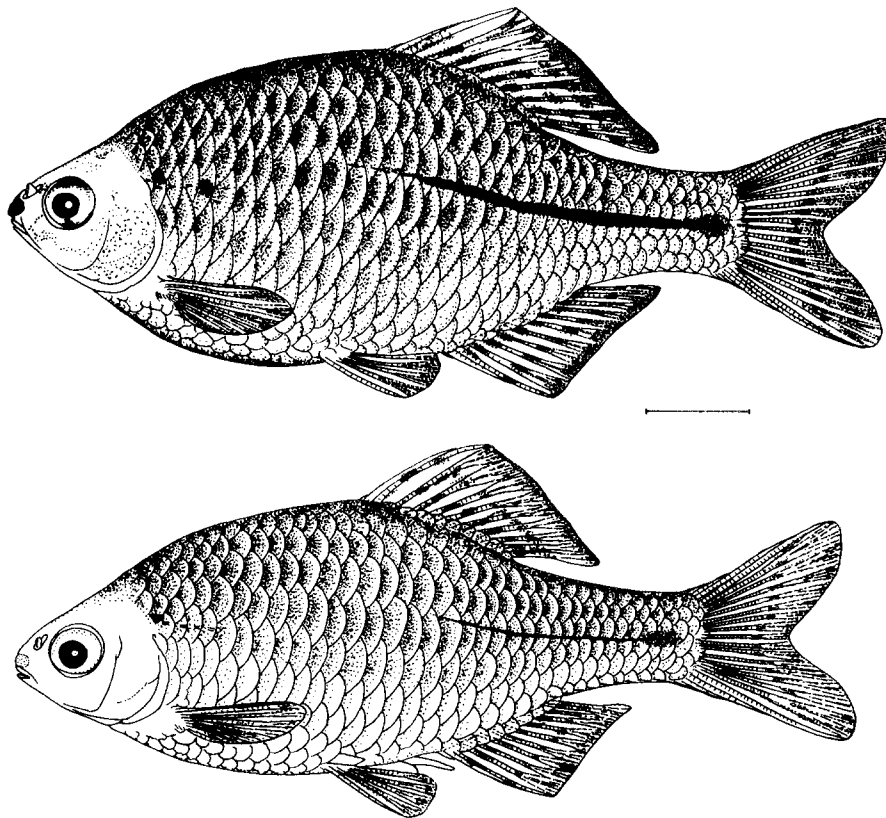
*Rhodeus mantchuricus* Mori, 1934 (p. 57).

**Material examined:** 39 specimens, 27.5-66.3 mm SL, October 29, 1990; 27 specimens, 31.5-71.4 mm SL, August 2, 1991; 15 specimens, 36.

2-56.6 mm SL, November 16, 1991. All the above specimens were collected at Maegok-ri, Konggun-myon, Hoengsong-gun, Kangwon-do, Korea.

**Description:** Counts and proportional measurements for the present specimens are shown in Table 1. Dorsal fin rays III-9-10, anal fin rays III-9-11, inner gill rakers 7-13, outer gill rakers 24-28, scales of transverse series 34-37, lateral line scales 4-6, vertebrae 30-31. Head length 22.9%, snout length 6.6%, eye diameter 7.5%, pre-dorsal length 50.7%, head depth 21.9%, depth of caudal peduncle 12.9% and inter-orbital width 9.9% of standard body length.

Body compressed, deep, long ovoid profile and covered with large scales (34 to 37 transverse series); lateral line incomplete but 4 to 6 anterior



**Fig. 1.** *Rhodeus sericeus* (Pallas). Upper: male, 68.8 mm SL, 84.4 mm TL; bottom: female, 64.9 mm SL, 80.5 mm TL. Scale bar represents 10 mm.

**Table 1.** Counts and proportional measurements of *Rhodeus sericeus* from Kungye stream, Namhan River, South Korea

Characters	Range	Mean $\pm$ SD
Number of individuals	20	
Counts		
Dorsal fin rays	9~10	9.2 $\pm$ 0.4
Anal fin rays	9~11	10.2 $\pm$ 0.5
Pectoral fin rays	11~12	11.3 $\pm$ 0.5
Ventral fin rays	6~7	6.6 $\pm$ 0.5
Caudal fin rays	16~18	17.0 $\pm$ 0.3
Scales of transverse series	34~37	35.7 $\pm$ 0.7
Lateral line scales	4~6	4.9 $\pm$ 0.6
Gill rakers (inner)	7~13	9.9 $\pm$ 1.8
Gill rakers (outer)	24~28	26.0 $\pm$ 1.3
Vertebrae*	30~31	30.1 $\pm$ 0.3
Measurements		
In % of standard length		
Head length	21.8~23.7	22.9 $\pm$ 0.5
Snout length	6.1~7.3	6.6 $\pm$ 0.4
Eye diameter	6.9~8.2	7.5 $\pm$ 0.4
Pre-pectoral length	22.1~24.5	23.1 $\pm$ 0.8
Pre-dorsal length	49.3~52.9	50.7 $\pm$ 0.9
Pre-ventral length	42.0~46.7	44.2 $\pm$ 1.2
Pre-anal length	57.7~63.6	60.7 $\pm$ 1.6
Head depth	20.6~24.2	21.9 $\pm$ 0.9
Body depth	38.5~43.3	40.8 $\pm$ 1.3
Body depth at anus	30.6~35.7	32.8 $\pm$ 1.5
Depth of caudal peduncle	11.9~13.6	12.9 $\pm$ 0.4
Length of caudal peduncle	20.3~23.8	21.7 $\pm$ 0.9
Inter-orbital width	9.3~10.6	9.9 $\pm$ 0.4
Dorsal fin length	15.6~19.4	17.6 $\pm$ 1.0
Anal fin length	14.5~16.6	15.7 $\pm$ 0.7
Ventral fin length	14.8~16.3	15.7 $\pm$ 0.5
Dorsal fin base length	20.2~23.3	21.4 $\pm$ 0.7
Anal fin base length	18.1~21.3	19.6 $\pm$ 0.8
In % of head length		
Snout length	26.0~31.7	28.8 $\pm$ 1.7
Eye diameter	30.8~35.8	32.9 $\pm$ 1.5
Inter-orbital width	41.0~45.8	43.3 $\pm$ 1.3
Depth/Length of caudal peduncle	54.9~65.2	57.9 $\pm$ 6.6

\*Number of vertebrae excluding Weberian apparatus

scales with pore; head small and compressed; snout pointed at tip and short, equal to or slightly shorter than eye diameter; interorbital space somewhat wide and convex; mouth small, slightly oblique, subterminal, with semicircular ventral profile, without barbels; lower jaw a little shorter than the upper; posterior edge of maxillary reaching below posterior nostril; caudal peduncle

long and compressed, tapering posteriorly; origin of dorsal fin above anus; origin of anal fin under the 4th to 6th branched dorsal ray.

**Distribution:** Europe, Far-East Asia (Amur River Basin, Manchuria, Korea).

**Coloration:** Dorsolateral part grey-brown, sides silvery with a reddish purple flush, ventral part pale yellow in female but black in male. First spot

small and dark, and on the first or second scale just above the upper end of operculum. Second spot somewhat blurred and on the fifth or sixth scale behind first spot. These two spots being often obscure in females. Upper and lower part of eye always black. Blue-green stripe on side, widening towards tail, beginning under dorsal fin origin or middle part of dorsal fin base and ending at caudal fin base. Stripe of female somewhat slender and shorter than that of male. All fins yellow. Three row of dark spot on the dorsal and anal fin. Apical part of dorsal fin in male without spot, more yellowish than other part of fin. Yellow color of fins more distinct in breeding season. In juveniles, one large dark spot on the anterior part of dorsal fin.

**Habitat:** The examined specimens were found mainly in the densely weeded zones of slow-flowing stream but were often found in scarcely weeded zones. The bottom of the habitat was composed of mud or sand. The depth of water was about 1 meter. There was many freshwater mussels, *Unio douglasiae*.

**Remarks:** The counts and measurements of

present specimens agree well with previous descriptions (Uchida, 1939; Berg, 1949; Wu, 1964) except that these fishes have less vertebrae, more deeper body and more shorter head (Table 2). The color of present specimens is similar to that of *R. sericeus* in Europe (Muus and Dahlstrom, 1971; Cihar, 1976; Wheeler, 1978). It was reported that the color of the dorsolateral body was dark blue (Uchida, 1939; Wu, 1964) but that of present specimens was grey-brown. In the specimens from Amur River, Wu (1964) described that the color of the upper part of eye is red. And that of the other species in the genus *Rhodeus* is also red for breeding season at least (Choi, 1989; Kawanabe and Mizuno, 1989). It seems that, therefore, this is a common characteristic in the genus *Rhodeus*. In contrast with that, however, our specimens had black color only on the upper part of eye through the year.

Our specimens of the present species are easily distinguished from the other species of the genus *Rhodeus* by the following respects. The number of scales of transverse series is more than 34. The head is shorter and snout is somewhat longer than

**Table 2.** Comparison of known data on the morphological characters of *Rhodeus sericeus*

Characters	Present specimens	Uchida (1939)	Berg (1949)	Wu (1964)
Number of individuals	20	10	—	—
Counts				
Dorsal fin rays	9~10	9	9~11	8~10
Anal fin rays	9~11	8~9	8~10	8~10
Scales of transverse series	34~37	33~37	36~40	34~40
Lateral line scales	4~6	6~7	5~10	5~7
Gill rakers (inner)	7~13	7~10	—	9~13
Gill rakers (outer)	24~28	23	—	—
Vertebrae	30~31	31~34	—	—
Measurements				
In % of standard length				
Head length	21.8~23.7	22.7~28.6	—	21.3~25.6
Body depth	38.5~43.3	31.3~40.0	32.3~40.0	28.6~40.0
Depth of caudal peduncle	11.9~13.6	10.6~14.5	—	—
Length of caudal peduncle	20.3~23.8	17.9~25.0	22~26	22.7~27.0
In % of head length				
Snout length	26.0~31.7	26.3~32.3	—	22.7~34.5
Eye diameter	30.8~35.8	25.6~33.3	28.5~40.0	27.0~33.3
Inter-orbital width	41.0~45.8	32.3~45.5	—	—
Depth/length of caudal peduncle	54.9~65.2	55.6~71.4	—	—

those of the other species (Table 3). The upper part of eye in male is always black. The reddish purple flush in the present species is unique among species of the genus *Rhodeus*.

It has been known that the southern limit of distribution of *R. sericeus* is the Yonghung River in Hamgyongnam-do, north-eastern part of Korean Peninsula (Uchida, 1939; Nagata, 1976; Chyung, 1977). But present specimens were found at the Namhan River (37° 32' 38" N, 127° 58' 57" E) which flows westward through central part of the Korean Peninsula. Thus the range of the distribution of *R. sericeus* is extended more southerly.

The main distribution area of *R. sericeus* in Korean Peninsula is the streams drained into Sea

of Japan which locate at north-eastern part of the peninsula (Chyung, 1977). In China, *R. sericeus* distributes mainly in Heilung River (Wu, 1964). Those river and streams were parts of the Paleo-Amur River Basin (Nishimura, 1980). It is very interest in biogeographic aspect in that the newly discovered habitat of *R. sericeus* lies southern part of the peninsula and belongs to the Paleo-Whangho River Basin. Some plausible interpretations on the presence of present population are as follows. The first is that *R. sericeus* expanded southward its distribution range recently. Secondly, This is a relic population of glacial age. Even if the two were true, it seems that penetration into the Han River from the eastern slope of Taebaik Mountain Chain is impossible.

**Table 3.** Comparison of some morphological characters among the species in genus *Rhodeus*

Characters	<i>R. sericeus</i>	<i>R. uyekii</i>	<i>R. notatus</i>	<i>R. ocellatus</i>
Number of individuals	20	27	29	43
Counts				
Dorsal fin rays	9.2±0.4 (9~10)	9.1±0.4 (9~11)	9.8±0.4 (9~10)	11.3±0.5 (11~12)
Anal fin rays	10.2±0.5 (9~11)	9.3±0.5 (9~11)	9.7±0.5 (9~10)	10.7±0.6 (9~12)
Scales of transverse series	35.7±0.7 (34~37)	33.2±0.6 (32~34)	33.0±0.6 (32~34)	33.3±0.7 (32~34)
Lateral line scales	4.9±0.6 (4~6)	2.9±1.1 (1~5)	5.0±0.7 (4~6)	3.9±1.0 (2~5)
Measurements				
In % of standard length				
Head length	22.9±0.5 (21.8~23.7)	26.1±1.5 (22.9~28.5)	25.4±1.1 (23.8~17.9)	25.0±0.7 (23.5~26.4)
Body depth	40.8±1.3 (38.5~43.3)	41.3±2.4 (36.9~46.5)	36.2±1.2 (34.4~38.4)	41.6±2.2 (37.3~47.6)
Depth of caudal peduncle	12.9±0.4 (11.9~13.6)	13.6±0.6 (12.2~15.1)	12.7±0.5 (11.9~13.7)	12.2±0.6 (10.7~13.3)
Length of caudal peduncle	21.7±0.9 (20.3~23.8)	22.3±1.3 (19.6~24.6)	22.0±0.9 (19.8~23.7)	20.6±1.3 (18.5~23.1)
In % of head length				
Snout length	28.8±1.7 (26.0~31.7)	23.9±1.5 (21.2~27.2)	22.5±1.6 (19.5~25.7)	25.7±1.4 (22.8~29.9)
Eye diameter	32.9±1.5 (30.8~35.8)	32.3±1.4 (30.1~36.0)	35.6±1.6 (30.7~39.5)	32.8±1.2 (30.6~35.9)
Inter-orbital width	43.3±1.3 (41.0~45.8)	42.1±2.2 (39.1~46.0)	37.1±1.8 (34.0~40.4)	39.2±2.2 (33.1~43.0)
Depth/length of caudal peduncle	57.9±6.6 (54.9~65.2)	61.3±5.1 (53.8~72.9)	57.8±3.3 (53.2~63.5)	59.4±5.0 (49.0~68.8)

This can be interpreted by stream capture phenomenon. But it is also not plausible because the capture takes place eastward commonly in Taebaik Mountain Chain and this population is far away from the main Mountain Chain. The third is that newly discovered population may be a different taxonomic group from *R. sericeus* or the other species of the genus *Rhodeus*. This possibility also can not be excluded because present specimens have less vertebrae, deeper body and different coloration from the previous descriptions (Uchida, 1939; Berg, 1949; Wu, 1964). For ascertaining these possibilities, therefore, it is needed not only to survey the precise distribution pattern in the Korean Peninsula but also to compare comprehensively with the populations from Amur River Basin and north-eastern Korean Peninsula.

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(Accepted January 30, 1993)

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### 남줄개 *Rhodeus sericeus*(Pallas) (잉어과, 어강)의 신분포지 채병수, 양홍준(경북대학교 사범대학 생물교육과)

남한강의 지류인 섬강의 상류(강원도 횡성군 공근면 매곡리 금계천: 37° 32' 38" N, 127° 58' 57" E)에서 남줄개 *Rhodeus sericeus*(Pallas) 81개체를 채집하였다. 이것은 한반도의 중남부에서는 최초의 기록이다. 이 종은 종렬린수가 34개 이상 (34~37, 평균 35.7 ± 0.7)이며 두장이 짧고 문장이 길다는 점, 그리고 체측면은 연한 적자색을 띠며 동공상부는 생식시기에도 검은색을 띤다는 점에서 *Rhodeus*속 내의 다른 종들과 구분된다. 지금까지 *R. sericeus*의 분포에 있어서 남방한계는 함경남도 용흥강으로 알려져 있었으나 이번 발견에 의해 분포의 범위가 한반도의 중부지역인 한강수계까지 남하되었다.